Report of the Japanese Government
to the IAEA Ministerial Conference on Nuclear Safety

- The Accident at TEPCO's Fukushima Nuclear Power Stations -

June 2011

Nuclear Emergency Response Headquarters

Government of Japan

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1. Introduction

The Tohoku District - off the Pacific Ocean Earthquake and the resulting tsunamis struck the Fukushima Dai-ichi and Fukushima Dai-ni Nuclear Power Stations (hereinafter, the "Fukushima NPSs") of Tokyo Electric Power Co. (TEPCO) at 14:46 on March 11, 2011 (all times herein are JST), followed by a nuclear accident unprecedented in both scale and timeframe.

The situation has become extremely trying for Japan, insofar as it has had to execute countermeasures for the nuclear accident whilst also dealing with the broader disaster caused by the earthquake and tsunamis.

This nuclear accident has turned out to be a major challenge for Japan, with numerous relevant domestic organizations working together to respond to the situation while also receiving support from many countries around the world. The fact that this accident has raised concerns around the world about the safety of nuclear power generation is a matter which Japan takes with the utmost seriousness and remorse. Above all, Japan sincerely regrets causing anxiety for people all over the world about the release of radioactive materials.

Currently, Japan is dealing with the issues and working towards settling the situation utilizing accumulated experience and knowledge. It is incumbent upon Japan to share correct and precise information with the world continually in terms of what happened at the Fukushima NPSs, including regarding how events progressed and how Japan has been working to settle the situation. Japan also recognizes a responsibility to share with the world the lessons it has learned from this process.

On the basis of the recognitions stated above, this report has been prepared as the report from Japan for the International Atomic Energy Agency (IAEA) Ministerial Conference on Nuclear Safety, which will convene in June 2011. The Government-TEPCO Integrated Response Office is engaged in working toward settling the situation from the accident under the supervision of Mr. Banri Kaieda, Minister of Economy, Trade and Industry, in conjunction with and joining forces with the Nuclear and Industrial Safety Agency and also with TEPCO. This report was prepared by the Government Nuclear Emergency Response Headquarters, taking into account the approach toward the restoration of stable control taken by the Government-TEPCO Integrated Response Office and hearing the views of outside experts. The work has been managed as a whole by Mr. Goshi Hosono, Special Advisor to the Prime Minister designated by Prime Minister Naoto Kan in his capacity as General Manager of the Government Nuclear Emergency Response Headquarters (GNER HQs).

This report is a preliminary accident report and represents a summary of the evaluation of the accident and the lessons learned to date based on the facts ascertained about the situation so far. In terms of its range, the summary is centered on technical matters related to nuclear safety and nuclear emergency preparedness and responses up to the present moment. Issues related to nuclear damage compensation, the wider societal effects, and so on are not covered.

In addition to preparing this report, the Government has established the “Investigation Committee on the Accidents at the Fukushima Nuclear Power Station of Tokyo Electric Power Company” (hereinafter the “Investigation Committee”) in order to provide an overall investigation of the utility of countermeasures being taken against the accident that has occurred at the Fukushima NPSs. Aspects stressed within this Investigation Committee are independence from Japan’s existing nuclear energy administration, openness to the public and the international community, and comprehensiveness in examining various issues related not only to technical elements but also to institutional aspects. These concepts are used as the basis for strictly investigating all activities undertaken so far, including activities by the Government in terms of countermeasures against the accident. The contents of this report will also be investigated by the Investigation Committee and the progress of the investigation activities will be released to the world.

Japan's basic policy is to release information about this accident with a high degree of transparency. In preparing this report under this policy, attention has been paid to providing as accurately as possible an exact description of the facts of the situation, together with an objective evaluation of countermeasures against the accident, clearly distinguishing between known and unknown matters. Factual descriptions are based on findings current as of May 31, 2011.

Japan intends to exert its full efforts to properly tackle the investigation and analysis of this accident and to continue to provide those outcomes to both to the IAEA and to the world as a whole.

2. Situation regarding Nuclear Safety Regulations and Other Regulatory Frameworks in Japan before the Accident

Safety regulations governing NPSs in Japan are mandated under the "Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors" and "The Electricity Business Act." The Nuclear and Industrial Safety Agency (NISA) within the Ministry of Economy, Trade and Industry is responsible for these regulations. The Nuclear Safety Commission (NSC), established under the Cabinet Office, has the role of supervising and auditing the safety regulation activities implemented by NISA and has the authority to make recommendations through the Prime Minister to the Minister of Economy, Trade and Industry to take necessary measures, as necessary. When the Minister of Economy, Trade and Industry issues a license for the establishment of an NPS, the Minister is required to seek in advance the NSC's views regarding safety issues.

The monitoring and measurement activities for preventing radiation damages and for evaluating radioactivity levels are carried out by related government bodies including the Ministry of Education, Culture, Sports, Science & Technology (MEXT) based on the related laws and regulations.

Responses to nuclear accidents in Japan are supposed to be carried out based on the Act on Special Measures Concerning Nuclear Emergency Preparedness, (hereinafter "ASMCNE"), which was established after the occurrence of a criticality accident in a JCO nuclear fuel fabrication facility in 1999. ASMCNE complements the Disaster Countermeasures Basic Law should a nuclear emergency occur. ASMCNE stipulates that the national and local governments, and the licensee, shall address a nuclear emergency by acting in close coordination with each other, that the Prime Minister shall declare a nuclear emergency situation in response to the occurrence of a nuclear emergency situation and give instructions to evacuate area(s) or to take shelter as appropriate, that the GNER HQs headed by the Prime Minister shall be established to respond to the situations, and so on.

Emergency environmental monitoring, which is one of the responses to be taken at the time of a nuclear disaster, shall be implemented by local governments and supported by MEXT.

3. Disaster Damage in Japan from the Tohoku District - off the Pacific Ocean Earthquake and Resulting Tsunamis

The Pacific coast area of eastern Japan was struck by the Tohoku District - off the Pacific Ocean Earthquake, which occurred at 14:46 on March 11, 2011. This earthquake occurred in an area where the Pacific plate sinks beneath the North American plate and the magnitude of this earthquake was 9.0, the largest in Japan's recorded history. The seismic source was at latitude 38.1 north, longitude 142.9 east and at a depth of 23.7km.

The crustal movement induced by this earthquake extended over a wide range, from the Tohoku District to the Kanto District. Afterwards, tsunamis struck the Tohoku District in a series of seven waves, resulting in the inundation of an area as large as 561km^2. As of the date that this report was issued, approximately 25,000 people are reported dead or missing.

In terms of the earthquake observed at the Fukushima NPSs, the acceleration response spectra of the earthquake movement observed on the basic board of reactor buildings exceeded the acceleration response spectra of the response acceleration to the standard seismic ground motion Ss for partial periodic bands at the Fukushima Dai-ichi NPS. As for the Fukushima Dai-ni NPS, the acceleration response spectra of the earthquake movement observed on the basic board of the reactor buildings was below the acceleration response spectra of the response acceleration to the standard seismic ground motion Ss. The earthquake damaged the external power supply.

Thus far, major damage to the reactor facilities which are important for safety functions has yet to be recognized. Further investigation is needed because the details of the situation remain unknown.

In terms of the damage to the external power supply at the Fukushima NPSs, a total of six external power supply sources had been connected to the Dai-ichi Power Station on the day the earthquake hit. However, all power supplied from these six lines stopped due to damage to the breakers, etc. and the collapse of the power transmission line tower due to the earthquake. Furthermore, at the Fukushima Dai-ni NPS, while a total of four external power supply sources had been connected as of the day of the earthquake, only one of them remained to supply electricity after the quake struck, as one line was under maintenance, one stopped due to the earthquake, and yet another also stopped. (After the completion of restoration works at 13:38 the following day, March 12, one power supply line was restored, resulting in two sources supplying the electricity thereafter.)

With respect to the strike of the tsunamis, the Fukushima Dai-ichi NPS was hit by the first enormous wave at 15:27 on March 11 (41 minutes after the earthquake), and the next enormous wave around 15:35, while the Fukushima Dai-ni NPS was hit by the first enormous wave at around 15:23 (37 minutes after the earthquake) and by the next enormous wave at around 15:35 (as stated in TEPCO's announcement). The license for the establishment of nuclear reactors at the Fukushima Dai-ichi NPS was based on the assumption that the maximum design basis tsunami height expected was 3.1m. The assessment in 2002 based on the "Tsunami Assessment Method for Nuclear Power Plants in Japan" proposed by the Japan Society of Civil Engineers (JSCE) indicated a maximum water level of 5.7m, and TEPCO raised the height of its Unit 6 seawater pump installation in response to that assessment. However, the inundation height due to the tsunami this time was 14 to 15m, and in all units, the seawater pump facilities for cooling auxiliary systems were submerged and stopped functioning. In addition to that, all the emergency diesel power generators and the distribution boards installed in the basements of the reactor buildings and turbine buildings except for Unit 6 were inundated and stopped functioning.

For the Fukushima Dai-ni NPS, the maximum design basis tsunami height was expected to be 3.1 to 3.7m. Further, the said assessment by JSCE in 2002 indicated a maximum water level of 5.1 to 5.2m. Because of the tsunamis, most of the seawater pump facilities for cooling auxiliary systems, except for some, were submerged and stopped functioning, and the emergency diesel power generators installed in the basement of the reactor buildings stopped.

Thus, the assumption of, and the preparedness for, the onslaught of enormous tsunamis were not sufficient.

4. Occurrence and Development of the Accident at the Fukushima Nuclear Power Stations

(1) Outline of the Fukushima Nuclear Power Stations

The Fukushima Dai-ichi NPS is located in the towns of Okuma and Futaba, which are in the county of Futaba in Fukushima Prefecture. This NPS consists of six Boiling Water Reactors (BWR) installed-- Units 1 to 6-- with a total generating capacity of 4,696MW.

The Fukushima Dai-ni NPS is located in the towns of Tomioka and Naraha of Futaba county in Fukushima Prefecture, and consists of 4 BWRs whose total generating capacity is 4,400MW.

(2) Status of safety assurance for the Fukushima NPSs

In facilities with nuclear reactors, the occurrence of failures must be prevented even if natural phenomenon, etc. should occur. However, assuming that failures may nevertheless happen, protective measures are provided to ensure safety even when the unusual situation of design basis event should happen. In addition, Japan started undertaking accident management measures in 1992, designed to minimize to the greatest possible extent the possibility of reaching a state of a severe accident should these protective measures not be enough and mitigate the effects even if the situation were to reach the state of a severe accident. Implementation of these accident management measures is not required by law under the safety regulations. The accident management measures are implemented by nuclear operators voluntarily, and the government requires them to make reports on their implementation.

The accident management measures at the Fukushima NPSs have been implemented for the following four functions: functions to shutdown the nuclear reactor, functions to inject water into the nuclear reactors and the PCVs, functions to remove heat from the PCVs, and functions to support the safety functions. For example, measures to maintain functions to inject water into the nuclear reactors include that the connection to the piping be secured for water injection functions to nuclear reactors through PCV cooling systems and that, as alternative water-injection equipment, the core spray system from the existing Make Up Water Condensate (MUWC) system and the fire extinguishing system be utilized.

(*Severe Accident: An event that significantly exceeds the design basis event, and a situation where appropriate cooling for the reactor core or control of reactivity is rendered inoperable by the postulated measures under the evaluation for safety design, resulting in serious damage to the reactor core.)

(**Accident Management: Measures taken to prevent an event leading to a severe accident, or to mitigate its influence in the event of a severe accident, by utilizing a) functions other than the anticipated primary ones under the safety margin and safety design included in the current design or b) newly installed equipment in preparation for a severe accident, etc.)

(3) Operating status of the Fukushima NPSs before the earthquake

In terms of the operating status at the Fukushima NPSs before the earthquake on March 11, Unit 1 was under operation at its rated electric power, Units 2 and 3 were under operation at their rated thermal power, and Units 4, 5 and 6 were under periodic inspection. Among these Units, Unit 4 was undergoing a major construction for renovations, with all the nuclear fuel in the RPV having already been transferred to the spent fuel pool. Moreover, 6,375 units of spent fuel were stored in the common spent fuel pool.

At the Fukushima Dai-ni NPS, all the nuclear reactors from Units 1 to 4 were under operation at their rated thermal power.

(4) The incidence and development of the accident at the Fukushima NPSs

At the Fukushima Dai-ichi NPS, Units 1 to 3 which were under operation automatically shut down at 14:46 on March 11. All six external power supply sources were lost because of the earthquake. This caused the emergency diesel power generators to start up. However, seawater pumps, emergency diesel generators and distribution boards were submerged because of the tsunami strike, and all emergency diesel power generators stopped except for one generator in Unit 6. For that reason, all AC power supplies were lost except at Unit 6. One emergency diesel power generator (an air-cooled type) and the distribution board escaped submersion and continued operation at Unit 6. In addition, since the seawater pumps were submerged by the tsunami, residual heat removal systems to release the residual heat inside the reactor to the seawater and the auxiliary cooling systems to release the heat of various equipment to the seawater lost their functions..

TEPCO's operators followed TEPCO's manuals for severe accidents and urgently attempted to secure power supplies in cooperation with the government, in order to recover various kinds of equipment within the safety systems while the core cooling equipment and the water-injection equipment, which had automatically started up, were operating. However, ultimately power supplies could not be secured.

Since the core cooling functions using AC power were lost in Units 1 to 3, core cooling functions not utilizing AC power were put into operation, or, alternately, attempts were made to put them into operation. These were operation of the isolation condenser*** in Unit 1, the operation of the reactor core isolation cooling system**** (RCIC) in Unit 2 and the operation of the RCIC and the high pressure injection system***** (HPCI) in Unit 3.

These core cooling systems that do not utilize AC power supplies stopped functioning thereafter, and were switched to alternative injections of freshwater or sea water by fire extinguishing lines, using fire engine pumps.

Concerning Units 1 to 3 of the Fukushima Dai-ichi NPS, as the situation where water injection to each RPV was impossible to continue for a certain period of time, the nuclear fuel in each reactor core was not covered by water but was exposed, leading to a core melt. Part of the melted fuel stayed at the bottom of the RPV.

A large amount of hydrogen was generated by chemical reactions between the zirconium of the fuel cladding tubes, etc. and water vapor. In addition, the fuel cladding tubes were damaged and radioactive materials therein were discharged into the RPV. Further, these hydrogen and radioactive materials were discharged into the PCV during the depressurization process of the RPV.

Injected water vaporizes after absorbing heat from the nuclear fuel in the RPV. Accordingly, the inner pressure rose in the RPVs which had lost their core cooling functions, and this water vapor leaked through the safety valves into the PCV. Due to this, the inner pressure within the PCVs in Units 1 to 3 rose gradually, with PCV wet well vent operations carried out a number of times, in which the gases in the PCVs are released from the gas phase area in the suppression chamber into the atmosphere, through the ventilation stack, for the purpose of preventing damage to the PCV caused by the pressure therein.

(***Isolation condenser: Equipment with the function of returning water condensed from water vapor in the RPV by natural circulation (that is, with no driving by pumps required) to cool the RPV, when the RPV is isolated due to the loss of external power supply, etc. (when reactor cooling cannot be done by the main condenser). An isolation condenser has a structure to cool the water vapor that was led into the heat transfer tube with the water stored in the condenser (body side).

(****Reactor core isolation cooling system (RCIC): A system that cools the reactor cores when reactors are isolated from feed water and condenser systems due to loss of external power, etc. Either the condensate storage tank or the pressure suppression pool water can be used as a water source. The driving system for the pump is a turbine which uses some of the steam in the reactors.)

(*****High pressure injection system (HPCI): One of the emergency core cooling systems that injects water, with the pump driven by providing the water vapor generated by the decay heat to the turbine.)

After the wet well venting of the PCVs, explosions presumably caused by hydrogen which had leaked from the PCV occurred in the upper area of the reactor buildings, ruining the operation floor in the reactor buildings of Units 1 and 3. As a result of these incidents, a lot of radioactive materials were discharged to the atmosphere. Following the ruination of the Unit 3 building, an explosion probably caused by hydrogen occurred in the reactor building of Unit 4, ruining its upper area. In Unit 4, all core fuels had been transferred to the spent fuel pool for periodic inspection before the earthquake. During this time, it seems that in Unit 2 a hydrogen explosion occurred and caused damage at a point presumed to be near the suppression chamber.

The most urgent task at the site, along with recovery of the power supply and the continuation of water injection to reactor vessels, was water injection to the spent fuel pools. In the spent fuel pool in each unit, the water level continued to drop on account of the evaporation of water caused by the heat of the spent fuel in the absence of the pool water cooling system, due to the loss of power supply. Water injection to the spent fuel pool was carried out by the Self-Defense Forces, the Fire and Disaster Management Agency and the National Police Agency, using helicopters and water cannon trucks. Concrete pump trucks were ultimately secured, which led to stable water injection using freshwater from nearby reservoirs after the initial seawater injection.

(5) Status of each Unit at the Fukushima NPSs

1) Fukushima Dai-ichi NPS Unit 1

· *Loss of power supply*

The reactor was scrammed by the earthquake that occurred at 14:46 on March 11. The external power supply was lost due to the earthquake and two emergency diesel generators started up. The two emergency diesel generators stopped functioning as a result of the tsunami at 15:37 on the same day and all AC power was lost.

· *Cooling of the reactor*

The emergency isolation condenser* (IC) automatically started up at 14:52 on March 11 and started cooling the reactor. Subsequently, the IC stopped functioning at 15:03 on the same day. According to the operation procedure document, the cooling speed is to be adjusted to 55 degrees Celsius/hour. The pressure in the reactor rose and fell three times afterwards, which indicates that the IC had been operated manually. According to TEPCO, fresh water injection from a fire extinguishing line started at 05:46 on March 12, using a fire engine pump, and 80,000 liters of water were injected by 14:53 on the same day, but they claim that it is unknown when water injection stopped. Seawater injection started at 19:04 by means of a fire extinguishing line. There was some confusion between the government and the main office of TEPCO in communications and in the chain of command on seawater injection, but seawater injection continued following the decision by the director of the Fukushima Dai-ichi NPS. Injection of freshwater resumed on March 25 with the injection of water stored in a pure water tank. For at least one hour after the earthquake, the water level in the reactor was not low enough to trigger an automatic start-up (L-L: 148cm below the bottom of the separator) of the High Pressure Coolant Injection system (HPCI), and there has been no record of a start-up.

· *Status of the reactor core*

Water injection seemed to have stopped for 14 hours and 9 minutes, after the total loss of AC power at 15:37 on March 11 until the start of freshwater injections at 5:46 on March 12. From the results of the evaluation by NISA (on the assumption that the HPCI was not operating), it seems that the fuel was exposed due to a drop in the water level around 17:00 on March 11, and that the core melt started afterwards. A considerable amount of melted fuel seems to have moved to and accumulated at the bottom of the RPV. There is a possibility that the bottom of the RPV was damaged and some of the fuel might have dropped and accumulated on the D/W floor (lower pedestal).

· *Hydrogen explosion*

Wet well venting of the PCV was carried out at 14:30 on March 12. Afterwards, a hydrogen explosion occurred in the reactor building at 15:36 on the same day. Zirconium appears to have reacted with water as the temperature rose in the RPV, generating hydrogen. It appears that the gas containing the hydrogen accumulating in the upper area of the reactor buildings due to leakage, etc. from the PCV triggered the hydrogen explosion. Injecting nitrogen into the PCV started on April 7.

· *Leakage of cooling water*

The cooling water that has been injected into the RPV appears to be leaking from the bottom of the RPV. The total amount of water injected into the RPV was approximately 13,700 metric tons (information from TEPCO; current as of May 31), and total amount of steam generated is estimated at 5,100 metric tons. Therefore the amount of leakage seems to be the difference between these two, approximately 8600 metric tons, minus the amount inside the RPV (approximately $350m^3$).

2) Fukushima Dai-ichi NPS Unit 2

· *Loss of power supply*

The reactor was scrammed by the earthquake at 14:47 on March 11 and the external power supply was lost and two emergency diesel generators started up. The two emergency diesel generators were stopped by the tsunami and all AC power supply was lost at 15:41 on the same day.

· *Cooling of the reactor*

TEPCO started up the Reactor Core Isolation Cooling System (RCIC) manually around 14:50 on March 11. The RCIC automatically stopped because of the high water level in the reactor at around 14:51 on the same day. Afterwards, TEPCO manually started it up at 15:02 and it stopped again at 15:28 on the same day. TEPCO started it up again manually at 15:39 on the same day. The RCIC stopped at 13:25 on March 14. Seawater injection using a firefighting pump started at 19:54 on the same day.

· *Status of the reactor core*

Water injection appears to have stopped for 6 hours and 29 minutes, from 13:25 on March 14 when the RCIC stopped, until seawater injection resumed at 19:54 on the same day. According to the results of NISA's analysis, it seems that the fuel was exposed due to a drop in the water level at around 18:00 on March 14 and that the core started melting afterwards. A considerable part of melted fuel seems to have moved to and accumulated at the bottom of the RPV. There is a possibility that the bottom of the RPV was damaged and some of the fuel might have dropped and accumulated on the D/W floor (lower pedestal).

· *Explosion noise*

A PCV wet vent operation, which included that of small valves, was carried out from around 11:00 on March 13. Noise of an explosion occurred at around 6:00 on March 15 around the suppression chamber of the containment vessel. There is a possibility that the explosion occurred in the torus room, as the gas, including hydrogen, was generated by a reaction between the zirconium and water along with a temperature rise in the RPV, invading the suppression chamber by such means as the opening of the main steam safety relief valve.

· *Leakage of cooling water*

As of now, injected cooling water is thought to be leaking at the bottom of the RPV. The total amount of injected water to the RPV was approximately 21,000 metric tons (information by TEPCO; current as of May 31), and the total amount of steam generated is estimated at 7,900 metric tons. Therefore, the amount of leakage appears to be the difference between these two, approximately 13,100 metric tons minus the amount inside the RPV (approximately 500 m^3).

3) Fukushima Dai-ichi NPS Unit 3

· *Loss of Power supply*

The reactor was scrammed by the earthquake at 14:47 on March 11, and the external power supply was lost and two emergency diesel generators started up. The two emergency diesel generators were stopped by the tsunami and all AC power was lost at 15:41 on the same day.

· *Cooling of the reactor*

The Reactor Core Isolation Cooling System (RCIC) was manually started at 15:05 on March 11. It stopped automatically at 15:25 on the same day due to a rise in the reactor water level. It was started manually at 16:03 on the same day, and the RCIC stopped at 11:36 on March 12. The High Pressure Core Injection System (HPCI) automatically started due to the reactor low water level (L-2) at 12:35 on the same day, and the HPCI stopped at 2:42 on March 13. The reason for that appears to have been a drop in pressure in the reactor. Another probable cause could be water vapor outflow from the HPCI system.

· *Status of the reactor core*

The operation to inject water containing boric acid commenced using a fire extinguishing line at around 9:25 on March 13. However, the water could not be injected sufficiently due to the high pressure in the reactor, and the water level in the reactor lowered. As a result, water injection was halted for at least 6 hours and 43 minutes after the HPCI stopped at 02:42 on March 13 until water injection using the fire extinguishing line started at 09:25 on the same day. According to the results of NISA's analysis, the fuel appears to have been exposed due to a drop in the reactor water level at around 08:00 on March 13, with the core starting to melt afterwards. A considerable part of melted fuel seems to have moved to and accumulated at the bottom of the RPV. However, there is a possibility that the bottom part of the RPV was damaged and some of the fuel might have dropped and accumulated on the dry well floor (lower pedestal).

· *Hydrogen explosion*

A wet well vent operation of the PCV was carried out at 05:20 on March 14. A hydrogen explosion occurred at the reactor building at 11:01 on the same day. It seems that zirconium and water reacted along with a rise in temperature in the PCV, and that gas containing hydrogen by such means as leakage from the PCV accumulated in the upper area of the reactor buildings, triggering a hydrogen explosion.

· *Leakage of cooling water*

It is assumed at the moment that injected cooling water is leaking at the bottom of the RPV. The total amount of water injected into the RPV was approximately 20,700 metric tons (information by TEPCO; current as of May 31) and the total amount of steam is estimated to be approximately 8,300 metric tons. A substantial amount equivalent to the difference between these two, approximately 12,400 metric tons minus the amount in the RPV (approximately 500m^3), appears to have been leaked.

4) Fukushima Dai-ichi NPS Unit 4

· *Cooling of the spent fuel pool*

The reactor had been shut down for periodic inspection, with the nuclear fuel having been transferred to the spent fuel pool. External power supply was lost by the earthquake on March

11 and one emergency diesel generator started up. (The other one was under inspection and did not start up.) The emergency diesel generator stopped due to tsunami at 15:38 on the same day, and all AC power was lost. Both the cooling and feed water functions were thus lost. The spraying of water over the spent fuel pool started from March 20.

· *Explosion in the reactor building*

At around 6:00 on March 15, an explosion in the reactor building occurred, resulting in all the walls above the bottom of the operation floor and the walls on the west side and along the stairs collapsing. A fire broke out near the northwest corner on the 4th floor of the reactor building at 09:38 on the same day. With regard to the explosion in the reactor building, an inflow of hydrogen from Unit 3 may be possible, as the exhaust pipe for venting the PCV joins the exhaust pipe from unit 4 before the exhaust stack. However, the cause of the explosion has not yet been determined.

5) Fukushima Dai-ichi NPS Unit 5

· *Securing a power supply*

This reactor had already been shut down for periodic inspection. Upon the loss of the external power supply due to the earthquake at 14:46 on March 11, two emergency diesel generators started up. However, the two emergency diesel generators stopped at 15:40 on the same day due to the tsunamis, causing all AC power to be lost. An alternate power supply was taken from the emergency diesel generator of Unit 6 on March 13, 2011.

· *Cooling of the reactor and the spent fuel pool*

Although an RPV pressure reduction operation was carried out at 06:06 on March 12, the reactor pressure slowly increased due to the effects of decay heat. The alternate power supply was taken from the emergency diesel generator of Unit 6 on March 13, and water injection into the reactor became possible, using the transfer pump for the condenser of Unit 5. Reduction of pressure through a safety relief valve had been carried out since 05:00 on March 14, and there was repeated replenishment of the water from the condensate storage tank to the reactor through the transfer pump in order to control the pressure and water level of the reactor. To carry out cooling by the residual heat removal system, a temporary seawater pump was installed and started up, and cooling of the reactor and of the spent fuel pool were carried out in turn by switching the system constitution for the Residual Heat Removal (RHR) system on March 19. As a result, the reactor reached cold shutdown status at 14:30 on March 20.

6) Fukushima Dai-ichi NPS Unit 6

· *Securing of power supply*

This reactor had already been shut down for periodic inspection. Three emergency diesel generators started up upon the loss of external power supply due to the earthquake at 14:46 on March 11. Two emergency diesel generators stopped running due to the tsunami at 15:40 on the same day, and the power supply was maintained by making use of the remaining emergency diesel generator.

· *Cooling of the reactor and the spent fuel pool*

Reactor pressure rose slowly due to the effect of decay heat. Water injection into the reactor became possible on March 13, using the transfer pump for the condenser with the emergency diesel generator. Reduction of the pressure by means of a safety relief valve has been carried out since March 14, with repeated replenishment of the water from the condensate storage tank to the reactor through the transfer pump, in order to control the pressure and the water level of the reactor. To carry out cooling through the residual heat removal system, a temporary seawater pump was installed and started up, and cooling of the reactor and the spent fuel pool was carried out in turn by switching the system constitution for the residual heat removal system on March 19. The reactor reached cold shutdown status at 19:27 on March 20.

7) Fukushima Dai-ni NPS

· *Overall*

Reactors from Units 1 to 4 at the Fukushima Dai-ni NPS which had been in operation were scrammed at 14:48 on March 11. A total of four external power supply lines had been connected to this NPS. One line was undergoing maintenance, another stopped due to the earthquake and yet another stopped one hour after the earthquake, which resulted in electric supply being provided by a single line. (Restoration work was completed at 13:38 on March 12, thereby making two lines available.) The RHR systems of Unit 1, Unit 2 and Unit 4, etc. were damaged upon the reactors being hit by the tsunami at around 15:34 on the same day.

· *Unit 1*

In terms of the reactor, cooling and water level maintenance were carried out by means of the reactor core isolation cooling system and the Make Up Water Condensate (MUWC) system.

However, the temperature of the suppression pool water exceeded 100 degrees Celsius because not all the heat could be removed. Cooling through dry well spraying started at 07:10 on March 12. Cooling of the suppression pool started with the operation of the RHR system by connecting a temporary cable from the functioning distribution board at 01:24 on March 14. The temperature of the suppression pool became lower than 100 degrees Celsius at 10:15 on the same day, and the reactor reached cold shutdown status at 17:00 on the same day.

· *Unit 2*

In terms of the reactor, cooling and water level maintenance were carried out by means of the reactor core isolation cooling system and the Make Up Water Condensate (MUWC) system. However, the temperature of the suppression pool water exceeded 100 degrees Celsius because not all the heat could be removed. Cooling through dry well spraying started at 07:11 on March 12. Cooling of the suppression pool started with the operation of the RHR system by connecting a temporary cable, just as happened at Unit 1, at 07:13 on March 14. The temperature of the suppression pool became lower than 100 degrees Celsius at 15:52 on the same day and the reactor reached cold shutdown status at 18:00 on the same day.

· *Unit 3*

The RHR system (A) and low pressure core spray system became unusable as a result of the tsunami. However, the RHR system (B) was not damaged and cooling by this system remained ongoing. Therefore the reactor reached cold shutdown status at 12:15 on March 12.

· *Unit 4*

In terms of the reactor, although cooling and water level maintenance were carried out by the RCIC and the MUWC system, the temperature of the suppression pool water exceeded 100 degrees Celsius because not all the heat could be removed. Cooling of the suppression pool started at 15:42 on March 14 with the operation of the RHR system. The temperature of the suppression pool became lower than 100 degrees Celsius and the reactor reached cold shutdown status at 07:15 on March 15.

(3) Status of the other NPSs

1) Higashidori NPS of Tohoku Electric Power Co.

The Higashidori NPS of Tohoku Electric Power Co. (one BWR) had been shut down for periodic inspection, and all fuels in the core had been transferred to the spent fuel pool. All three external power supply lines stopped due to the earthquake, and power was supplied by an emergency diesel generator.

2) Onagawa NPS of Tohoku Electric Power Co.

At the Onagawa NPS of Tohoku Electric Power Co. (BWR Units 1 to 3) Units 1 and 3 were under operation and Unit 2 was under reactor start-up operation before the earthquake on March 11. All 3 reactors were scrammed by the earthquake. Four of five external power supply lines stopped due to the earthquake, leaving one line remaining. Unit 1 suffered an on-site power loss and power was supplied by emergency diesel generators. Water injection into the reactor was carried out by the reactor core isolation cooling system, etc. and the reactor reached cold shutdown status at 0:57 on March 12. In Unit 2, the external power supply was maintained and the cooling function of the reactor was not affected. In Unit 3, although the external power supply was maintained, the auxiliary equipment cooling seawater pump stopped. After that, water was injected into the reactor by the RCIC, etc. and the reactor reached cold shutdown status at 1:17 on March 12.

3) Tokai Dai-ni NPS of Japan Atomic Power Company

Tokai Dai-ni NPS of the Japan Atomic Power Company (one BWR) was undergoing rated thermal power operation, and the reactor was automatically scrammed due to the earthquake at 14:48 on March 11. Although all three lines of external power supply stopped, three emergency diesel generators started up. One of those emergency diesel generators stopped due to the tsunami, but with the remaining two securing the power supply, the reactor reached cold shutdown status at 0:40 on March 15.

5. Response to the Nuclear Emergency

(1) Emergency response after the accident occurred

At the Fukushima Dai-ichi NPS, all AC power was lost due to the disaster of the earthquake and tsunamis. In accordance with Paragraph 1, Article 10 of the Special Law of Emergency Preparedness for Nuclear Disaster, TEPCO notified the government at 15:42 on March 11, 2011, the day on which the earthquake occurred, that all AC power had been lost in Units 1 to 5.

After that, TEPCO recognized that the injection of water via the emergency core cooling systems was impossible at Units 1 and 2 of the Fukushima Dai-ichi NPS and notified the government at 16:45 on the same day of a State of Nuclear Emergency in accordance with the Article 15 of the Special Law of Emergency Preparedness for Nuclear Disaster.

The Prime Minister declared a state of nuclear emergency at 19:03 on the same day and established the Nuclear Emergency Response Headquarters and the Local Nuclear Emergency Response Headquarters, both of which are headed by the Prime Minister as Director General.

On March 15, the Integrated Headquarters for the Response to the Incident at the Fukushima Nuclear Power Stations (later renamed the Government–TEPCO Integrated Response Office on May 9) was established so that the government and the operator could work together in a concerted manner, decide to take necessary measures and promptly respond while sharing information on the state of the disasters at the nuclear facilities and on necessary measures

The Prime Minister, who serves as the Director-General of Nuclear Emergency Response Headquarters, determined the evacuation area and the in-house evacuation area according to the assessment of the possibility of discharging radioactive materials, and instructed Fukushima Prefecture and relevant cities, towns and villages to act in accordance with this determination. Responding to the status of accidents at the Fukushima Dai-ichi NPS, at 21:23, March 11, the evacuation area was set at the area within a 3km radius and the in-house evacuation area was a 3 to 10km radius from the Fukushima Dai-ichi NPS. Afterwards, according to the escalation of events, the evacuation area was expanded to a 20km radius at 18:25, March 12, and the in-house evacuation area was expanded to a 30km radius at around 11:00, March 15. Also, responding to the status of the accidents at the Fukushima Dai-ni NPS, the evacuation area within a 3km radius and the in-house evacuation area of a 3 to 10 km radius were set at the same time a nuclear emergency situation was declared at 7:45, March 12, with the evacuation area expanded to a 10 km radius at 17:39 on the same day. Then, the evacuation area was changed to a 8 km radius on April 21. Evacuation and stay-in-house instructions immediately after the accident were promptly implemented through a concerted effort by residents in the vicinity, local governments, the police and other relevant authorities.

The Prime Minister determined that evacuation areas within a 20km radius of Fukushima Dai-ichi NPS would be a “restricted area,” in accordance with the Basic Act on Disaster Control and instructed the mayors of cities and towns and the heads of villages and concerned local governments to prohibit access to the area on April 21.

The Local Nuclear Emergency Response Headquarters started its activities at an Off-Site Center as designated by the Basic Plan for Emergency Preparedness. However, it was moved to the Fukushima Prefectural Office in Fukushima City due to high-level radiation as the nuclear accident escalated, in addition to a communication blackout and a lack of fuel, food and other necessities caused by logistic congestion around the site.

The longer the accident lasted, the heavier the burden on residents in the vicinity of the NPS became. In particular, many of the residents who were instructed to stay within their houses were voluntarily evacuated and those who remained in the area found it increasingly difficult to sustain their livelihoods due to congestion in the distribution of goods and logistics problems. In response to this situation, the government launched support measures.

The primary functions of the Emergency Response Support System (ERSS), which monitors the status of reactors and forecasts the progress of the accident when a nuclear emergency occurs, could not be utilized because necessary information from the plants could not be obtained. In addition, the primary functions of the System for Prediction of Environmental Emergency Dose Information (SPEEDI), which conducts a quantitative forecast of variations of atmospheric concentrations of radioactive materials and air dose rates, could not be utilized because source term information could not be obtained. Although they were used in alternative ways, their operation processes and the disclosure of their results have remained as an issue.

(2) Implementation of environmental monitoring

In the Basic Plan for Emergency Preparedness, local governments are in charge of environmental monitoring when a nuclear emergency occurs. However, most of the monitoring posts became dysfunctional at first when the accident occurred. From March 16, it was decided that the Ministry of Education, Culture, Sports, Science and Technology (MEXT) would take charge of summarizing the environmental monitoring carried out by MEXT, local governments and cooperating U.S. organizations.

As for the land areas outside the premises of the NPS, MEXT measures the air dose rate, radioactive concentrations in the soil, and concentrations of radioactive materials in the air and takes environmental samples in cooperation with the Japan Atomic Energy Agency, Fukushima Prefecture, the Ministry of Defense, and electric companies. MEXT also carries out monitoring by aircraft in cooperation with the Ministry of Defense, TEPCO, the U.S. Department of Energy, etc. TEPCO carries out environmental monitoring at NPS sites and their vicinities, etc.

In terms of the sea areas near the NPS, MEXT, the Fisheries Agency, the Japan Agency for Marine-Earth Science and Technology, the Japan Atomic Energy Agency, TEPCO, and others cooperate with each other to carry out the monitoring of radioactive concentrations, etc. in the seawater and in the seabed, while the Japan Agency for Marine-Earth Science and Technology simulates the distribution and spread of radioactive concentrations.

The Nuclear Safety Commission evaluates and announces the results of these environmental monitoring efforts as they become available.

Environmental monitoring of the air, sea and soil of the premises and the surrounding areas of the Fukushima NPSs is conducted by TEPCO.

(3) Measures regarding agricultural products, drinking water, etc.

The Ministry of Health, Labour and Welfare decided that the "Indices relating to limits on food and drink ingestion" indicated by the Nuclear Safety Commission of Japan shall be adopted for the time being as provisional regulation values, and foods which exceed these levels shall not be supplied to the public for consumption, pursuant to the Food Sanitation Act. The Prime Minister, as the Director-General of Government Nuclear Emergency Response Headquarters, has instructed relevant municipalities to restrict shipments of foods that exceed the provisional regulation level.

As for tap water, the Ministry of Health, Labour and Welfare notified departments and agencies concerned in the local governments of the necessity to avoid drinking tap water if the radioactive concentration of tap water exceeds the level indicated by the Nuclear Safety Commission from March 19 onward, and released the monitoring results by the local governments concerned, as well.

(4) Measures for additional protected area

The environmental monitoring data have revealed that there were areas where radioactive materials were accumulated at high levels even outside of the 20 km radius. Therefore, the Prime Minister as Director-General of NERHQs instructed the heads of relevant local governments on April 22 that deliberate evacuation areas needed to be established for specific areas beyond the 20 km radius, and area between the 20 km and 30 km radius which had been set as in-house evacuation areas, excluding the areas within it qualifying as deliberate evacuation areas, was renamed an “evacuation-prepared area in case of emergency,” since the residents there could possibly be instructed to stay in-house or evacuate in the case of future emergencies. In this way, residents inside the deliberate evacuation area were directed to evacuate in a planned manner, and residents inside of the area prepared for evacuation in case of emergency were directed to prepare for evacuation or for in-house evacuation in case of an emergency.

6. Discharge of Radioactive Materials to the Environment

(1) Amount of radioactive materials discharged to the atmosphere

On April 12, NISA and the Nuclear Safety Commission each announced the total discharged amount of radioactive materials to the atmosphere so far.

NISA estimated the total discharged amount from reactors at the Fukushima Dai-ichi NPSs according to the results analyzing reactor status, etc. by JNES and presumed that approximately 1.3x 10^{17} Bq of iodine-131 and approximately 6.1x 10^{15} Bq of cesium-137 were discharged. Subsequently, JNES re-analyzed the status of the reactors based on the report which NISA collected on May 16 from TEPCO on the plant data immediately after the accident occurred. Based on this analysis of reactor status and others by JNES, NISA estimated that the total discharged amount of iodine-131 and cesium-137 were approximately 1.6 x 10^{17} Bq and 1.5 x 10^{16} Bq, respectively. The Nuclear Safety Commission estimated the amount of certain nuclides discharged into the atmosphere (discharged between March 11 to April 5) with assistance from the Japan Atomic Energy Agency (JAEA) through back calculations, based on the data of environmental monitoring and air diffusion calculation; the estimations are 1.5 x 10^{17} Bq for iodine-131 and 1.2 x 10^{16} Bq for cesium-137. The discharged amount since early April has been declining and is about 10^{11} Bq/h to 10^{12} Bq/h in iodine-131 equivalent.

(2) Discharged amount of radioactive materials to seawater

Water containing radioactive materials diffused from the RPV leaked into the PCV at the Fukushima Dai-ichi NPS. Also, because of water injections into the reactors from the outside for cooling, some injected water leaked from the PCVs and accumulated in reactor buildings and turbine buildings. The management of contaminated water in reactor buildings and turbine buildings became a critical issue from the standpoint of workability in the buildings, and the management of contaminated water outside of the buildings became a critical issue from the standpoint of preventing the diffusion of radioactive materials into the environment.

On April 2, it was discovered that highly contaminated water with a radiation level of over 1000mSv/h had accumulated in the pit of power cables near the water intake of Unit 2 of the Fukushima Dai-ichi NPS and it was flowing into the seawater. Despite that, the outflow was halted by stopping work on April 6, and the total discharged amount of radioactive materials was assumed to be approximately 4.7x 10^{15} Bq. As an emergency measure, it was decided that this highly contaminated water would be stored in tanks. However, as no tanks were available at the time, low-level radioactive water was discharged into the seawater from April 4 to April 10 in order to secure storage capacity for the contaminated water. The total amount of discharged radioactive materials was presumed to be approximately 1.5x 10^{11} Bq.

7. Situation regarding radiation exposure

The government has changed the dose limit for personnel engaged in radiation work from 100mSv to 250mSv in light of the present situation of the accident in order to prevent escalation of the accident. This was decided based on the information that a 1990 recommendation by the International Commission on Radiological Protection provided for 500mSv as the dose limit to avoid deterministic effects that has been set for personnel engaged in emergency rescue work.

With regard to the activities by personnel engaged in radiation work in TEPCO, there was no alternative but for the chief workers to carry personal dosimeters and observe radioactivity for their entire work group unit, because a lot of personal dosimeters had been soaked by seawater, rendering them unusable. Afterwards, as personal dosimeters became available, all workers have been able to carry personal dosimeters since April 1.

The status of exposure doses of personnel engaged in radiation work is as follows. As of May 23, the total number of workers that had entered the area was 7,800, with an average exposure dose of 7.7mSv. Thirty of these workers had exposure doses above 100mSv. The internal exposure measurement of the radiation workers has been delayed and the exposure dose, including internal exposure of a certain number of workers, could exceed 250mSv in the future. On March 24, two workers stepped into accumulated water and their exposure doses have been estimated at less than 2 or 3Sv.

As for radiation exposure to residents in the vicinity, no cases of harm to health were found in 195,345 (the number as of May 31) residents who received screening in Fukushima Prefecture. All 1,080 children who went through thyroid gland exposure evaluation received results lower than the screening level.

The estimation and the evaluation of exposure doses of residents in the vicinity, etc. are planned to be carried out through the use of the results of environmental monitoring, in a prompt manner after the survey of evacuation routes and activities conducted mainly by Fukushima Prefecture, with the assistance of relevant ministries, agencies and the National Institute of Radiological Science, etc.

8. Cooperation with the International Community

Since the occurrence of this nuclear accident, experts have visited Japan from the United States, France, Russia, the Republic of Korea, China and the United Kingdom, exchanged views with relevant organizations in Japan, and given significant amounts of advice regarding stabilizing the nuclear reactors and the spent fuel pools, preventing the diffusion of radioactive materials, and implementing countermeasures against radioactive contaminated water. Japan has also received support from these countries and accepted materials necessary to undertake measures against the nuclear accident.

Experts from international organizations specializing in nuclear power such as the IAEA and the OECD Nuclear Energy Agency (OECD/NEA) visited Japan, providing advice and so on. Also, international organizations such as the IAEA, the World Health Organization (WHO), the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), and the International Commission on Radiological Protection (ICRP) have provided necessary information to the international community from their own technical standpoints.

9. Communication regarding the Accident

Initially after the occurrence of the accident, accurate and timely information was not sufficiently provided, typically demonstrated in delays in notifying local governments and municipalities, a situation which has been identified as a challenge in the field of communication regarding the accident. Transparency, accuracy and rapidity are important in domestic and international communication about accidents. The Japanese Government has utilized various levels and occasions such as press conferences at the Prime Minister's Office as well as press conferences held jointly by relevant parties. While these have been improved as needed, in reflection of what and how information should be provided, efforts to improve communication must be ongoing.

Briefings on important issues regarding the accident have been provided at press conferences by the Chief Cabinet Secretary to explain to the citizens the status of the accident as well as the views of the Japanese Government. TEPCO as a nuclear operator and NISA as a regulatory authority have also held press conferences on the status, details and development of the accident. The NSC has provided important technical advice and explained the evaluation of environmental monitoring results and other matters at press conferences.

Joint press conferences with the participation of relevant organizations have been held since April 25 in order to share information in an integrated manner. The Special Advisor to the Prime Minister, NISA, MEXT, the Secretariat of the NSC, TEPCO and other relevant organizations have participated in these joint press conferences.

As for inquiries from the general public, NISA has opened a counseling hotline on the nuclear accident, etc., and MEXT has also opened a counseling hotline on the impact of radiation on health, etc. Experts in academia, including members of the Atomic Energy Society of Japan, have actively explained and provided information to citizens.

Regarding the provision of information to the international community, the Japanese Government reported the accident status to the IAEA promptly pursuant to the Convention on Early Notification of a Nuclear Accident, beginning with the first report on 16:45 on March 11, immediately after the accident occurred. The Japanese Government has also reported the provisional evaluations of the International Nuclear and Radiological Event Scale (INES) when the government made its announcement regarding each evaluation.

As for opportunities for communication with countries across the world including neighboring countries, briefings to diplomats in Tokyo and press conferences for the foreign media have been conducted.

Notification to other countries including neighboring countries about the deliberate discharge of accumulated water of low-level radioactivity to the sea on April 4 was not satisfactory. This is a matter of sincere regret and every effort has been made to ensure sufficient communication with the international community and to reinforce the notification system.

Provisional evaluations based on the INES have been as follows:

(1) The first report

A provisional evaluation of Level 3 was issued, based on the determination by NISA at 16:36 on March 11 that the emergency core cooling system for water injection had become unusable. This situation occurred because motor-operated pumps lost function due to all-around losses of power at Units 1 and 2 of the Fukushima Dai-ichi NPS.

(2) The second report

On March 12, the PCV venting of Unit 1 of the Fukushima Dai-ichi NPS was conducted, and an explosion at its reactor building occurred. Based on environmental monitoring, NISA confirmed the emission of radioactive iodine, cesium and other radioactive materials, and made an announcement on a provisional evaluation of Level 4, because NISA determined that over approximately 0.1% of the radioactive materials in the reactor core inventory had been emitted.

(3) The third report

On March 18, as some incidents causing fuel damage had been identified at Units 2 and 3 of the Fukushima Dai-ichi NPS, NISA announced a provisional evaluation of Level 5 because the release of several percentages of the radioactive materials in the core inventory was determined to have occurred, based on the information ascertained at that moment, including that of the status of Unit 1.

(4) The fourth report

On April 12, regarding the accumulated amount of the radioactive materials released in the atmosphere, NISA announced its estimates from analytical results of the reactor status, etc., while NSC announced its estimates from dust monitoring data. (Please refer to VI. 1.) The estimation by NISA was 370,000TBq of radioactivity in iodine equivalent, while the calculated value based on the estimate of NSC was 630,000TBq. Based on these results, NISA announced a provisional evaluation of Level 7 the same day. One month had passed between the third and fourth reports, and the provisional INES evaluation should have been made more promptly and appropriately.

10. Future Efforts to Settle the Situation regarding the Accident

Regarding the current status of the Fukushima Dai-ichi NPS, freshwater has been injected to the RPVs through feed water systems at Units 1, 2 and 3 and has been continuously cooling the fuel in the RPVs. This has helped the temperature around the RPVs stay around 100 to 120 degrees Celsius at the lower part of RPVs. Review and preparation for circulation cooling systems, including the process of transferring and treating accumulated water, have been underway. Although the RPV and PCV of Unit 1 have been pressurized to some extent, steam generated in some units such as Units 2 and 3 seems to have leaked from the RPV and PCV, which appears to have condensed to form accumulations of water found in many places, including the reactor buildings, and some steam seems to have been released into the atmosphere. To respond to this issue, the status has been checked by dust sampling in the upper part of the reactor buildings, and discussion and preparation for covering the reactor buildings has been underway.

Cold shutdown of Units 5 and 6 has been maintained using residual heat removal systems with temporary seawater pumps and their reactor pressure has been stable, ranging from 0.01 ~ 0.02 MPa (Gauge pressure).

Details of the current status of each unit are listed in the following chart.

(Megapascal: Unit of pressure 1MPa = 9.9 atmosphere. Gauge pressure is absolute pressure minus atmospheric pressure.)
TEPCO announced the “Roadmap towards Restoration from the Accident in Fukushima Daiichi Nuclear Power Station” on April 17, with the following 2 steps as targets: "Radiation dose in steady decline" as "Step 1" and "Release of radioactive materials is under control and radiation dose is being significantly held down" as "Step 2." The timeline for achieving targets is tentatively set as follows: "Step 1" is set at around 3 months and "Step 2" is set at around 3 to 6 months after achieving Step 1.

Subsequently, coolant leakage from the PCVs was found in Units 1 and 2. Since the same risk was found in Unit 3, TEPCO announced a revised roadmap on May 17. In the new roadmap, basically no changes were made to the schedule, but new efforts were added, including reviewing and improving cooling reactors, adding measures against tsunamis and aftershocks, and improving the work environment for workers.

In particular, in the review of the issues regarding the “Reactors,” the establishment of a “circulation cooling system” in which contaminated water accumulated in buildings (accumulated water), etc. is processed and reused for water injection into reactors, was prioritized for “cold shutdown” in Step 2.

The NERHQs also presented an approach toward settling the situation and that related to the evacuation area in the announcement, “Temporary approach policy for measures for nuclear sufferers,” of May 17.

11. Responses at Other Nuclear Power Stations

On March 30, NISA instructed all electric power companies and related organizations to implement emergency safety measures at all NPSs, in order to prevent the occurrence of nuclear disasters and core damage, etc. caused by tsunami-triggered total AC power loss, on the basis of the latest knowledge gained from the accident at the Fukushima NPSs. On May 6, NISA carried out on-site inspections at all NPSs (except the Onagawa NPS, Fukushima Dai-ichi and Fukushima Dai-ni NPS), and confirmed that emergency safety measures were appropriately implemented at these NPSs. On May 18, NISA received an implementation status report from the Onagawa NPS, where work to prepare against tsunamis was delayed after it was hit by the tsunamis. Regarding the Fukushima Dai-ni NPS, which achieved a stable condition after cold shutdown on April 21, NISA also instructed the NPS to implement emergency safety measures, and received an implementation status report from it on May 20. NISA confirmed that all the nuclear power stations in Japan have appropriately arranged measures against total AC power loss, etc. which are expected to be implemented immediately as emergency safety measures.

Based on the presumed causes of the accident and the additional knowledge gained from the accident, which are stated in this report, and the lessons learned from the accident, which are mentioned in Section 12, NISA and other relevant ministries are to improve and strengthen the emergency safety measures that have been put in place. NISA will strictly verify the implementation status of enhanced measures by the nuclear operators and promptly come up with mid- and long-term measures.

The Headquarters for Earthquake Research Promotion of MEXT has estimated that within the next 30 years there is an 87% percent chance of an imminent magnitude 8 earthquake in the Tokai region near the Hamaoka Nuclear Power Station of Chubu Electric Power Co., Inc. As this is accompanied by increasing concerns over the high possibility of a large-scale tsunami resulting from the envisioned earthquake, the government has placed its highest priority on public safety above all else, and, determining that the operation of all Units at the Hamaoka NPS should be halted until mid- to long-term countermeasures such as the construction of an embankment that can sufficiently withstand a tsunami resulting from the envisioned Tokai Earthquake are implemented, requested on May 6 that Chubu Electric Power Co., Inc., halt all reactors at the NPS. Chubu Electric Power Co., Inc. accepted this request and stopped operation of all the Units by May 14.

12. Lessons Learned from the Accident Thus Far

The Fukushima NPS accident has the following aspects: it was triggered by a natural disaster; it led to a severe accident with damage to nuclear fuel, Reactor Pressure Vessels and Primary Containment Vessels; and accidents involving multiple reactors arose at the same time. Moreover, as nearly three months have passed since the occurrence of the accident, a mid- to long-term initiative is needed to settle the situation imposing a large burden on society, such as a long-term evacuation of many residents in the vicinity, as well as having a major impact on industrial activities, including the farming and livestock industries in the related area. There are thus many aspects different from the accidents in the past at the Three Mile Island Nuclear Power Plant and the Chernobyl Nuclear Power Plant.

The accident is also characterized by the following aspects. Emergency response activities had to be performed in a situation where the earthquake and tsunami destroyed the social infrastructure such as electricity supply, communication and transportation systems across a wide area in the vicinity. The occurrence of aftershocks frequently impeded various accident response activities.

This accident led to a severe accident, shook the trust of the public, and warned those engaged in nuclear energy of their overconfidence in nuclear safety. It is therefore important to learn lessons thoroughly from this accident. The lessons are being presented classified into five categories at this moment, bearing in mind that the most important basic principle in securing nuclear safety is having defenses in depth.

Thus the lessons that have been learned to date are presented as classified in five categories. We consider it inevitable to carry out a fundamental review on nuclear safety measures in Japan based on these lessons. While some of them are specific to Japan, these specific lessons have been included regardless, from the standpoint of showing the overall structure of the lessons.

The lessons in category 1 are those learned based on the fact that this accident has been a severe accident, and from reviewing the sufficiency of preventive measures against a severe accident.

The lessons in category 2 are those learned from reviewing the adequacy of the responses to this severe accident.

The lessons in category 3 are those learned from reviewing the adequacy of the emergency responses to the nuclear disaster in this accident.

The lessons in category 4 are those learned from reviewing the robustness of the safety infrastructure established at nuclear power stations.

The lessons in category 5 are those learned from reviewing the thoroughness in safety culture while summing up all the lessons.

Lessons in category 1

Strengthen preventive measures against a severe accident

(1) Strengthen measures against earthquakes and tsunamis

The earthquake was an extremely massive one caused by plurally linked seismic centers. As a result, at the Fukushima Dai-ichi Nuclear Power Station, the acceleration response spectra of seismic ground motion observed on the base mat exceeded the acceleration response spectra of the design basis seismic ground motion in a part of the periodic band. Although damage to the external power supply was caused by the earthquake, no damage caused by the earthquake to systems, equipment or devices important for nuclear reactor safety at nuclear reactors has been confirmed. However, further investigation should be conducted as the details regarding this situation remain unknown.

The tsunamis which hit the Fukushima Dai-ichi Nuclear Power Station were 14-15m high, substantially exceeding the height assumed under the design of construction permit or the subsequent evaluation. The tsunamis severely damaged seawater pumps, etc., causing the failure to secure the emergency diesel power supply and reactor cooling function. The procedural manual did not assume flooding from a tsunami, but rather only stipulated measures against a backrush. The assumption on the frequency and height of tsunamis was insufficient, and therefore, measures against large-scale tsunamis were not prepared adequately.

From the viewpoint of design, the range of an active period for a capable fault which needs to be considered in the seismic design for a nuclear power plant is considered within 120,000-130,000 years (50,000 years in the old guideline). The recurrence of large-scale earthquakes is expected to be appropriately considered. Moreover, residual risks must be considered. Compared with the design against earthquake, the design against tsunamis has been performed based on tsunami folklore and indelible traces of tsunami, not on adequate consideration of the recurrence of large-scale earthquakes in relation to a safety goal to be attained.

Reflecting on the above issues, we will consider the handling of plurally linked seismic centers as well as the strengthening of the quake resistance of external power supplies. Regarding tsunamis, from the viewpoint of preventing a severe accident, we will assume appropriate frequency and adequate height of tsunamis in consideration of a sufficient recurrence period for attaining a safety goal. Then, we will perform a safety design of structures, etc. to prevent the impact of flooding of the site caused by tsunamis of adequately assumed heights, in consideration of the destructive power of tsunamis. While fully recognizing a possible risk caused by the flooding into buildings of tsunamis exceeding the ones assumed in design, we will take measures from the viewpoint of having defenses in depth, to sustain the important safety functions by considering flooded sites and the huge destructive power of run-up waves.

(2) Ensure power supplies

A major cause of this accident was the failure to secure the necessary power supply. This was caused by the facts that power supply sources were not diversified from the viewpoint of overcoming vulnerability related to failures derived from a common cause arising from an external event, and that the installed equipment such as a switchboard did not meet the specifications that could withstand a severe environment such as flooding. Moreover, it was caused by the facts that battery life was short compared with the time required for restoration of the AC power supply and that a time goal required for the recovery of the external power supply was not clear.

Reflecting on the above facts, Japan will secure a power supply at sites for a longer time set forth as a goal, even in severe circumstances of emergencies, through the diversification of power supply sources by preparing various emergency power supply sources such as air-cooled diesel generators, gas turbine generators, etc., deploying power-supply vehicles and so on, as well as equipping switchboards, etc. with high environmental tolerance and generators for battery charging, and so on.

(3) Ensure robust cooling functions of reactors and PCVs

In this accident, the final place for release of heat (the final heat sink) was lost due to the loss of function of the seawater pumps. Although the reactor cooling function of water injection was activated, core damage could not be prevented due to the drain of the water source for injection, the loss of power supplies, etc., and furthermore, the PCV cooling functions also failed to run well. Thereafter, difficulties remained in reducing the reactor pressure and, moreover, in injecting water after the pressure was reduced, because the water injection line into a reactor through the use of heavy machinery such as fire engines, etc. had not been developed as measures for accident management. In this manner, the loss of cooling functions of the reactors and PCVs aggravated the accident.

Reflecting on the above issues, Japan will secure robust alternative cooling functions for its reactors and PCVs by securing alternative final heat sinks for a durable time. This will be pursued through such means as diversifying alternative water injection functions, diversifying and increasing sources for injection water, and introducing air-cooling systems.

(4) Ensure robust cooling functions of spent fuel pools

In the accident, the loss of power supplies caused the failure to cool the spent fuel pools, requiring actions to prevent a severe accident due to the loss of cooling functions of the spent fuel pools concurrently with responses to the accident of the reactors. Until now, a risk of a major accident of a spent fuel pool had been deemed small compared with that of a core event and measures such as alternative means of water injection into spent fuel pools, etc. had not been considered.

Reflecting on the above issues, Japan will secure robust cooling measures by introducing alternative cooling functions such as a natural circulation cooling system or an air-cooling system, as well as alternative water injection functions, in order to maintain the cooling of spent fuel pools even in case of the loss of power supplies.

(5) Thorough accident management (AM) measures

The accident reached the level of a so-called “severe accident.” Accident management measures had been introduced to the Fukushima NPSs to minimize the possibilities of severe accidents and to mitigate consequences in the case of severe accidents. However, looking at the situation of the accident, although some portion of the measures functioned, such as the alternative water injection from the fire extinguishing water system to the reactor, the rest did not fulfill their roles within various responses, including ensuring the power supplies and the reactor cooling function, with the measures turning out to be inadequate. In addition, accident management measures are basically regarded as voluntary efforts by operators, not legal requirements, and so the development of these measures lacked strictness. Moreover, the guideline for accident management has not been reviewed since their development in 1992 and has not been strengthened or improved.

Reflecting on the above issues, we will change the accident management measures from voluntary safety efforts by operators to legal requirements, and develop accident management measures to prevent severe accidents, including a review of design requirements as well, by utilizing a probabilistic safety assessment approach.

(6) Response to issues concerning the siting with more than one reactor

The accident occurred at more than one reactor at the same time, and the resources needed for accident response had to be dispersed. Moreover, as two reactors shared the facilities, the physical distance between the reactors was small and so on. The development of an accident occurring at one reactor affected the emergency responses at nearby reactors.

Reflecting on the above issues, Japan will take measures to ensure that emergency operations at a reactor where an accident occurs can be conducted independently from operation at other reactors if one power station has more than one reactor. Also, Japan will assure the engineering independence of each reactor to prevent an accident at one reactor from affecting nearby reactors. In addition, Japan will promote the development of a structure that enables each unit to carry out accident responses independently, by choosing a responsible person for ensuring the nuclear safety of each unit.

(7) Consideration of NPS arrangement in basic designs

Response to the accident became difficult since the spent fuel storage pools were located at a higher part of the reactor buildings. In addition, contaminated water from the reactor buildings reached the turbine buildings, meaning that the spread of contaminated water to other buildings has not been prevented.

Reflecting on the above issues, Japan will promote the adequate placement of facilities and buildings at the stage of basic design of NPS arrangement, etc. in order to further ensure the conducting of robust cooling, etc. and prevent an expansion of impacts from the accident, in consideration of the occurrence of serious accidents. In this regard, as for existing facilities, additional response measures will be taken to add equivalent levels of functionality to them.

(8) Ensuring the water tightness of essential equipment facilities

One of the causes of the accidents is that the tsunami flooded many essential equipment facilities including the component cooling seawater pump facilities, the emergency diesel generators, the switchboards, etc., impairing power supply and making it difficult to ensure cooling systems.

Reflecting on the above issues, in terms of achieving the target safety level, Japan will ensure the important safety functions even in the case of tsunamis greater than ones expected by the design or floods hitting facilities located near rivers. In concrete terms, Japan will ensure the water-tightness of important equipment facilities by installing watertight doors in consideration of the destructive power of tsunamis and floods, blocking flooding routes such as pipes, and installing drain pumps, etc.

Lessons in Category 2
Enhancement of response measures against severe accidents

(9) Enhancement of measures to prevent hydrogen explosions

In the accident, an explosion probably caused by hydrogen occurred at the reactor building in Unit 1 at 15:36 on March 12, 2011, as well as at the reactor in Unit 3 at 11:01 on March 14. In addition, an explosion that was probably caused by hydrogen occurred at the reactor building in Unit 4 around 06:00 on March 15, 2011. Consecutive explosions occurred as effective measures could not be taken beginning from the first explosion. These hydrogen explosions aggravated the accident. A BWR inactivates a PCV and has a flammability control system in order to maintain the soundness of the PCV against design basis accidents. However, it was not assumed that an explosion in reactor buildings would be caused by hydrogen leakage, and as a matter of course, hydrogen measures for reactor buildings were not taken.

Reflecting on the above issues, we will enhance measures to prevent hydrogen explosions, such as by installing flammability control systems that would function in the event of a severe accident in reactor buildings, for the purpose of discharging or reducing hydrogen in the reactor buildings, in addition to measures to address hydrogen within the PCVs.

(10) Enhancement of containment venting system

In the accident, there were problems in the operability of the containment venting system. Also, as the function of removing released radioactive materials in the containment venting system was insufficient, the system was not effective as an accident management countermeasure. In addition, the independence of the vent line was insufficient and it may have had an adverse effect on other parts through connecting pipes, etc.

Reflecting on the above issues, we will enhance the containment venting system by improving its operability, ensuring its independence, and strengthening its function of removing released radioactive materials.

(11) Improvements to the accident response environment

In the accident, the radiation dosage increased in the main control room and operators could not enter the room temporarily, and the habitability in the main control room has decreased, as it still remains difficult to work in that room for an extended period. Moreover, at the on-site emergency station, which serves as a control tower for all emergency measures at the site, the accident response activities were affected by increases in the radiation dosage as well as by the worsening of the communication environment and lighting.

Reflecting on the above issues, we will enhance the accident response environment that enables continued accident response activities even in case of severe accidents through measures such as strengthening radiation shielding in the control rooms and the emergency centers, enhancing the exclusive ventilation and air conditioning systems on site, as well as strengthening related equipment, including communication and lightening systems, without use of AC power supply.

(12) Enhancement of the radiation exposure management system at the time of the accident

As these accidents occurred, although adequate radiation management became difficult as many of the personal dosimeters and dose reading devices became unusable due to their submergence in seawater, personnel engaged in radiation work had to work on site. In addition, measurements of concentration of radioactive materials in the air were delayed, and as a result the risk of internal exposure increased.

Reflecting on the above issues, we will enhance the radiation exposure management system at the time an accident occurs by storing the adequate amount of personal dosimeters and protection suits and gears for accidents, developing a system in which radioactive management personnel can be expanded at the time of the accident and improving the structures and equipment by which the radiation doses of radiation workers are measured promptly.

(13) Enhancement of training responding to severe accidents

Effective training to respond to accident restoration at nuclear power plants and adequately work and communicate with relevant organizations in the wake of severe accidents was not sufficiently implemented up to now. For example, it took time to establish communication between the emergency office inside the power station, the Nuclear Emergency Response Headquarters and the Local Headquarters and also to build a collaborative structure with the Self-Defense Forces, the Police, Fire Authorities and other organizations which played important roles in responding to the accident. Adequate training could have prevented these problems.

Reflecting on the above issues, we will enhance training to respond to severe accidents by promptly building a structure for responding to accident restoration, identifying situations within and outside power plants, facilitating the gathering of human resources needed for securing the safety of residents and collaborating effectively with relevant organizations.

(14) Enhancement of instrumentation to identify the status of the reactors and PCVs

Because the instrumentation of the reactors and PCVs did not function sufficiently during the severe accident, it was difficult to promptly and adequately obtain important information to identify how the accident was developing, such as the water levels and the pressure of reactors, and the sources and amounts of released radioactive materials.

In respond to the above issues, we will enhance the instrumentation of reactors and PCVs, etc. to enable them to function effectively even in the wake of severe accidents.

(15) Central control of emergency supplies and equipment and setting up rescue teams

Logistic support has been provided diligently by those responding to the accident and supporting affected people with supplies and equipment gathered mainly at J Village. However, because of the damage from the earthquake and tsunami in the surrounding areas shortly after the accident, we could not promptly or sufficiently mobilize rescue teams to help provide emergency supplies and equipment or support accident control activities. This is why the on-site accident response did not sufficiently function.

Reflecting on the above issues, we will introduce systems for centrally controlling emergency supplies and equipment and setting up rescue teams for operating such systems in order to provide emergency support smoothly even under harsh circumstances.

Lessons in Category 3
Enhancement of nuclear emergency responses

(16) Responses to combined emergencies of both large-scale natural disasters and prolonged nuclear accident

There was tremendous difficulty in communication and telecommunications, mobilizing human resources, and procuring supplies among other areas when addressing the nuclear accident that coincided with a massive natural disaster. As the nuclear accident has been prolonged, some measures such as the evacuation of residents, which was originally assumed to be a short-term measure, have been forced to be extended.

Reflecting on the above issues, we will prepare the structures and environments where appropriate communication tools and devices and channels to procure supplies and equipment will be ensured in the case of concurrent emergencies of both a massive natural disaster and a prolonged nuclear accident. Also, assuming a prolonged nuclear accident, we will enhance emergency response preparedness including effective mobilization plans to gather human resources in various fields who are involved with accident response and support for affected persons.

(17) Reinforcement of environmental monitoring

Currently, local governments are responsible for environmental monitoring in an emergency. However, appropriate environmental monitoring was not possible immediately after the accident because the equipment and facilities for environmental monitoring owned by local governments were damaged by the earthquake and tsunami and the relevant individuals had to evacuate from the Off-site Center Emergency Response Center. To bridge these gaps, MEXT has conducted environmental monitoring in cooperation with relevant organizations.

Reflecting on the above issues, the Government will develop a structure through which the Government will implement environmental monitoring in a reliable and well-planned manner during emergencies.

(18) Establishment of a clear division of labor between relevant central and local organizations

Communication between local and central offices, as well as with other organizations, was not achieved to a sufficient degree, due to the lack of communication tools immediately after the accident and also due to the fact that the roles and responsibilities of each side were not clearly defined. Specifically, responsibility and authority were not clearly defined in the relationship between the NERHQs Nuclear Emergency Response Headquarters and Local NERHQs Headquarters, between the Government and TEPCO, between the Head Office of TEPCO and the NPS on site, or among the relevant organizations in the Government. Especially, communication was not sufficient between the government and the main office of TEPCO as the accident initially began to unfold.

Reflecting on the above issues, we will review and define roles and responsibilities of relevant organizations including the NERHQs, clearly specify roles, responsibilities and tools for communication while also improving institutional mechanisms.

(19) Enhancement of communication relevant to the accident

Communication to residents in the surrounding area was difficult because communication tools were damaged by the large-scale earthquake. The subsequent information to residents in the surrounding area and local governments was not always provided in a timely manner. The impact of radioactive materials on health and the radiological protection guidelines of the ICRP, which are the most important information for residents in the surrounding area and others, were not sufficiently explained. Japan focused mainly on making accurate facts publicly available to its citizens and has not sufficiently presented future outlooks on risk factors, which sometimes gave rise to concerns about future prospects.

Reflecting on the above issues, we will reinforce the adequate provision of information on the accident status and response, along with appropriate explanations of the effects of radiation to the residents in the vicinity. Also, we will keep in mind having the future outlook on risk factors included in the information delivered while incidents are still ongoing.

(20) Enhancement of responses to assistance from other countries and communication to the international community

The Japanese Government could not appropriately respond to the assistance offered by countries around the world because no specific structure existed within the Government to link such assistance offered by other countries to domestic needs. Also, communication with the international community including prior notification to neighboring countries and areas on the discharge of water with low-level radioactivity to the sea was not always sufficient.

Reflecting on the above-mentioned issues, the Japanese Government will contribute to developing a global structure for effective responses by cooperating with the international community, for example, developing a list of supplies and equipment for effective responses to any accident, specifying contact points for each country in advance in case of an accident, enhancing the information sharing framework through improvements to the international notification system, and providing faster and more accurate information to enable the implementation of measures that are based upon scientific evidence.

(21) Adequate identification and forecasting of the effect of released radioactive materials

The System for Prediction of Environmental Emergency Dose Information (SPEEDI) could not make proper predictions on the effect of radioactive materials as originally designed, due to the lack of information on release sources. Even under such restricted conditions, it should have been utilized as a reference of evacuation activities and other purposes by presuming diffusion trends of radioactive materials under certain assumptions. Although the results generated by SPEEDI are now being disclosed, disclosure should have been conducted from the initial stage.

The Japanese Government will improve its instrumentation and facilities to ensure that release source information can be securely obtained. Also, it will develop a plan to effectively utilize SPEEDI and other systems to address various emergent cases and disclose the data and results from SPEEDI, etc. from the earliest stages of such cases.

(22) Clear definition of widespread evacuation areas and radiological protection guidelines in nuclear emergency

Immediately after the accident, an Evacuation Area and In-house Evacuation Area were established, and cooperation of residents in the vicinity, local governments, police and relevant organizations facilitated the fast implementation of evacuation and “stay-in-house” instruction. As the accident became prolonged, the residents had to be evacuated or stay within their houses for long periods. Subsequently, however, it was decided that guidelines of the ICRP and IAEA, which have not been used before the accident, would be used when establishing Deliberate Evacuation Area and Emergency Evacuation Prepared Area. The size of the protected area defined after the accident was considerably larger than a 8 to 10km radius from the NPS, which had been defined as the area where focused protection measures should be taken.

Based on the experiences gained from the accident, the Japanese Government will make much greater efforts to clearly define evacuation areas and guidelines for radiological protection in nuclear emergencies.

Lessons in Category 4
Reinforcement of safety infrastructure

(23) Reinforcement of safety regulatory bodies

Governmental organizations have different responsibilities for securing nuclear safety. For example, NISA of METI is responsible for safety regulation as a primary regulatory body, while the Nuclear Safety Commission of the Cabinet Office is responsible for regulation monitoring of the primary governmental body, and relevant local governments and ministries are in charge of emergency environmental monitoring. This is why it was not clear where the primary responsibility lies in ensuring citizens’ safety in an emergency. Also, we cannot deny that the existing organizations and structures hindered the mobilization of capabilities in promptly responding to such a large-scale nuclear accident.

Reflecting on the above issues, the Japanese Government will separate NISA from METI and start to review implementing frameworks, including the NSC and relevant ministries, for the administration of nuclear safety regulations and for environmental monitoring.

(24) Establishment and reinforcement of legal structures, criteria and guidelines

Reflecting on this accident, various challenges have been identified regarding the establishment and reinforcement of legal structures on nuclear safety and nuclear emergency preparedness and response, and related criteria and guidelines. Also, based on the experiences of this nuclear accident, many issues will be identified as ones to be reflected in the standards and guidelines of the IAEA.

Therefore, the Japanese Government will review and improve the legal structures governing nuclear safety and nuclear emergency preparedness and response, along with related criteria and guidelines. During this process, it will reevaluate measures taken against age-related degradation of existing facilities, from the viewpoint of structural reliability as well as the necessity of responding to new knowledge and expertise, including progress in system concepts. Also, the Japanese Government will clarify technical requirements based on new laws and regulations or on new findings and knowledge for facilities that have already been approved and licensed-- in other words, it will clarify the status of retrofitting in the context of the legal and regulatory framework. The Japanese Government will make every effort to contribute to improving safety standards and guidelines of the IAEA by providing related data.

(25) Human resources for nuclear safety and nuclear emergency preparedness and responses

All the experts on severe accidents, nuclear safety, nuclear emergency preparedness and response, risk management and radiation medicine should get together to address such an accident by making use of the latest and best knowledge and experience. Also, it is extremely important to develop human resources in the fields of nuclear safety and nuclear emergency preparedness and response in order to ensure mid- and long-term efforts on nuclear safety as well as to bring restoration to the current accident.

Reflecting on the above-mentioned issues, the Japanese Government will enhance human resource development within the activities of nuclear operators and regulatory organizations along with focusing on nuclear safety education, nuclear emergency preparedness and response, crisis management and radiation medicine at educational organizations.

(26) Ensuring the independence and diversity of safety systems

Although multiplicity has been valued until now in order to ensure the reliability of safety systems, avoidance of common cause failures has not been carefully considered, and independence and diversity have not been sufficiently secured.

Therefore, the Japanese Government will ensure the independence and diversity of safety systems so that common cause failures can be adequately addressed and the reliability of safety functions can be further improved.

(27) Effective use of probabilistic safety assessment (PSA) in risk management

PSA has not always been effectively utilized in the overall reviewing processes or in risk reduction efforts at nuclear power plants. While a quantitative evaluation of risks of quite rare events such as a large-scale tsunami is difficult and may be associated with uncertainty even within PSA, Japan has not made sufficient efforts to improve the reliability of the assessments by explicitly identifying the uncertainty of these risks.

Considering knowledge and experiences regarding uncertainties, the Japanese Government will further actively and swiftly utilize PSA while developing improvements to safety measures, including effective accident management measures, based on PSA.

Lessons in Category 5

Thoroughly instill a safety culture

(28) Thoroughly instill a safety culture

All those involved with nuclear energy should be equipped with a safety culture. “Nuclear safety culture” is stated as, “A safety culture that governs the attitudes and behavior in relation to safety of all organizations and individuals concerned must be integrated in the management system” (IAEA, Fundamental Safety Principles, SF-1, 3.13). Learning this message and putting it into practice is the starting point, the duty and the responsibility of those who are involved with nuclear energy. Without a safety culture, there will be no continual improvement of nuclear safety.

Reflecting on the current accident, the nuclear operators whose organization and individuals have primary responsibility for securing safety should look at every item of knowledge and every finding and confirm whether or not they indicate a vulnerability of a plant. They should reflect as to whether they have been serious in introducing appropriate measures for improving safety, when they are not confident that risks concerning the public safety of the plant remain low.

Also, organizations or individuals involved in national nuclear regulations, as those who responsible for ensuring the nuclear safety of the public, should reflect whether they have been serious in addressing new knowledge in a responsive and prompt manner, not leaving any doubts in terms of safety.

Reflecting on this viewpoint, Japan will establish a safety culture by going back to the basics, namely that pursuing defenses in depth is essential for ensuring nuclear safety, by constantly learning professional knowledge on safety, and by maintaining an attitude of trying to identify weaknesses as well as room for improvement in the area of safety.

13. Conclusion

The nuclear accident that occurred at the Fukushima Nuclear Power Station (NPS) on March 11, 2011 was caused by an extremely massive earthquake and tsunami rarely seen in history and resulted in an unprecedented serious accident that extended over multiple reactors simultaneously. Japan is extending its utmost efforts to confront and overcome this difficult accident.

In particular, at the accident site, people engaged in the work have been making every effort under severe conditions to settle the situation. It is impossible to resolve the situation without these contributions. The Japanese Government is determined to make its utmost efforts to support the people engaged in this work.

We take very seriously the fact that the accident, triggered by a natural disaster of an earthquake and tsunamis, became a severe accident due to such causes as the losses of power and cooling functions, and that consistent preparation for severe accidents was insufficient. In light of the lessons learned from the accident, Japan has recognized that a fundamental revision of its nuclear safety preparedness and response is inevitable.

As a part of this effort, Japan will promote the “Plan to Enhance the Research on Nuclear Safety Infrastructure” while watching the status of the process of settling the situation. This plan is intended to promote, among other things, research to enhance preparedness and responses against severe accidents through international cooperation, and to work to lead the results achieved for the improvement of global nuclear safety.

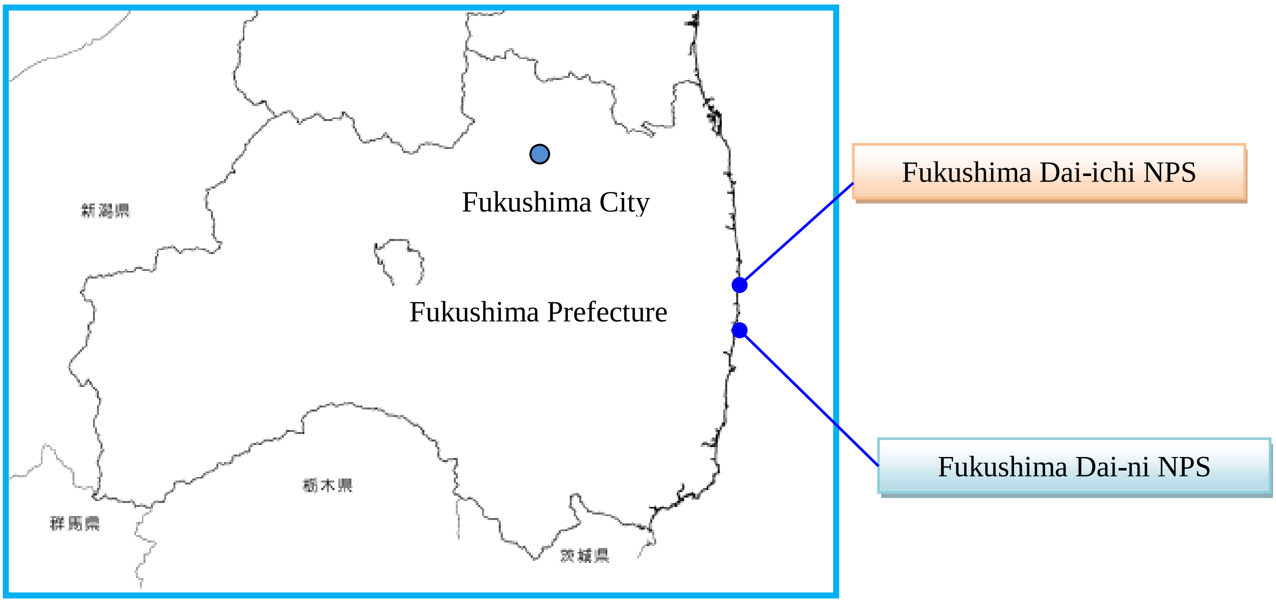
At the same time, it is necessary for Japan to conduct national discussions on the proper course for nuclear power generation while disclosing the actual costs of nuclear power generation, including the costs involved in ensuring safety.

Japan will update information on the accident and lessons learned from it in line with the future process of restoration of stable control and also further clarification of its investigations. Moreover, it will continue to provide such information and lessons learned to the International Atomic Energy Agency as well as to countries around the world.

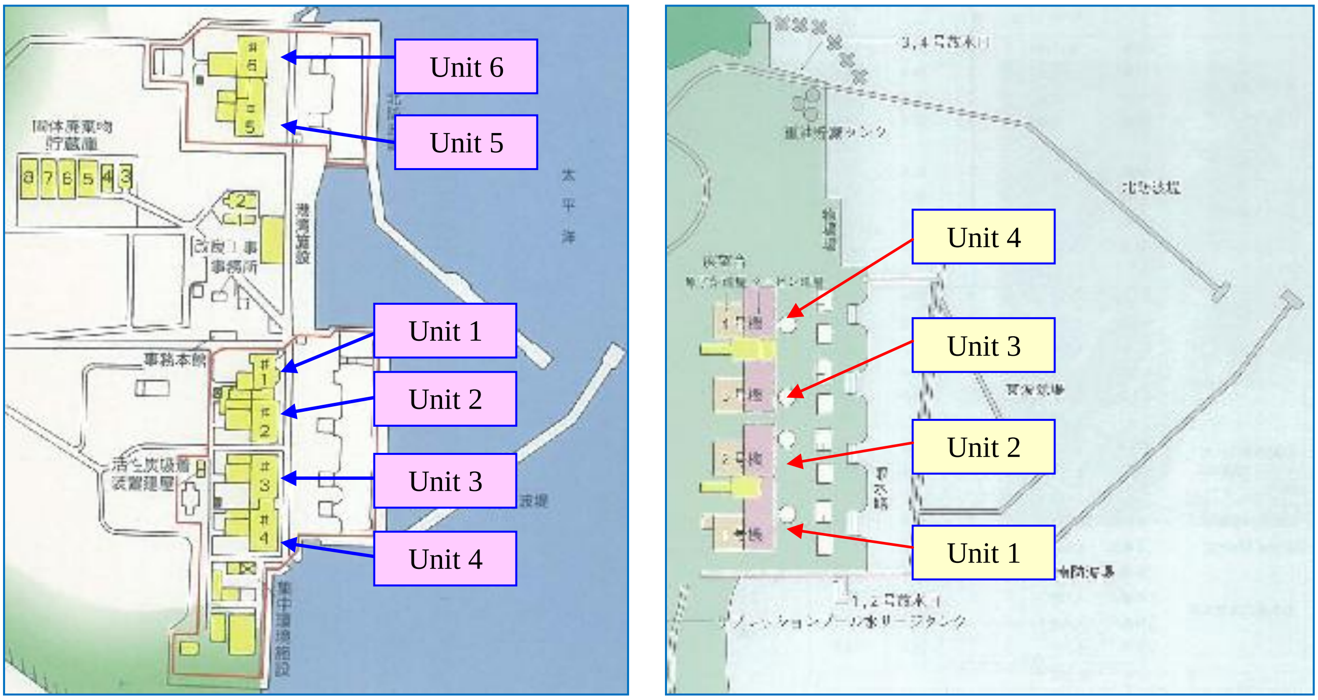
Moreover, we feel encouraged by the support towards restoration from the accident received from many countries around the world, to which we express our deepest gratitude, and we would sincerely appreciate continued support from the IAEA and countries around the world.

We are prepared to confront much difficulty towards restoration from the accident and also confident that we will be able to overcome this accident by uniting the wisdom and efforts of not only Japan but also the world.

Location of NPSs in the Tohoku District



Location of NPSs within Fukushima



Layouts of Fukushima Dai-ichi NPS and Fukushima Dai-ni NPS

Generation Facilities at the Fukushima Dai-ichi NPS

<table>
<tr><td></td><td>Unit 1</td><td>Unit 2</td><td>Unit 3</td><td>Unit 4</td><td>Unit 5</td><td>Unit 6</td></tr>
<tr><td>Electric output (MWe)</td><td>460</td><td>784</td><td>784</td><td>784</td><td>784</td><td>1100</td></tr>
<tr><td>Commercial operation</td><td>1971/3</td><td>1974/7</td><td>1976/3</td><td>1978/10</td><td>1978/4</td><td>1979/10</td></tr>
<tr><td>Reactor model</td><td>BWR3</td><td colspan="3">BWR4</td><td colspan="2">BWR5</td></tr>
<tr><td>PCV model</td><td colspan="5">Mark-1</td><td>Mark-2</td></tr>
<tr><td>Number of fuel assemblies in the core</td><td>400</td><td>548</td><td>548</td><td>548</td><td>548</td><td>764</td></tr>
</table>

Generation Facilities at the Fukushima Dai-ni NPS

<table>
<tr><td></td><td>Unit 1</td><td>Unit 2</td><td>Unit 3</td><td>Unit 4</td></tr>
<tr><td>Electric output (MWe)</td><td>1100</td><td>1100</td><td>1100</td><td>1100</td></tr>
<tr><td>Commercial operation</td><td>1982/4</td><td>1984/2</td><td>1985/6</td><td>1987/8</td></tr>
<tr><td>Reactor model</td><td colspan="4">BWR5</td></tr>
<tr><td>PCV model</td><td>Mark-2</td><td colspan="3">Mark-2 Advance</td></tr>
<tr><td>Number of fuel assemblies in the core</td><td>764</td><td>764</td><td>764</td><td>764</td></tr>
</table>

Status of Each Unit at the Fukushima Dai-ichi NPS (As of May 31)

Unit No.	Unit 1	Unit 2	Unit 3	Unit 5	Unit 6
Situation of water injection into reactor	Injecting fresh water via a water supply line. Flow rate of injected water : 6.0 m^3/h	Injecting fresh water via a fire extinguishing and water supply line. Flow rate of injected water: 7.0m^3/h(via the fire protection line), 5.0m^3/h(via the feedwater line)	Injecting fresh water via the water supply line. Flow rate of injected water : 13.5 m^3/h	Water injection is unnecessary as the cooling function of the reactor cores are in normal operation.	
Reactor water level	Fuel range A : Off scale Fuel range B : -1,600mm	Fuel range A : -1,500mm Fuel range B : -2,150mm	Fuel range A:-1,850mm Fuel range B:-1,950mm	Shut down range measure ment 2,164mm	Shut down range measure ment 1,904mm
Reactor pressure	0.555MPa g(A) 1.508MPa g(B)	-0.011MPa g (A) -0.016MPa g (B)	-0.132MPa g (A) -0.108MPa g (B)	0.023 MPa g	0.010 MPa g
Reactor water temperature	(Collection impossible due to low system flow rate)			83.0°C	24.6 °C
Temperatures related to Reactor Pressure Vessel (RPV)	Feedwater nozzle temperature: 114.1 °C Temperature at the bottom head of RPV: 96.8 °C	Feedwater nozzle temperature: 111.5 °C Temperature at the bottom head of RPV: 110.6 °C	Feedwater nozzle temperature: 120.9 °C Temperature at the bottom head of RPV: 123.2 °C	(Monitoring water temperature in the reactors.)	
D/W Pressure, S/C Pressure	D/W: 0.1317 MPa abs S/C: 0.100 MPa abs	D/W: 0.030 MPa abs S/C: Off scale	D/W: 0.0999 Mpa abs S/C: 0.1855 MPa abs	-	
Status	We are working on ensuring the reliability of the cooling function by installing temporary emergency diesel generators and sea water pumps as well as receiving electricity from external power supplies at each plant.				

I. Introduction

The Tohoku District - off the Pacific Ocean Earthquake and tsunami caused by the earthquake attacked the Fukushima Dai-ichi and Fukushima Dai-ni Nuclear Power Stations (hereinafter referred to as Fukushima NPS) of Tokyo Electric Power Co. (TEPCO) at 14:46 on March 11, 2011 (JST, the same shall apply hereinafter) and a nuclear accident followed at an unprecedented scale and over a lengthy period.

For Japan, the situation has become extremely severe since countermeasures to deal with the nuclear accident have had to be carried out along with dealing with the broader disaster caused by the earthquake and tsunami.

This nuclear accident has turned to be a major challenge for Japan, and Japan is now responding to the situation, with the relevant domestic organizations working together, and with support from many countries around the world. The fact that this accident has raised concerns around the world about the safety of nuclear power generation is a matter which Japan takes with the utmost seriousness and remorse. Above all, Japan sincerely regrets causing anxiety for people all over the world about the release of radioactive materials. Currently, Japan is dealing with the issues and working towards restoration from the accident utilizing accumulated experience and knowledge. It is Japan's responsibility to share correct and precise information with the world continuously in terms of what happened at Fukushima NPS, including details about how the events progressed, and how Japan has been working to restore from the accidents. Japan also recognizes its responsibility to inform the world of the lessons it has learned from this process.

This report is prepared based on the recognition mentioned above, as the report from Japan for the International Atomic Energy Agency (IAEA) Ministerial Conference on Nuclear Safety which is convened in June 2011.

The Government-TEPCO Integrated Response Office is engaged in working toward restoration from the accidents under the supervision of Mr. Banri Kaieda, the Minister of Economy, Trade and Industry in conjunction with and joining forces with the Nuclear and Industrial Safety Agency, and TEPCO. Preparation of this report was carried out by the Government Nuclear Emergency Response Headquarters in considering the approach taken by the Government-TEPCO Integrated Response Office toward restoration and by hearing the opinions from outside experts. The work has been managed as a whole by Mr. Goshi Hosono, special advisor to the Prime Minister, who was designated by the Prime Minister in his capacity as Director-General of the Government Nuclear Emergency Response Headquarters.

This report is a preliminary accident report, and represents a summary of the evaluation of the accident and the lessons learned to date based on the facts gleaned about the situation obtained so far. In terms of the range of the summary, technical matters related to nuclear safety and nuclear emergency preparedness and responses at this moment are centered on, and issues related to compensation for nuclear damage and the wider societal effects and so on are not included.

On top of preparing this report, the Government has established "Investigation Committee on the Accident at the Fukushima Nuclear Power Stations" (hereinafter referred to as "the Investigation Committee") in order to provide an overall verification of the utility of countermeasures being taken against the accidents that have occurred at the Fukushima NPS. In the Investigation Committee, independence from Japan's existing nuclear energy administration, openness to the public and international community, and comprehensiveness in examining various issues related not only to technical elements but also to institutional aspects, are stressed. These concepts are used as the base to strictly investigate all activities undertaken so far, including activities by the Government in terms of countermeasures against accident. The contents of this report will also be investigated by the Investigation Committee, and the progress of the investigation activities will be released to the world.

Japan's basic policy is to release the information about this accident with a high degree of transparency. In terms of the preparation of this report under this policy, we have paid attention to providing as accurately as possible an exact description of the facts of the situation, together with an objective evaluation of countermeasures against the accident, providing a clear distinction between known and unknown matters. Factual descriptions are based on the things that were found by May 31, this year.

Japan intends to exert all its power to properly tackle the investigation and analysis of this accident, and to continue to provide information on its policy to both the IAEA and to the world as a whole.

II. Situation regarding Nuclear Safety Regulations and Other Regulatory Frameworks in Japan Before the Accident

This Chapter provides an overview of the legislative and regulatory framework for nuclear safety and nuclear emergency preparedness and responses.

1. Legislative and regulatory framework for nuclear safety

(1) Main laws and regulations

In the legislative framework for nuclear safety in Japan, in respect of the standards of IAEA, under the Atomic Energy Basic Act (Act No. 186 of 1955), which is at the top of the framework and defines basic philosophy for utilization of nuclear energy, the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (Act No. 166 of 1957; hereinafter referred to as the "Reactor Regulation Act") which provides for safety regulation by the Government and obligations of the operators, the Law for Prevention of Radiation Hazards due to Radioisotopes, etc., the Electricity Business Act, and the Act on Special Measures Concerning Nuclear Emergency, among others, have been put in place (Figure II-1-1). Other than these, the Nuclear Safety Commission (hereinafter referred to as "the NSC Japan") developed the guidelines to be used in the evaluationof the safety review and assessment conducted by the regulatory authority. These guidelines are also used when the regulatory authority conducts safetyreview and assessment, for the efficiency and facilitation of safety reviews and assessment by the Government (Table II-1-1).

As for dose limits, etc. for occupational exposure, etc., pursuant to the Law for Technical Standards of Radiation Hazards Prevention (Act No. 162 of 1958), the Radiation Review Council established in the Ministry of Education, Culture, Sports, Science and Technology (hereinafter referred to as "MEXT") is to discuss the introduction to Japan of the International Commission on Radiological Protection (ICRP)'s recommendations and to state its views on the policy of relevant Ministries and Agencies on the adoption of the recommendations.Furthermore, if technical standards concerning the prevention of radiation hazards provided for in the laws and regulations such as dose limits to radiation workers are to be established, the government agency having jurisdiction of the laws and regulations in question must consult the Radiation Review Council established in MEXT.

1) The Atomic Energy Basic Act

The Atomic Energy Basic Act prescribes the basic policy of the utilization of nuclear energy as follows: “the research, development and utilization of nuclear energy shall be limited to peaceful purposes, shall aim at ensuring safety, and shall be performed independently under democratic administration, and the results obtained shall be made public so as to actively contribute to international cooperation. ”

2)The Reactor Regulation Act

The Reactor Regulation Act stipulates, for commercial power reactors, The procedures for safety regulation and the licensing criteria for the permission of establishment of a reactor, approval of operational safety regulations, Operational Safety Inspection and decommissioning of a reactor, among others, as regulations necessary for the establishment and operation of a reactor. The act also provides for dispositions such as suspension of operation and license revocation and criminal punishment including imprisonment and fine.

The Ministerial Ordinances and other regulations established under the Reactor Regulation Act are the “Rules for Commercial Nuclear Power Reactors concerning the Installation, Operation, etc.” and the “Notice onDose Limits”.

3)The Electricity Business Act

The Electricity Business Act, which is applied not only to nuclear power generation but also to thermal and hydraulic power generation, is an act that comprehensively regulates the electricity business in Japan, and provides for the procedures for safety regulation including approval of design and construction method, pre-service inspection and facility periodic inspection for commercial power reactors.

The Ministeral Ordinances and other regulations which are established under the Electricity Business Act and are related with the safety regulation of nuclear installation are the Rules for the Electricity Business, the Ordinance of Establishing Technical Requirements for Nuclear Power Generation” the Ordinance of Establishing Technical Requirements on Nuclear Fuel Material for Power Generation and the Technical Requirements on Dose Equivalent, etc. due to Radiation Relating to Nuclear Power Generation Equipment.

(2) Licensing system

1) Licensing system

a. In establishing a commercial nuclear reactor, one must receive a license by the Minister of Economy, Trade and Industry in accordance with the provisions of the Reactor Regulation Act. When the Minister of Economy, Trade and Industry grants alicense, he/she must hear the views of the NSC Japan onthe technical competence of establishingand correctly implementing the operationof a reactor, and on whether there is no problem in reactor's emergency response.

b. A person who has obtained the license for reactor establishment(hereinafter referred to as the "licensee of reactor operation") must obtain an approval from the Minister of Economy, Trade and Industry on the construction plan prior to construction based on the provisions of the Electricity Business Act.

c. Regarding the fuel assembly to be loaded into the reactor, its design must be approved by the Minister of Economy, Trade and Industry based on the provisions of the Electricity Business Act.

2)Inspection system

a. In construction of a nuclear facility, the licensee of reactor operation must undergo and pass the pre-service inspection, which is conducted for each construction process by the Minister of Economy, Trade and Industry, based on the provisions of the Electricity Business Act.

b. The fuel assembly to be loaded into the reactor must undergo and pass the fuel assembly inspection conductedby the Minister of Economy, Trade and Industry, based on the provisions of the Electricity Business Act.

c. Aftercommissioning, the licensee of reactor operation must undergo the periodic inspection conducted by the Minister of Economy, Trade and Industry on the pre-determined components that are important in terms of safety.

d. As to the operational safety of the operating facilities, the licensee of reactor operation must undergo the Operational Safety Inspection conducted by Nuclear Safety Inspector of the Nuclear and Industrial Safety Agency (hereinafter referred to as "NISA"), relegated by the Minister of Economy, Trade and Industry.

e. As for inspection on physical protection, the compliance inspection of physical protection program is conducted in accordance with the provisions of the Reactor Regulation Act,

(3) Government Institutions

The Minister of Economy, Trade and Industry (hereinafter referred to as "METI") has jurisdiction over nuclear power reactor facility in Japan, and the Law for Establishment of the METI clearly stipulates that NISA is the "organization to ensure the safety of nuclear energy," and it is positioned as a special organization of the Agency for Natural Resources and Energy of METI. NISA has definitive authorities and functions for the safety regulation based on the provisions of the Reactor Regulation Act and the Electricity Business Act.

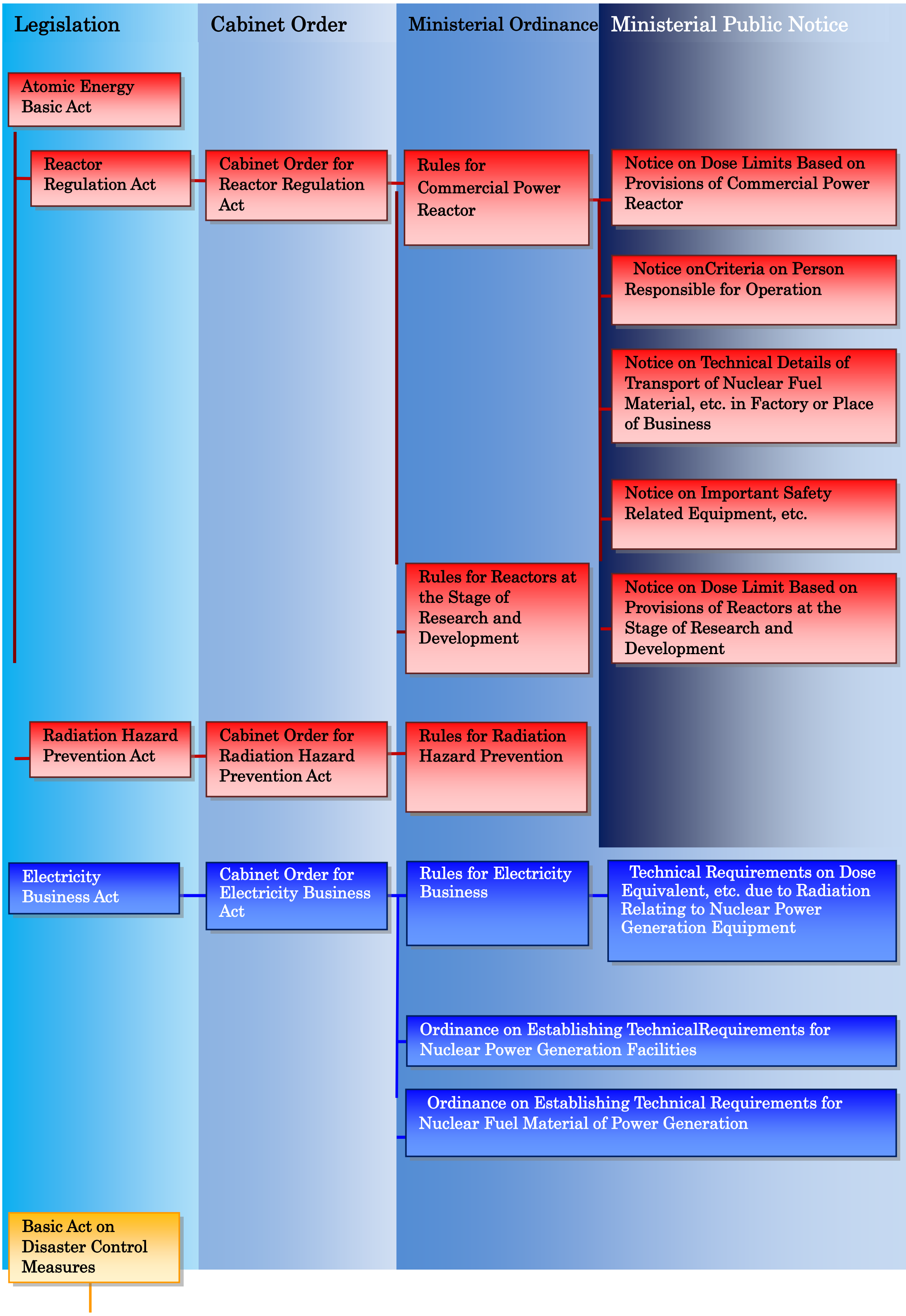
In concrete terms, the Minister of METI is responsible for the regulatory activities over the nuclear installation such as the license for reactor installment pursuant to the Reactor Regulation Act, and the approval of construction plan and pre-service inspection pursuant to the Electricity Business Act. The Minister of METI relagates these regulatory activities to NISA, which independently makes decisions or may consult its proposed decision with the Minister of METI without involvement of the Agency for Natural Resources and Energy.

The NSC Japan is an organization established under the Cabinet Office, independent from the ministries and agencies involved in theutilization of nuclear power. It supervises and audits the safety regulation implemented by the regulatory bodies from the independent perspective and has the authorities to make recommendations to the regulatory bodies through the Prime Minister, if necessary. Moreover, NISA established the Japan Nuclear Energy Safety Organization (hereinafter referred to as "JNES") as their technical support organization in October, 2003. JNES conducts a part of inspection of nuclear facilities pursuant to the laws, and provides technical support to the safety review and assessment on the nuclear installations and the consolidationof the safety regulation standard conducted by NISA (Figure II-1-2).

MEXT is responsible for monitoring and measurement activities to prevent radiation damages and to evaluate radioactivity levels.

The emergency monitoring is supposed to be carried out by the local governments in the current

Nuclear Emergency Preparedness system, and MEXT is supposed to support the local governments' emergency monitoring activities by mobilizing the emergency monitoring members and devices to dispatch to the site, with the cooperation by the designated public organizations (National Institute of Radiological Sciences and Japan Atomic Energy Agency), etc.



Legislation
Cabinet Order
Ministerial Ordinance
Ministerial Public Notice
Atomic Energy Basic Act
Reactor Regulation Act
Cabinet Order for Reactor Regulation Act
Rules for Commercial Power Reactor
Notice on Dose Limits Based on Provisions of Commercial Power Reactor
Notice onCriteria on Person Responsible for Operation
Notice on Technical Details of Transport of Nuclear Fuel Material, etc. in Factory or Place of Business
Notice on Important Safety Related Equipment, etc.
Rules for Reactors at the Stage of Research and Development
Notice on Dose Limit Based on Provisions of Reactors at the Stage of Research and Development
Radiation Hazard Prevention Act
Cabinet Order for Radiation Hazard Prevention Act
Rules for Radiation Hazard Prevention
Electricity Business Act
Cabinet Order for Electricity Business Act
Rules for Electricity Business
Technical Requirements on Dose Equivalent, etc. due to Radiation Relating to Nuclear Power Generation Equipment
Ordinance on Establishing TechnicalRequirements for Nuclear Power Generation Facilities
Ordinance on Establishing Technical Requirements for Nuclear Fuel Material of Power Generation
Basic Act on Disaster Control Measures

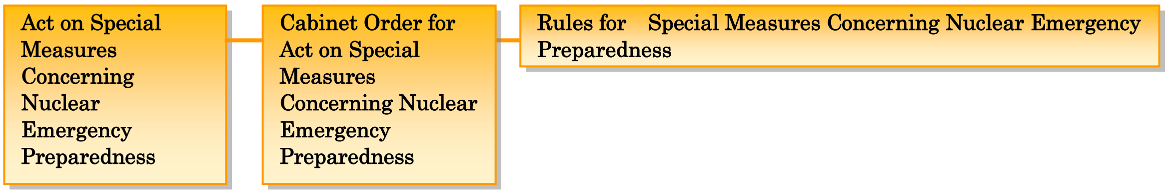


Figure II-1-1 Main Legal Structure of Safety of Nuclear Reactor Facilities in Japan

Hazards Prevent	**Siting**	Regulatory Guide for Reviewing Nuclear Reactor Site Evaluation and Application Criteria
	Design	Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Classification of Importance of Safety Functions of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Fire Protection of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Radiation Monitoring in Accidents of Light Water Nuclear Power Reactor Facilities
		Fundamental Policy to be Considered in Reviewing of Liquid Radioactive Waste Treatment Facilities
	Safety Evaluation	Regulatory Guide for Evaluating Safety Assessment of Light Water Reactor Facilities
		Regulatory Guide for Evaluating Core Thermal Design of Pressurized Water Cooled Nuclear Power Reactors
		Regulatory Guide for Evaluating Emergency Core Cooling System Performance of Light Water Power Reactors
		Regulatory Guide for Evaluating Reactivity Insertion Events of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Evaluating Dynamic Loads on BWR MARK-I Containment Pressure Suppression Systems
		Regulatory Guide for Evaluating Dynamic Loads on BWR MARK-II Containment Pressure Suppression Systems
		Regulatory Guide for Meteorological Observation for Safety Analysis of Nuclear Power Reactor Facilities
	Dose Target	Regulatory Guide for the Annual Dose Target for the Public in the Vicinity of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Evaluation of Dose Target for Surrounding Area of Light Water Nuclear Reactor Facilities
		Guide for Radiation Monitoring of Effluent Released from Light Water Nuclear Power Reactor Facilities
Technical Competence		Regulatory Guide for Examining Technical Competence of License Holder of Nuclear Power

Table II-1-1 Major Regulatory Guides Specified by the NSC Japan for Power Generating Light Water Reactors

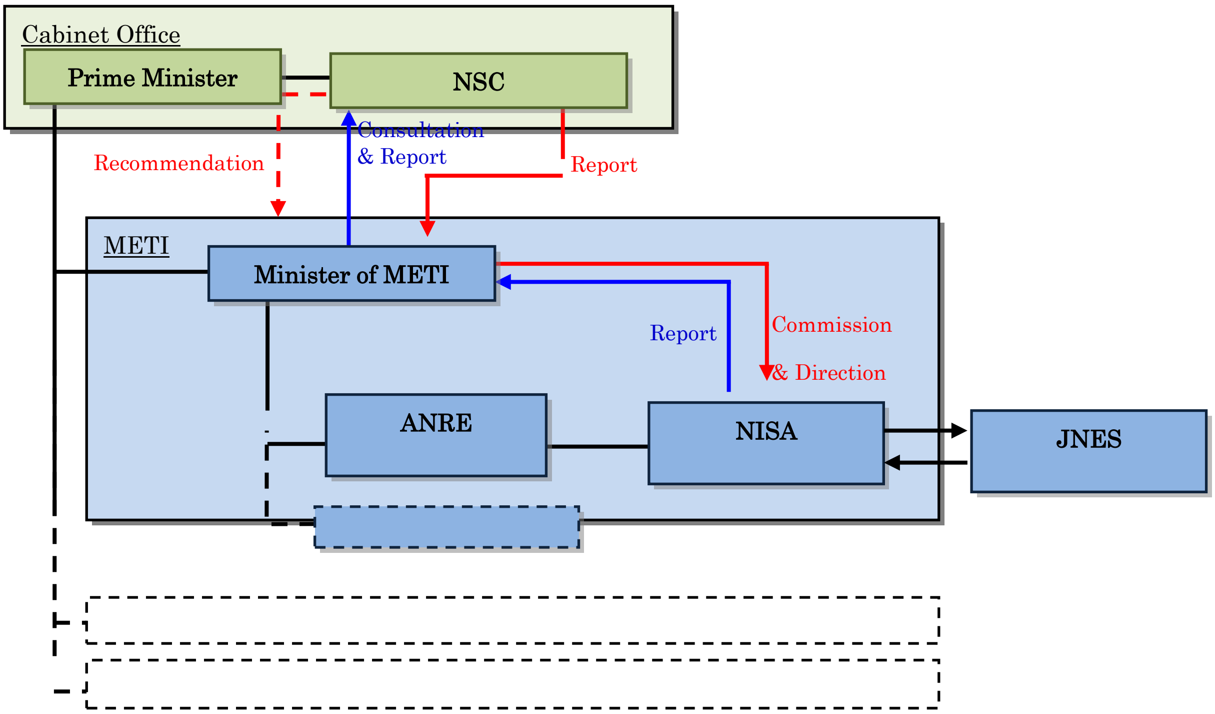


Figure II-1-2 Position of NISA in the Government

2. Mechanism for nuclear emergency responses

(1) The Act on Special Measures Concerning Nuclear Emergency Preparedness

The Nuclear Emergency Preparedness Act (hereafter referred to as “the Nuclear Emergency Preparedness Act”) was established after the criticality accident which occurred at JCO nuclear fuel fabrication facilities in 1999, and stipulates the licensees’ duties on prevention of nuclear disaster, declaration of the Nuclear Emergency and establishment of the Nuclear Emergency Response Headquarters (hereinafter referred to as “NERHQs”), implementation of emergency response measures, measures for restoration from nuclear emergencies, etc.

The Basic Plan for Emergency Preparedness, containing the Basic Act on Disaster Control Measures, forms the basis of the nuclear emergency response and states the measures to prevent occurrence and expansion of nuclear disaster and restore the nuclear disaster. In addition, the Basic Plan for Emergency Preparedness states that the “Regulatory Guide: Emergency Preparedness for Nuclear Facilities”, the prevention guide established by the NSC Japan, shall be fully taken into consideration for technical and special matters (Attachment II).

(2) Nuclear emergency

In a nuclear emergency, closely coordinated response among relevant organizations shall be performed based on the Nuclear Emergency Preparedness Act, and in an emergency at nuclear power reactor facilities, the following responses shall be taken.

1) The licensee of reactor operation shall immediately report to the Minister of Economy, Trade and Industry and heads of local governments when an event stipulated in Article 10 of the Nuclear Emergency Preparedness Act (Specific Event) occurs (Figure II-2-1).
2) The Minister of Economy, Trade and Industry, receiving the notification, shall trigger activities according to the procedure stipulated by law. Staff with expertise in emergency measures shall be sent to local governments on request. The Senior Specialists for Nuclear Emergency Preparedness assigned to work on-site shall collect information and perform duties necessary to smoothly implement the prevention of the expansion of a nuclear disaster.
3) When the Minister of Economy, Trade and Industry recognizes that the Specific Event has exceeded the predetermined level and developed into a nuclear emergency stiation, the Minister shall immediately report it to the Prime Minister.
4) The Prime Minister shall declarea "Nuclear Emergency Situation" in response to it and direct relevant local governments to take emergency response measures such as sheltering or evacuation and preventive stable iodine administration.
5) The Prime Minister shall establishe NERHQs in Tokyo, which he shall head, and the "Nuclear Emergency Response Local Headquarters" (hereinafter referred to as "Local NERHQs") at the concerned Off-Site Center.
6) In a nuclear emergency, the NSC Japan shall convene the "Technical Advisory Organization in an Emergency" that is composed of the Commissioners and the Advisors for Emergency Response and shall give technical advice to the Prime Minister.
7) Local governments shall establish their own emergency response headquarters.
8) In order to share information among the National Government, local governments, and related organizations such as licensees, etc., and, if necessary, to coordinate emergency measures to be implemented by the respective organizations, "the Joint Council for Nuclear Emergency Response" shall be established at the Off-Site Center (Figure II-2-2).

(3) Nuclear emergency response drill

The purpose of a nuclear emergency response drill is 1) to enhance understanding of, and to facilitate actions for, nuclear emergency response by the relevant personnel of the National Government, local governments, the licensee, and residents, and 2) to verify whether emergency response measures function as planned , and whether information sharing and cooperation among related organizations are sufficient. The National Government, local governments, designated public organizations and the licensee cooperate and participate in drills, which cover communication, monitoring, decision on emergency measures to be taken, sheltering or evacuation, etc.. In Japan, various forms of drills are performed and a large scale national drill is performed once a year.

Events	Criteria for Specific Event	Criteria for Nuclear Emergency
a) Radiation dose near the site boundary	5 micro Sv/h or more at one point for more than consecutive 10 minutes	500 micro Sv/h or more at one point for more than consecutive 10 minutes
	5 micro Sv/h or more at two or more points simultaneously	500 micro Sv/h or more at two or more points simultaneously
b) Detection of radioactive materials in usual release points such as exhaust pipes	When the concentration of radioactive materials equivalent to 5 micro Sv/h or more continues for 10 minutes or more, or radioactive materials equivalent to 50 micro Sv/h or more are released	When the concentration of radioactive materials equivalent to 500 micro Sv/h or more continues for 10 minutes or more, or radioactive materials equivalent to 5 mSv/h or more are released
c) Detection of radiation or radioactive materials by fire, explosion, etc (outside the control zone)	Radiation dose of 50 micro Sv/h or more	Radiation dose of 5 mSv/h or more
	Release of radioactive materials equivalent to 5 micro Sv/h or more	Release of radioactive materials equivalent to 500 micro Sv/h or more
d) Individual events of each nuclear installation		
Failure of reactor scram	When the nuclear reactor shutdown cannot be performed by usual neutron absorbers	When all reactor shutdown functions are lost in a case where emergency reactor shutdown is necessary
Loss of reactor coolant	When leakage of nuclear reactor coolant occurs, which needs operation of the emergency core coolant system (ECCS)	When water cannot be injected into the nuclear reactor by any ECCS
Loss of all AC power supplies	When power supply from all AC power supplies is failed for 5 minutes or more	When all functions for cooling a reactor are lost with loss of all AC power supplies
Decrease in water level of the spent fuel pool at reprocessing facilities	When water level is decreased to the point where a fuel assembly is exposed	

- The competent minister sends staff with expertise on request of local governments. - The resident Senior Specialist for Nuclear Emergency Preparedness carries out necessary work. - Related ministries and agencies organize a joint task group in Tokyo on nuclear accident countermeasures. - Related local organizations organize a joint local task group in the Off- Site Center.	- The competent minister reports the nuclear emergency to the Prime Minister after confirming the situation. - The Prime Minister declares “Nuclear Emergency” and takes the following responses: - to lead, advise or direct related local governments on necessary measures such as sheltering or evacuation; - to establish NERHQs and Local NERHQs; and - to establish the Joint Council for Nuclear Emergency Response for information exchange among the National Government and local governments

Figure II-2-1 Specific Event and Nuclear Emergency Provided for in the Act on Special Measures Concerning Nuclear Emergency Preparedness

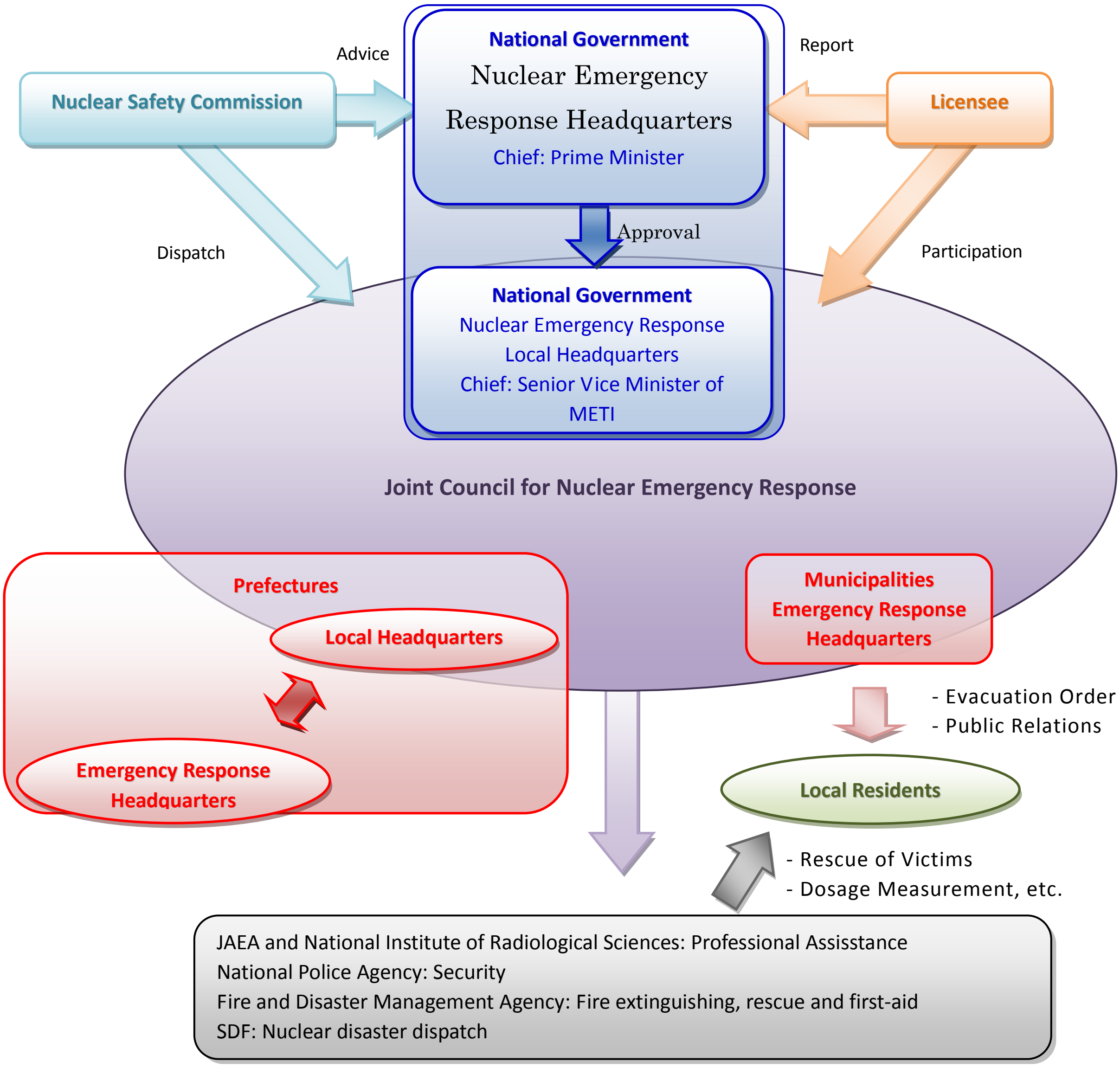


Figure II-2-2 Outline of the organizations relating to nuclear emergency responses

III. Disaster Damage in Japan from the Tohoku District - Off the Pacific Ocean Earthquake and Resulting Tsunamis

1. Damage by the earthquake and tsunami in Japan

(1) Outline of the Tohoku District - Off the Pacific Ocean Earthquake

1) Tectonic setting and earthquake mechanism

The Japanese Archipelago is situated at the boundaries of four tectonic plates: the North American, Eurasian, Pacific and Philippine Sea plates, as shown in Figure III-1-1. The Japanese Archipelago receives strong compression from two directions caused by subductions of the Pacific and Philippine Sea plates.

The Tohoku District – Off the Pacific Ocean Earthquake (hereinafter referred to as this earthquake) occurred on the boundary of the North American plate along the Japan Trench and the Pacific plate as shown in Fig. III-1-1 at 14:46 on March 11, 2011. The Japan Meteorological Agency (JMA) estimated that the hypocenter was approximately 130 km off the coast of Sanriku, the depth was 24 km and the size was Moment Magnitude[1] M_w9.0 (The 16th report from JMA). And the Headquarters for Earthquake Research Promotion (hereinafter referred to as HERP) assumes that the source area of this earthquake covered from the offshore area of Iwate Prefecture to that of Ibaraki Prefecture, and its size was above 400km long, and approximately 200km wide. Mechanism solutions showed a reverse fault with a compressional axis in the west-northwest- east-southeast direction. ("Evaluation of Tohoku District - Off the Pacific Ocean Earthquake" released by the earthquake investigation committee, HERP on April 11).

The hypocenter of this earthquake was off the coast of Miyagi Prefecture as shown in Figure III-1-2 and the rupture was estimated to have propagated simultaneously from the hypocenter in the area off Miyagi Prefecture to the area off Iwate Prefecture in the north and the area off Fukushima Prefecture and Ibaraki Prefecture in the south according to documents released by the HERP and so on. The offshore area of Miyagi Prefecture, as a part of source area of this earthquake, consists of two source areas A and B as shown in

1 Moment magnitude: A magnitude scale relating the size of an earthquake to the energy released. It can accurately measure the sizes of large earthquakes.

Fig. III-1-2. It is estimated that the rupture started at the hypocenter, which was located in B, propagated westwards to area A, and further spread to the area east to area B. As shown in a cross-section of a-a’ in Figure III-1-2, the estimated rupture started at the hypocenter (about 24 km deep), propagated to area A in the deep portion, and further spread to the shallow portion east to area B. It is estimated that the areas with large slip were the area near the southern trench off the Sanriku coast and a part of near-trench areas from the offshore area of North Sanriku to that of Boso, with the maximum slip of above 20 m.

2) Examples of analysis for crustal movement, seismic source process and tsunami source process

The Geospatial Information Authority of Japan (GSI) has released a report of crustal movements caused by the earthquake on the basis of GPS observation as shown in Fig.III-1-3. According to this figure, the significant crustal movement occurred in the area from the coast of Miyagi Prefecture to Fukushima Prefecture, and subsidence ranged from 0.5 m to 1.2 m (average subsidence is about 0.8 m). At Ojika observatory in Miyagi Prefecture, the horizontal displacement in a east-southeast direction was about 5.3 m and the vertical displacement was about 1.2 m.

The JMA analyzed source process[2] for this earthquake and has released slip distribution information as shown in Fig.III-1-4 with the use of observation records from K-NET and KiK-net operated by the National Research Institute for Earth Science and Disaster Prevention (NIED), together with waveform data from JMA accelerometers. JMA assumed the fault size as 450 km long and 150 km wide, and its analysis results was that a moment magnitude of 9.0 was obtained and the rupture duration time was 170 sec. In this analysis, slip gradually enlarged near the rupture start point (hypocenter: at 38.10 degrees north latitude, 142.86 degrees east longitude and 23.7 km deep) for about 0 to 60 seconds, and proceeded to the south and to the north separately. The area with large slip was east to northeast side of the rupturing start point (shallower than the hypocenter) and the maximum slip amount was about 30 m. The area with large slip is generally consistent with results from other Japanese or oversea research institutes.

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2 Source process: rupture propagation on the fault plane. Usually inferred from waveform inversion which minimizes the difference between the observed waveforms and theoretical ones synthesized from those of subfaults.

For example, Fujii and Satake carried out tsunami waveform inversion[3] by using tsunami observation records from JMA and other institutions and analyzed the process of tsunami wave source (Refer to Fig.III-1-5). In this, also, the areas with large slip amount is distributed in northeast side of the seismic source (black area in the Figure), which agrees with JMA results. Results of slip distribution analysis by the JMA and results of tsunami analysis by Fujii and Satake indicate that the large slip at the shallow plate boundary in the east side of the start point of rupturing is the factor that brought about the large tsunami.

3) Relation with HERP evaluation of long-term seismicity in Japan

The HERP has released evaluation results of earthquake occurrence probability within the next 10, 30 and 50 years, respectively, , as shown in Fig.III-1-6 for those trench-type earthquakes with a certain magnitude (earthquake occurrence probability within 30 years, based on January 1, 2011). Among these evaluation cases, the HERP has estimated a 99% occurrence probability within 30 years for the Miyagi-ken Oki (literately, off the coast of Miyagi Prefecture) earthquake (seen in Fig. III-1-6) with a magnitude of M7.5 and was alerting the public to this probability. The rupture start point (in the offshore area of Miyagi Prefecture), the assumption of consecutive ruptures of two seismic sources A and B within the same area and the timing of the occurrence were almost the same as evaluated. However, the committee admitted that the size of the source area, which covers the offshore areas of central Sanriku, Miiyagi Prefecture, Fukushima Prefecture, and Ibaraki Prefecture, the consecutive rupturing, and the magnitude M9 were beyond expectation (Earthquake Research Committee, HERP: The evaluation of the Tohoku District - Off the Pacific Ocean Earthquake released on March 11). Moreover, in contrast to the fact that the rupture spread from the hypocenter to the shallow area of the plate boundary, and slip amount was above 20m, it was assumed that the shallow plate boundary along the Japan trench in the offshore area of Miyagi Prefecture was not able to store a large amount of strain energy, because the area was assumed to be creeping. Some experts, however, commented that the area was strongly coupled, the strain energy has hence been stored for a long time, and the rupturing off the coast of Miyagi Prefecture became the trigger for this earthquake.

(2) Ground motion and tsunami height of the Tohoku District – Off the Pacific Ocean Earthquake

[3] Tsunami wave inversion: Analysis method to estimate source process by using the time-series data.

1) Ground motion observation

Acceleration waveforms (two horizontal components and one vertical component) recorded at NIED K-NET and KiK-net observation stations in the vicinity of Onagawa NPS, Fukushima Dai-ichi NPS, Fukushima Dai-ni NPS and Tokai Dai-ni NPS are showed in Fig.III-1-7.

Large peaks were produced around 30 seconds and 80 seconds after the earthquake occurred at the observation station (MYG011: distance from the epicenter 127 km) around Onagawa NPS near the epicenter. Although a similar peak is observed in the acceleration records at the observation station near Fukushima Dai-ichi NPS (FKS011: distance from the epicenter 176 km), the second peak was larger than the first. These two peaks are assumed to be caused by rupturing in the vicinity of source area A and source area B.

Incidentally, only one peak was observed 120 seconds after in the acceleration waveform at the observation station near the Tokai Dai-ni Power Station (IBR007: distance from the epicenter 274 km). As for the reason for this, it is assumed that ground motion due to rupturing at seismic sources B and A within the offshore area of Miyagi Prefecture decayed and the effect of the rupture propagation from the offshore areas of Fukushima Prefecture to Miyagi Prefecture on the ground motions in the vicinity of Tokai Dai-ni NPS became larger. Factors effecting significantly on ground motion at a NPS site may include, of the wide source area, the rupture area close to the site, the rupture characteristics, and the consecutive rupturing pattern. Meanwhile, factors effecting significantly on tsunami water level might include the magnitude, the range of the source area, the slip amounts, and the consecutive rupture pattern. It is expected that the difference among those factors will be clarified hereafter in research institutes at home and abroad.

The seismic intensity distribution in East Japan is shown in Fig.III-1-8. The maximum intensity in Kurihara City in Miyagi Prefecture was 7. The area that was hit by a JMA intensity 5 or stronger covered a large area from the Tohoku district and Kanto regions. The intensity at the area near Onagawa NPS, Fukushima Di-ichi NPS, Fukushima Dai-ni NPS and Tokai Dai-ni NPS were 5 strong to 6 strong.

2) Tsunami observation

The observed tsunami waveform by the GPS wave meter at Kamaishi City in Iwate

Prefecture as measured by the Port and Airport Research Institute is shown in Fig. III-1-9. The observed maximum level of the tsunami was 6.7 m for the first wave that hit approximately 26 minutes after the earthquake struck at 14:46. The cycle of the tsunami was irregular and uncertain for the first to third waves, but the intervals between the fourth to the seventh waves were approximately 50 minutes. As for its features, the first wave had two steps and was 2 m at 6 minutes after the event and this increased to 6.7 m during the next 4 minutes.

The observed tsunami water level as measured by the JMA in the coastal area of East Japan is shown in Fig. III-1-10. The observed tsunami water level was 8.5 m or more in Miyako point, 8.6 m or more in Ayukawa point in Ishinomaki City and 9.3 m or more in Soma point. Tsunamis were also observed hitting the Pacific coast in Canada, the U.S. and Latin America etc., and a maximum height of 2 m was observed in Chile.

According to Satake, the wave height of the tsunami is assumed to have been made by the superposition of the long–period wave accompanied by the slip in rather deep areas, such as with the Jogan Earthquake (in 869) and short- period high waves by the slip in shallow areas such as the Meiji Sanriku-oki Earthquake (in 1896) (Refer to Fig.III-1-11). Therefore, it is assumed that after the short-period high tsunami arrived at the coast area and ran up subsequently, the long-period tsunami surged repeatedly over a large duration and hence enlarged the run-up area. The run-up height was 38.9 m in Aneyoshi, Miyako City, Iwate Prefecture, according to an investigation by the Japan Society of Civil Engineers. The run-up height in the Sanriku area exceeded that of the Meiji Sanrikuoki Earthquake (1896) and the Showa Sanrikuoki Earthquake (1933) (Refer to Fig. III-1-12).

3) Occurrence of aftershocks and induced earthquakes

Cumulated numbers of aftershocks of M5 or greater, M6 or greater, and M7 or greater were 444, 76 and 5, respectively, as of May 6. The most powerful aftershock occurred at 15:15 on March 11, and the magnitude of the earthquake was M7.7. As for other main aftershocks, they occurred at 15:25 on the same day far off the coast of Miyagi Prefecture (the depth was approximately 34 km and M7.5), and at 23:32 on April 7 off the coast of Miyagi Prefecture (depth was approximately 40 km and M7.0).The aftershock on April 7 occurred at approximately 40 km east from Ojika Peninsula, and large ground motion was observed in Onagawa NPS.

The occurrence of the triggered earthquakes is shown in Fig.III-1-13. Triggered earthquakes occurred all over Japan including Nagano Prefecture, Akita Prefecture, and Fujinomiya in Shizuoka Prefecture and Fukushima Prefecture. As for earthquakes near NPPs, a M6.7 earthquake occurred near the Tokamachi fault belt in the northern area of Nagano Prefecture approximately 50km southeast from Kashiwazaki NPS on March 12. And a M7.1 earthquake occurred near the Idozawa fault belt approximately 50 km southwest of Fukushima Dai-ichi NPS on April 11. This earthquake was a normal fault-type earthquake with a tension axis that ran along a west-southwest to east-northeast direction, and which occurred at the shallow depth within the plate. The Tohoku Region is a region with a distinctive distribution of active faults in reverse faults, and this is the first time a normal-fault-type inland earthquake was found.

Along with this, on April 28, the Nuclear Safety Commission (NSC) stated the following opinions written below and issued an investigation demand to NISA, which has been reviewing the seismic safety evaluation for existing nuclear reactor facilities etc. (hereinafter referred to as “seismic back-checks”) by reflecting the “Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities“(decided by the NSC on September 19, 2006, hereinafter referred to as “new seismic guidelines”). NISA issued a similar direction to the utilities on April 28.

- If an earthquake occurrence was identified in the areas where earthquake activity was not active, or if an earthquake occurred near faults which were not the active faults that require seismic design consideration, the earthquake has to be evaluated.

- If there is a fault with the possibility to affect the sites after implementing evaluations mentioned above, it is necessary to evaluate the ground motion.

(3) Major damage status caused by the Tohoku District-Off the Pacific Ocean Earthquake

1) Emergency earthquake information (alert) by JMA and related measures taken by local governments

a. Announcement of emergency earthquake information (alert) and details of tsunami information

When a tsunami disaster is anticipated, the JMA announces a “tsunami alert” or “tsunami advisory" approximately three minutes (targeted) after the earthquake occurs. The announcement procedure for providing information for earthquakes and tsunamis is shown in Fig.III-1-14, and details of the tsunami alert and tsunami advisory are shown in Table III-1-1.

b. The time and details of announcement of tsunami alert by JMA and comparison with those confirmed

The estimated arrival time, height, and confirmed results are compared in Table III-1-2 as for each announcement for a tsunami alert by the JMA for the Pacific coast of East Japan. JMA announced tsunami alerts or tsunami announcements three times at 14:49 (3 minutes after the earthquake struck), at 15:14 (28 minutes after the earthquake), and at 15:30 (44 minutes after the earthquake) after the earthquake at 14:46. The main contents are shown below.

- In the first announcement (14:49, 3 minutes after the earthquake), the JMA announced tsunamis of 6m and 3m would hit Miyagi and Fukushima Prefectures, respectively.

- In the second announcement (15:14, 28 minutes after the earthquake), the tsunami's arrival had already been identified in Aomori, Iwate, Miyagi, and Fukushima Prefectures. At this point, the estimated tsunami height was corrected to 6 m, 10 m or more, and to 6m in Iwate Prefecture, Miyagi Prefecture, and in Fukushima Prefecture, respectively. However, a tsunami measuring 8m maximum arrived at Miyako, Kamaishi and Ofunato cities in Iwate Prefecture between 4 to 7 minutes after the announcement. Also in Ayukawa in Miyagi Prefecture, 8.6 m or more wave arrived 12 minutes after.

- In the third announcement(15:30, 44 minutes after the earthquake), arrival was confirmed in Aomori, Iwate, Miyagi, Fukushima and Chiba prefectures, and the arrival of a tsunami was also estimated for Ibaraki Prefecture. In these cases the estimated tsunami height was corrected to 10 m or more in all prefectures except for Aomori Prefecture. The highest waves had already arrived in Miyako City and Ofunato City in Iwate Prefecture, ,and Ayukawa in Miyagi Prefecture.

The estimated tsunami height in the third announcement (15:30, 44 minutes after the earthquake) by the JMA was 8 m and 10 m or more, but the highest waves had already arrived approximately 10 to 12 minutes before the announcement.

c. Evacuation status in the local governments who received Tsunami alert from JMA

A "tsunami alert (large tsunami)" announced by the JMA initially estimated the height as 3 m or so for Iwate and Fukushima Prefectures (from the beginning a 6 m height tsunami was predicted for Miyagi Prefecture). However, this was corrected to 6 m 30 minutes later, and corrected again to 10 m or higher 15 minutes later. The evacuation status in each local government responding to these tsunami alerts is shown in Table III-1-3 by taking examples of the responses from Yamada Town, Kamaishi City, Ofunato City and Rikuzen Takada City in Iwate Prefecture, and Mminamisanriku Town, and Kesennuma City in Miyagi Prefecture based on the homepage of the Asahi Shimbun.

The details of the announcements over the community wireless systems in cities, towns and villages were different from government to government. Some cities, towns and villages were not able to receive the follow-up reports due to electric outages, and continued to announce waves of heights of "3 meters or so" in line with the initial report. Therefore there were some local communities where many people suffered causalities because they considered it sufficiently safe to shelter only to the second floors of buildings, for example rather than evacuating to higher ground. The announced height of three m may well have played a role in preventing appropriate evacuation in some cases. Announcements ordering people to evacuate instead of just announcing the estimated tsunami height were effective for some local governments.

d Improvement measures for tsunami alerts by JMA

The JMA did the best to announce information for this earthquake and tsunami in light of current technologies. However, it is realized that a complete back-check and extensive preparations for future situations is essential to provide best-case information that enables a safe and effective response to future M9-class mega earthquakes. Therefore the JMA announced on May 19, 2011 to progress with the improvement of tsunami information steadily by learning lessons from the experience of this earthquake and tsunami.

Specific details are as follows. (1) Verification of details and timing of issued tsunami alerts, (2) Verification of technical issues points (the initially announced magnitude was M7.9; the magnitude was re-evaluated, and was revised higher as time went by.

Therefore it is essential to develop technology to estimate the correct magnitude as quickly as possible). (3) To identify what kinds of issues are remained for the future.

The JMA announced that it would conduct study sessions whose members are experts from universities, research institutes, etc., and related organizations, etc. for disaster preparedness, toward the improvement of tsunami alerts, and that the first session would be held on June 8. The JMA also announced that it would summarize their direction of its tsunami alert improvement after gathering and sorting out opinions from experts, by around the autumn of this year.

Adding to that, the JMA mentioned that it would substantiate its information issuance such that the public will be able to use it in practice. In this, the JMA is moving forward not only by itself, but in collaboration with various organizations including related administrative agencies and local governments. The JMA also mentioned that, in the case of tsunami, the point of view of education is important and it would try to make the public better informed and conduct educational outreach.

2) Overall damage situation

In terms of the area inundated by the tsunami, according to the GSI, Miyagi Prefecture had an area of 327 km^2 inundated, Fukushima Prefecture an area of 112 km^2 and Iwate Prefecture had an area 58 km^2 inundated. The total inundated area was up to 561 km^2 (GSI No.5 Report on approximate inundated area). The total number of residential buildings damaged was approximately 475,000 including fully-destroyed, half-destroyed, partially-destroyed and inundated structures. The number of cases of damage to public buildings and cultural and educational facilities was as many as 18,000.

In terms of the extent of damage to infrastructural lifelines, there were approximate 4,000 spots of road damage identified and approximately 7,280 spots of damage to railways (including approximately 1,680 spots caused by the tsunamis). In addition, approximately 460,000 households suffered from gas supply stoppages, approximately 4,000,000 households were cut off from electricity, and 800,000 phone lines were knocked out. (Sources: Emergency Disaster Response Headquarters as of 16:00 on May 30; East Japan Railway Company as of April 17; Japan Gas Association, as of March 12; Ministry of Economy, Trade and Industry as of April 12; Emergency Disaster Response Headquarters, peak damage estimate calculated from 12:00 on March 12).

There were over 120 sites of damage from landslides including mudslides, slope failures, and ground deformation (NIED release as of May 19). Dams burst, and several people went missing in Fukushima Prefecture. Large-scale ground liquefaction occurred in the coastal areas such as Urayasu City, Makuhari City etc. and on the Kujukuri plain etc. in Chiba Prefecture (Environment Research Center in Chiba Prefecture (Second Report) posted on April 15).

24,769 people have been reported as dead or missing (Emergency Disaster Response Headquarters, as of 17:00 on May 30.)

3) Damage to seawalls and the like around harbor installations

Based on the research results of damage to seawalls and ancillary facilties, the effect of scouring[4] and wave power is shown as follows.

The ground around the bases of tidal embankments and seawalls were scoured by runups and rundowns and many of the bases were observed to have suffered collapses as shown in Fig. III-1-15. And the lining of embankments and seawalls (concrete portions that cover rocks and ground inside embankments) suffered boring from the lower edge of bases, and failed to play a role of lining. Given this situation, there is the possibility that sand embankments would collapse through by scouring due to runups and rundowns and breakwater walls would be scoured or collapse if tsunamis breach the sand embankments when these are used as coastal defenses. Therefore technical guidelines should be prepared and organized for several kinds of countermeasures.

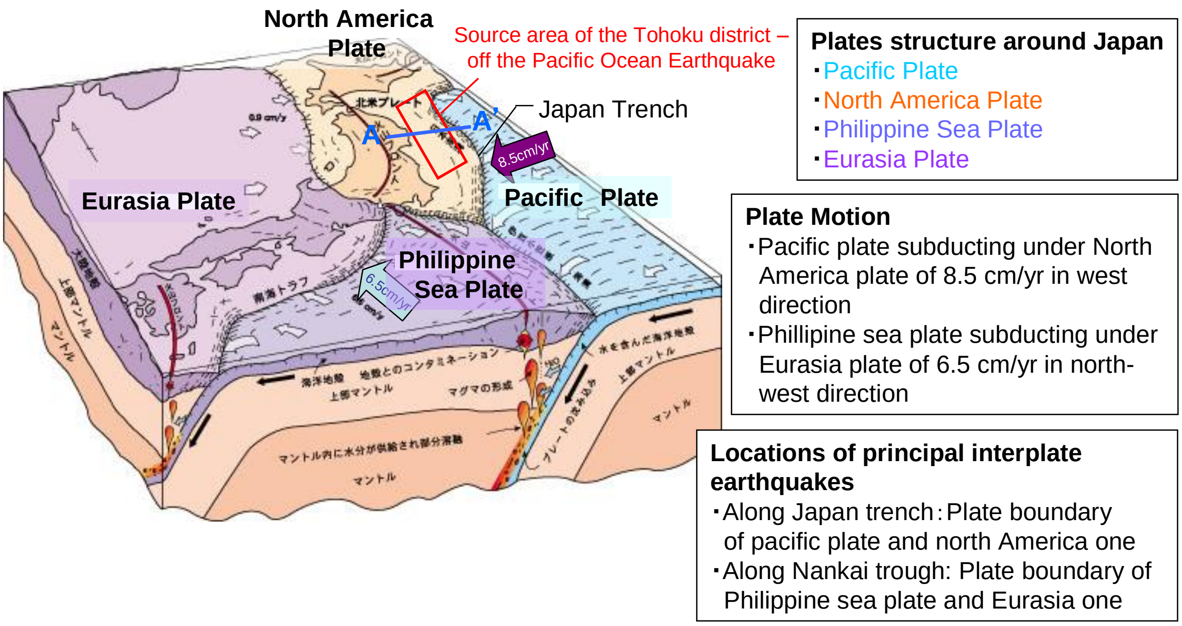
Ancillary facilities for embankments were run down by strong wave pressure of tsunami as shown in Fig. III-1-15. As for treatment of wave pressure, the Tsunami Evaluation Subcommittee in the Japan Society of Civil Engineers pointed out in 2002 that it was necessary to improve the treatment of wave pressure distribution characteristics etc. of soliton breakup waves, in the wave pressure calculation formula. Therefore the calculation formula in the tsunami assessment method (2007) in this committee was improved by using the data obtained from water tank testing. Further upgrading of assessment technologies is important along with the application of this formula to damage by this

[4] Scouring: Phenomenon in which seashores and earth and sand at the sea bottom are shove off mechanically by Tsunami. Grounds around the bases of embankments were rushed away due to runups and rundowns in this tsunami, and bases lost their bearing capacity, and embankments collapsed.

tsunami and for verification.

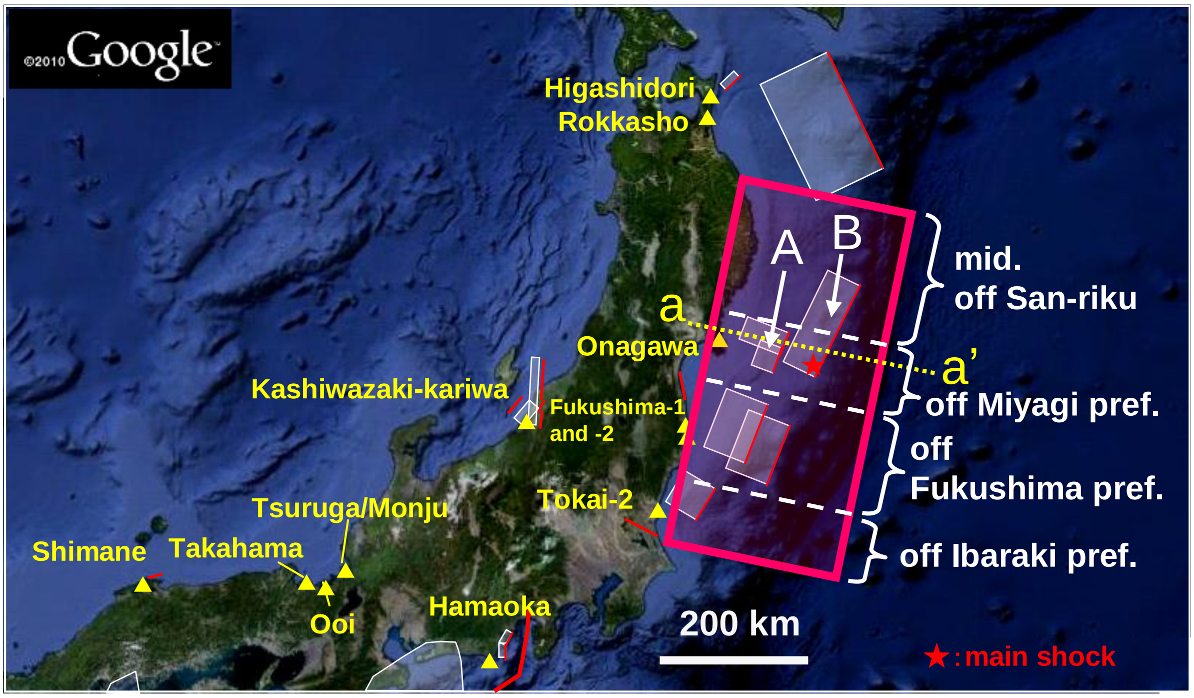
The tidal embankment in the Taro area of Miyako City in Iwate Prefecture is referred to locally as the “Great Wall of China” as it towers 10 meters high. However, even this collapsed when hit by a tsunami that was 15m high, or possibly higher, and significant damage occurred within the embankment as shown in Fig. III-1-16 (left photo) (Asahi Shimbun posted on March 20). Incidentally, the 15.5 m embankment as shown in Fig. in III-1-16 (right photo) was installed in the Ootabu area, Fudai village in Iwate Prefecture following a strong desire of the village chief learning from previous experiences with tsunami. This embankment was able to resist the 15m tsunami and prevented the damage within the embankment zone (Yomiuri Shimbun, posted on April 3). These areas are rias type coastlines that have, historically, suffered significantly from giant tsunamis in the 15m range such as the Meiji Sanriku Tsunami (1896) and the Showa Sanriku Tsunami (1933), the lesson of preparation against a 15m-class tsunami has been instructed. (Yomiuri Shimbun, posted on March 30). Against these tsunamis, there was a sharp contrast between the Ootabe area, which heeded the lessons of the past, and the Taro area.

In the Aneyoshi area, Miyako City in Iwate Prefecture, there is a stone monument with the warning not to build houses in the area lower than that point as shown in Fig. III-1-17 (left picture) at the entrance (height 60 m) of the village, showing lessons learned from runups of the two historical tsunamis mentioned above. By observing this lesson, the area was able to avoid casualties this time even though the tsunami ran up (the actual runup height was 38.9 m) near the village as shown in the figure (right picture).

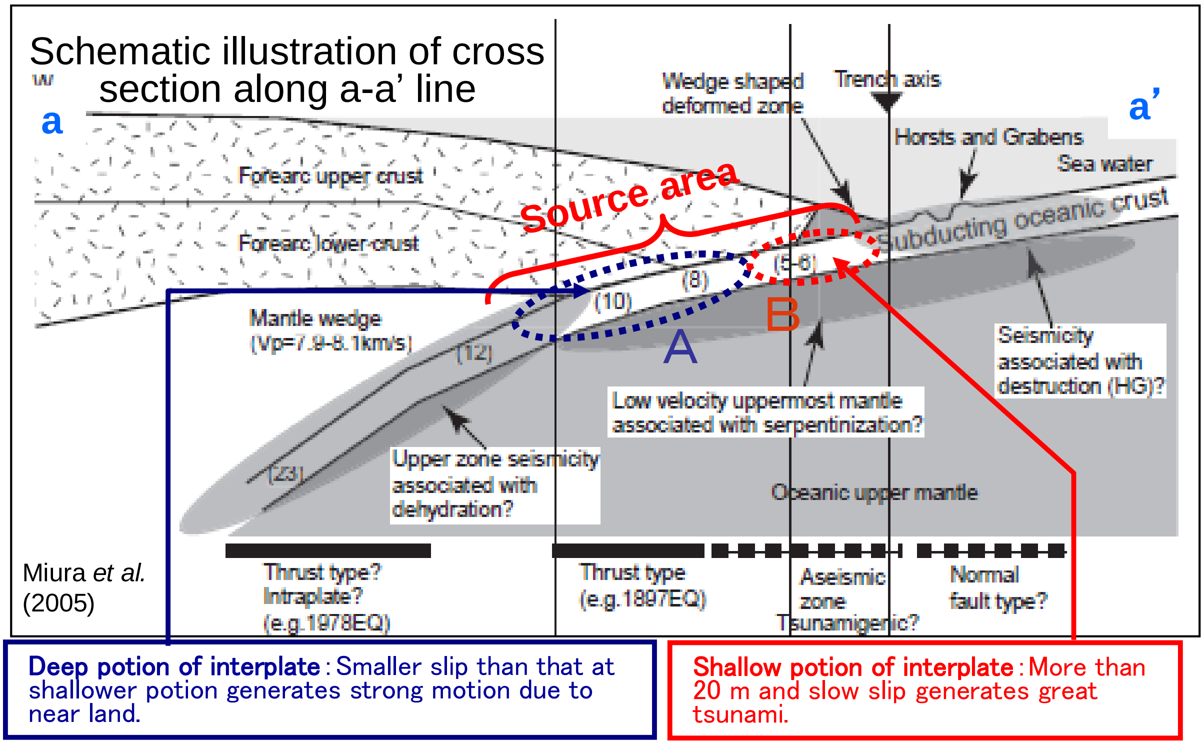


Reference: JGCA HP [Online]. http://www.zenchiren.or.jp/tikei/index.htm
Partially modified by JNES.

Fig. III-1-1 Plate tectonics around Japan.

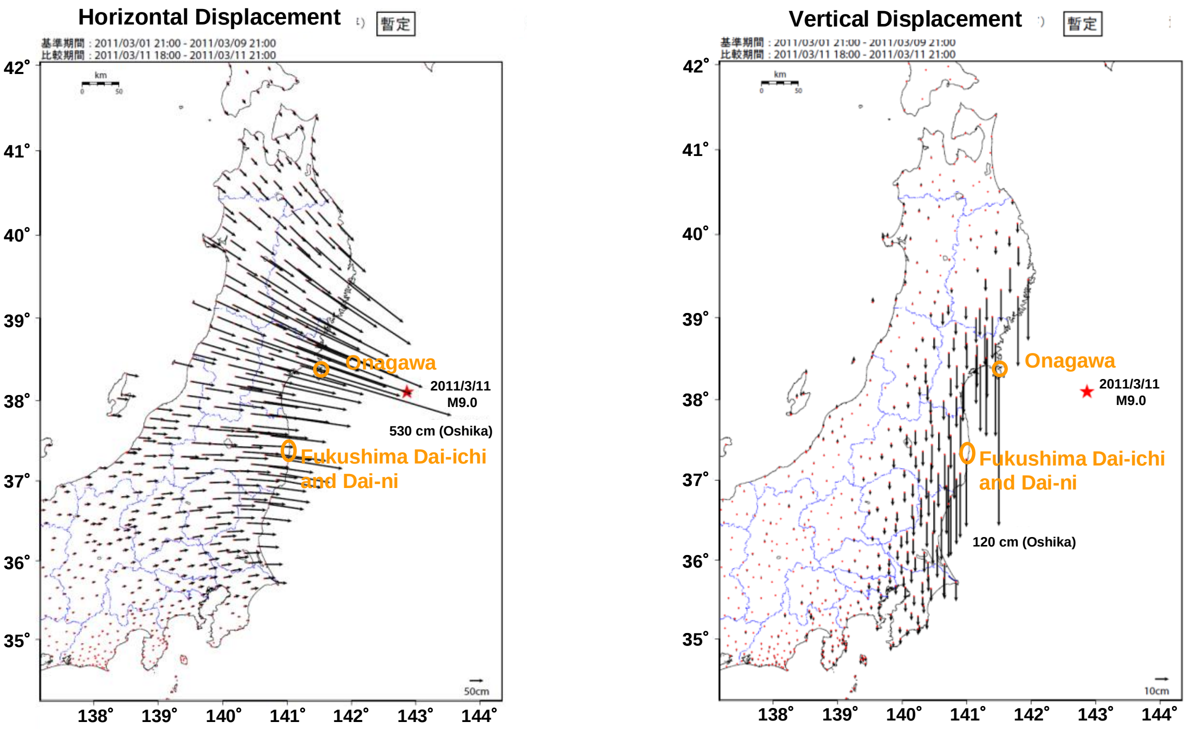


JNES modified a part of the Google map.



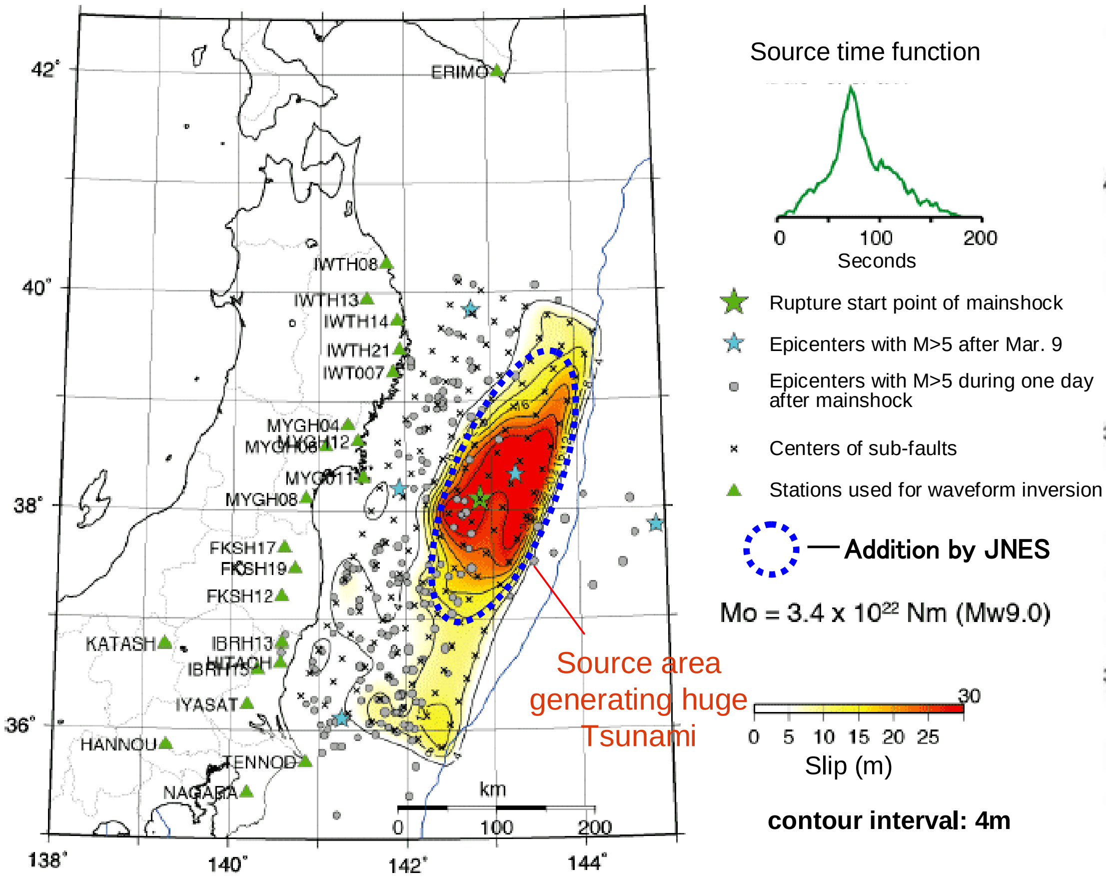
Reference: Miura et al. (2005: Tectonophysics, Vol.407)
Partially modified by JNES.

Fig. III-1-2 The source area of the earthquake on Mar. 11 consisting of multi-segment rupture.



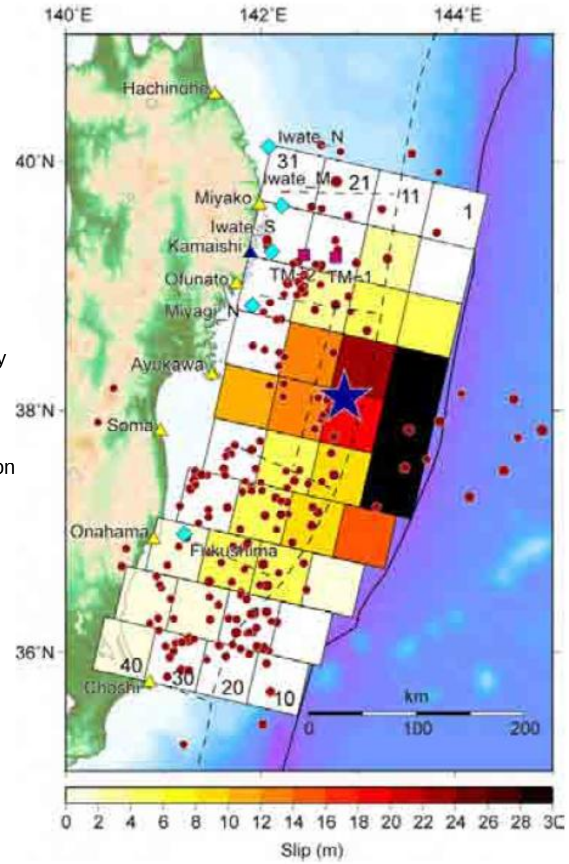
Reference: GSI Release (GSI preliminary values at 11. Mar. 2011)
[Online]. http://www.gsi.go.jp/
Partially modified by JNES.

Fig. III-1-3 Coseismic crustal deformation associated with the main shock. Horizontal deformation (Left) and vertical deformation (Right).



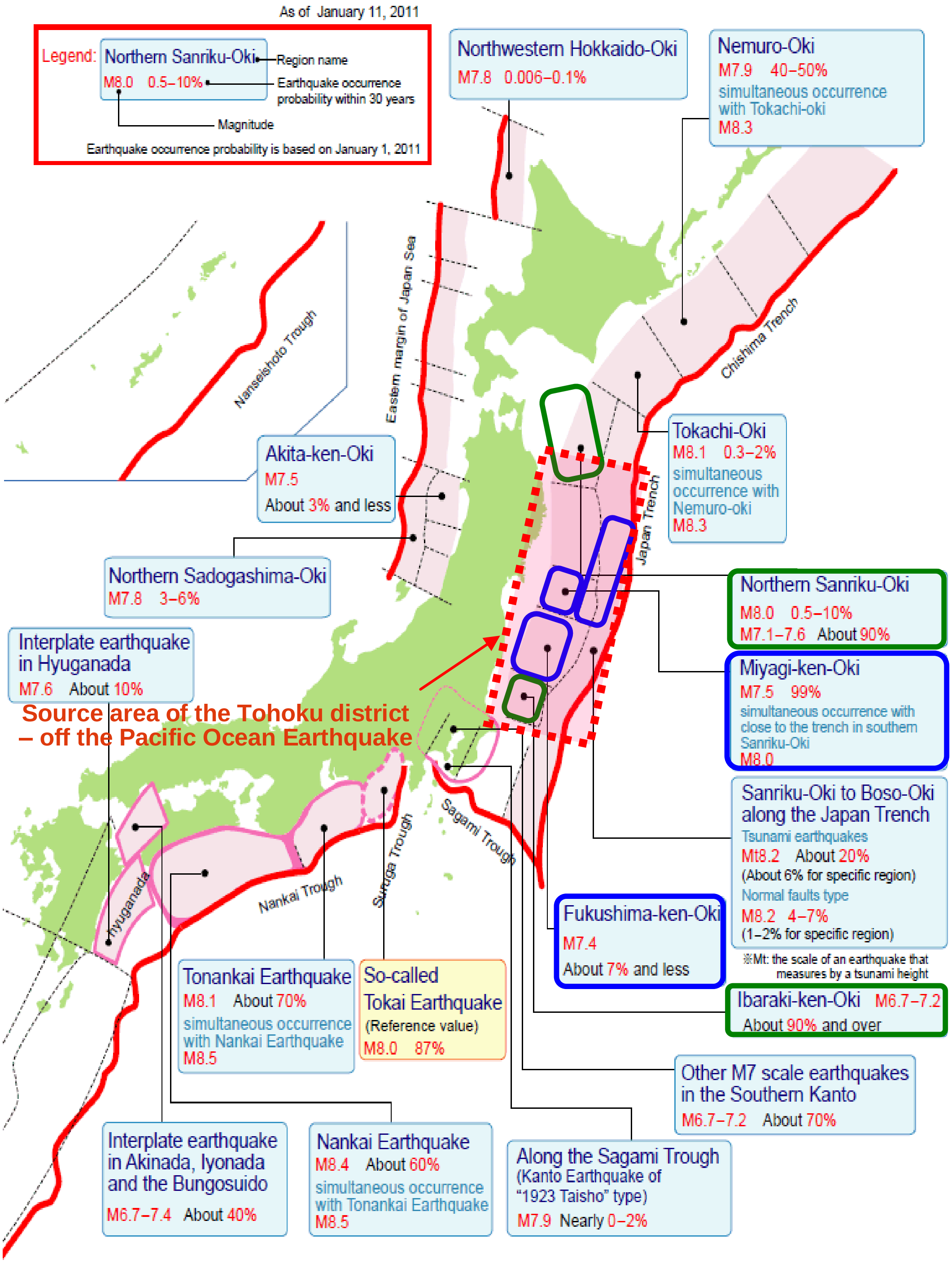
Reference: JMA Release
[Online]. http://www.mri-jma.go.jp/Dep/sv/2011tohokutaiheiyo/source-process2.pdf
Partially modified by JNES.

Fig. III-1-4 Source model based on seismic waveform inversion (JMA).



Reference: Fujii and Satake (Tsunami source model (Ver. 4.0) [Online]. http://iisee.kenken.go.jp/staff/fujii/OffTohokuPacific2011/tsunami_ja.html
Partially modified by JNES.

Fig. III-1-5 Source model from tsunami inversion.



Reference: Earthquake Research Comit., HERP Release
[Online]. http://www.jishin.go.jp/main/index-e.html
Partially modified by JNES.

Fig. III-1-6 Comparison of the source areas of the main shock and scenario earthquakes evaluated by Long-Term Evaluation Subcommittee, Earthquake Research Committee, Headquarters for Earthquake Research Promotion (HERP).

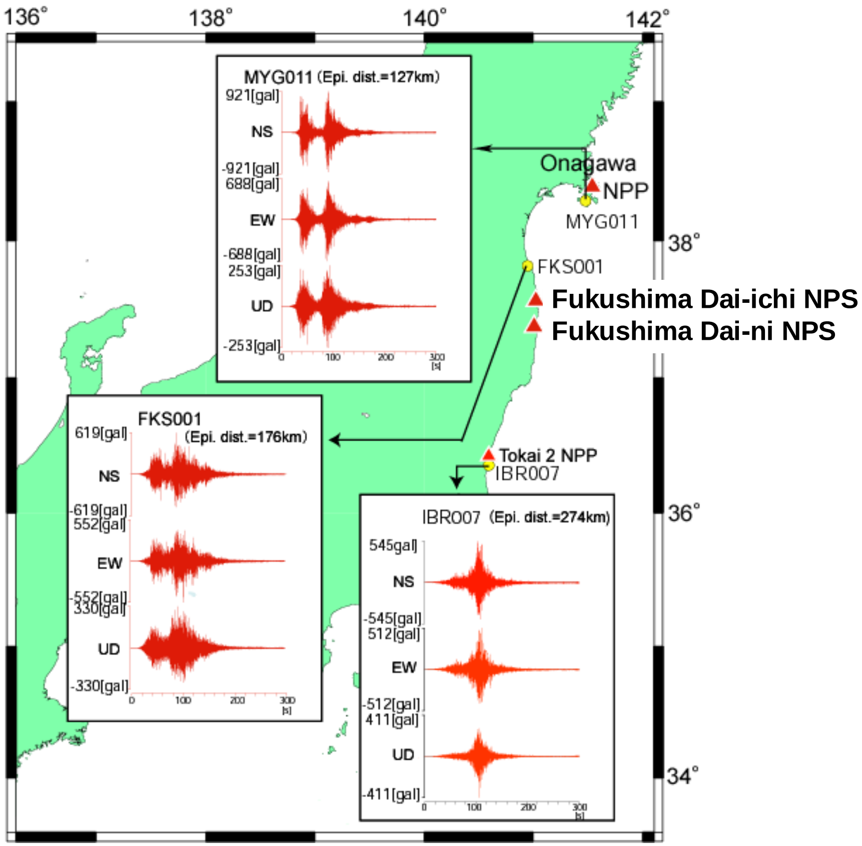
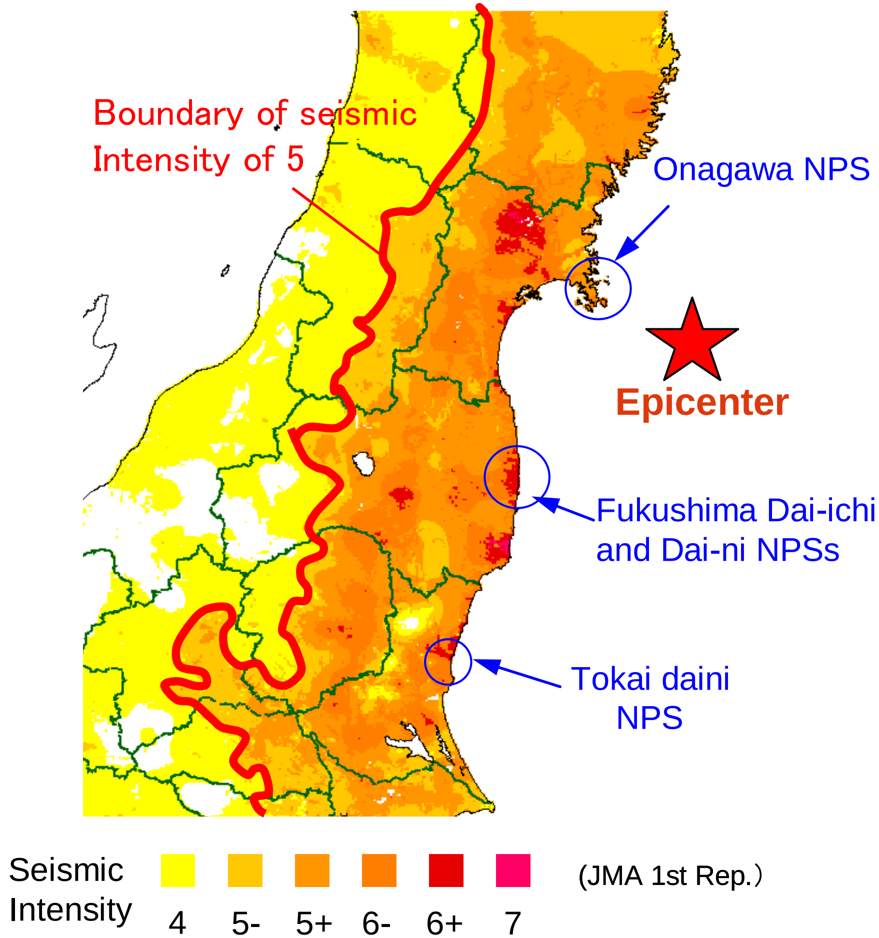


Fig. III-1-7 Acceleration seismograms recorded at around NPSs.



Reference: JMA Release [Online]. http://www.jma.go.jp/jma/index.html
Partially modified by JNES.

Fig. III-1-8 Map of JMA seismic intensities observed during the main shock.

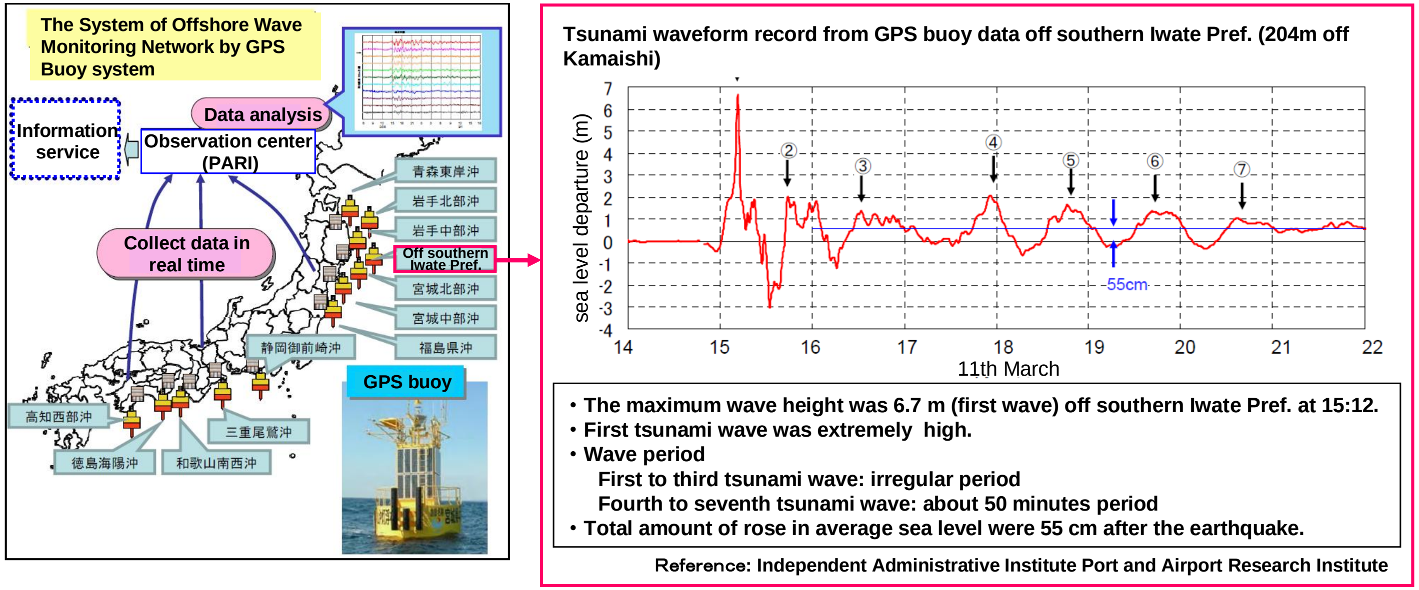
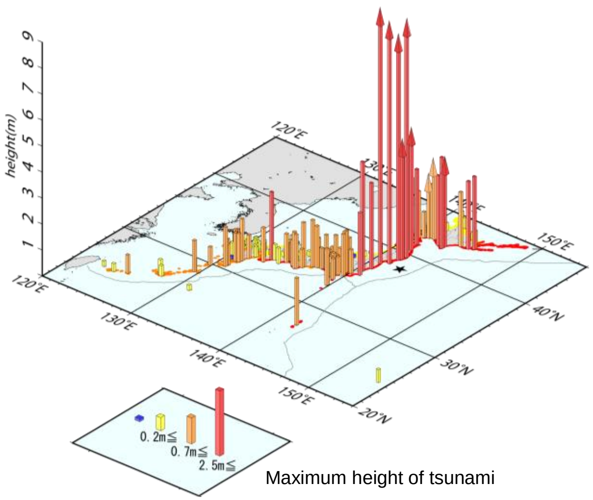


Fig. III-1- 9 A tsunami wave observed at off southern Iwate Pref..

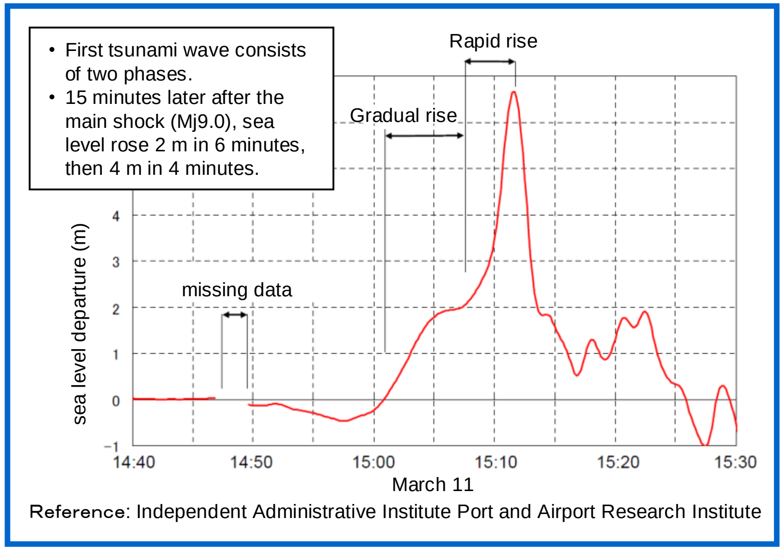


Observed Tsunami (time and height)

Station name	First tsunami	Maximum height of tsunami
Soma (Fukushima)*	March 11, 14:55 JST +0.3m	March 11, 15:51 JST +9.3m<=
Miyako (Iwate)*	March 11, 14:48 JST +0.2m	March 11, 15:26 JST +8.5m<=
Ofunato (Iwate)*	March 11, 14:46 JST -0.2m	March 11, 15:18 JST +8.0m<=
Ishinomaki (Miyagi)*	March 11, 14:46 JST +0.1m	March 11, 15:26 JST +8.6m<=
Oarai (Ibaraki)	March 11, 15:15 JST +1.8m	March 11, 16:52 JST +4.2m
Kamaishi (Iwate)*	March 11, 14:45 JST -0.1m	March 11, 15:21 JST +4.1m<=
Mutsu (Aomori)	March 11, 15:20 JST -0.1m	March 11, 18:16 JST +2.9m
Nemuro (Hokkaido)	March 11, 15:34 JST slight	March 11, 15:57 JST +2.8m
Tokachi (Hokkaido)*	March 11, 15:26 JST -0.2m	March 11, 15:57 JST +2.8m<=
Urakawa (Hokkaido)	March 11, 15:19 JST -0.2m	March 11, 16:42 JST +2.7m

*Maximum height of tsunami cannot be retrieved so far to the troubles.
Actual maximum height might be higher.

Fig. III-1-10 Map showing observed tsunami height (quoted from the paper preparing for the 1st meeting "Learn from Tohoku district – off the Pacific Ocean Earthquake" of expert examination committee, Central Disaster Prevention Council).



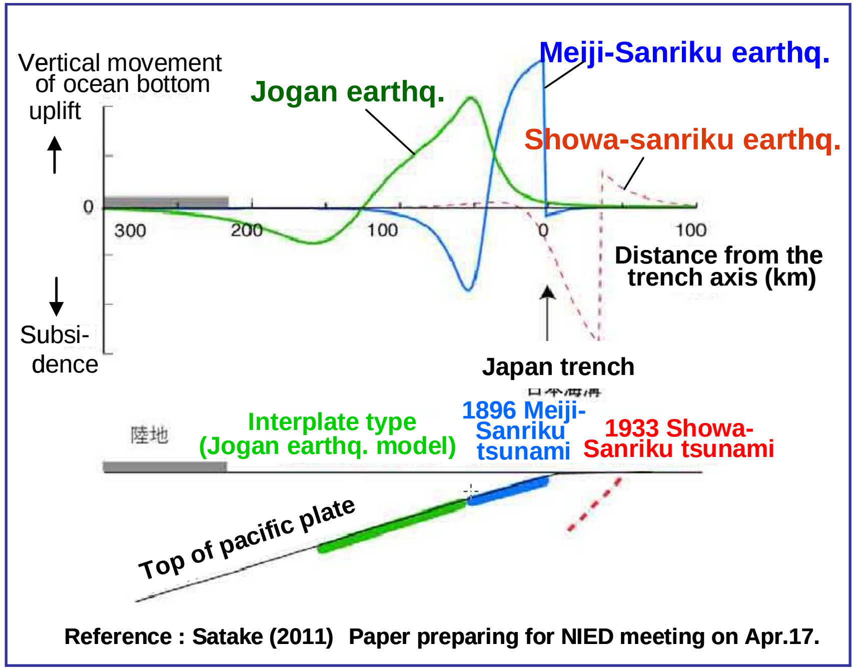


Fig. III-1-11 Characteristics of tsunami wave observed at off southern Iwate pref. for the main shock.

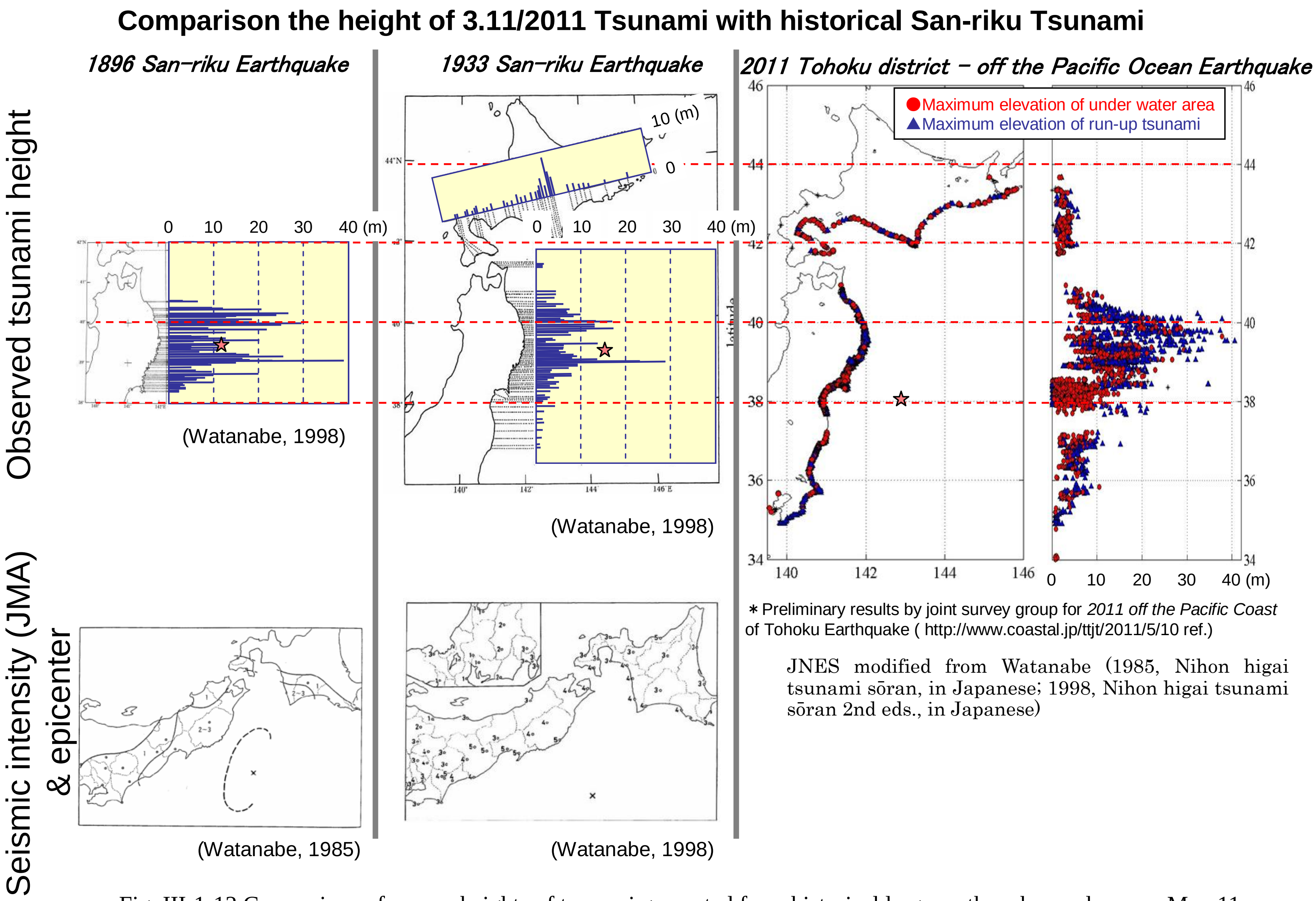
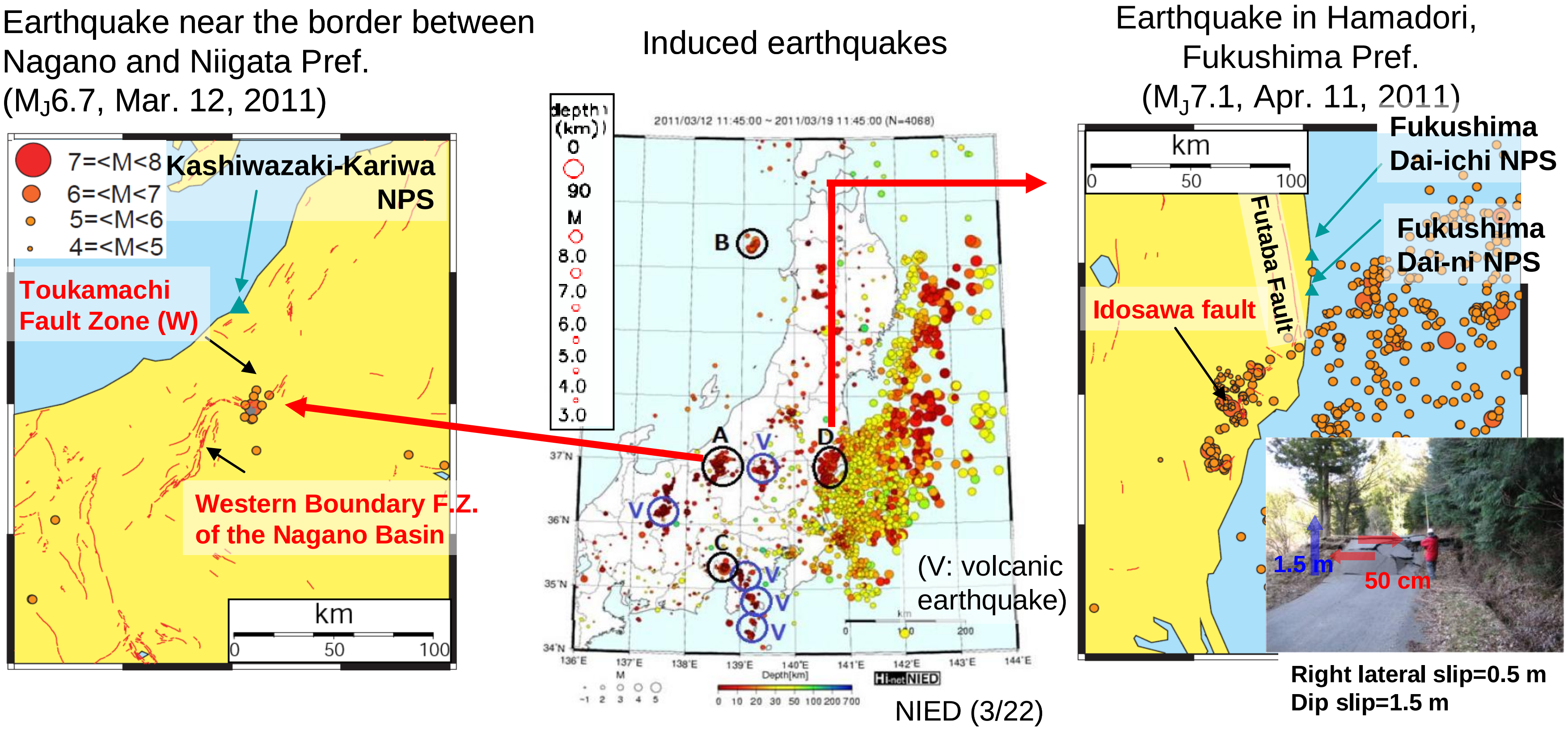
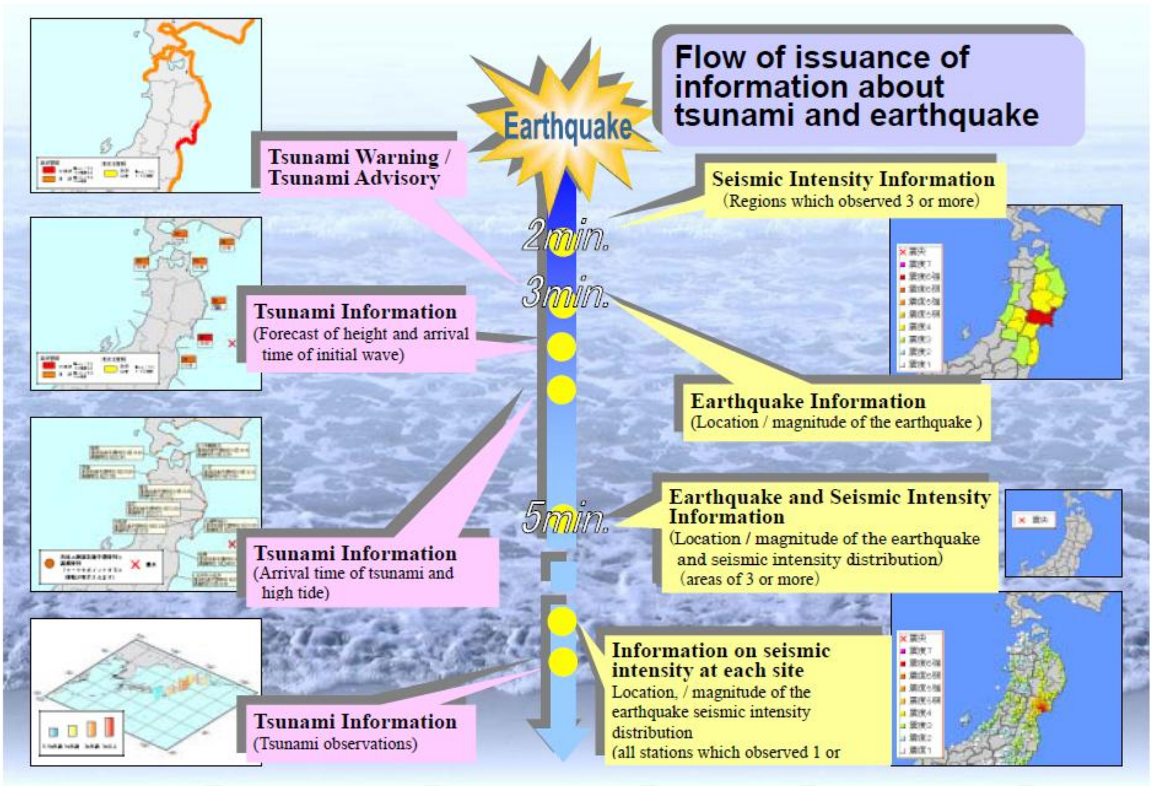


Fig. III-1-12 Comparison of run-up heights of tsunami generated from historical large earthquakes and one on Mar. 11.



Basemap from NIED
[Online]. http://www.bosai.go.jp/news/oshirase/20110323_01.pdf

Fig. III-1-13 Induced earthquakes by the mainshock.



Reference: JMA Release [Online]. http://www.seisvol.kishou.go.jp/eq/eng/fig/info.html

Fig. III-1-14 Flow of issuance of information about tsunami and earthquake by JMA.

Table III-1-1 Explanation of tsunami information and tsunami warning/advisory issued by JMA.

Tsunami Warning / Advisory

Category		Indication	Forecast tsunami height
Tsunami Warning	Major tsunami	Tsunami height is expected to be 3 meters or more.	Forecast heights are specifically indicated for every region; namely 3m, 4m, 6m, 8m and 10m or more.
	Tsunami	Tsunami height is expected to be up to 2 meters.	Same as above, but 1m or 2m.
Tsunami Advisory		Tsunami height is expected to be about 0.5 meters.	0.5m

Tsunami Warning / Advisory and Tsunami Information

Messages about tsunami	Indication
Tsunami Warning / Advisory	When the earthquake with the possibility that the tsunami is generated occurs, JMA provide the tsunami warning or tsunami advisory according to expected tsunami height. Tsunami warning (Major tsunami, tsunami) or tsunami advisory is provided within about three minutes after the occurrence of earthquake.
Tsunami information (forecast of height and arrival time of initial wave)	Forecast of height and arrival times of initial wave are provided for each forecast region.
Tsunami Information (arrival time of tsunami and high tide)	Information on high tide and forecast arrival time of tsunami at several points are provided.
Tsunami Information (tsunami observations)	Arrival time and observed tsunami height at tsunami observation stations are provided.

Reference: JMA Release [Online]. http://www.seisvol.kishou.go.jp/eq/eng/fig/tsunamiinfo.html

Table III-1-2 Comparison of issuing times, arrival times and heights for estimated tsunami and observed one.

Tsunami Forecast Region	Estimated Tsunami Arrival Time and Height						Observed Tsunami Arrival Time and Height of Initial and Maximum Tsunami			
	Issued at 14:49* JST 11 Mar (3 minutes after the earthquake)		Updated at 15:14 JST 11 Mar (28 minutes after the earthquake)		Updated at 15:30* JST 11 Mar (44 minutes after the earthquake)		Initial Tsunami		Maximum Height Tsunami	
	Estimated Tsunami Arrival Time	Estimated Tsunami Height	Estimated Tsunami Arrival Time	Estimated Tsunami Height	Estimated Tsunami Arrival Time	Estimated Tsunami Height	Observed Time	Observed Tsunami Height	Observed Time	Observed Tsunami Height
PACIFIC COAST OF AOMORI PREF.	15：30	1m	Arrival of tsunami confirmed	3m	Arrival of tsunami confirmed	8m	Hachinohe 15：22	(-) 0.8m	Hachinohe 16：57	4.2m or higher
IWATE PREF.	Arrival of tsunami inferred	3m	Arrival of tsunami confirmed	6m	Arrival of tsunami confirmed	10m or higher	Kamaishi 14：45 Miyako 14：48 Ofunato 14：46	(-) 0.1m (+) 0.2m (-) 0.2m	Kamaishi 15：21 Miyako 15：26 Ofunato 15：18	4.1m or higher 8.5m or higher 8.0m or higher
MIYAGI PREF.	15：00	6m	Arrival of tsunami confirmed	10m or higher	Arrival of tsunami confirmed	10m or higher	Ayukawa 14：46	(+) 0.1m	Ayukawa 15：26	8.6m or higher
FUKUSHIMA PREF.	15：10	3m	Arrival of tsunami confirmed	6m	Arrival of tsunami confirmed	10m or higher	Soma 14：55	(+) 0.3m	Soma 15：51	9.3m or higher
IBARAKI PREF.	15：30	2m	15：30	4m	Arrival of tsunami inferred	10m or higher	Oarai 15：15	(+) 1.8m	Oarai 16：52	4.2m
KUJUKURI AND SOTOBO AREA, CHIBA PREF.	15：20	2m	15：20	3m	Arrival of tsunami confirmed	10m or higher	Choshi 15：13	(+) 0.5m	Choshi 17：22	2.4m

Reference: JMA (Tsunami Information: Estimated Tsunami arrival time and Height (Issued at 14:50* JST, 11 March 2011)) [Online]. http://www.jma.go.jp/jp/tsunami/info_04_20110311145026.html

JMA (Tsunami Information: Estimated Tsunami arrival time and Height (Updated at 15:14 JST, 11 March 2011)) [Online]. http://www.jma.go.jp/jp/tsunami/info_04_20110311151439.html

JMA (Tsunami Information: Estimated Tsunami arrival time and Height (Updated at 15:31* JST, 11 March 2011)) [Online]. http://www.jma.go.jp/jp/tsunami/info_04_20110311153109.html

JMA (The 2011 off the Pacific coast of Tohoku Earthquake ~14th report~) [Online]. http://www.jma.go.jp/jma/press/1103/13a/kaisetsu201103130900.pdf

JMA (Observed values of Tsunami records at Miyako and Ofunato) [Online]. http://www.jma.go.jp/jma/press/1103/23b/stn03231400.pdf

JMA (Observed values of Tsunami records at Ayukawa, Ishinomaki City) [Online]. http://www.jma.go.jp/jma/press/1103/29c/201103291900.pdf

JMA (Observed values of Tsunami records at Soma) [Online]. http://www.jma.go.jp/jma/press/1104/13a/201104131600.pdf

JMA (Observed values of Tsunami records at Hachinohe) [Online]. http://www.jma.go.jp/jma/press/1105/27b/kaisetsu201105271730.pdf

JMA (Observed values of Tsunami records at Ayukawa, Ishinomaki City (revised)) [Online]. http://http://www.jma.go.jp/jma/press/1106/03b/tsunami_ayukawa2.pdf

*Note）Announced time of tsunami warning presented on this table is slightly different from that on prompt reports on JMA web site.

Table III-1-3 Tsunami information in municipal disaster management radio communication network each local government.

■ Broadcasting from Municipal Disaster Management Radio Communication Network on Iwate Prefecture

	State of the broadcasting	Article related to Observed Tsunami	Evacuation in Responding to the Broadcast
Yamada Town	They said "more than 3 meters" of tsunami height. After that, they prepared the broadcast after they confirmed through the information of television that the expected tsunami heights reassessed at 6 meters. However they could not make the broadcast due to evacuating themselves to the rooftop because they could see the tsunami from the fire station building.	No description in articles.	Mr. Taro says that "Many people evacuated to the second floor of their house because they imagined tsunami of about 3 meters height. I evacuated in panic when I saw the tsunami getting over the sea wall."
Kamaishi City	They said through the loudspeakers at 96 points within the City that "It can be expected tsunami heights of about three meters at the most. We order the inhabitants who staying near coastlines the to immediate evacuation toward high ground level areas or tsunami shelters", based on the expectation issued by the Japan Meteorological Agency (JMA) at 2:50pm. The JMA reassessed the expectation of tsunami heights at 6 meters at 3:14pm, also reassessed it at more than 10 meters at 3:31pm. However the city hall has become to not receive the prefectural office's emails of information issued by the JMA. Meanwhile they repeated the instruction broadcasting 6 times.	Actually, it was assumed that the tsunami of about 9 meters height attacked the Port of Kamaishi.	In the citizens of Kamaishi City, there were many people who imagined "the tsunami of 3 meters high" and decided the safety by evacuation to the second floor. From 150 to 200 people in neighboring area of Unosumai District run in the disaster mitigation centre containing second floor located in the district, however the survivor was about 30 people because from the first to second floor of the centre was devastated by Tsunami. Mr. Furukawa who is refugee says "I would escaped from the event to hills if I could recognize the tsunami having higher than my understanding." Mr. Sakamoto who is fisherman says that we thought to not need to evacuate against the tsunami of 3 meters height because we have the complete sea walls for protection from a tsunami. Death and missing people was over 1300 in Kamaishi City.
Ofunato City	They did not say concerning tsunami heights from the beginning, however, they called out the issued warning against major tsunami and evacuation to high ground area.	The tsunami height which attacked the Port of Ofunato was assumed at about 9.5 meters.	Death and missing people was over about 500 in Ofunato City.
Rikuzentakada City and Ohtsuchi Town	They could not recognize the broadcast situation on that time because the recording documents about them were washed away.	No description in articles.	No description in articles.

■ Broadcasting from Municipal Disaster Management Radio Communication Network on Miyagi Prefecture

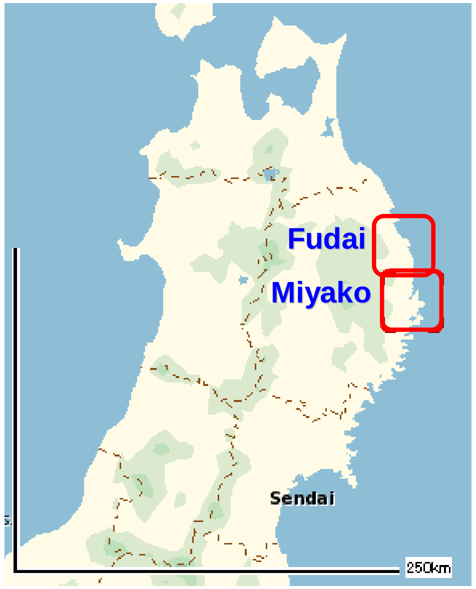
	State of the broadcasting	Article related to Observed Tsunami	Evacuation in Responding to the Broadcast
Minami Sanriku Town	They called out through the Municipal Disaster Management Radio Communication Network just after the earthquake immediately that "6 meters height of tsunamis are coming" because the JMA issued the warning against major tsunami of 6 meters height from the beginning.	The actual tsunami height exceeded 15 meters.	There were many people who evacuated to high ground areas in accordance with the radio broadcasting. Many officers were dead because the entire the three-story building of the town's Crisis Management Department was submerged by the tsunami.
Kesennuma City	According to the head office of countermeasures on Kesennuma City, they called out the evacuation through the Municipal Disaster Management Radio Communication Network when the JMA issued the warning against major tsunami on the day. Although they did not have records whether they could give a lot of care by indicated specific tsunami heights, they say that "we thoroughly called out the evacuation to high ground areas in any case".	No description in articles.	No description in articles.

Reference: The Asahi Shimbun Company Release [Online]. http://www.asahi.com/national/update/0420/TKY201104200249.html

Destruction by tsunami scouring

Destruction by wave pressure

Fig. III-1-15 Damages of seawall and harbor installation due to the tsunami.



The 10m-high seawall was destroyed in Taro district, Miyako city, Iwate Pref.

The 15.5m-high seawall was undestroyed in Otabe district, Fudai village, Iwate Pref.

Fig. III-1-16 Difference of seawall heights resulting in different consequence.

A photo from the village’s point of view (i.e. facing the coast)

A photo from a viewpoint of facing the village taken at the spot slightly below the stone monument

Fig. III-1-17 Photos of a stone monument and tsunami invading area below the stone monument.

2. Damage caused by the earthquake and tsunami hitting Fukushima NPSs

(1) Seismic ground motion and tsunami height observed at Fukushima Dai-ichi NPS

1) Matters related to seismic ground motion

a Seismic ground motion observation system and observation records

The seismic ground motion observation system of Fukushima Dai-ichi NPS, as shown in Figure III-2-1, consists of seismometers installed on the first basement and the second floor of the reactor buildings, seismometers in underground down-hole array (five seismometers in each part hole) at two parts in the south and north of the site and observation record device. Seismometers observe acceleration time history of two horizontal and vertical components.

Seismometers are installed at 53 points in Fukushima Dai-ichi NPS. Seismic ground motion was recorded at 29 points out of them. However, according to TEPCO's investigation, records of acceleration time history were interrupted at around 130 to 150 seconds at seven points. TEPCO's investigation revealed that the cause was failure of recoding device software.

Table III-2-1 shows the list of maximum acceleration of seismic ground motion observed in three components (east-west, north-south and vertical) at the base mat level of the reactor buildings. Maximum acceleration in horizontal direction was 550 Gal at Unit 2 (east-west) and that in vertical direction was 302 Gal at Unit 2.

b Comparison between standard seismic ground motion Ss and seismic ground motion observed

In the seismic back check, the standard seismic ground motion Ss (Ss-1 to Ss-3) are established to envelop the seismic ground motion caused by plate boundary earthquake off the coast of Fukushima Prefecture, intraslab earthquake[5] beneath the site, earthquake by capable fault around the site and possible earthquake from diffuse seismicity.

Table III-2-1 shows maximum response acceleration to the standard seismic ground

[5] Intraslab earthquake: The earthquake caused by a fault rupture within a descending oceanic crust.

motion Ss at the site where seismometers were installed at the base mat level on the first basement level of the reactor buildings. The table shows that observed maximum acceleration is mostly smaller than maximum response acceleration to the standard seismic ground motion Ss. However, maximum acceleration observed in east-west direction at Units 2, 3 and 5 is larger than maximum response acceleration to Ss. Figure III-2-2(a) shows acceleration time history of east-west component in Unit 2.

Figure III-2-2(b) shows the comparison chart between the response spectra of observed seismic ground motion at the base mat level of the reactor building of Units 2, 3 and 5 and the response spectra at the base mat level of the building, inputting the standard seismic ground motion Ss into the base mat. The Figure shows that the response spectra of observation records of Units 2, 3 and 5 exceeds the response to Ss with a period of 0.2 to 0.3 second.

c Probabilistic seismic hazard assessment and exceedance probability of the standard seismic ground motion Ss

The Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities was revised in 2006. Under the revised Guide, considering the residual risk, the standard seismic ground motion Ss exceedance probability is referred from the standpoint that the possibility of seismic ground motion exceeding the standard seismic ground motion Ss is undeniable. NISA instructed TEPCO to conduct seismic back check (evaluation of Ss adequacy and safety of facilities) based on revision of the Guide. TEPCO evaluated the standard seismic ground motion Ss exceedance probability according to the seismic hazard evaluation procedures of the Seismic PSA Implementation Standards of the Atomic Energy Society of Japan as a part of seismic back check, and reported to NISA.

Figure III-2-3 shows the uniform hazard spectra of Fukushima Dai-ichi NPS. In the Figure, Ss-1H and Ss-2H response spectra are also shown. The figure shows exceedance probability of the standard seismic ground motion Ss is within the range of 10^{-4} to 10^{-6} per year.

2) Matters related to tsunami

a Tide level observation system and observed records

The tide level observation system consists of tide gauge and observation recording device. The tide gauge is installed in quiet area in harbor, and the tide level observation recoding device is installed in the data transfer building. According to the press conference of TEPCO (April 9), initial major tsunami arrived at around 15:27 (41 minutes later of mainshock occurrence) and tsunami height was approximately 4 m height. Though secondary major tsunami arrived at 15:35, the water level is unknown due to tide gauge failure. Maximum scale of the gauge is 7.5 m.

The site height of Fukushima Dai-ichi NPS is 10 m at Units 1 to 4, and 13 m at Units 5 and 6. At Fukushima Dai-ichi NPS, tsunami rushed from the offshore area in front of the site, and most part of the site where main buildings were placed was flooded. TEPCO reported about the inundation height based on the results of trace investigation at flooding. The results of the report are shown in Figure III-2-4. The inundation height of the ocean-side site such as reactor buildings of Units 1 to 4, turbine buildings, etc. is O.P. approximately +14 to 15 m at points H to K in the Figure(O.P.: Onahama Port base tide level for construction). Experts estimate that the tsunami height caused by this earthquake is more than 10 m from the picture (refer to Fig. III-2-5) showing the overflow status of tsunami seawall (10 m) released by TEPCO. It is hence assumed that tsunami height at the sea water pump is more than 10 m.

The average ground subsidence level is approximately 0.8 m along the coast area of Miyagi to Fukushima prefectures in this earthquake, and it is necessary to consider that the site height may change by ground subsidence when hit by tsunami.

b Comparison between design basis tsunami height and observed tsunami height

As shown in Figure III-2-6, in the application document for establishment permit, subject tsunami source is Chile Earthquake (M9.5 in 1960) and the design basis tsunami water level is 3.1 m. In 2002, TEPCO evaluated the design tsunami height based on the "Tsunami Assessment Method for Nuclear Power Plants in Japan (2002)" of the Tsunami Evaluation Subcommittee, the Nuclear Civil Engineering Committee, Japan Society of Civil Engineers (hereafter referred to as Tsunami Assessment Method of JSCE), assessing off the coast of Fukushima Prefecture Earthquake (M7.9 in 1938) shown in Figure III-2-6 as M8.0 voluntary, and the highest water level of each Unit was set as 5.4 to 5.7 m. According to the evaluation, elevation of Unit 6 sea water pump motor of emergency diesel generator was raised up 20 cm and also that of sea water pump motor for High Pressure Core Spray was raised up 22 cm.

Tsunami Assessment Method of JSCE above is also reflected in IAEA Tsunami Hazard Guide DS417. However, the tsunami recurrence period is not identified in the method,

At the 32nd Joint Working Group for Earthquake, Tsunami, Geology, and Foundations under the Seismic and Structural Design Subcommittee (June 24, 2009) held in order to conduct examination related to earthquake, it was pointed out that although the investigation report about tsunami by the Jogan earthquake in 869 was made by National Institute of Advanced Industrial Science and Technology and Tohoku University, the earthquake causing the tsunami was not dealt with. Regarding this, NISA requested TEPCO at the 33rd Joint Working Group (July 13, 2009) to take into account the Jogan earthquake for evaluating design tsunami height when new knowledge on the tsunami of the Jogan earthquake is obtained.

c Probabilistic tsunami hazard evaluation and exceedance probability of design basis tsunami height

The Tsunami Assessment Subcommittee of JSCE is at work on consideration about probabilistic tsunami hazard analysis method. As a part of the consideration, the tsunami hazard assessment method and the trial assessment of tsunami exceedance probability (Fig. III-2-7) are already announced but not yet completed. Other trial assessment of tsunami hazard is also announced.

3) Matters related to damage

a Matters related to external power supply system outside the site

Figures III-2-8(a) and III-2-8(b) show the transmission network of external power supply of Fukushima Dai-ichi NPS and the damage situation. As shown in the Figures, the Okuma Nos. 1 and 2 power transmission lines (275 kV) from Shin Fukushima Power Substation connected to the normal high voltage switchboards of Units 1 and 2 via the switchyards for Units 1 and 2, and in addition, TEPCO nuclear line (66 kV) from Tohoku Electric Power Co., Inc. connected to the normal high voltage switchboard of Unit 1 via the switchyards for Units 1 and 2. As to Units 3 and 4, the Okuma Nos. 3 and 4 transmission lines (275 kV) connected to the normal high voltage switchboard of Units 3 and 4 via the switchyards for Units 3 and 4 as well. For Units 5 and 6, the Yorunomori Nos. 1 and 2 transmission lines (66 kV) connected to the normal high voltage switchboard of Units 5 and 6, too.

In addition, the normal high voltage switchboard of Unit 1, the normal high voltage switchboard of Unit 2, and the normal high voltage switchboard of Units 3 and 4 were connected mutually, and electric power interchange was possible. However, the switchyard for the Okuma No. 3 transmission line in the switchyards of Units 3 and 4 was under construction on the day when the earthquake occurred, and as a result, external transmission line in the total of six lines was connected to Fukushima Dai-ichi NPS. The Shin Fukushima Power Substation is located approximately 8 km from the site, and the seismic intensity of this earthquake is estimated to be 6 upper.

The earthquake caused damage to the breakers of the switchyards of Units 1 and 2. As to TEPCO nuclear line from Tohoku Electric Power, although it is not possible to estimate the cause, cables were damaged. Concerning Units 3 and 4, in addition to the Okuma No. 3 transmission line under construction, the breakers of Nos. 3 and 4 transmission lines on the side of Shin Fukushima Power Substation failed. In addition, for Units 5 and 6, one transmission line tower (tower No. 27) connecting to the switchyards of Units 5 and 6 was collapsed. As a result, all external power supplies of Units 1 to 6 were lost.

b Sea water system pump and emergency power supply system in the site

As to the sea water pump facilities for component cooling (height: 5.6 to 6 m) at Fukushima Dai-ichi NPS, all Units were flooded by tsunami as shown in Figure III-2-4. Whether or not they were damaged by wave power is under investigation. In addition, the Emergency Diesel Generators and switchboards installed in the basement floor of the reactor buildings and the turbine buildings (height: 0 to 5.8 m) were flooded except for Unit 6, and the emergency power source supply was lost. Regarding Unit 6, two out of three Emergency Diesel Generators were installed in the first basement of the reactor building and was flooded, but one Generator installed on the first floor of Diesel Generator building was not flooded and the emergency power supply was possible.

(2) Seismic ground motion and tsunami observed at Fukushima Dai-ni NPS

1) Matters related to seismic ground motion

a Seismic ground motion observation system, and observation records and observation seismic ground motion

The seismic ground motion observation system of Fukushima Dai-ni NPS is basically similar to that of Fukushima Dai-ichi NPS previously described in 2 (1). The seismometers are installed at 43 points in Fukushima Dai-ni NPS. All of these seismometers recorded the acceleration time history data of the seismic ground motion by this earthquake. However, in the same way as Fukushima Dai-ichi NPS, recording of acceleration time history was interrupted at around 130 to 150 seconds at 11 points due to failure of recoding device software.

Table III-2-2 shows observation records of maximum response acceleration in three components, two horizontal (east-west and north-south) and one vertical components, on the base mat of reactor building. Maximum acceleration in horizontal direction was 277 Gal at Unit 3 (north-south direction) and that of vertical direction was 305 Gal at Unit 1.

b Comparison between standard seismic ground motion Ss and seismic ground motion observed

The standard seismic ground motion Ss (Ss-1 to Ss-3) are established to envelop the seismic ground motion caused by plate boundary earthquake off the coast of Fukushima Prefecture, intraslab earthquake beneath the site, earthquake by capable fault around the site and possible earthquake from diffuse seismicity. Table III-2-2 shows maximum response acceleration to the standard seismic ground motion Ss at the site where seismometers were installed at the base mat level on the first basement level of the reactor buildings. The table also shows that maximum acceleration of observation records of all Units were smaller than maximum response acceleration to the standard seismic ground motion Ss.

Figure III-2-9 shows the acceleration time history and the response spectra of observed seismic ground motion at the base mat level of the reactor building of Unit 3 whose acceleration in horizontal direction was highest. The figure also shows the response spectra on the base mat level inputting the standard seismic ground motion Ss into the base mat. The figure implies that the response spectra obtained from observation records fall below the response spectra inputting the standard seismic ground motion Ss

c Probabilistic seismic hazard assessment and exceedance probability of the standard seismic ground motion Ss

Figure III-2-10 shows the uniform hazard spectra of Fukushima Dai-ni NPS. The response spectra of Ss-1H and Ss-2H are also shown. The Figure shows that the exceedance probability of the standard seismic ground motion Ss is within the range of 10^{-4} to 10^{-6} per year.

2) Matters related to tsunami

a Tide level observation system and observed records

The tide level observation system of Fukushima Dai-ni NPS is basically similar to that of Fukushima Dai-ichi NPS previously mentioned in section 2.(1). According to the press conference of TEPCO on Apr. 9, initial major tsunami arrived at around 15:23 (37 minutes later of main shock occurrence) and next major tsunami at 15:35. After that, the circumstance is not clear.

Because the tide gauge was damaged, the observation records were not preserved. As a result, tsunami time history and maximum tsunami height were not clear.

TEPCO reported about the inundation height based on the results of trace investigation at flooding as well as Fukushima Dai-ichi NPS previously described in section 2.(1). Figure III-2-11(a) shows the report results. Fukushima Dai-ni NPS consists of the ocean-side area where seawater pumps, etc. are installed and the raised mountain-side area where reactor buildings, turbine buildings, etc. are installed. Tsunami at first flooded from the ocean-side area in front of the site. Afterward, as shown in the Figure, tsunami flooded from the narrow space between the south side of Unit 1 and the slope in the mountain-side area, and reached the back of the mountain-side area. There was no flooding except from the narrow place. The inundation height in the ocean-side area was O.P. approximately +6.5 to 7 m, and O.P. approximately +14 to 15 m in the mountain-side area (O.P. means base level of Onahama Port construction).

b Comparison between design basis tsunami height and observed tsunami height

In the application document for construction permit , subject tsunami source is Chile Earthquake (M9.5 in 1960) and the design basis tsunami height of each Unit is 3.1 to 3.7 m in the same way as Fukushima Dai-ichi NPS. In the previously mentioned assessment based on the Tsunami Assessment Method for Nuclear Power Plants in Japan (2002), off the coast of Fukushima Prefecture Earthquake (M7.9 in 1938) was assessed as M8.0, in the same way as Fukushima Dai-ichi NPS, and the design height of each Unit was 5.1 to 5.2 m.

3) Matters related to damage

a Matters related to external power supply system outside the site

The transmission network of external power supply of Fukushima Dai-ni NPS contain four lines including two lines of the extra high voltage switchyard on the site used in combination among Units 1 to 4 and the Tomioka Nos. 1. and 2 transmission lines outside the site (500 kV), and two lines of the Iwaido Nos.1 and 2 transmission lines (66 kV), and they connect to Shin Fukushima Power Substation, 8km upstream, and further, connect to Shin Iwaki Switchyard, approximate 40 km upper. Out of these transmission lines, power supply from Iwaido No.1 had been stopped for maintenance.

The seismic intensity in the area around Shin Fukushima Power Substation is estimated to be 6 upper. The Tomioka No. 2 transmission line (500 kV) and the Iwaido No. 2 transmission line (66 kV) to Units 1 to 4 of Fukushima Dai-ni NPS stopped transmission due to failure of devices on the side of the switchboard, caused by strong ground motion in this earthquake. However, the power supply to Units 1 to 4 was continued since the Tomioka No. 1 transmission line could supply electric power (refer to Fig.III-2-8(a)).

b Sea water system pump and emergency power supply system in the site

The sea water pump facilities for component cooling of all Units (height: 6 m) were flooded by tsunami and lost its function except Unit 3, which was not flooded and kept its function.

The Emergency Diesel Generators installed in the basement of the reactor buildings (height: 0 m) kept their functions for Unit 3 and 4, however, those for other Units lost their functions by completely flooding (Fig. III-2-11(b)).

As shown above, the sea water pump facilities for component cooling and the emergency diesel generator kept those functions only for Unit 3.

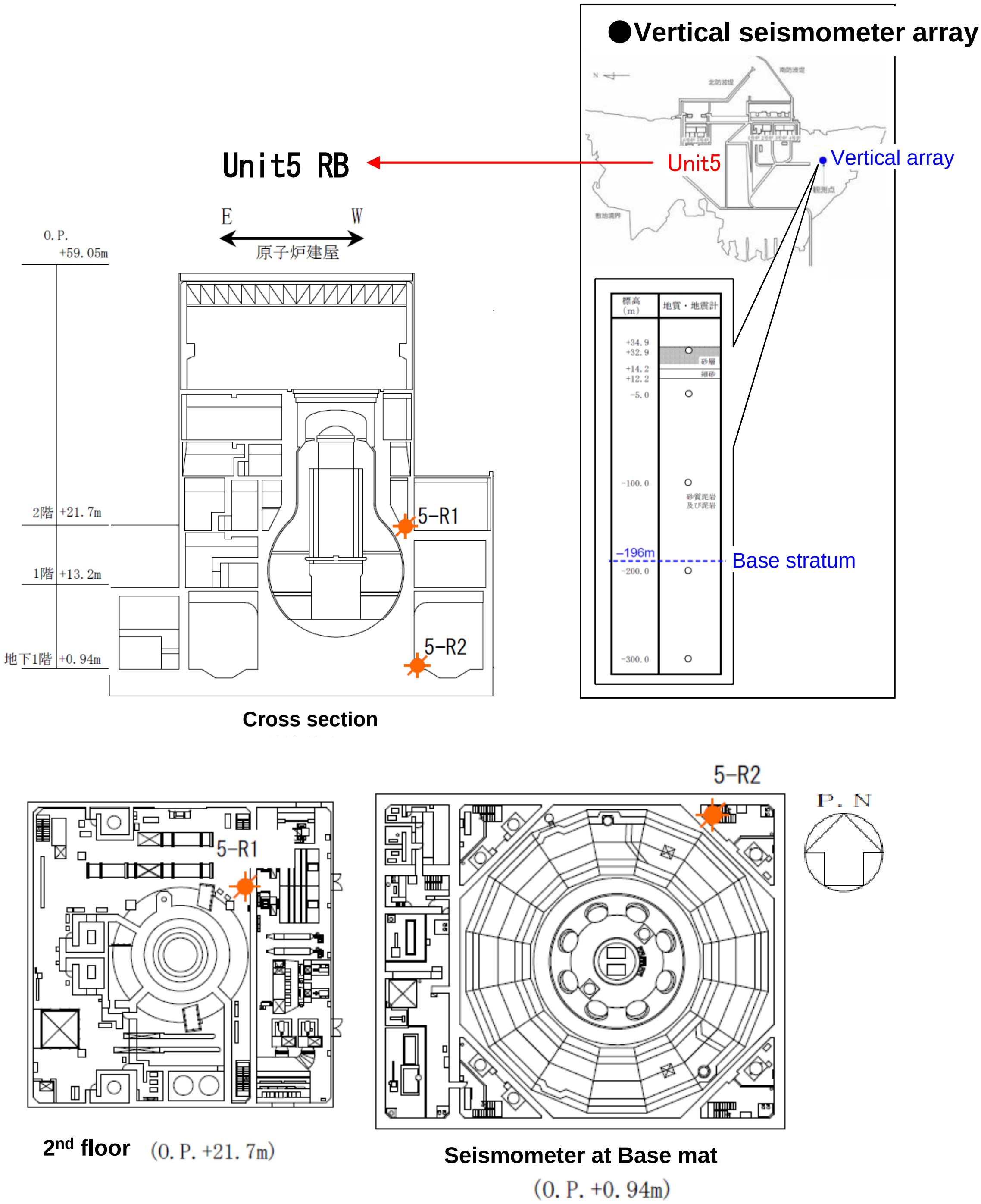


Fig. III-2-1 Deployment of seismometers at Fukushima Dai-ichi NPS and R/B in unit 5.

Table III-2-1 Max. acceleration values observed in reactor buildings at Fukushima Dai-ichi NPS.

Loc. of seismometer (bottom floor of reactor bld.)		Record*1 Max. acc. (Gal)			Max. response acceleration to the DBGM Ss (Gal)		
		NS	EW	UD	NS	EW	UD
Fukushima Dai-ichi	Unit 1	460*2	447*2	258*2	487	489	412
	Unit 2	348*2	550*2	302*2	441	438	420
	Unit 3	322*2	507*2	231*2	449	441	429
	Unit 4	281*2	319*2	200*2	447	445	422
	Unit 5	311*2	548*2	256*2	452	452	427
	Unit 6	298*2	444*2	244	445	448	415

***1 These are temporal values, and may be corrected later.**
***2 Each recording was interrupted at around 130-150 s from recording start time.**

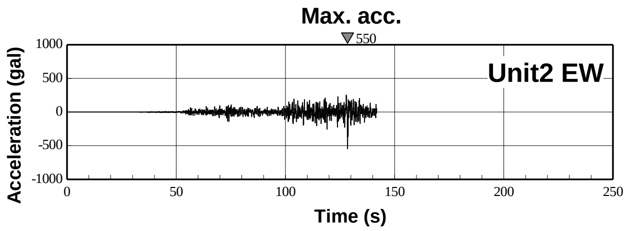


Fig. III-2-2(a) Acceleration seismogram on the base mat at R/B in Unit-2 at Fukushima Dai-ichi NPS.

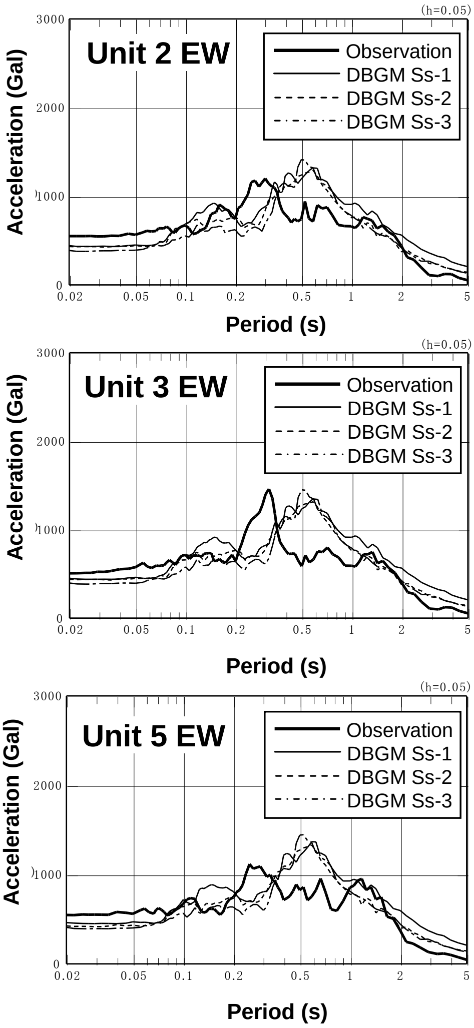


Fig. III-2-2(b) Response spectra on the base mats at R/Bs at Fukushima Dai-ichi NPS.

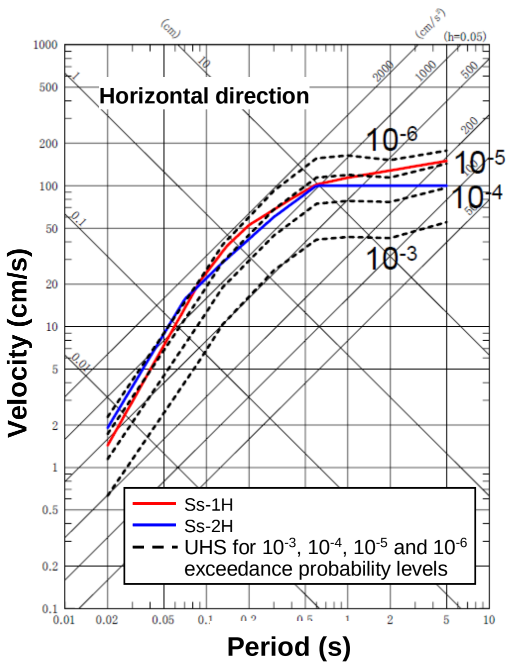
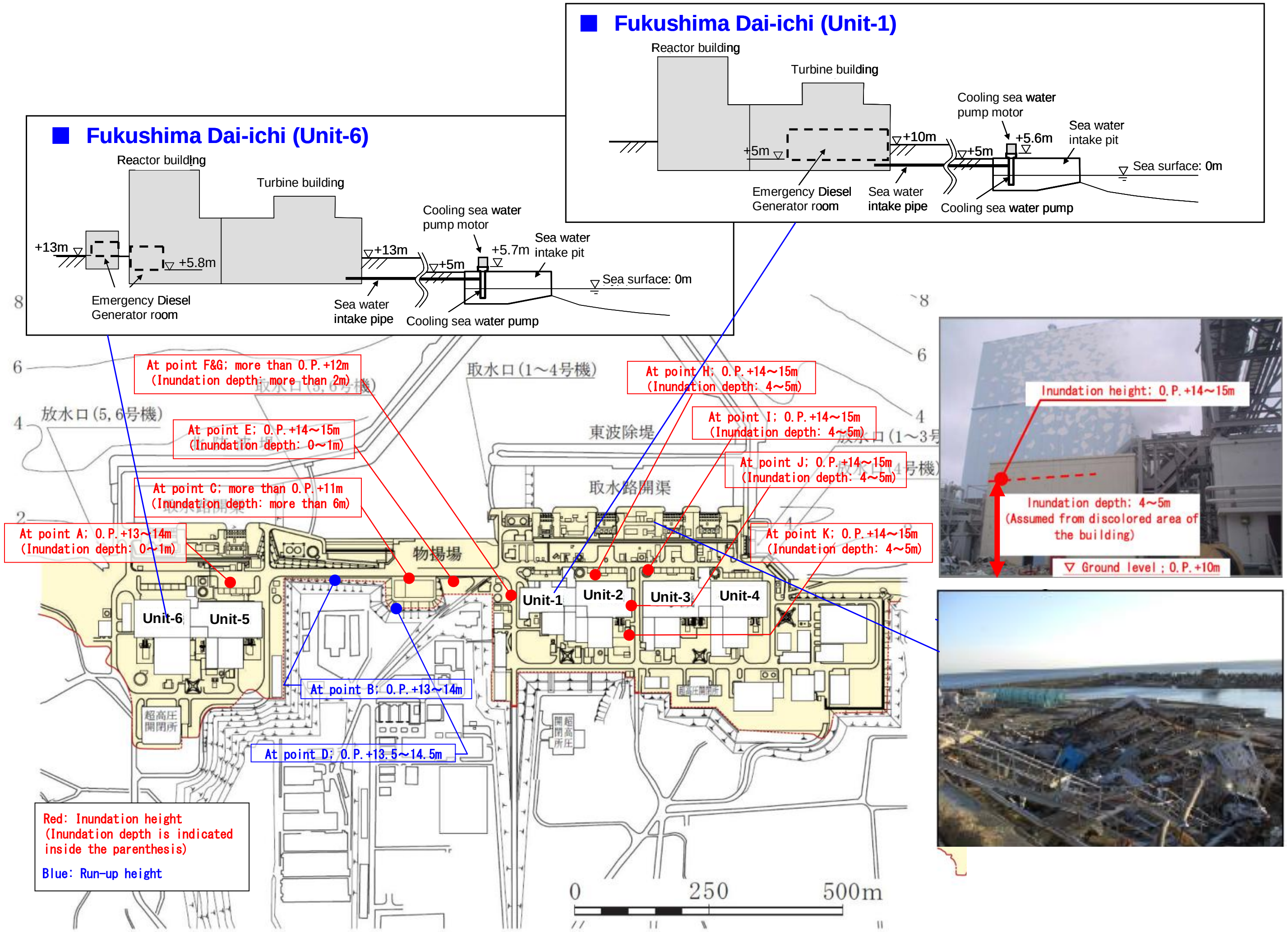


Fig. III-2-3 DBGM Ss and Uniform Hazard Spectra (UHS) for Fukushima Dai-ichi NPS.

Presented by TEPCO



Reference: The Tokyo Electric Power Co., Inc. Release [Online]. http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/110409e9.pdf
Partially modified by JNES.

Reference: The Tokyo Electric Power Co., Inc. Release [Online]. http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/110409e9.pdf
Partially modified by JNES.

Fig. III-2-4(a) Damage of Fukushima Dai-ichi NPS due to the tsunami.

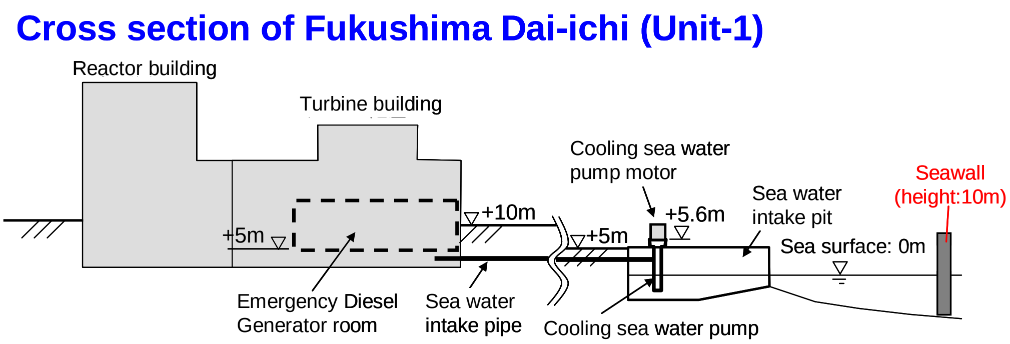
【福島第1原発　津波来襲状況　2011年3月11日　固体廃棄物貯蔵庫東側のり面(5号機の近傍(南側)から東側を撮影】＝東京電力提供

【福島第1原発への津波来襲状況　2011年3月11日　廃棄物処理建屋4階から北側を撮影】午後3時43分ごろ(2)＝東京電力提供

【福島第1原発　津波来襲状況　2011年3月11日　固体廃棄物貯蔵庫東側のり面(5号機の近傍(南側)から東側を撮影】＝東京電力提供

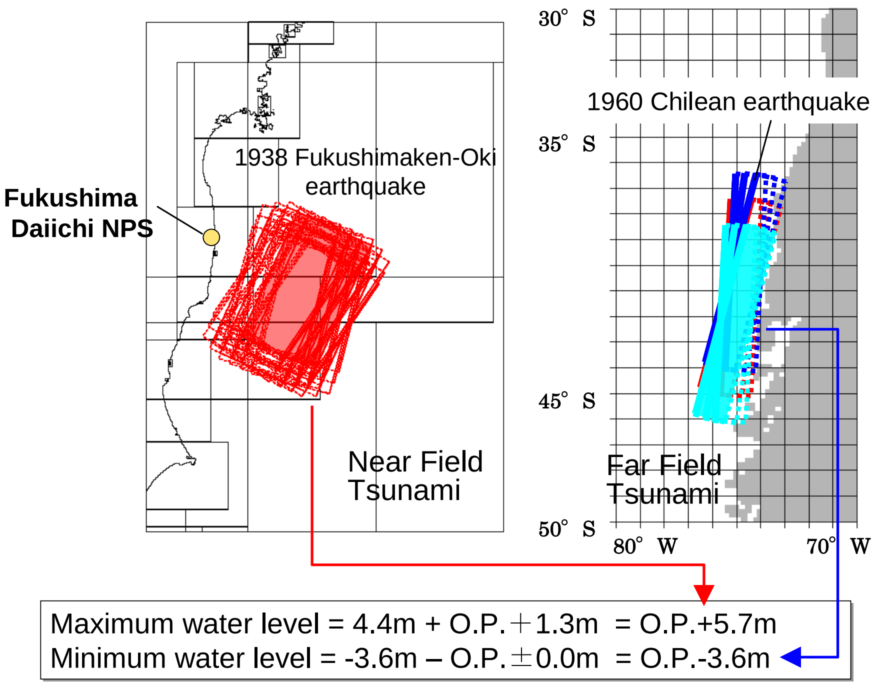
Reference: The Tokyo Electric Power Co., Inc. Release [Online].http://www.tepco.co.jp/tepconews/pressroom/110311/index-j.html

Fig. III-2-4(b) Photos showing plant damages at the Fukushima Dai-ichi NPS.



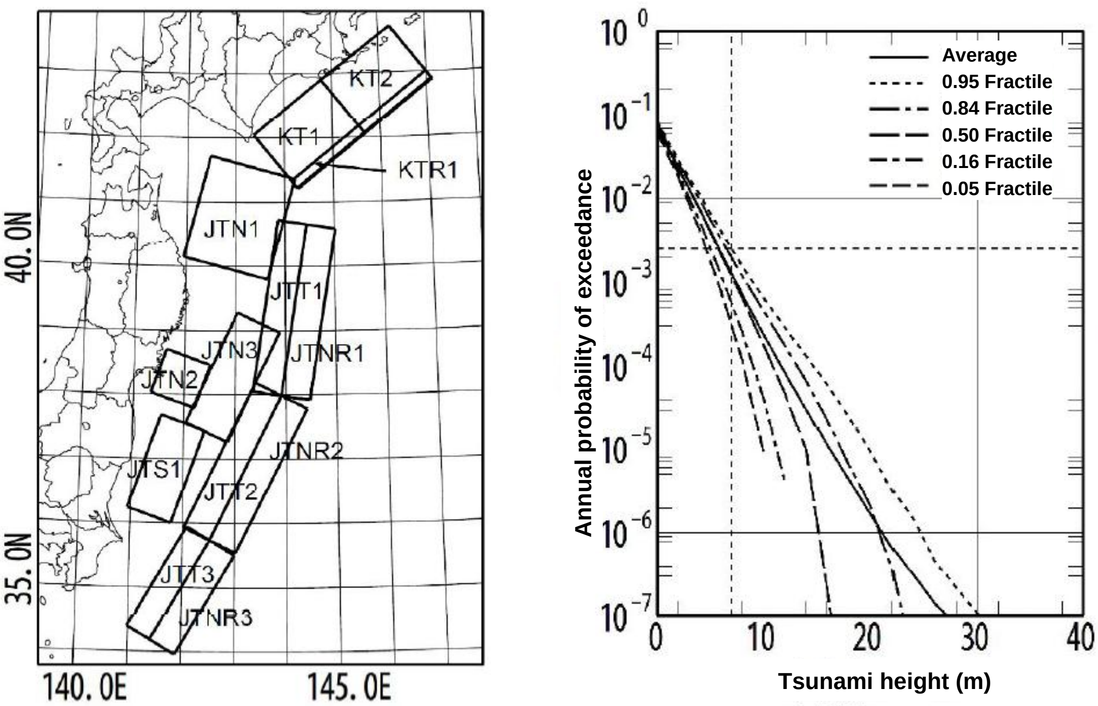
Reference: The Tokyo Electric Power Co., Inc. Release [Online].http://www.tepco.co.jp/tepconews/pressroom/110311/index-j.html

Fig. III-2-5 Tsunami getting over seawall at the Fukushima Dai-ichi NPS.



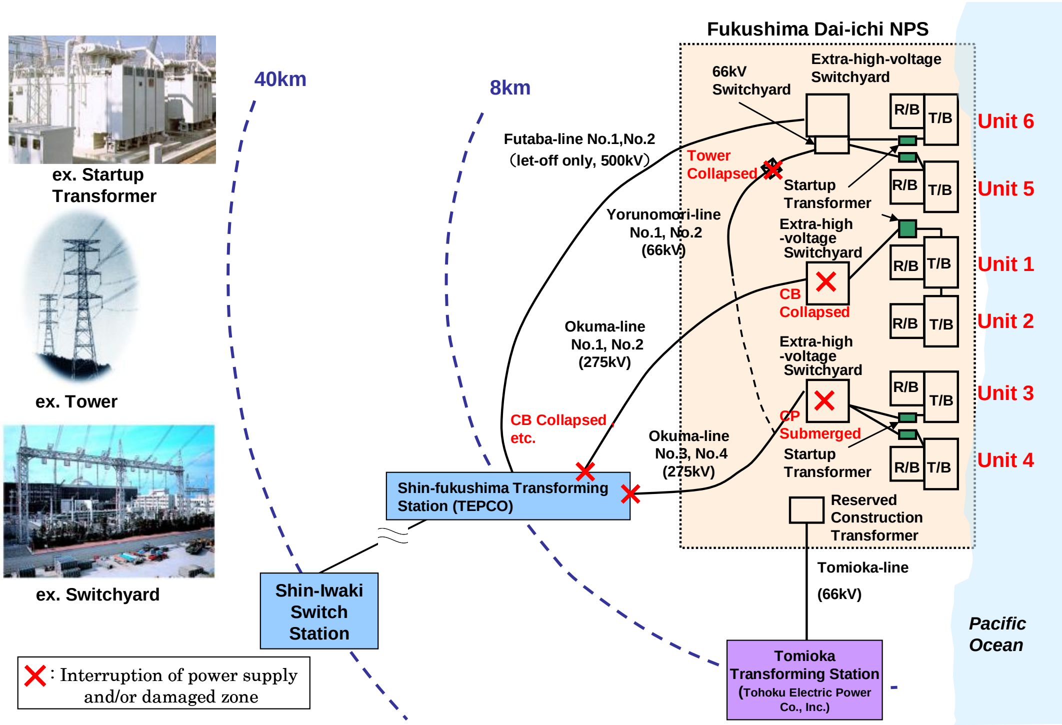
Reference: Takao (2010) [Online].
http://www.jnes.go.jp/seismic-symposium10/presentationdata/3_sessionB/B-11.pdf
Partially modified by JNES.

Fig. III-2-6 Design tsunami level evaluated by TEPCO for the Fukushima Dai-ichi NPS.

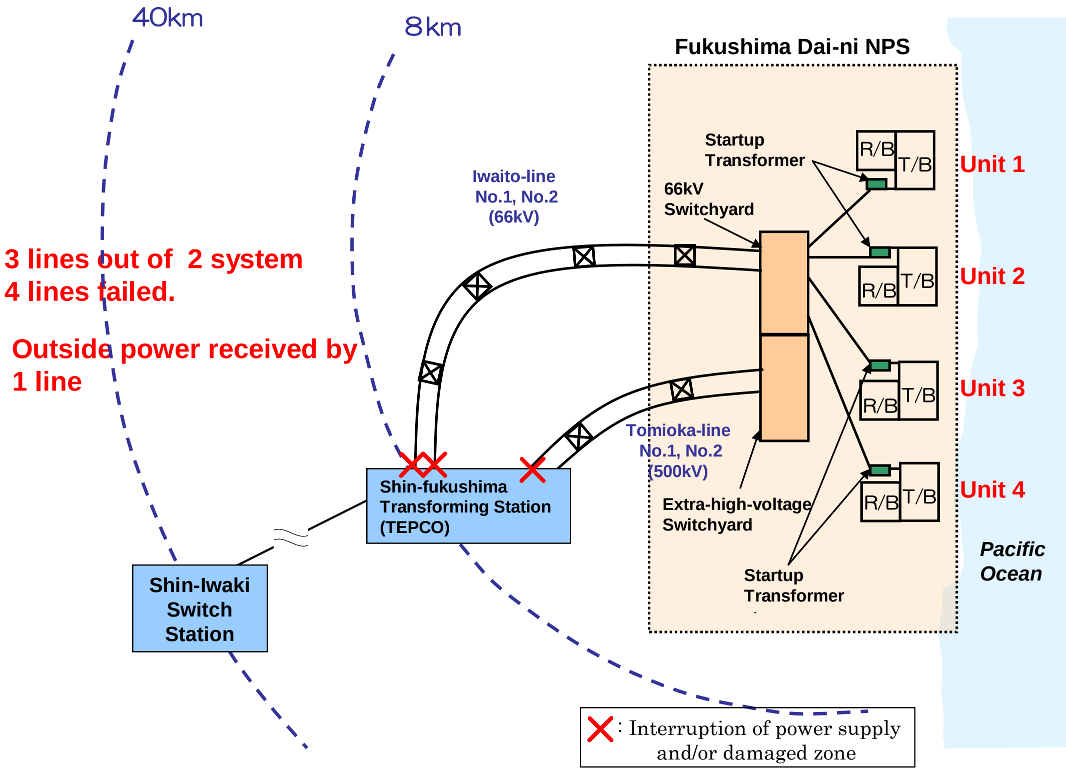


Reference: The Tsunami Evaluation Subcommittee, The Nuclear Civil Engineering Committee, JSCE (2010)
[Online].http://www.jstage.jst.go.jp/article/jscejb/63/2/168/_pdf/-char/ja/

Fig. III-2-7 Evaluation results of tsunami hazard curves based on near- and far-field tsunami sources for Yamada villages, Iwate Pref..



Reference: The Tokyo Electric Power Co., Inc. Release [Online]. http://info.nicovideo.jp/pdf/2011-03-18_1930_touden_genpatsu.pdf
http://www.tepco.co.jp/nu/kk-np/info/tohoku/pdf/23032202.pdf



Reference: The Tokyo Electric Power Co., Inc. Release [Online]. http://www.tepco.co.jp/nu/kk-np/tiiki/pdf/230325.pdf

Fig. III-2-8(a) Damage of external power supply systems for the Fukushima Dai-ichi and Dai-ni NPSs (1).

Okuma line 1L (O-81)
Circuit Breaker damaged

Okuma line 2L (O-81)
Circuit Breaker damaged

Okuma line 3L, Ground wire (disconnected)

Okuma line 3L & 4L, Steel structure for lead-in (tilted)

Yorunomori line, Cable in substation (subsidence)

Landslide of slope

Overview of landslide

Collapsed tower

Reference: The Tokyo Electric Power Co., Inc. Release
[Online]. http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/110516e23.pdf
http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/110516e19.pdf
http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/110516e20.pdf

Fig. III-2-8(b) Damage of external power supply systems of the Fukushima Dai-ichi and Dai-ni NPSs (2).

Table III-2-2 Max. accelerations values observed in reactor buildings at the Fukushima Dai-ni NPS.

Loc. of seismometer (bottom floor of reactor bld.)		Record*1 Max. acc. (Gal)			Max. response acceleration to the DBGM Ss (Gal)		
		NS	EW	UD	NS	EW	UD
Fukushima Dai-ni	Unit 1	254	230*2	305	434	434	512
	Unit 2	243	196*2	232*2	428	429	504
	Unit 3	277*2	216*2	208*2	428	430	504
	Unit 4	210*2	205*2	288*2	415	415	504

***1 These are temporal values, and may be corrected later.**
***2 Each recording was interrupted at around 130-150 s from recording start time.**

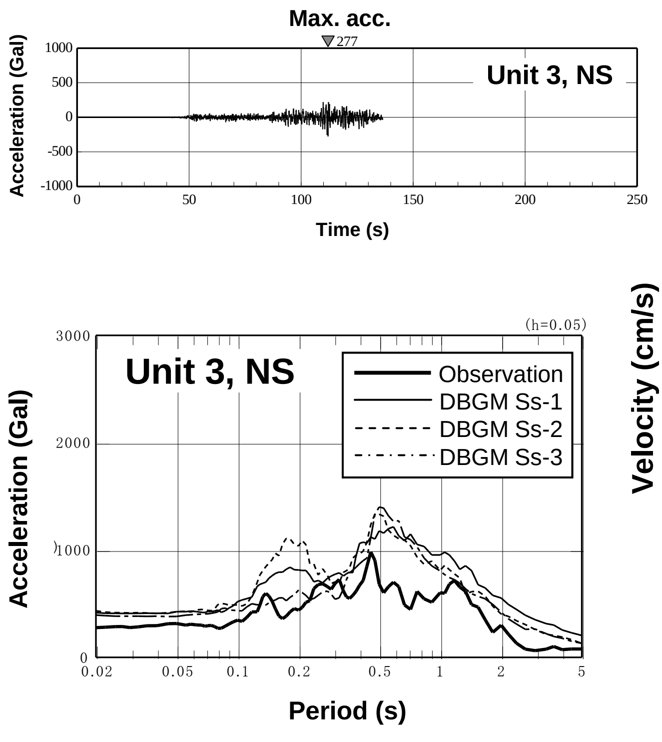


Fig. III-2-9 Acceleration seismogram and response spectra on the base mat at R/B in Unit-3 at the Fukushima Dai-ni NPS.

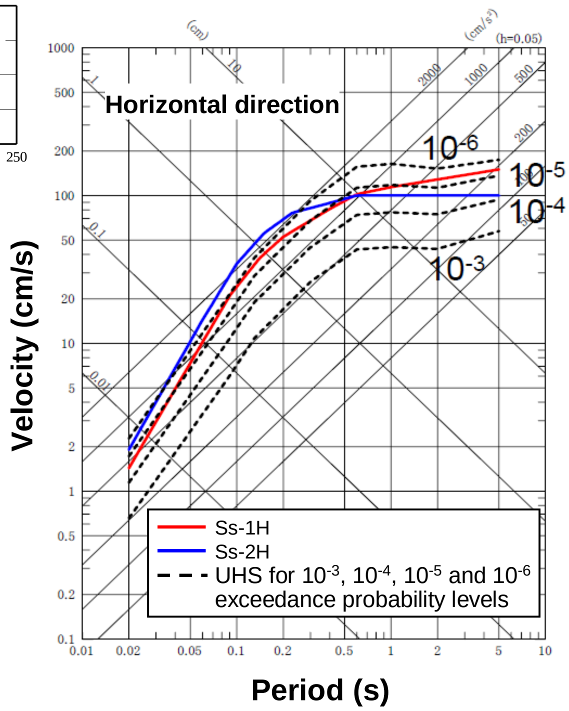
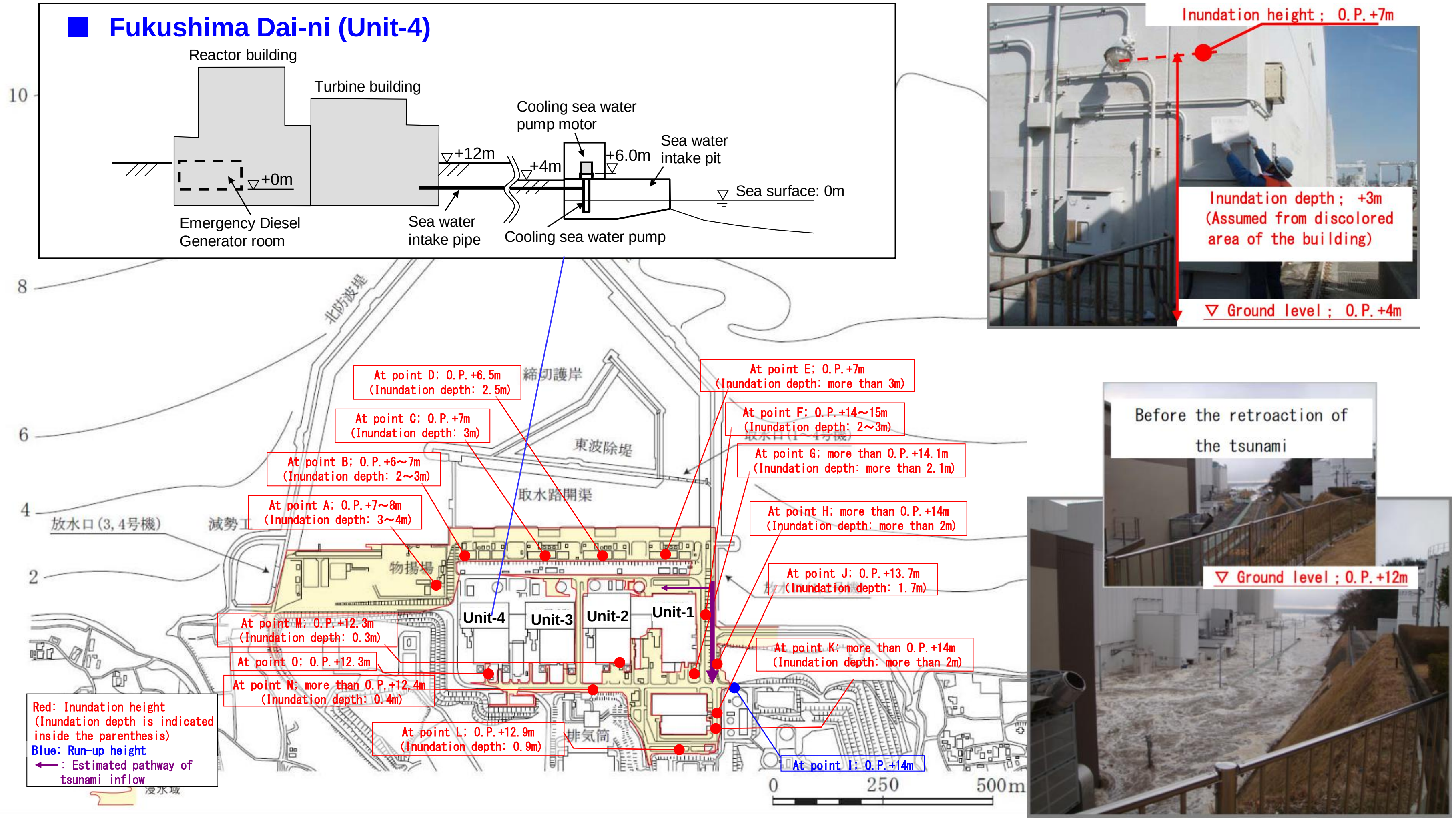


Fig. III-2-10 DBGM Ss and Uniform Hazard Spectra (UHS) for the Fukushima Dai-ni NPS.

Presented by TEPCO



Reference: The Tokyo Electric Power Co., Inc. Release [Online]. http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/110409e10.pdf
Partially modified by JNES.

Fig. III-2-11(a) Damage of Fukushima Dai-ni NPS due to the tsunami.

Damages of heat exchanger room and heat exchanger (Unit 1)

Damages of reactor building and emergency diesel generator (Unit 1)

Presented by TEPCO

Fig. III-2-11(b) Damage of Fukushima Dai-ni NPS due to the tsunami.

3. Seismic and tsunami damage to other NPSs

(1) Seismic ground motion and tsunami height observed at Onagawa NPS

1) Matters related to Seismic ground motion

a Seismic ground motion observation system, its observation records and observed ground motions

The seismic observation system is composed of seismometers and recording devices. Seismometers are installed at four points (on the rooftop, the refueling floor, i.e. the 5th floor, the 1st floor and the base mat) of the reactor building of Unit 1, at four points (the same as of Unit 1, except the refueling floor, i.e. the 3rd floor) of Unit 2, and at four points (the same as of Unit 2) of Unit 3, respectively. They are also installed at the upper part of the bedrock on the site (representing the base stratum). These seismometers are designed to observe acceleration time history of two horizontal and one vertical components.

Table III-3-1 shows the maximum acceleration values of seismic ground motions in three components, i.e. horizontal east-west and north-south and vertical components, which were observed on the base mats of the reactor buildings. On the base mat level, the maximum horizontal acceleration value was 607 Gal at Unit 2 (in the north-south direction), and the maximum vertical acceleration value was 439 Gal at Unit 1.

b Comparison between standard seismic ground motion Ss and observed seismic ground motion

The standard seismic ground motion Ss (Ss-B, Ss-D and Ss-F) is established to envelop the seismic ground motions of an assumed consecutive Miyagi-ken Oki earthquake, intraslab earthquake beneath the site, and the possible earthquake from diffuse seismicity.

Table III-3-1 shows the maximum response acceleration values for the standard seismic ground motion Ss at the level of seismometers located inside the buildings. It can be seen that most of the observed maximum acceleration values are below the maximum response acceleration for the standard seismic ground motion Ss. However, the observed maximum acceleration values on the base mat level at Unit 1 (in the east-west and north-south directions), Unit 2 (in the north-south direction), and Unit 3 (in the north-south direction) somewhat go beyond the maximum response acceleration for the standard seismic ground motion Ss. The observed vertical maximum acceleration values on the base mat level at all units are below the maximum response acceleration for the standard seismic ground motion Ss.

Figure III-3-1 shows a comparison between response spectra of the observed seismic ground motions at the upper part of the bedrock on the site and response spectra for the standard seismic ground motion Ss. Response spectra of the observed seismic ground motions exceed response spectra for the standard seismic ground motion Ss in the periodic band between 0.2 and 1.0 sec.

c Probabilistic seismic hazard assessment and exceedance probability of standard seismic ground motion Ss

Figure III-3-2 shows the evaluation of the uniform hazard spectrum of DBGM Ss for Onagawa NPS. Response spectra for Ss-Dh are also shown in the figure. The exceedance probability for Ss is between 10^{-3} and 10^{-5} per year.

2) Matters related to tsunami

a Tide level observation system and observed records

The tide level observation system is composed of a tide gauge and recording devices. The tide gauge is installed in a quiet area in the harbor, and the tsunami recording devices are installed in the buildings.

Figure III-3-3 shows the tsunami time history recorded by the tide gauge. From the record, it can be seen that the first big wave arrived at about 15:29 (43 min after the main shock). The observed tsunami height was about 13 m relative to O.P. (O. P.: the reference surface for construction of Onagawa NPS), which did not exceed the height of the site, i.e. 13.8 m relative to O.P. (the real height of the site is 14.8 m, adjusted to sinking by about 1 m due to crustal deformation, according to the Geographical Survey Institute QE, see Figure III-3-4). Although seawater was found to have entered the sea-facing side of the site, it did not reach the major buildings.

b Comparison between design basis tsunami height and observed tsunami height

The design basis tsunami height is evaluated as 9.1 m, for the Keicho Sanriku Earthquake (M8.6 in 1611), according to the application for establishment permit, and as 13.6 m, for the Meiji Sanriku Earthquake (M8.3 in 1896), based on the tsunami evaluation method of the Japan Society of Civil Engineers (2002) mentioned previously. Thus, the design basis tsunami heights were higher relative to those tsunami height observed above.

3) Matters related to damage

a External power supply

Units 1 to 3 are connected to a transmission network of one 275 kV system with two power lines from the Ishinomaki transforming station, about 25 km away from the site; one 275 kV system with two power lines from the Miyagi central switchyard, about 65 km away from the site; and one 66 kV system with one power line from the Onagawa nuclear transforming station.

The seismic intensity of the main shock was estimated to be upper 6 near the Ishinomaki transforming station, and lower 6 near the Miyagi central switchyard. The power transmission from three lines of the 275 kV systems and one line of the 66 kV system were disrupted due to the seismic ground motion. Of the power receiving equipment on the NPS site, a start up transformer of Unit 1 failed, thereby losing its function. On March 12, as the start up transformer came back online, the power was switched to the external regular power supply (275 kV) and the normal power supply system was returned.

b Seawater pump and emergency power supply

Figure III-3-5(a) and Figure III-3-5(b) show the layout of intake channel, seawater pump, seawater pump room, and heat exchanger room of the component cooling system. As shown in the figure, the seawater pump room is located on the higher site, which is 14.8 m high, about 100 m away from the coast, and is structurally designed to prevent being submerged by a run-up tsunami. Inside the room, the tide gauge is installed with an opening. This tide gauge is designed to allow the automatic stop of the seawater pump in short of seawater due to the backrush of a tsunami.

The observed tsunami height was 13 m, and despite the land sinking, the tsunami did not cause the seawater pump room (on the site as high as 13.8 m, adjusted to sinking by about 1 m) to be directly submerged. However, as the water level rose due to the tsunami, the water level in the underground intake pit also rose as shown in Figure III-3-5, caused by the siphon phenomenon. This resulted in seawater overflowing through the opening of the tide gauge into the seawater pump room. Then the seawater flowed from the pump room, via the trench, into the basement floors of the reactor buildings, causing the heat exchanger room of the component cooling water system in the second basement to be submerged. In addition, the component cooling water pump of Unit 2 was also submerged, which thereby caused the cooling function of emergency diesel generators to be lost, with two units stopped out of those three generators.

Tohoku Electric Power Company Inc. took measures to prevent the piping penetrations and the cable tray penetrations from the seawater pump room to the trench. They stated that the company would remove the water gauge in the seawater pump room and relocate it to an improved area to prevent exposure to water, and they would also set up a flood barrier around the seawater pump room.

4) Integrity assessment of the reactor buildings in the main shock and its aftershocks

a In the wake of the main shock

Response spectra observed on the position corresponding to the surface of the base stratum exceeded response spectra of the standard seismic ground motion Ss in a certain periodic band.

NISA directed Tohoku Electric Power Company Inc. to prepare an “inspection and evaluation plan” of equipments and piping systems unit by unit and implement the plan.

Tohoku Electric Power Company conducted an integrity assessment of the reactor buildings, based on the same procedures as the integrity assessment for the building structure of the Kashiwazaki-Kariwa Nuclear Power Station after the Chuetsu-oki Earthquake in July 2007. The response analyses on the reactor buildings of Units 1 to 3 were made with the observed acceleration records as the input of seismic ground motion. Figure III-3-6 shows the shear strain and shear force at the building by floor for each

Unit. It can be seen that shear strain at each floor was below the JEAG4681-2008 evaluation criteria (2.0×10^{-3}), and shear force was also below the elasticity limit. The ratio between the evaluation criteria and shear strain results at each floor was around 2.5 to 5.6.

JNES has conducted an integrity assessment of the reactor buildings of Units 1, 5, 6 and 7 at the Kashiwazaki-Kariwa Nuclear Power Station in the wake of the Chuetsu-oki Earthquake. The ratio between the evaluation criteria and shear strain was the same or more as the above.

b In the wake of the aftershocks

An aftershock on April 7 around the Onagawa NPS had a magnitude of 7.1, at a depth of about 66 km, and was estimated to be an intraslab earthquake. NISA directed Tohoku Electric Power Company, as of April 13, to analyze the seismic observation data obtained from the aftershock, and confirm the seismic safety of important safety-related equipments. Tohoku Electric Power Company, as of April 25, reported the analysis results of the above seismic observation data. The report stated that: the observed maximum vertical acceleration at the Unit 2 reactor building (on the 3rd floor, the rooftop) and the Unit 3 reactor building (on the 3rd floor) exceeded the maximum response acceleration for the standard seismic ground motion Ss; the observed response spectra exceeded horizontal response spectra for the standard seismic ground motion Ss in a certain periodic band; and the reactor buildings maintained their functions.

(2) Seismic ground motion and tsunami height observed at Tokai Dai-ni NPS

1) Matters related to seismic ground motion

a Seismic ground motion observation system, observation records and observed ground motions

The seismic observation system is composed of seismometers and recording devices, and is installed at eight points (one on the 6th, 4th and 2nd floors, respectively, and five on the base mat of the second basement) of the reactor building. These seismometers are designed to observe the time history of seismic acceleration in two horizontal and vertical directions.

Table III-3-2 shows maximum acceleration values of observed seismic ground motions, in horizontal and vertical directions, at the reactor building. On the base mat level, maximum horizontal acceleration was 214 Gal (north-south direction), and maximum vertical acceleration was 189 Gal.

b Comparison between standard seismic ground motion Ss and observed seismic ground motion

Standard seismic ground motion Ss (Ss-D and Ss-1) is decided to envelop the seismic ground motions of an interplate earthquake in Kashima-nada, an intraslab earthquake in the south of Ibaraki Prefecture, earthquakes caused by near-field active faults and possible earthquake from diffuse seismicity.
Maximum acceleration of the observed seismic ground motions was below maximum response acceleration for the standard seismic ground motion in application document for construction approval (hereinafter referred to as the design basis seismic wave in application document for construction approval) and the standard seismic ground motion Ss for the purpose of seismic back-check. Floor response spectra observed on the second basement to 6th floors exceeded floor response spectra for the design basis seismic wave at the construction approval in a certain periodic band (between about 0.65 and 0.9 sec.). However, spectra of observed seismic ground motion was below that for the design basis seismic wave at the construction approval around main natural periods of important equipments and piping systems related to seismic design.

c Probabilistic seismic hazard assessment and exceedance probability of standard seismic ground motion Ss

Figure III-3-7 shows the evaluation of the uniform hazard spectrum of DBGM Ss for Tokai Dai-ni NPS. Response spectra for Ss-D_H are also shown here. It can be seen that the exceedance probability for standard seismic ground motion Ss is approximately between 10^{-4} and 10^{-5} per year.

2) Matters related to tsunami

a Tide level observation system and observed records

The tide level observation system is composed of a tide gauge and recording devices. The tide gauge is installed in a moderate wave area in the harbor, but there was no record of tide gauge because the tsunami's height exceeded its measurement scale and the power supply was disrupted from 16:40, March 11 onwards. Therefore, the tsunami height along the coast near the Tokai Dai-ni is unknown. The first big wave arrived at about 15:15 (30 min after main shock), the water level was 5.4 m.

Japan Atomic Power Co. has been surveying traces of how high the tsunami ran up on the NPS site. The results are shown in Figure III-3-8. The tsunami marked traces as high as H.P. + 5.9 m (5.0 m above sea level, H.P.: the reference surface for construction of Hitachi Port) to H.P. +6.3 m (5.4 m above sea level, provisional). Based on these findings, the height of the run-up tsunami was estimated to be approximately H.P. +6.3 m (5.4 m above sea level, provisional). The tsunami did not reach H.P. +8.9 m (8 m above sea level), on which the major buildings are located.

b Relation between design basis tsunami height and tsunami observed height

Design basis tsunami height is not contained in the application document for establishment permit. It is determined as H.P. +5.8 m (4.9 m above sea level), for the Boso-oki Earthquake (M8.2 in 1677), based on the tsunami evaluation method of the Japan Society of Civil Engineers (2002).

3) Matters related to damage

a External power supply

The Tokai Dai-ni Nuclear Power Station is connected to the following transmission network of one 275 kV system with two power lines from the Naka substation, about 15 km away from the site; and as external backup power, one 154 kV power system from the Ibaraki substation, about 8 km away from the site, via the Tokai switchyard.

The seismic intensity was estimated to be upper 6 near the Naka substation, and lower 6 near the Ibaraki substation. Immediately after the quake, the Naka substation and the Ibaraki substation stopped functioning due to the seismic ground motion, resulting in disrupted transmission of all lines. Of the power receiving equipment on the NPS site, a main transformer and a starting transformer experienced leakage of insulation oil. On

March 13, one 154 kV external backup system with one line came back. And on March 18, the Tokai Dai-ni switched to the external regular power supply (one 275 kV system) and returned to the normal power supply system.

b Seawater pump and emergency power supply

The tsunami flooded the north emergency seawater pump area in the seawater pump room, as shown in Figure III-3-8. Consequently one of three seawater pumps for emergency diesel generators was submerged, and one of three emergency diesel generators stopped. Meanwhile, the other two emergency diesel generators were able to operate, successfully ensuring emergency power supply.

When the earthquake hit the site, the north emergency seawater pump room was under leveling construction of its sidewall as protection against tsunami (H.P. +5.8 m, 4.9 m above sea level). This construction work put in place a new sidewall up to H.P. +7.0 m (6.1 m above sea level) outside the existing sidewall, but the waterproof sealing of the penetration (small holes for electric cables, etc.) of the wall had not been completed, and as a result the seawater came through the small holes into the pump room.

The height of the run-up tsunami was approximately H.P. +6.3 m (5.4 m above sea level), not going beyond the new sidewall, which was as high as H.P. +7.0 m (6.1 m above sea level).

4) Integrity assessment of the reactor building in the wake of a main shock

Floor response spectra of the observed seismic ground motion exceeded the design basis seismic ground motion in the application document for establishment permit and the standard seismic ground motion Ss in a certain periodic band. An integrity assessment of the reactor building was conducted, based on the same procedures of the Onagawa as mentioned above in 3.(1) 4).

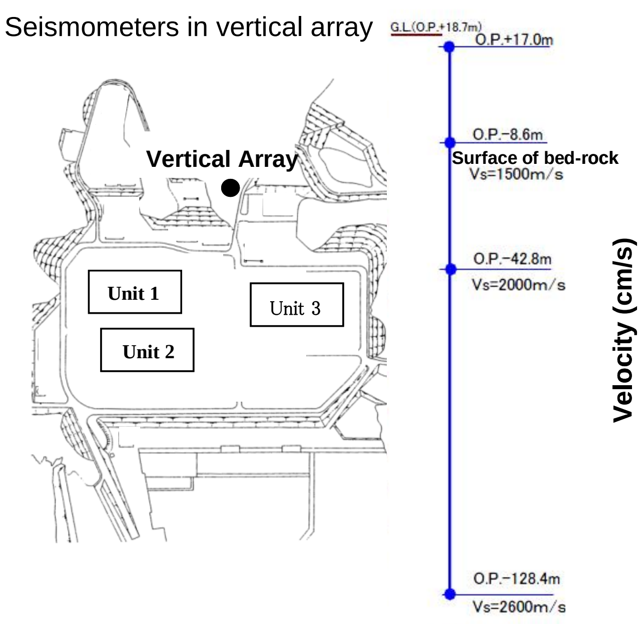
(3) Situation of Higashidori NPS at the time of the earthquake

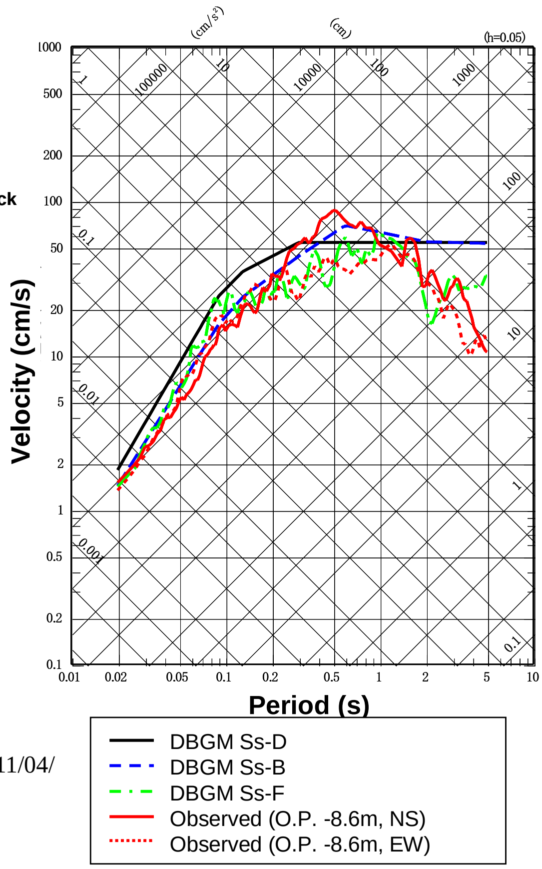
At the time of the Earthquake, the Higashidori Nuclear Power Station was in periodic inspection, and the reactor was not operated. On the site, no damage caused by seismic ground motion and tsunami was reported. The observed seismic ground motion at the reactor building was 17 Gal. The earthquake caused the external power supply (the Mutsu trunk line and Tohoku-Shiranuka line) to be lost, but an emergency diesel generator was able to operate, successfully ensuring power supply. Later the same day, at 23:59, the Tohoku-Shiranuka line was restored, which enabled the cooling of the spent fuel pool, etc. using the external power supply.

Table III-3-1 Max. acceleration values observed in reactor building at Onagawa NPS.

Loc. of seismometer		Record Max. acc. (Gal) NS	Record Max. acc. (Gal) EW	Record Max. acc. (Gal) UD	Max. response acceleration to the DBGM Ss (Gal) NS	Max. response acceleration to the DBGM Ss (Gal) EW	Max. response acceleration to the DBGM Ss (Gal) UD
Unit 1	Roof	2000	1636	1389	2202	2200	1388
	Refueling Floor(5F)	1303	998	1183	1281	1443	1061
	1ST F	573	574	510	660	717	527
	Base mat	540	587	439	532	529	451
Unit 2	Roof	1755	1617	1093	3023	2634	1091
	Ref. Floor(3F)	1270	830	743	1220	1110	968
	1ST F	605	569	330	724	658	768
	Base mat	607	461	389	594	572	490
Unit 3	Roof	1868	1578	1004	2258	2342	1064
	Ref. Floor(3F)	956	917	888	1201	1200	938
	1ST F	657	692	547	792	872	777
	Base mat	573	458	321	512	497	476

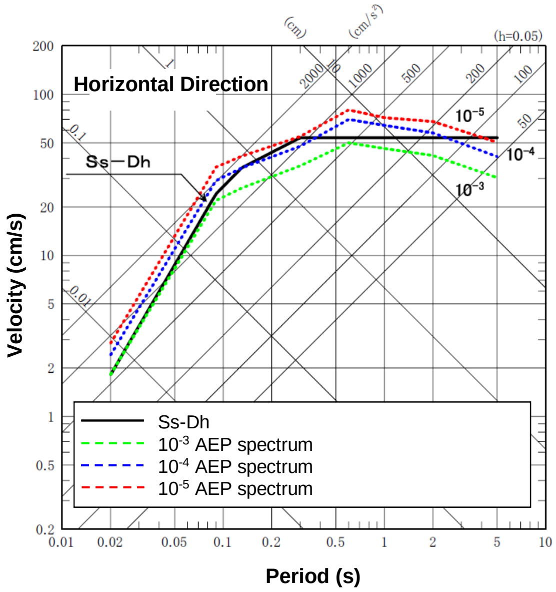
Reference: Tohoku Electric Power Co., Inc
[Online]. http://www.tohoku-epco.co.jp/ICSFiles/afieldfile/2011/04/07/110407_np_b1.pdf
Partially modified by JNES.





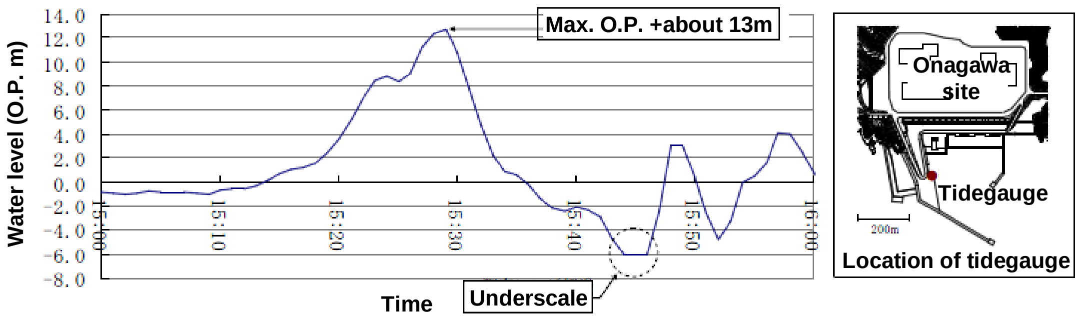
Reference: Tohoku Electric Power Co., Inc
[Online].http://www.tohoku-epco.co.jp/ICSFiles/afieldfile/2011/04/25/110425np_s.pdf
Partially modified by JNES.

Fig. III-3-1 Deployment of seismometers and comparison of observed response spectra with the DBGM Ss on a free surface (equivalent to the base stratum) at Onagawa NPS.



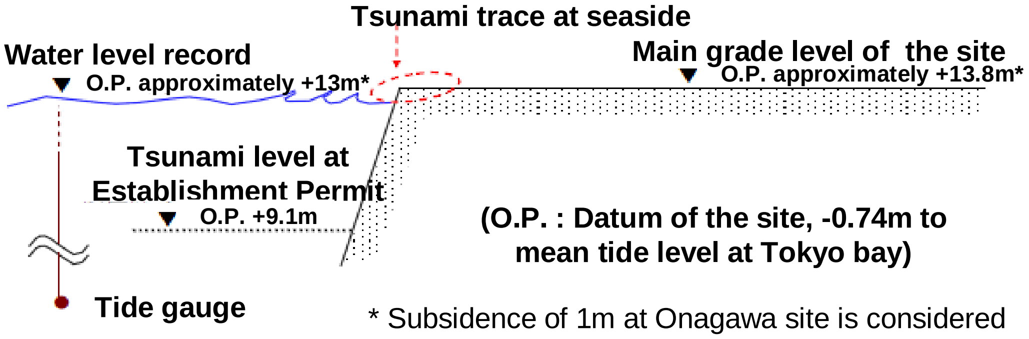
Reference: Tohoku Electric Power Co., Inc
[Online]. http://www.nisa.meti.go.jp/shingikai/107/3/2/017/17-2-1.pdf
Partially modified by JNES.

Fig. III-3-2 DBGM Ss and Uniform Hazard Spectra (UHS) for Onagawa NPS.



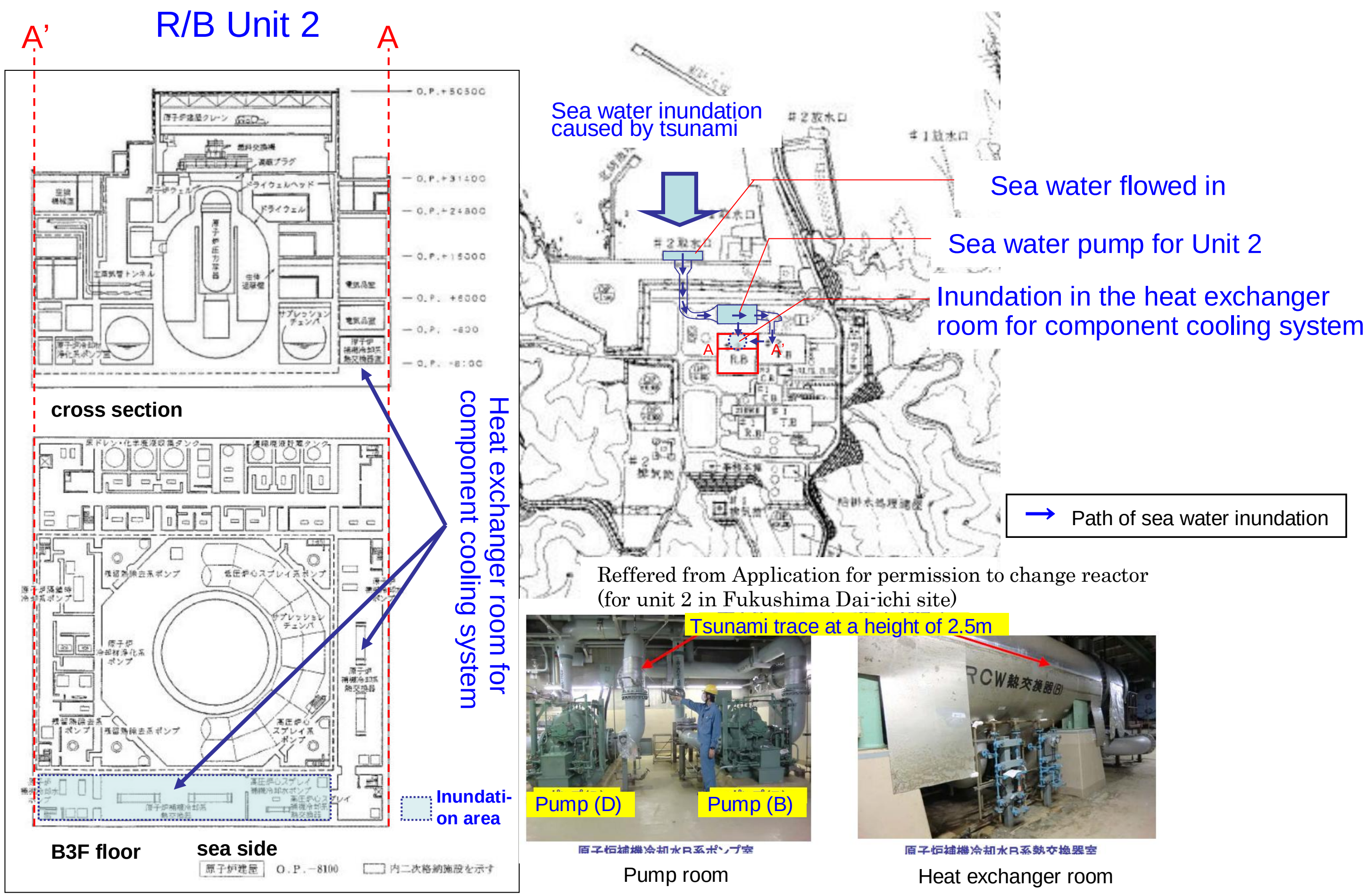
Reference: Tohoku Electric Power Co., Inc
[Online].http://www.tohoku-epco.co.jp/ICSFiles/afieldfile/2011/04/26/110407_np_t3.pdf
Partially modified by JNES.

Fig. III-3-3 Time history of water level changes observed at Onagawa NPS.



Reference: Tohoku Electric Power Co., Inc
[Online].http://www.tohoku-epco.co.jp/ICSFiles/afieldfile/2011/04/26/110407_np_t3.pdf
Partially modified by JNES.

Fig. III-3-4 Outline of tsunami arrival at Onagawa NPS.

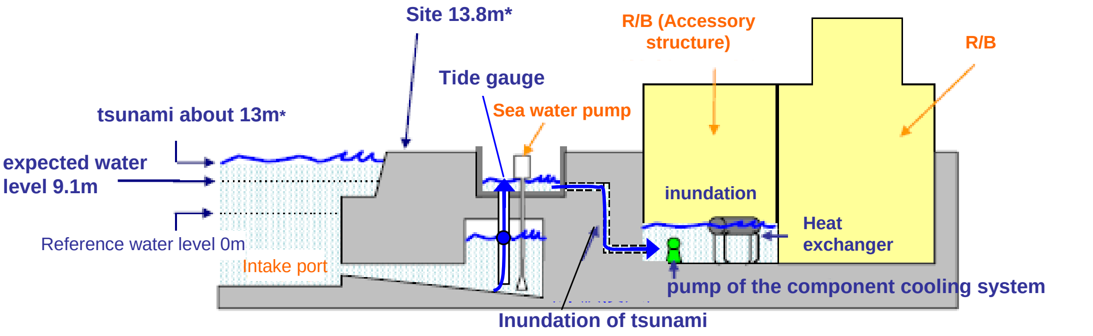


Reference (Photos): Tohoku Electric Power Co., Inc [Online]. http://www.tohoku-epco.co.jp/ICSFiles/afieldfile/2011/04/26/110426_siryou.pdf
Partially modified by JNES.

Reference (Photos): Tohoku Electric Power Co., Inc [Online]. http://www.tohoku-epco.co.jp/ICSFiles/afieldfile/2011/04/26/110426_siryou.pdf
Partially modified by JNES.

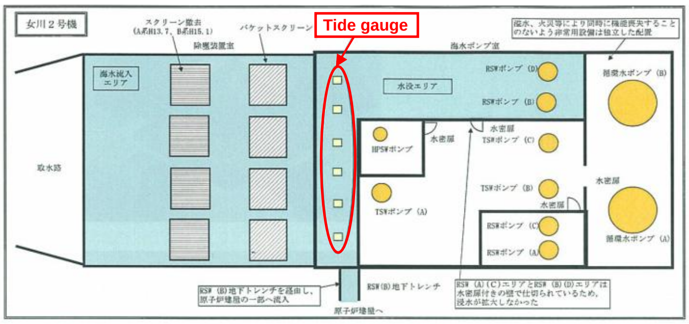
Fig. III-3-5(a) Inundation in the heat exchanger room for a component cooling system (1) at Onagawa NPS.

[Inundation pathway to Heat exchanger (B) room for component cooling system]

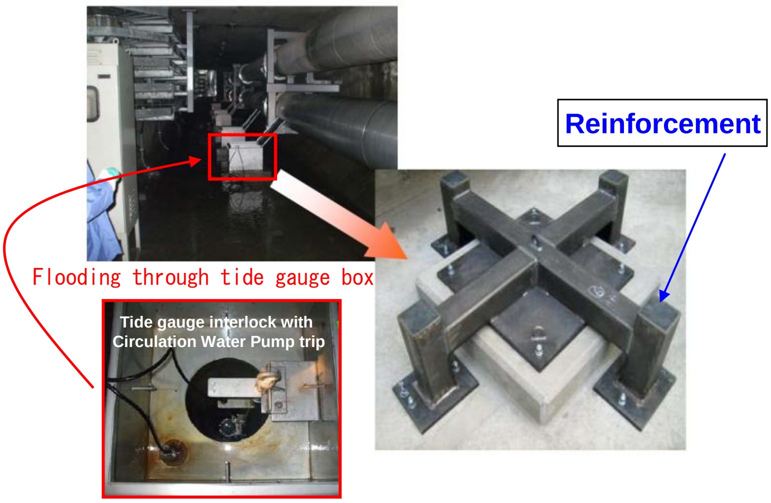


*Subsidence of 1m at Onagawa site is considered

[Installation position of tide gauge interlock with Unit 2 Circulation Water Pump trip]



[Tsunami countermeasure for tide gauge]



Reference: NISA [Online].
http://www.meti.go.jp/press/2011/05/20110530001/20110530001.pdf
Partially modified by JNES.

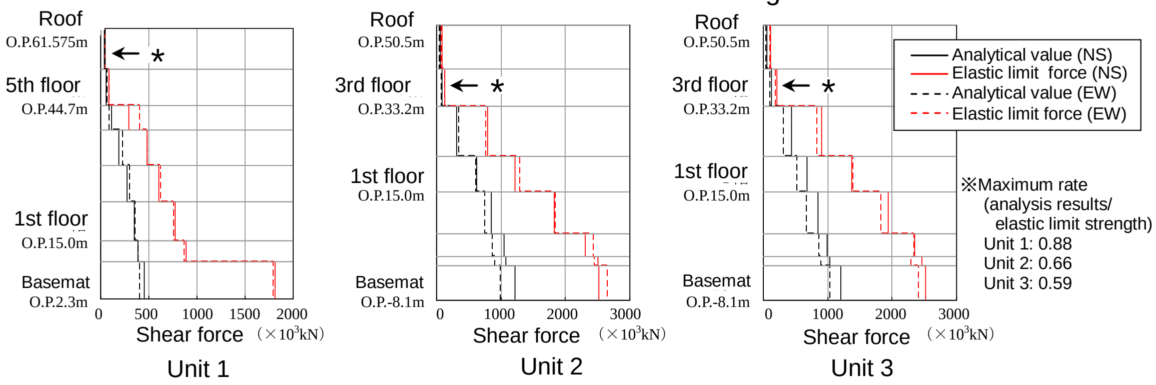
Fig. III-3-5(b) Inundation in the heat exchanger room for component cooling system (2) at Onagawa NPS.

Max. shear strain response of shear resisting at R/B

		Analytical result	Standard Value*	(Comparison) DBGM
Unit 1	NS	0.36×10^{-3}	2.0×10^{-3}	0.65×10^{-3}
	EW	0.35×10^{-3}		0.56×10^{-3}
Unit 2	NS	0.49×10^{-3}		1.15×10^{-3}
	EW	0.28×10^{-3}		0.55×10^{-3}
Unit 3	NS	0.81×10^{-3}		0.99×10^{-3}
	EW	0.18×10^{-3}		0.41×10^{-3}

* Standard values are established in JEAC4601-2008 (Japanese seismic design code for nuclear power plants; Japan Electric Association). They are twice the value of ultimate shear strain for reinforced concrete shear walls as safety factor.

Shear force of R/B aseismic resisting at each floor



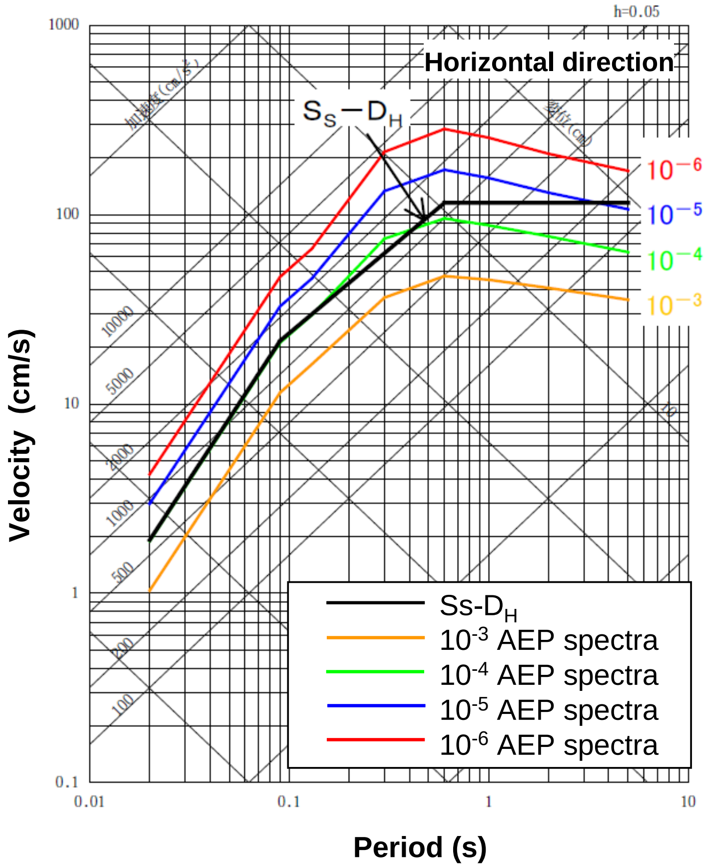
Reference: Tohoku Electric Power Co., Inc
[Online]. http://www.tohoku-epco.co.jp/ICSFiles/afieldfile/2011/04/07/110407_np_t1.pdf
Partially modified by JNES.

Fig. III-3-6 Verification of shear strain and shear force acted on seismic walls at each floor in R/Bs of Onagawa NPS.

Table III-3-2 Maximum accelerations values observed in reactor buildings at Tokai Dai-ni NPS.

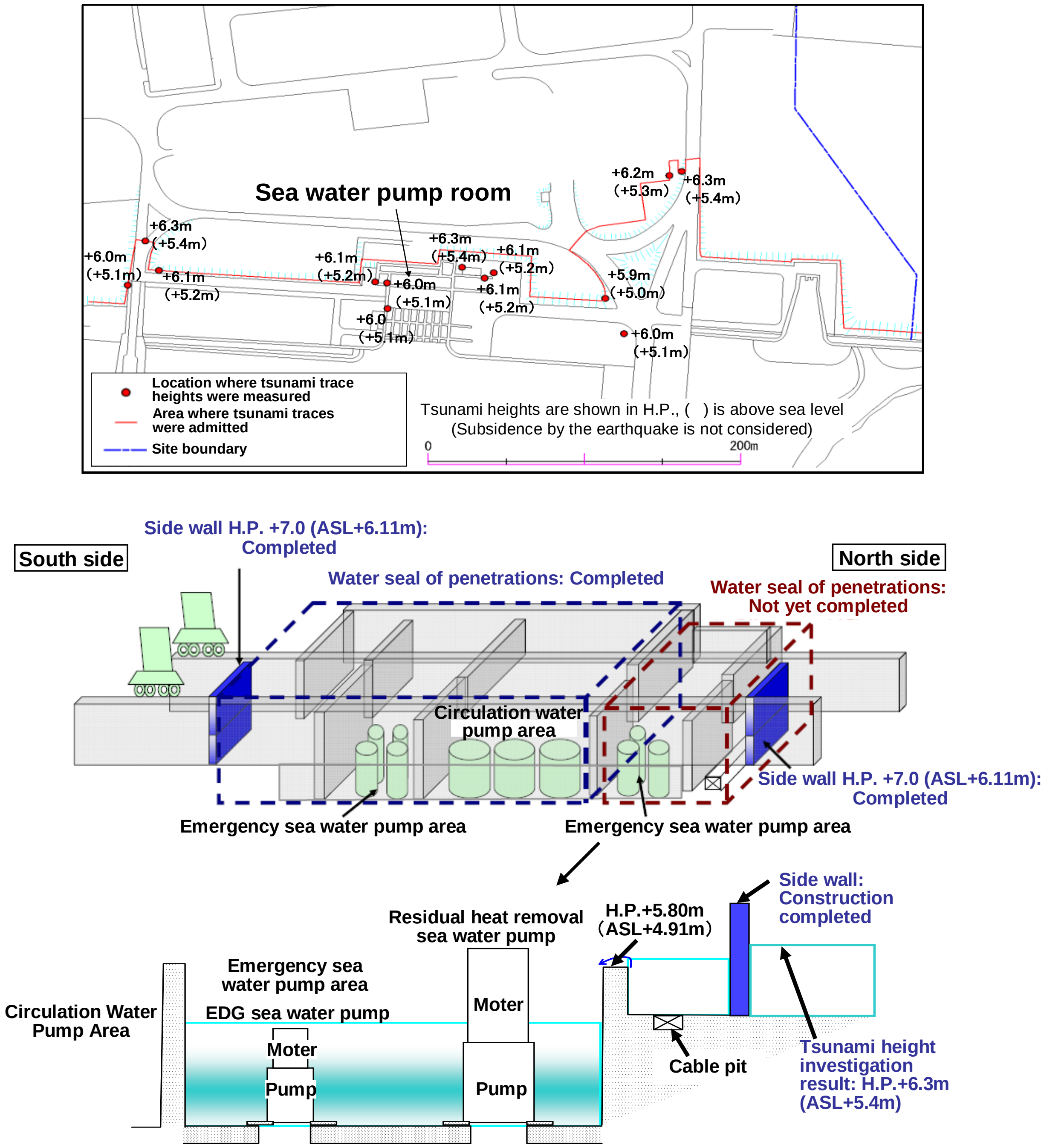
Loc. of seismometer		Record			Max. acceleration at construction (Gal)		Max. response acceleration to the DBGM Ss (Gal)		
		Max. acc. (Gal)							
		NS	EW	UD	NS	EW	NS	EW	UD
Reactor building	6 F	492	481	358	932	951	799	789	575
	4 F	301	361	259	612	612	658	672	528
	2 F	225	306	212	559	559	544	546	478
	Base mat (B2F)	214	225	189	520	520	393	400	456

Reference: The Japan Atomic Power Company
[Online]. http://www.japc.co.jp/news/bn/h23/230407.pdf
Partially modified by JNES.



Reference: The Japan Atomic Power Company
[Online]. http://www.nisa.meti.go.jp/shingikai/107/3/1/006/6-2-1-1.pdf
Partially modified by JNES.

Fig. III-3-7 DBGM Ss and Uniform Hazard Spectra (UHS) for Tokai Dai-ni NPS.



Reference: The Japan Atomic Power Company [Online]. http://www.japc.co.jp/news/bn/h23/230407.pdf Partially modified by JNES.

Fig. III-3-8 Map of the areas with tsunami traces identified at Tokai Dai-ni NPS.

4. Assessment of earthquake and tsunami damage

(1) Importance of incorporating combined rupture of multiple seismic source areas

This earthquake was an extremely huge event with a magnitude of 9.0. The focal area extending above 400 km long north-south and about 200 km wide east-west caused multiple ruptures of seismic sources starting in Off-Shore Miyagi Prefecture and propagating to the north, Off-Shore Iwate Prefecture, and to the south, Off-Shore Fukushima Prefecture and Off-Shore Ibaraki Prefecture. On this basis, importance of considering possible combined rupture of multiple seismic source areas was re-recognized regarding the evaluation of seismic ground motion. The same agenda was also recognized important regarding the assessment of the size of associated tsunamis.

(2) Importance of incorporating of exceedance probability for design basis seismic ground motion and design basis tsunami, defense in depth design, and residual risk assessment

Ground motions in this earthquake observed at some NPS exceeded the standard seismic ground motion in certain period ranges. The Regulatory Guide for Reviewing Seismic Design states that occurrence of a seismic ground motion exceeding standard ground motion can not be denied. In this context, the exceedance probability of standard seismic ground motions determined from the current procedure should be examined as to its appropriateness in terms of the safety goal to be achieved.

At Onagawa NPS, it was confirmed that the measures taken to protect the seawater pump system from inundation were appropriate even under uncertainties required for consideration in the Tsunami Assessment Method by the Japan Society of Civil Engineers (2002). At the Tokai Dai-ni NPS preventive actions were taken to protect the seawater pump system from inundation based on recognition of the uncertainties. At Fukushima Dai-ichi NPS, some actions were taken to lift seawater pumps. In the attack of the tsunami, Onagawa plant and the Tokai Dai-ni plant where inundation was slight and light enough were able to avoid total loss of the terminal heat sinks. At Fukushima Dai-ni Plant, the heat sink of the unit 3 were saved and functioned. In contrast, Fukushima Dai-ichi plant was inundated heavily beyond its tsunami protection capabilities, and lost all of them. This has led to recognition of need for comprehensive restructuring of the tsunami protection that will ensure defense in depth of NPS.

On this basis, it was recognized essential to take actions according to the context of the

Regulatory Guide for Reviewing Seismic Design, including determining design basis tsunami with appropriately large return period based on probabilistic tsunami hazard assessment, apply it to actual tsunami protection design, taking actions to cope with beyond-design tsunami, and validating the total system through the risk assessment in the light of defense in depth to realize required safety goal.

(3) Significance of diversity

Based on the damage caused by this tsunami, it can be seen that, of safety systems of redundant configuration, those safety systems having diversity contributed much, remaining operational, to defense against the tsunami hitting. Therefore, the significance of seeking diversity in constructing safety systems of redundant configuration has been seriously re-realized.

(4) Significance of measures against tsunami scouring and wave force

This tsunami caused the ground foundation of general harbor installations to be scoured by the tsunami run-up and backrush, resulting in collapse. The main units of harbor installations were also knocked down by the strong wave force. This has led to the recognition of significance of taking into consideration the severity of destructive power of wave force and scouring in designing NPSs, for the purpose of defending them against design basis tsunami by drawing on coastal structures. Furthermore, it has also been seriously recognized that, in order to prevent NPSs from being inundated and submerged by a tsunami above the design basis tsunami, the severity of destructive power of the run-up tsunami should be fully considered.

(5) Enhanced measures for seismic and tide level observation systems

During this earthquake, the records of acceleration time history at some NPSs were not fully secured, being cut off after approximately for 130 to 150 seconds. Functional failures in NPS seismic observation systems were also found in the Chuetsu-Oki Earthquake, and therefore, an in-depth study should have been done into maintaining the functions of the systems.

For the tide level observation systems, the measure ranges of tide level are not enough, and also, an in-depth study should have been done into maintaining the functions of the systems.

IV. Occurrence and Development of the Accident at the Fukushima Nuclear Power Stations

1. Outline of Fukushima Nuclear Power Stations

(1) Fukushima Daiichi Nuclear Power Station

Fukushima Daiichi Nuclear Power Station (hereinafter referred to as NPS) is located in Okuma Town and Futaba Town, Futaba County, Fukushima Prefecture, facing the Pacific Ocean on the east side. The site has a half oval shape with the long axis along the coastline and the site area is approx. 3.5 million square meters. This is the first nuclear power station constructed and operated by the Tokyo Electric Power Company, Incorporated (hereinafter referred to as TEPCO). Since the commissioning of Unit 1 in March 1971, additional reactors have been constructed in sequence and there are six reactors now. The total power generating capacity of the facilities is 4.696 million kilowatts.

Table IV-1-1 Power Generating Facilities of Fukushima Daiichi NPS

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Electric output (10,000 kW)	46.0	78.4	78.4	78.4	78.4	110.0
Start of construction	Sep. 1967	May 1969	Oct. 1970	Sep. 1972	Dec. 1971	May 1973
Commissioning	Mar. 1971	Jul. 1974	Mar. 1976	Oct. 1978	Apr. 1978	Oct. 1979
Reactor type	BWR-3	BWR-4				BWR-5
Containment type	Mark I					Mark II
Number of fuel assemblies	400	548	548	548	548	764
Number of control rods	97	137	137	137	137	185

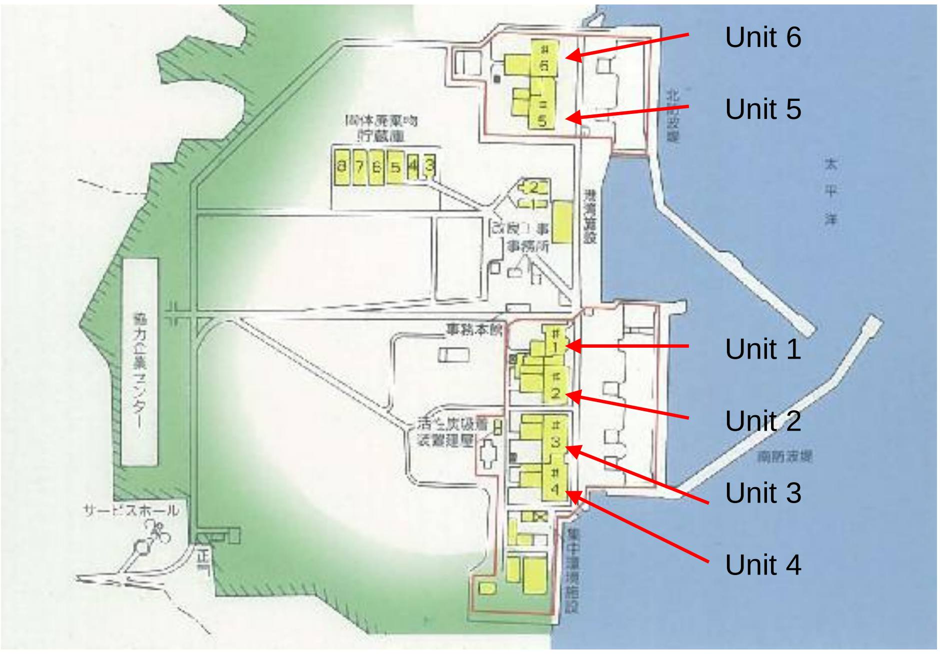


Figure IV-1-1 General Layout of Fukushima Daiichi NPS

(2) Fukushima Daini NPS

Fukushima Daini NPS is located in Tomioka Town and Naraha Town, Futaba County, Fukushima Prefecture, approx. 12 km south of Fukushima Daiichi NPS, and faces the Pacific Ocean on the east side. The site has a nearly square shape and the site area is approx. 1.47 million square meters. Since the commissioning of Unit 1 in April 1982, additional reactors have been constructed in sequence and there are four reactors now. The total power generating capacity of the facilities is 4.4 million kilowatts.

Table IV-1-2 Power Generating Facilities of Fukushima Daini NPS

	Unit 1	Unit 2	Unit 3	Unit 4
Electric output (10,000 kW)	110.0	110.0	110.0	110.0
Start of Construction	Nov. 1975	Feb. 1979	Dec. 1980	Dec. 1980
Commissioning	Apr. 1982	Feb. 1984	Jun. 1985	Aug. 1987
Reactor type	BWR-5			
Containment type	Mark II	Improved Mark II		
Number of fuel assemblies	764	764	764	764
Number of control rods	185	185	185	185

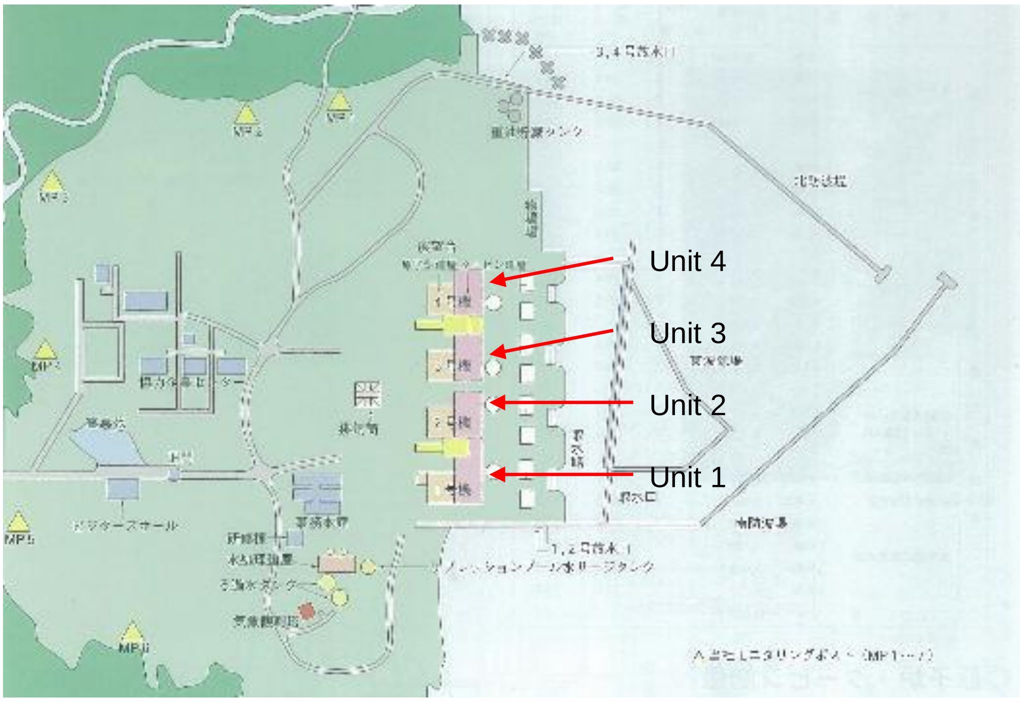


Figure IV-1-2 General Layout of Fukushima Daini NPS

2. Safety Assurance and Other Situations in Fukushima NPSs

(1) Design requirements of nuclear power stations

As described in Chapter II, nuclear power stations must satisfy legal requirements specified in the Reactor Regulation Act, the Electricity Business Act and other relevant laws and regulations.

When receiving an application for installing a nuclear power station from an applicant, Nuclear and Industrial Safety Agency (hereinafter referred to as NISA) conducts the primary safety review, should consult the Nuclear Safety Commission (hereinafter referred to as the NSC Japan) and shall receive their opinion based on the result of their secondary safety review. After NISA considers the opinions of the NSC Japan and examines the results of the safety reviews, the Minister of Economy, Trade and Industry gives the applicant permission to install individually for each reactor. In these safety reviews, NISA and the NSC Japan check that the basic design or the basic design policy of the nuclear power station conforms to the permission criteria specified in the Reactor Regulation Act, for example, in Article 24, “The location, structure, and equipment of the nuclear reactor facility shall not impair prevention of disasters caused by the nuclear reactor, its nuclear fuel material, or objects contaminated with the nuclear fuel material.” The NISA Japan conducts safety reviews based on the most recent knowledge and by referring to regulatory guides established by the NSC Japan as specific judgment criteria.

Regulatory guides are roughly divided into four types: siting, design, safety evaluation, and dose target values. One of the regulatory guides for design, the “Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities,”[IV2-1] (hereinafter referred to as Regulatory Guide for Reviewing Safety Design) specifies the basic design requirements for nuclear power stations. It contains a provision about design considerations against natural phenomena, which specifies that structures, systems, and components (SSCs) with safety functions shall be designed to sufficiently withstand appropriate design seismic forces and shall be designed such that the safety of the nuclear reactor facilities will not be impaired by postulated natural phenomena other than earthquakes, such as floods and tsunami.

It also specifies requirements for safety design against external human induced events, such as collapse of a dam, and fires and others.

Basic Judgment criteria for validation of design policies against earthquakes and tsunami are specified in the “Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities”[IV2-2] (the latest version established by the NSC Japan in September 2006, hereinafter referred as Regulatory Guide for Reviewing Seismic Design), which supplements the Regulatory Guide for Reviewing Safety Design.

The Regulatory Guide specifies the basic policy, “Those Facilities designated as important from a seismic design standpoint shall be designed to bear even those seismic forces exerted as a result of the earthquake ground motion, which could be appropriately postulated as having only a very low possibility of occurring within the service period of the Facilities and could have serious affects to the Facilities from seismological and earthquake engineering standpoints, considering the geological features, geological structures, seismicity, etc. in the vicinity of the proposed site, and such Facilities shall be designed to maintain their safety functions in the event of said seismic forces.” It also specifies that uncertainties (dispersion) in formulating the Design Basis Ground Motion Ss shall be considered by appropriate methods and that the probabilities of exceedence should be referred to.

The Regulatory Guide also contains consideration of tsunami as accompanying events of earthquakes, “Safety functions of the Facilities shall not be significantly impaired by tsunami of such magnitude that they could only be reasonably postulated to have a very low probability of occurring and hitting the Facilities within the service period of the Facilities.” A commentary in this Regulatory Guide describes that at the design of the Facilities, appropriate attention should be paid, to possibility of occurrence of the exceeding ground motion to the determined one and, recognizing the existence of this “residual risk”, every effort should be made to minimize it as low as practically possible.

The NSC Japan requests that government agencies ask licensees to conduct backchecks of seismic safety based on specifications in this Regulatory Guide, along with quantitative assessment of “residual risks” by positively introducing the probabilistic safety assessment (hereinafter referred to as PSA), and review the results. In response to this request, NISA issued “Implementation of seismic safety assessment on existing nuclear power reactor facilities and other facilities to reflect the revisions of the ‘Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities’ and other safety assessment regulatory guides”[IV2-3] and requested licensees to carry out backchecks of seismic safety and assess “residual risks”.

(2) Design basis events to be considered in safety assessment

1) Defining design basis events in safety assessment

As described in Chapter II, the Regulatory Guide for Evaluating Safety Assessment of Light Water Reactor Facilities identifies events to be considered in the safety design and assessment of nuclear facilities and defines them as design basis events.

Design basis events regarding loss of external power supply, total AC power loss, and systems for transporting heat to the ultimate heat sink (hereinafter referred to as the ultimate heat sink), which occurred as part of this accident, are described below.

The Regulatory Guide for Evaluating Safety Assessment of Light Water Reactor Facilities takes loss of external power supply as an abnormal transient during operation and requires check of appropriateness of relevant safety equipment. On the contrary, the Regulatory Guide for Reviewing Safety Design does not take total AC power loss as a design basis event. This is because it requires emergency power supply systems to be designed with a high degree of reliability as AC power supplies. Specifically, the "Regulatory Guide for Reviewing Classification of Importance of Safety Functions for Light Water Nuclear Power Reactor Facilities"[IV2-4] (established by the NSC Japan in August 1990, hereinafter referred as Regulatory Guide for Reviewing Classification of Importance of Safety Functions) classifies emergency power supply systems as systems with safety functions of especially high importance. The Regulatory Guide for Reviewing Safety Design specifies in its guidelines, such as Guideline 9 (Design Considerations for Reliability) and Guideline 48 (Electrical Systems), that systems with safety functions of especially high importance shall be designed with redundancy or diversity and independence and shall be designed such that adequately high reliability will be ensured. As described above, the Regulatory Guide for Reviewing Seismic Design specifies that safety functions shall be maintained in the event of an earthquake. Based on this prerequisite, the Regulatory Guide for Reviewing Safety Design specifies that the nuclear reactor facilities shall be designed such that safe shutdown and proper cooling of the reactor after shutting down can be ensured in case of a short-term total AC power loss, in Guideline 27 (Design Considerations against Loss of Power). However, the commentary for Guideline 27 states that no particular considerations are necessary against a long-term total AC power loss because the repair of interrupted power transmission lines or an emergency AC power system can be depended upon in such a case, and that the assumption of a total AC power loss is not necessary if the emergency AC power system is reliable enough by means of system arrangement or management. Accordingly, licensees are to install two independent emergency diesel generator systems (hereinafter referred to as emergency DG), which are designed such that one emergency DG is activated if the other emergency DG is failed, and that the reactor is shut down if a failure persists for a long time.

Loss of all seawater cooling system functions is not taken as a design basis event. This is because the Regulatory Guide for Reviewing Classification of Importance of Safety Functions classifies seawater pumps as systems with safety functions of especially high importance, just like emergency power supply systems. The Regulatory Guide for Reviewing Safety Design specifies that systems with safety functions of especially high importance shall be designed with redundancy or diversity and independence, in Guideline 9 (Design Considerations for Reliability), Guideline 26 (Systems for Transporting Heat to Ultimate Heat Sink) and other guidelines. Also, the Regulatory Guide for Reviewing Seismic Design specifies that safety functions shall be maintained in the event of an earthquake.

The generation of flammable gas inside the primary containment vessel (hereinafter referred to as PCV) when reactor coolant is lost is postulated in the design basis events as a cause of hydrogen explosion accidents. To prevent this event, a flammability control system (hereinafter referred to as FCS) that suppresses hydrogen combustion inside the PCV is installed in compliance with Guideline 33 of the Regulatory Guide for Reviewing Safety (the system controlling the atmosphere in the reactor containment facility). Additionally, keeping the atmosphere inside the PCV inert further reduces the possibility of hydrogen combustion. These designs are aimed at preventing hydrogen combustion in the PCV from the viewpoint of PCV integrity, and are not aimed at preventing hydrogen combustion inside the reactor building.

2) Safety design for the design standard events at Fukushima NPSs

The safety designs for the design basis events of offsite power supplies, emergency power supply systems, and reactor cooling functions related to the accidents at Fukushima NPSs are the following:

The power sources are connected to offsite power supply grids via two or more power lines. Multiple emergency diesel generators are installed independently with redundant design as the emergency power supplies for a loss of external power supply. Also, to cope with a short-period loss of all AC power sources, emergency DC power sources (batteries) are installed maintaining redundancy and independence.

Unit 1 of Fukushima Daiichi NPS is equipped with isolation condensers[1] (hereinafter referred to as IC) and a high pressure core injection system (hereinafter referred to as HPCI), and Unit 2 and Unit 3 of Fukushima Daiichi NPS are equipped with HPCI and a reactor core isolation cooling system[2] (hereinafter referred to as RCIC) to cool the reactors when they are under high pressure and the condenser does not work. Unit 1 of Fukushima Daiichi NPS is equipped with a core spray system (hereinafter referred to as CS) and a reactor shut-down cooling system (hereinafter referred to as SHC), and Unit 2 and Unit 3 of Fukushima Daiichi NPS are equipped with a residual heat removal system (hereinafter referred to as RHR) and a low pressure CS to cool the reactors when they are under low pressure.

Additionally, in the main steam line that leads to the reactor pressure vessel (hereinafter referred to as RPV) are installed main steam safety relief valves (hereinafter referred to as SRV) that discharge steam in the reactor to the suppression chamber (hereinafter referred to as S/C) and safety valves that discharge steam in the reactor to the dry well (hereinafter referred to as D/W) of the PCV. The SRV functions as an automatic decompression system. Table IV-2-1 shows a comparison between these safety systems. Their system structures are shown in Figures IV-2-1 to IV-2-7.

As shown in Figure IV-2-8 and Figure IV-2-9, the heat exchanger in the SHC for Unit 1 or RHR for Units 2 and 3 of Fukushima Daiichi NPS transfers heat using seawater supplied by the seawater cooling system to the sea, as the ultimate heat sink.

To prevent hydrogen explosion in the PCV, it is filled with nitrogen gas and a flammability control system FCS is installed.

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1 This facility condenses steam in the RPV and returns the condensed water to the RPV by natural circulation (driving pumps not needed), when the RPV is isolated due to loss of external power supplies, for example, (when the main condenser cannot work to cool the reactor). The IC cools steam that is led to a heat transfer tube with water stored in the condenser (in the shell side).

2 This system cools the reactor core when the RPV is isolated from the condensate system due to loss of external power supplies, for example. It can use water either in the condensate storage tank or in the suppression chamber. The turbine that uses part of the reactor steam drives the pump of this system.

(3) Measures against severe accidents

1) Basis of measures against severe accidents

a. Consideration of measures against severe accidents

Severe accidents [3] has drawn attention since “The Reactor Safety Study” (WASH-1400)[IV2-5], which assessed the safety of nuclear power stations by a probabilistic method, was published in the United States in 1975.

Severe accidents, which are beyond design basis events on which nuclear facilities are designed, are considered to be at defense depth level 4 in multiple protection as described in IAEA’s Basic Safety Principles for Nuclear Power Plants, 75-INSAG-3, Rev.1, INSAG-12 (1999)[IV2-6]. Multiple protection generally refers to a system that comprises multi-layered safety measures through ensuring design margin at each level of defense, and these levels include: preventing occurrence of abnormalities (level 1); preventing progression of abnormalities into accidents (level 2); and mitigating impact of accidents (level 3). The design basis events are usually for setting safety measures up to level 3. Measures against severe accidents belong to actions at level 4, and they provide additional means to prevent events from progression into severe accidents and mitigate impacts of severe accidents, and also provide measures effectively using existing facilities or based on procedures. They are stipulated as actions to control severe accidents or actions to protect the function of confining radioactive materials to prevent events from worsening.

In Japan, following the 1986 Chernobyl accident in the former Soviet Union, the NSC in Japan set up the Round-table Conference for Common Problems under its Special Committee on Safety Standards of Reactors in July 1987 to study measures against severe accidents. The Round-table Conference members did research on the definition of severe accidents, PSA methods, and maintaining the functions of the PCV after a severe accident, and they put together the “Report on Study of Accident Management as a Measure against Severe Accidents—Focused on the PCV”[IV2-7] in March 1992.

3 These events significantly exceed design basis events causing the system to become incapable of appropriately cooling the reactor core or controlling reactivity by any methods covered by the safety design, and consequently will lead to serious reactor core damage.

This report says, “Nuclear facility safety is secured through safety ensuring activities that deal with design basis events, and the risk of radioactive exposure of the general public in the vicinity is sufficiently low. Even if a severe accident or events that may lead to a severe accident occurred at a nuclear facility, appropriate accident management[4] based on the PSA would reduce the possibility of it becoming a severe accident or mitigate the impact of a severe accident on the general public, further lowering the risk of exposure.”

Following this report, the NSC Japan made a decision called “Accident Management as a Measure against Severe Accidents at Power Generating Light Water Reactors”[IV2-8] (herein after called the “Accident Management Guidelines”) in May 1992. Based on this decision, licensees have taken voluntary actions (not included in regulatory requirements), such as measures to prevent accidents from becoming severe accidents (phase I) and measures to mitigate the impact of severe accidents (phase II).

The (former) Ministry of International Trade and Industry, based on these Accident Management Guidelines, issued the “Implementation of Accident Management”[IV2-9] to request licensees to carry out PSA on each of their light water nuclear power reactor facilities, introduce accident management measures based on PSA, and submit result reports on these actions, the content of which MITI was to confirm.

After that, the Basic Safety Policy Subcommittee of the Nuclear and Industrial Safety Subcommittee studied overall safety regulations in Japan, and it put together a report “Issues on Nuclear Safety Regulations”[IV2-10] in 2010. This report says that based on moves overseas such as introducing severe accident measures as a regulatory requirement in some countries, it is appropriate to consider dealing with safety regulations on severe accidents measures in terms of their position in the regulation system and legislation. In response to this, NISA has been considering how to deal with severe accidents.

b. Utilization of risk information

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4 Appropriate severe management is measures taken to make effective use of not only safety margin allowed in the current design and original functions provided in safety design but also other functions expected to work for safety as well as newly installed components and equipment so that any situation which exceeds design basis events and may cause serious damage to core will not progress to a severe accident, and, even if the situation progresses to a severe accident, its influences will be mitigated.

The NSC Japan started a study of periodic safety reviews[5] (hereinafter referred to as PSR) in order to consider using PSA, and it worked out a basic policy on PSR including implementation of PSA in 1993.

This policy requested implementation of PSA as part of PSR activities to effectively improve the current level of safety even further, because PSA comprehensively and quantitatively assesses and helps get the whole picture of the safety of a nuclear power station by postulating a wide range of abnormal events that may occur at a nuclear power station. As a result, the (former) MITI has requested that licensees implement PSR since 1994, and has reported to the NSC Japan on licensees' assessment results including PSA.

Later in 2003, PSR was included in regulatory requirements as part of the measures for aging management, while PSA was left as voluntary measures taken by licensees. Then it was decided that PSR results would be confirmed by NISA and reports to the NSC Japan were discontinued. Meanwhile, licensees have been taking severe accidents measures using PSA.

In Japan, civil standards on PSA related to internal events are established. For external events, a civil standard on seismic PSA is also established, while study of PSA related to other external events such as flooding has only started.

The Study Group on Use of Risk Information of Nuclear and Industrial Safety Subcommittee studied utilization of risk information to put together "the basic policy of utilization of risk information in nuclear regulation"[IV2-11] in 2005. However, later the activity had been temporarily suspended. In 2010, this study group was resumed, and it has been considering measures for further utilization of risk information.

On the other hand, the safety goals associated with the use of risk information have been being examined by the Special Committee on Safety Goals of the NSC Japan since 2000, and the "Interim Report on Investigation and Examination"[IV2-12] was issued in 2003. In addition, the "Performance Goals of Commercial Light Water

5 It conducts comprehensive re-evaluation of the safety of nuclear power stations approximately once every ten years based on the latest technological knowledge in order to improve the safety of existing nuclear power plants. Specifically, it re-evaluates comprehensive evaluation of operating experience, reflection of the latest technological knowledge, conduction of technical evaluations for aging, and PSA results.

Reactor Facilities: Performance Goals Corresponding to Safety Goal Proposal"[IV2-13] was issued in 2006. However, the use of risk information based on the safety goals has not progressed because the safety goals of Japan have not been determined.

Accordingly, compared to other countries, Japan has not been sufficiently promoting the use of risk information.

c. Examination of total AC power loss and cooling functions, etc.

The following are the status of the severe accidents associated with the current accident.

According to the “Interim Report on the Conference on Common Issues”[IV2-14] issued by the NSC Japan ((the Special Committee on Nuclear Safety Standards of on February 27, 1989, hereinafter referred to as the "Common Issue Interim Report"), accident management during total AC power loss includes efforts such as core cooling by using RCIC powered by direct current (from batteries), recovery of offsite power systems or emergency DGs, bringing in portable diesel generators or batteries, and power interchange between emergency DGs in adjacent plants. The Common Issue Interim Report states that an accident has a high chance of being settled before it results in core damage if preparation has been made for such management.

In addition, if RHR lose its functionality, the inner pressure and temperature of the PCV increase with decrease in the pressure of the reactor. Accordingly, the Common Issue Interim Report additionally states that to prevent the PCV from being damaged, facilities for depressurization of the PCV to vent pressure in order to prevent PCV rupture (hereinafter referred to as “PCV vent”) should be built and that the procedures for the operation of the individual facilities should be prepared.

The accident management guidelines mention alternative coolant injection into the reactor by using a fire extinguishing line and the PCV vent as the Phase I (core damage prevention) accident management of BWR plants. The accident management guidelines also state that PCV vent facilities with a filtering function installed in combination with other measures, such as coolant injection into the PCV, may be an effective measure for Phase II (after core damage) accident management. The accident management guidelines additionally state that coolant injection into the PCV should be included in the Phase I (core damage prevention) and Phase II (after core damage) accident management of BWR plants. In the PSA that is the basis of this guideline, it was concluded that injecting an alternative coolant into the PCV would suppress increases in the temperature and pressure of the atmosphere in the PCV and prevent debris-concrete reaction[7] and melt shell attack[8].

2) Status of preparation for accident management by TEPCO

TEPCO issued the "Report on Accident Management Examination" [IV2-15] in March 1994, and has been preparing for accident management and establishing procedures, education, etc. associated with the application of the accident management based on the report. TEPCO presented the "Report on Preparation for Accident Management"[IV2-16] describing the status of the preparation for accident management to the Ministry of Economy, Trade and Industry in May 2002.

TEPCO has prepared accident management for the reactor shutdown function, coolant injection into reactors and PCVs function, heat removal from PCVs function, and support function for safety functions. The main measures of accident management are shown in Table IV-2-2. In addition, the system structures of accident management facilities of Units 1 to 3 are shown in Figs. IV-2-10 to IV-2-17.

With regard to alternative coolant injection in the Fukushima NPSs, TEPCO has built the following lines for injecting coolant into reactors: lines via condensate water makeup systems from the condensate storage tanks as the water sources; and lines via fire extinguishing systems and condensate water makeup systems from the filtrate tanks as the water sources. TEPCO has also developed "procedures for coolant injection using these lines during accidents (severe accidents)" (hereinafter referred to as "procedures for operation in severe accidents").

In addition, TEPCO has built a switching facility in Unit 3 for injecting seawater into the reactor via the residual heat removal sea water system (hereinafter referred to as RHRS)

[7] When core melt drops down through the bottom of RPV, it causes thermal decomposition of floor concrete as well as erosion with concrete constituents.

[8] When core melt drops down through the bottom of RPV, it drops into and spreads over the cavity area at the bottom of RPV. Then debris spreads over the dry well floor through a pedestal opening and causes damage to walls of PCV.

as shown in Fig. IV-2-12 and has developed a procedure for switching operation of the relevant facilities. However, Units 1 and 2 are not provided with such the facility because no seawater lines lead into the reactor buildings of Units 1 and 2.

TEPCO built new vent pipes extending from the S/C and D/W to the stacks from 1999 to 2001 as PCV vent facilities during severe accidents as shown in Figs. IV-2-13 and IV-2-14. These facilities were installed to bypass the standby gas treatment system (hereinafter referred to as SGTS) so that they can vent the PCV when the pressure is high. The facilities are also provided with a rupture disk in order to prevent malfunction.

The procedures for operation in severe accidents define the PCV vent conditions and the PCV vent operation during severe accidents as follows: PCV vent from the S/C (hereinafter referred to as “wet vent”) shall be given priority; and when the PCV pressure reaches the maximum operating pressure before core damage, when the pressure is expected to reach about twice as high as the maximum operating pressure after core damage and if RHR is not expected to be recovered, wet vent shall be conducted if the total coolant injection from the external water source is equal to or less than the submergence level of the vent line in the S/C or PCV vent from the D/W (hereinafter referred to as “dry vent”) shall be conducted if the vent line of the S/C is submerged. The procedures for operation in severe accidents specify that the chief of emergency response headquarters shall determine whether PCV vent operation should be conducted after core damage.

For accident management associated with the function of heat removal from the PCV, alternative coolant injection to a PCV spray (D/W and S/C) (hereinafter referred to as the alternative spray function) has also been provided as shown in Figs. IV-2-15 and IV-2-16. PCV sprays (D/W and S/C) are installed to reduce the pressure and temperature generated due to energy released within the PCV if reactor coolant is lost, according to guideline 32 (containment heat removal system) of the Regulatory Guide for Reviewing Safety Design. The procedures for operation in severe accidents specify criteria such as the standard for starting and terminating coolant injection from RHR by using this modified line and the criteria for starting and terminating coolant injection from the condensate water makeup system and the fire extinguishing system.

Power interchange facilities have been installed such that the power supply of the alternating current source for power machinery (6.9 kV) and the low voltage alternating current source (480 V) can be interchanged between adjacent reactor facilities (between Units 1 and 2, between Units 3 and 4, and between Units 5 and 6) as shown in Fig IV-2-17. The procedures for operation in severe accidents specify procedures for the relevant facilities.

In order to recover emergency DGs, the procedures for operation in severe accidents specify procedures for recognition of failures, detection of the location of failures, and recovery work for faulty devices by maintenance workers.

Table IV-2-1 Comparison between Engineering Safety Equipment and Reactor Auxiliary Equipment

Fukushima-Daiichi Nuclear Power Station		Unit 1	Unit 2	Unit 3
Core spray system (CS)	No. of systems	2	2	2
	Flow (T/hr per system)	550	1020	1141
	No. of pumps (per system)	2	1	1
	Pump discharge pressure (kg/cm2g)	20	35.2	35.2
Containment cooling system (CCS)	No. of systems	2	2	2
	Design flow (T/hr per system)	705	2960	2600
	No. of pumps (per system)	2	2	2
	No. of heat exchangers (per system)	1	1	1
High pressure coolant injection system (HPCI)	No. of systems	1	1	1
	Flow (T/hr)	682	965	965
	No. of pumps	1	1	1
Low pressure coolant injection system (LPCI)	No. of systems		2	2
	Flow (T/hr per pump)		1750	1820
	No. of pumps (per system)		2	2
Residual heat removal system (RHR)	Pump			
	No. of pumps		4	4
	Flow (t/h)		1750	1820
	Total pump head (m)		128	128
	Seawater pump			
	No. of seawater pumps		4	4
	Flow (m3/h)		978	978
	Total pump head (m)		232	232
	Heat exchanger			
	No. of units		2	2
	Heat transfer capacity (kcal/h)		7.76E+06	7.76E+06
Reactor shut-down cooling system (SHC)	Pump			
	No. of pumps	2		
	Flow (m3/h per unit)	465.5		
	Pump head (m)	45.7		
	Heat exchanger			
	No. of heat exchangers	2		
	Heat exchanging capacity (kcal/h)	3.8E+06		
Reactor core isolation cooling system (RCIC)	Steam turbine			
	No. of steam turbines		1	1
	Reactor pressure (kg/cm2g)		79-10.6	79-10.6
	Output (HP)		500-80	500-80
	Speed of rotation (rpm)		5000-2000	4500-2000
	Pump			
	No. of pumps		1	1
	Flow (t/h)		95	97
	Total pump head (m)		850-160	850-160
	Speed of rotation (rpm)		Variable	Variable
Isolation condenser (IC)	No. of systems	2		
	Effective water retention capacity of the tank (m3 per tank)	106		
	Steam flow (T/hr per tank)	100.6		
Standby gas treatment system (SGTS)	No. of systems	2	2	2
	No. of fans (per system)	1	1	1
	Exhaust capacity (m3/hr per unit)	1870	2700	2700
	Iodine filtration efficiency of the system (%)	≥ 97	≥ 99.9	≥ 99.9
Safety valve	No. of valves	3	3	3
	Total capacity (T/hr)	900	900	900
	Blowout pressure (kg/cm2g)	86.8 (two valves) 87.9 (one valve)	87.2	87.2
	Blowoff area	Drywell	Drywell	Drywell
Main steam safety relief valve	No. of valves	4	8	8
	Total capacity (T/hr)	1090	2900	2900
	Relief valve function	74.2 kg/cm2g (1 valve)	75.9 kg/cm2g (1 valve)	75.9 kg/cm2g (1 valve)
		74.9 kg/cm2g (2 valves)	76.6 kg/cm2g (3 valves)	76.6 kg/cm2g (3 valves)
		75.6 kg/cm2g (1 valve)	77.3 kg/cm2g (4 valves)	77.3 kg/cm2g (4 valves)
	Safety valve function	78.0 kg/cm2g (2 valves)	78.0 kg/cm2g (2 valves)	
		78.7 kg/cm2g (2 valves)	78.7 kg/cm2g (3 valves)	
			79.4 kg/cm2g (3 valves)	
	Blowoff area	Suppression Chamber	Suppression Chamber	Suppression Chamber

Table IV-2-2　Accident Management Measures at Fukushima Daiichi and Daini NPSs

	Fukushima Daiichi			Fukushima Daini
	Unit 1 (BWR-3)	Units 2 to 5 (BWR-4)	Unit 6 (BWR-5)	Units 1 to 4 (BWR-5)
1. Accident Management Associated with Reactor Shutdown Function				
(1) Recirculation Pump Trip (RPT) RPT is a function inducing an automatic trip of the recirculation pump to reduce the reactor power by using an instrumentation and control system that has been installed separate from the emergency reactor shutdown system.	○	○	○	○
(2) Alternative Control Rod Insertion ARI is a function for automatically opening a newly installed valve and inserting control rods to shut down the reactor upon detecting an abnormality by using an instrumentation and control system that has been installed separate from the emergency reactor shutdown system.	○	○	○	○
2. Accident Management Associated with Coolant Injection into Reactor and PCV				
(1) Alternative Means of Coolant Injection In order to effectively utilize the existing condensate water make-up systems, fire extinguishing systems, and PCV cooling systems, the destination of the piping is modified so that coolant injection into reactors is possible from these existing systems via systems such as core spray systems, so that they can be used as alternative means of coolant injection facilities.	○	○	○	○
(2) Automatic Reactor Depressurization (Reactor depressurization is already automatic. Therefore, it should be regarded as improvement in the reliability of ADS.) In the event where only the reactor water level is decreasing due to insufficient high pressure coolant injection during a abnormal transient signals indicating high D/W pressure are not generated, and the automatic depressurization system is not automatically activated in the conventional facilities. Accordingly, the reactor has been modified to be automatically depressurized by using safety relief valves after the occurrence of a signal indicating a low reactor water level, which makes it possible for systems, such as emergency low pressure core cooling systems, to inject coolant into the reactor even in such an event.	—	○	○	○
3. Accident Management Associated with Heat Removal Functions in PCV				
(1) Alternative Heat Removal with D/W coolers and Reactor Coolant Cleanup System D/W coolers and reactor coolant cleanup systems are manually activated to remove heat from PCV. The procedure is defined in the accident operation standard.	○	○	○	○
(2) Recovery of PCV Cooling System (Residual Heat Removal System) Recognition of failures of the PCV cooling system (residual heat removal system), detection of the locations of failures, and recovery work for the failures by maintenance workers are defined in the recovery procedure guidelines as basic procedures.	○	○	○	○
(3) Compressive Strengthening Vent Reactor containment vent lines with strengthened pressure resistance are installed to be directly connected to stacks from inert gas systems without passing through standby gas treatment systems, so that the applicability of depressurization operation as a means of prevention of over-pressurization in the PCV is extended to improve the heat removal function in PCV.	○	○	○	○
4. Accident Management Associated with Support Function for Safety Functions				
(1) Interchange of Power Supplies Power supply capacity is improved by constructing tie lines of low-voltage AC power supplies between adjacent reactor facilities.	○	○	○	○
(2) Recovery of Emergency DGs Recognition of failures of emergency DGs, detection of the location of failures, and recovery work for the failures by maintenance workers are defined in the recovery procedure guidelines as basic procedures.	○	○	○	○
(3) Dedicated Use of Emergency DGs One of the two emergency DGs was commonly used between adjacent Units. However, new emergency DGs have been installed at Units 2, 4, and 5, so that each DG is used for only one Unit.	○	○	○	○

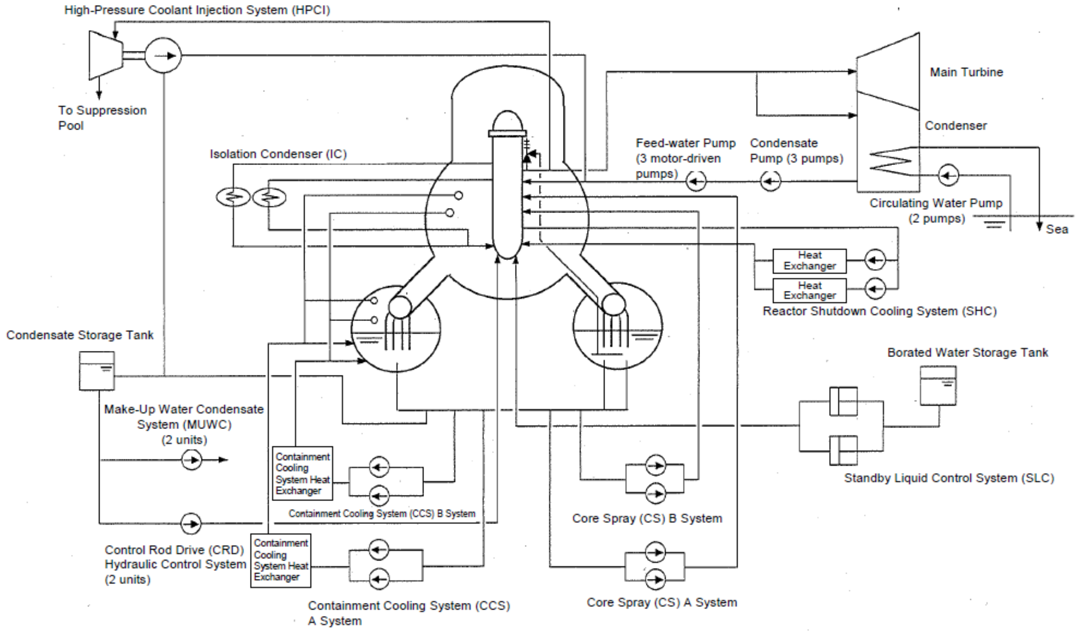


Fig. IV-2-1 System Structure Diagram of Fukushima Daiichi NPS Unit 1

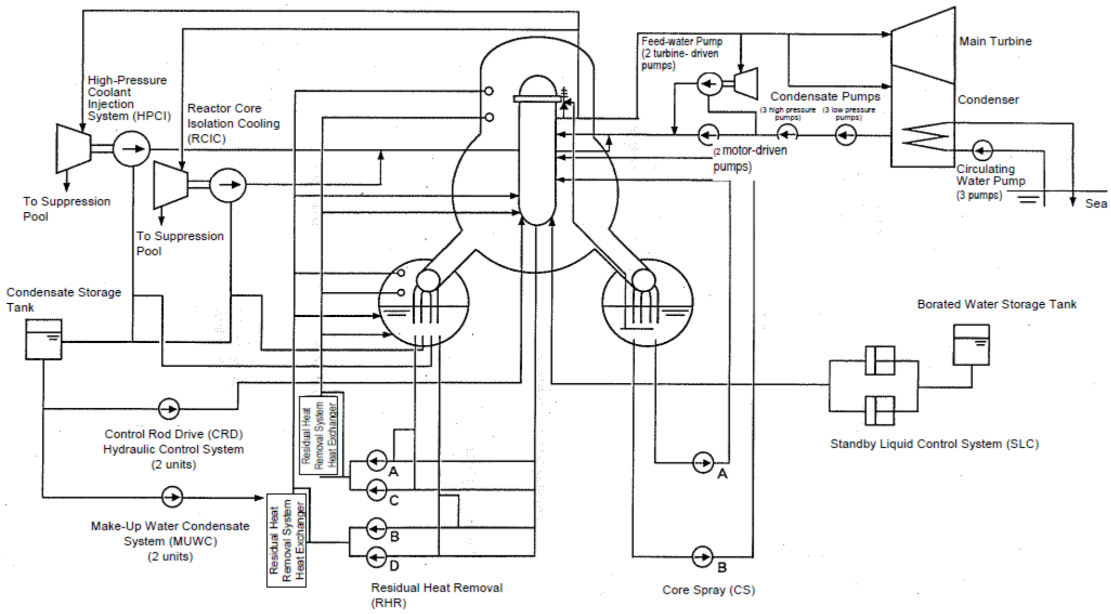
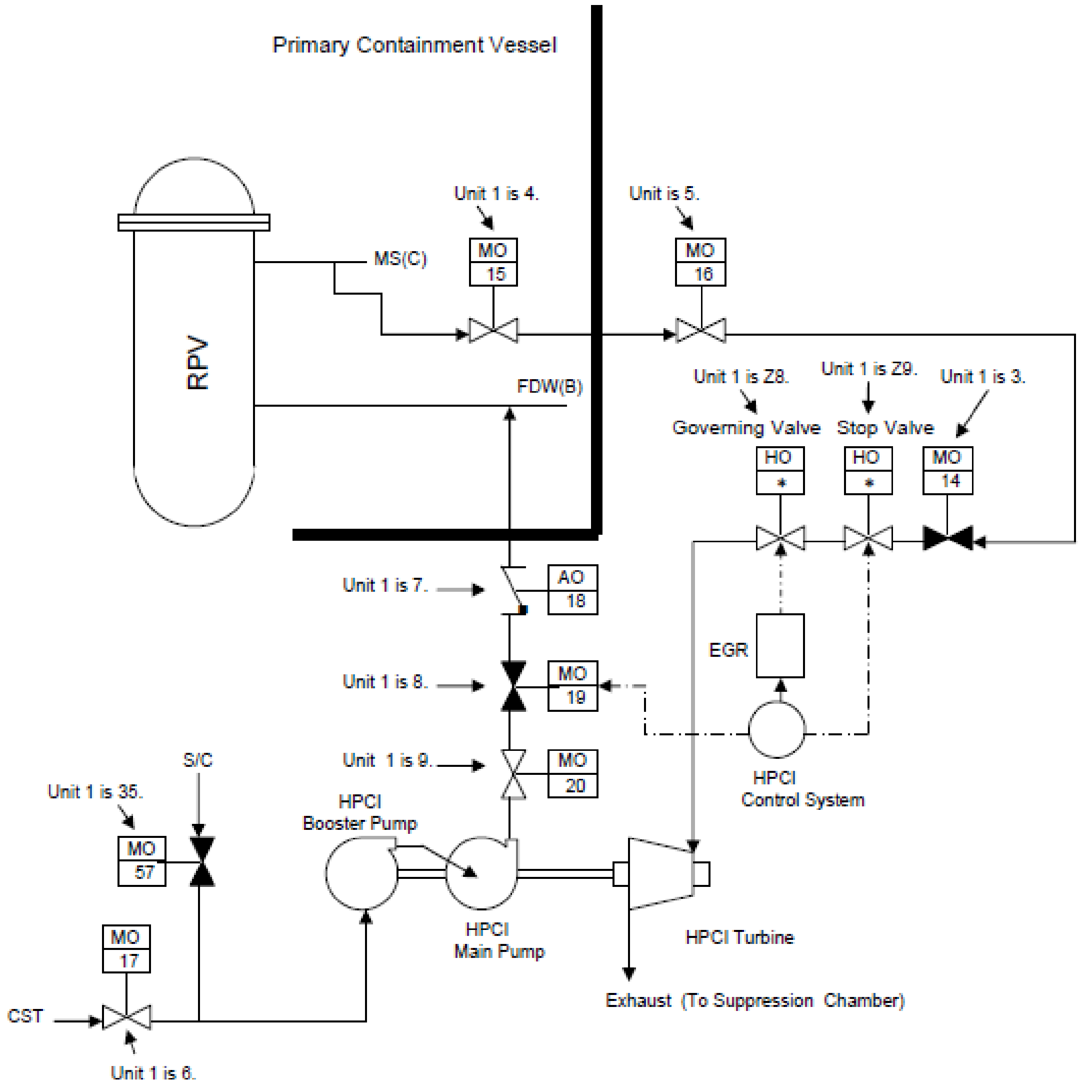
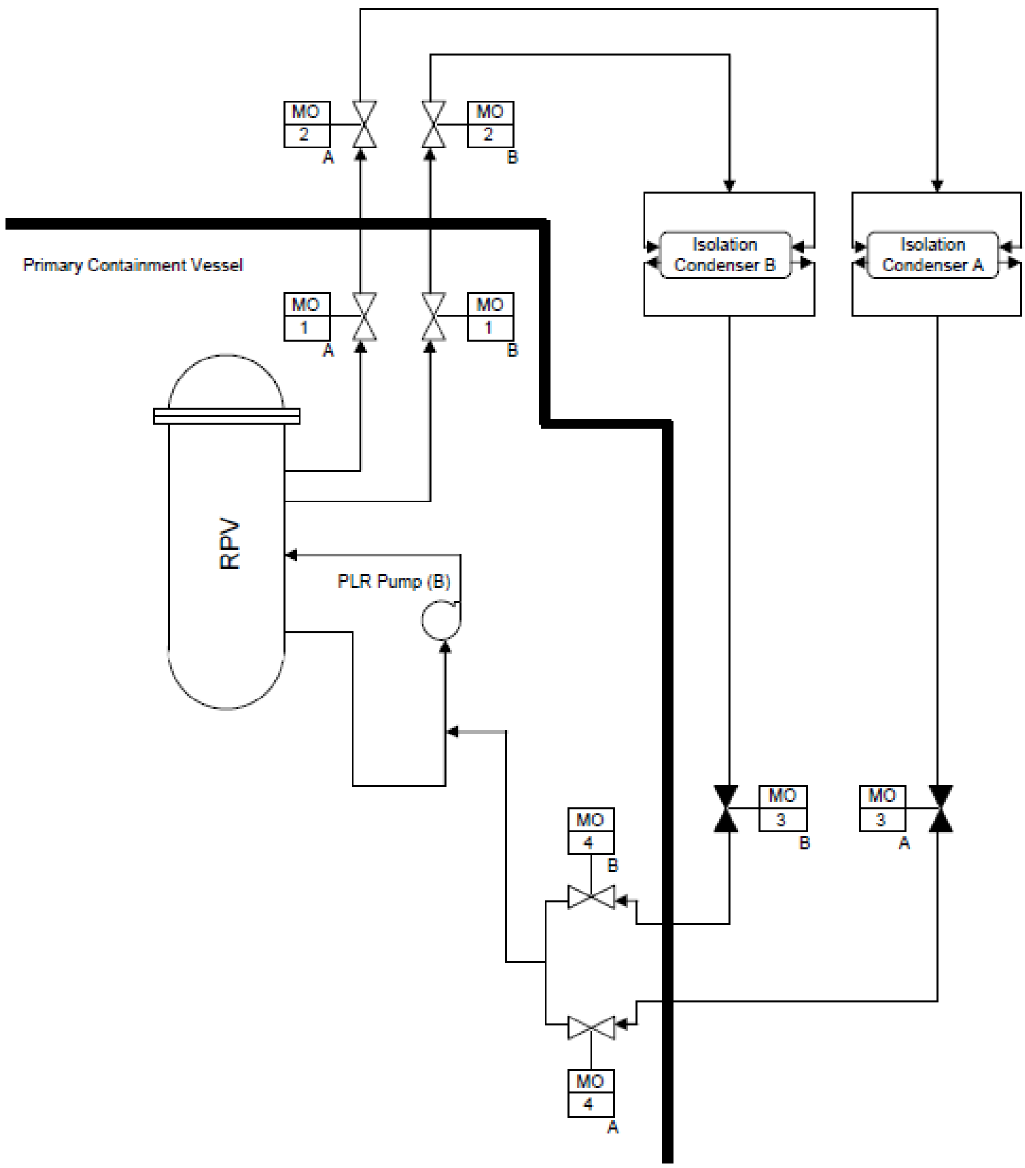


Fig. IV-2-2 System Structure Diagram of Fukushima Daiichi NPS Units 2 and 3



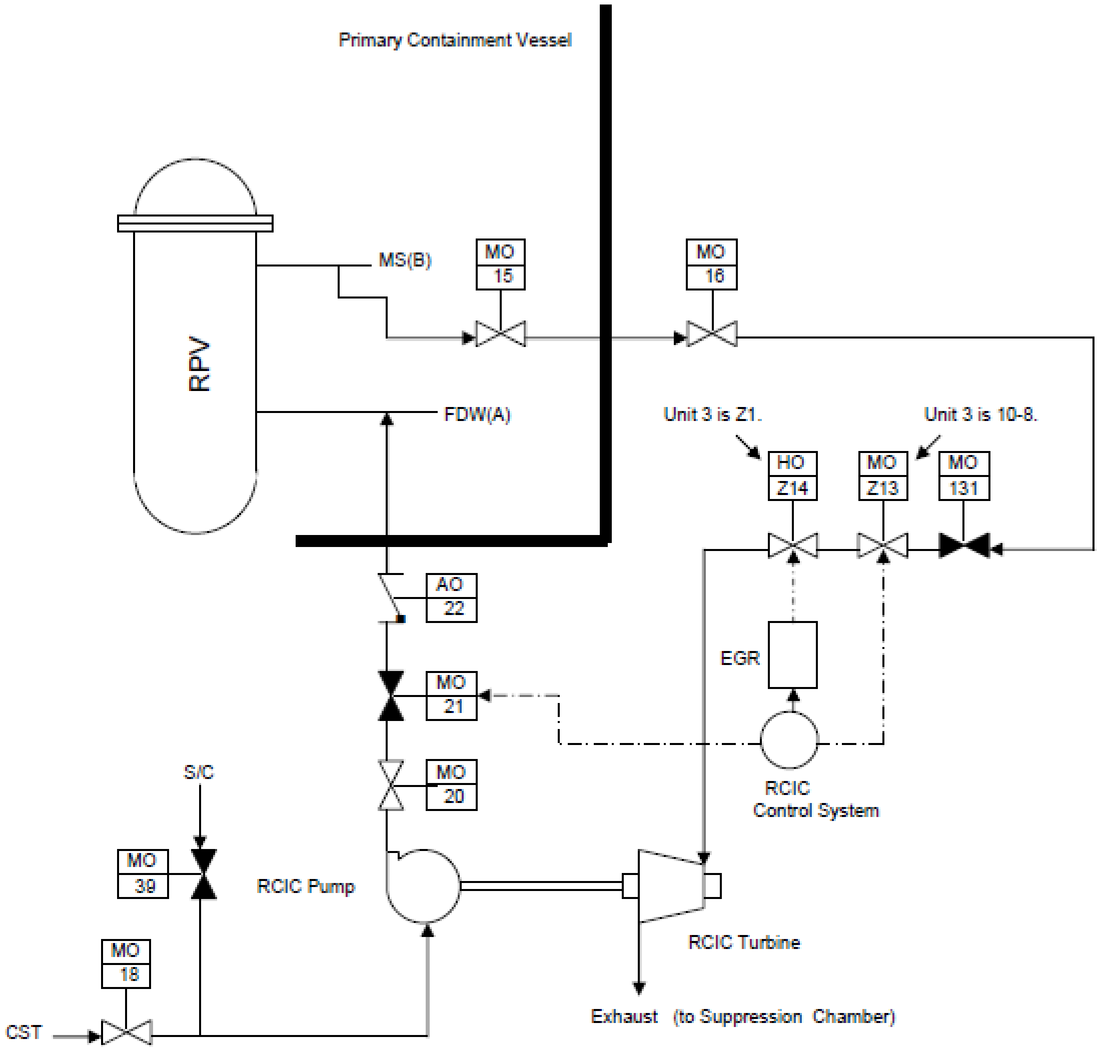
*1: During normal operation, MO-15, 16, 17, 20 and HO valves are "open" and MO-14 and 19 valves are "close".
At startup, 14 and 19 valves are "open".
*2: MO-15 valve is inoperative due to AC power loss. (as-is)
*3: MO-14, 16, 17, 19 and 20 valves are inoperative due to DC power loss (the separate power source from isolation logic circuits). (as-is)
*4: During DC power loss, isolation (close) logic circuits are operative.
At that time, if the drive power of each valve (written in *2 and *3) is activated, each valve is closed. If the drive power of each valve is already lost, the circuits are inoperative. (as-is)

Fig. IV-2-3 System Structure Diagram of High Pressure Coolant Injection System (Units 1 to 3)



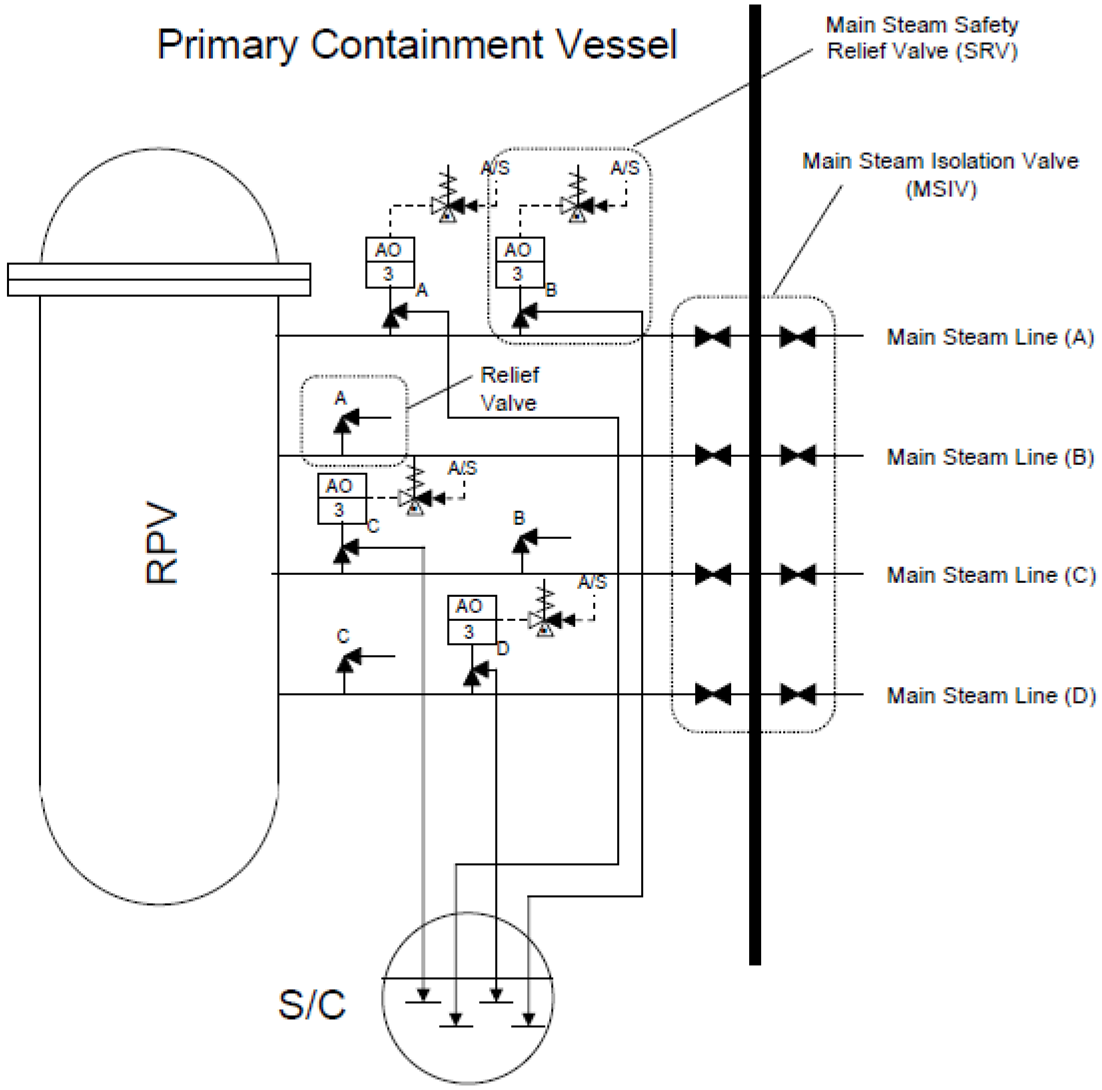
*1: During normal operation (in a standby condition), MO-1, 2 and 4 valves are "open" and MO-3 valve is "close". At startup, MO-3 valve is "open".
*2: MO-1 and 4 valves are inoperative due to AC power loss. (as-is)
*3: MO-2 and 3 valves are inoperative due to DC power loss (the same power source as isolation logic circuits). (as-is)
*4: During DC power loss, isolation (close) logic circuits are operative. At that time, if the drive power of each valve (written in *2 and *3) is activated, each valve is closed. If the drive power of each valve is lost, the valves are inoperative. (as-is)

Fig. IV-2-4 System Structure Diagram of Isolation Condenser (Unit 1)



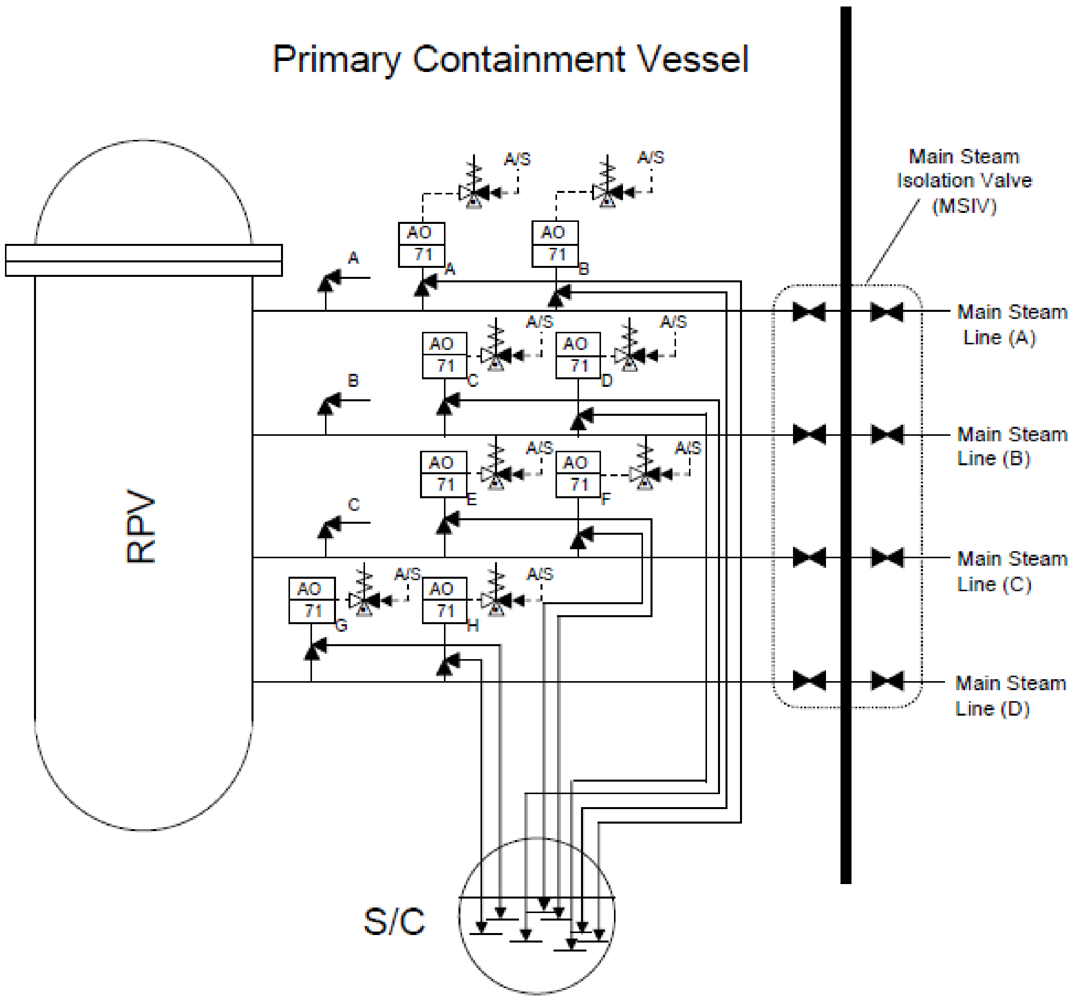
*1: During normal operation (in a standby condition), MO-15, 16, 18, 20 and Z13 valves and HO-Z14 are "open" and MO-131 and 21 valves are "close".
At startup, 131 and 21 valves are "open".
*2: MO-15 valve is inoperative due to AC power loss. (as-is)
*3: MO-16. 18, 20, 21 and 131 valves are inoperative due to DC power loss (the separate power source from isolation logic circuits). (as-is)
*4: During DC power loss, isolation (close) logic circuits are operative.
At that time, the drive power of each valve (written in *2 and *3) is activated, each valve is closed. If the drive power of each valve is already lost, the valves are inoperative. (as-is)

Fig. IV-2-5 System Structure Diagram of Reactor Core Isolation Cooling System (Units 2 and 3)



*1: The main steam safety relief valves (4 valves) are AO valves, and open drive air is supplied by the energized solenoid valves of air supply lines.
During power loss, solenoid valves become deenergized and main steam relief valves are in a closed condition.

Fig. IV-2-6 System Structure Diagram of Main Steam Safety Relief Valve
(Unit 1)



*1: Main steam safety relief valves (8 valves) are AO valves, and open drive air is supplied by the energized solenoid valves of air supply lines.
During power loss, solenoid valves become deenergized and main steam relief valves are in a closed condition.

Fig. IV-2-7 System Structure Diagram of Main Steam Safety Relief Valve (Units 2 and 3)

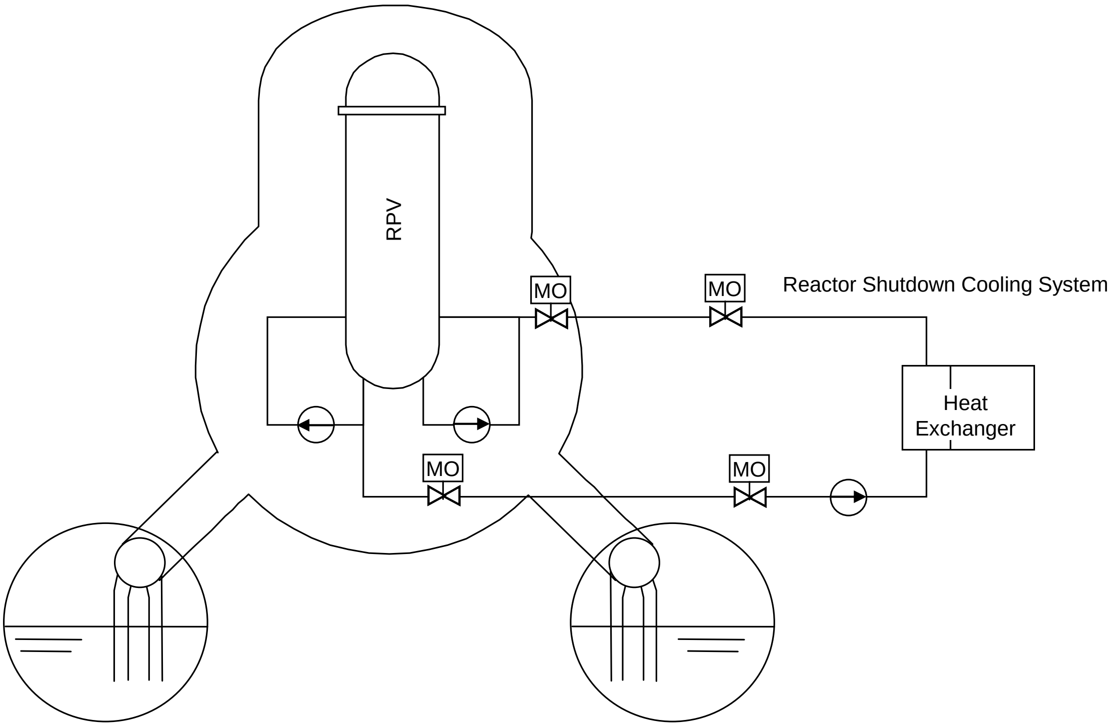


Fig. IV-2-8 System Structure Diagram of Reactor Shutdown Cooling System (Unit 1)

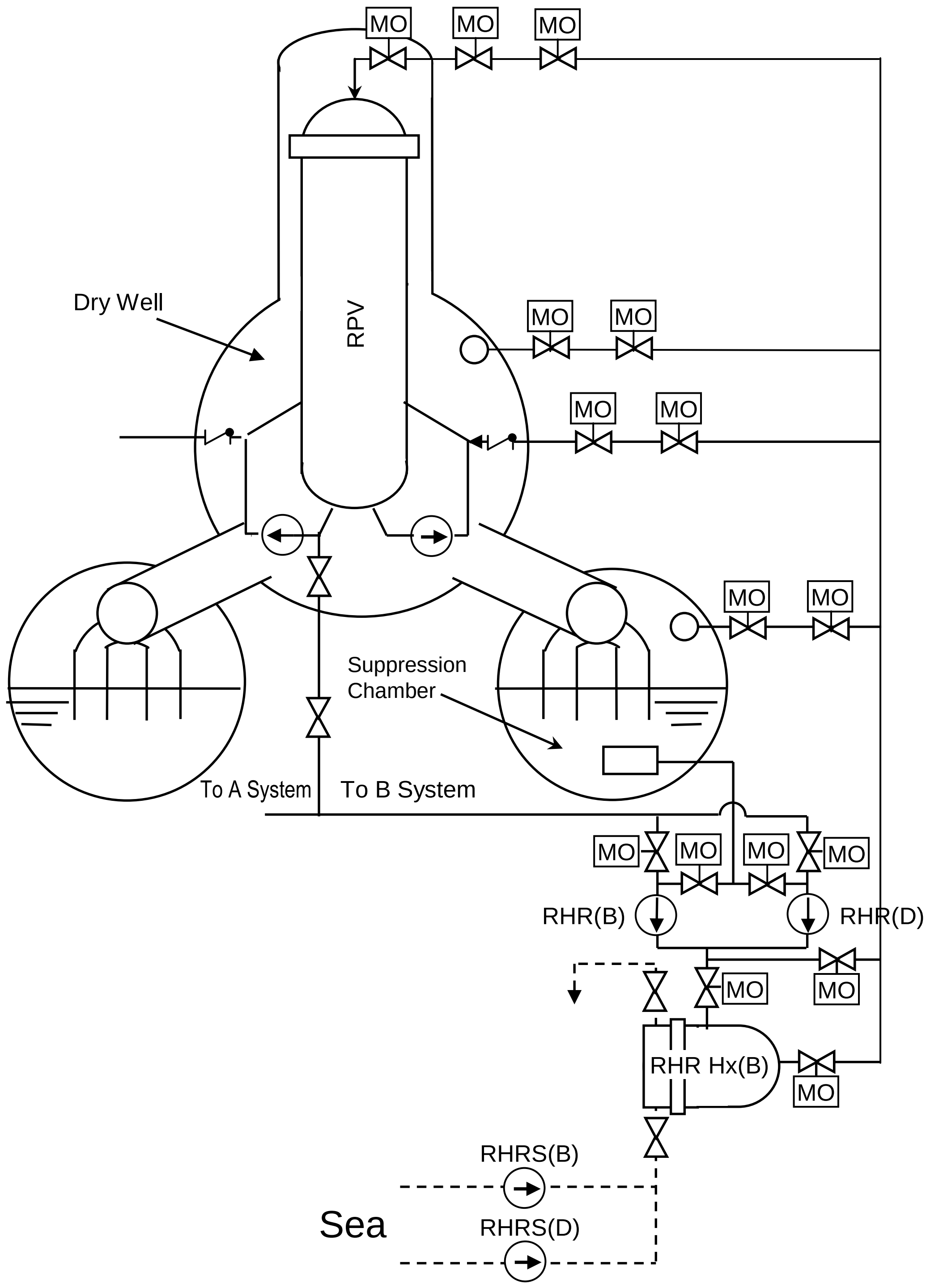


Fig. IV-2-9 System Structure Diagram of Residual Heat Removal System (Units 2 and 3)

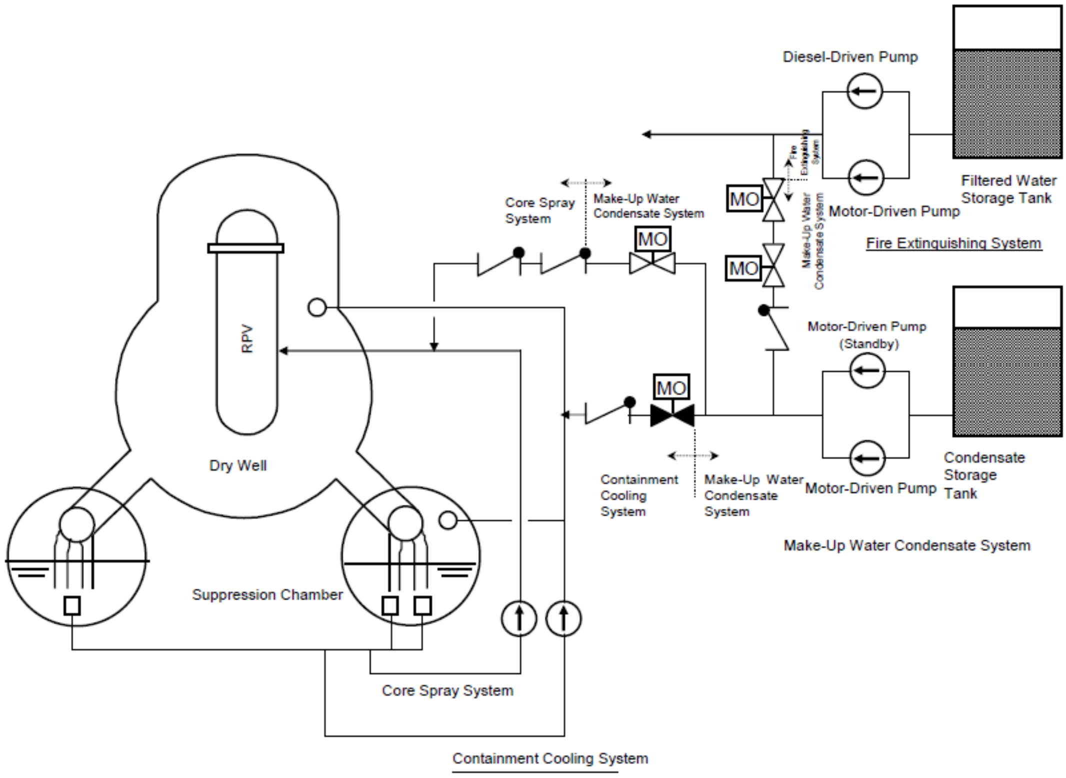


Figure IV-2-10 Overview of the Alternate Water Injection Facility for Unit 1 (by Fresh Water)

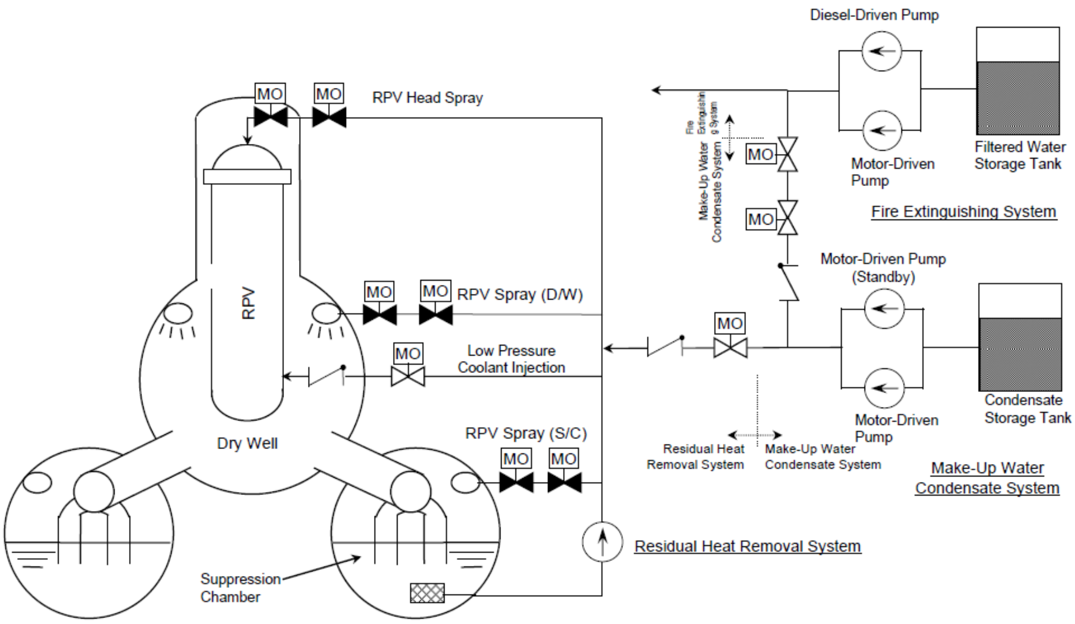


Figure IV-2-11 Overview of the Alternative Water Injection Facility for Units 2 and 3 (by Fresh Water)

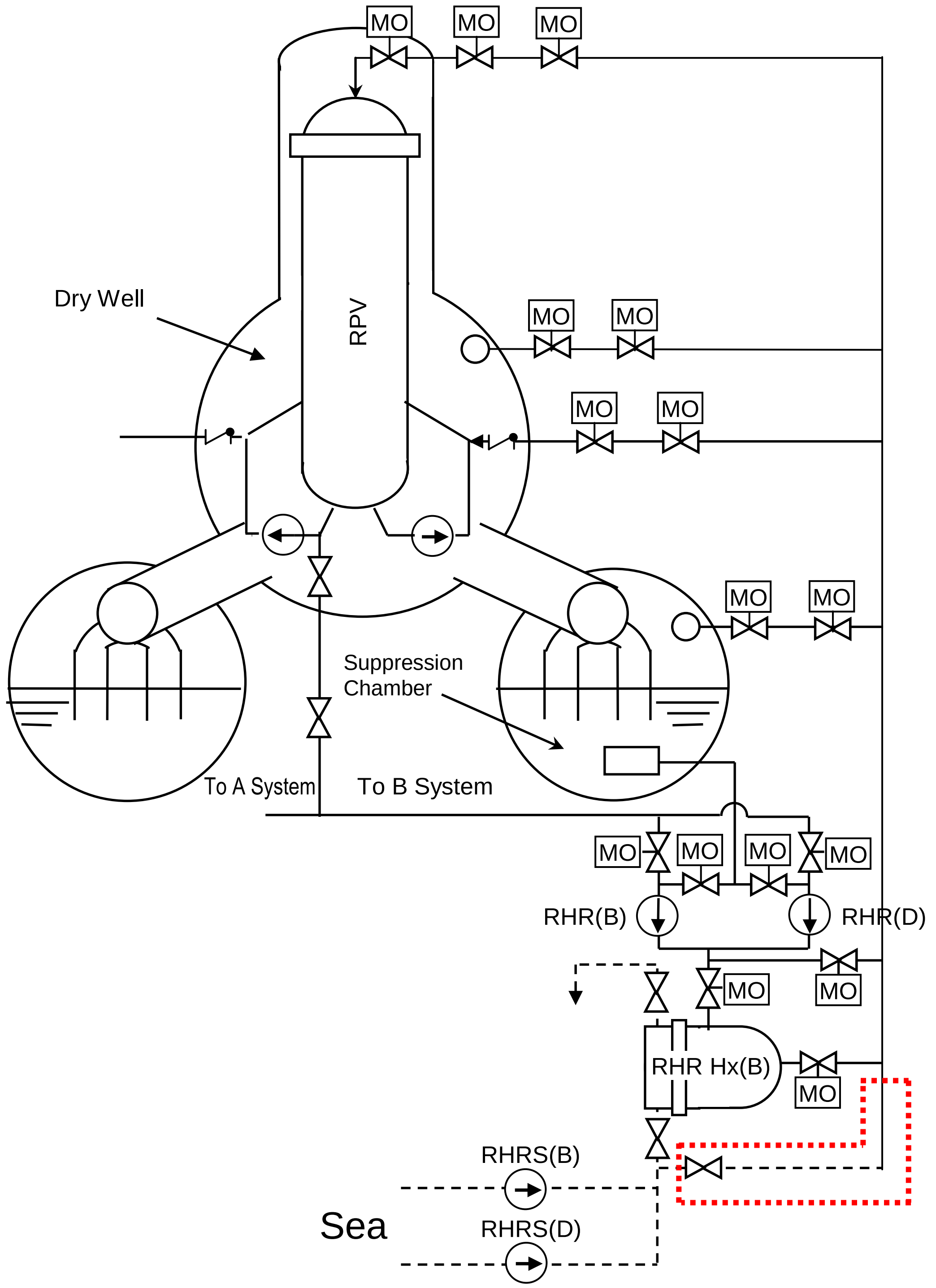


Figure IV-2-12 Overview of the Alternative Water Injection Facility for Unit 3 (by Seawater)

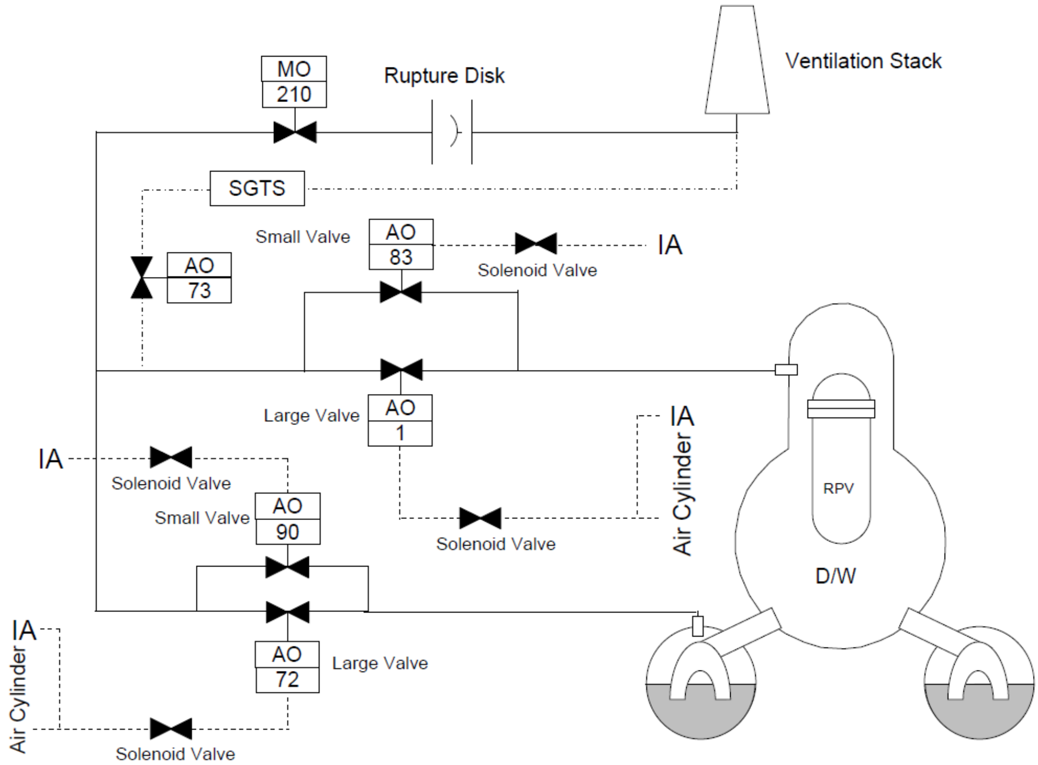


Figure IV-2-13 Overview of PCV Venting Facility (Unit 1)

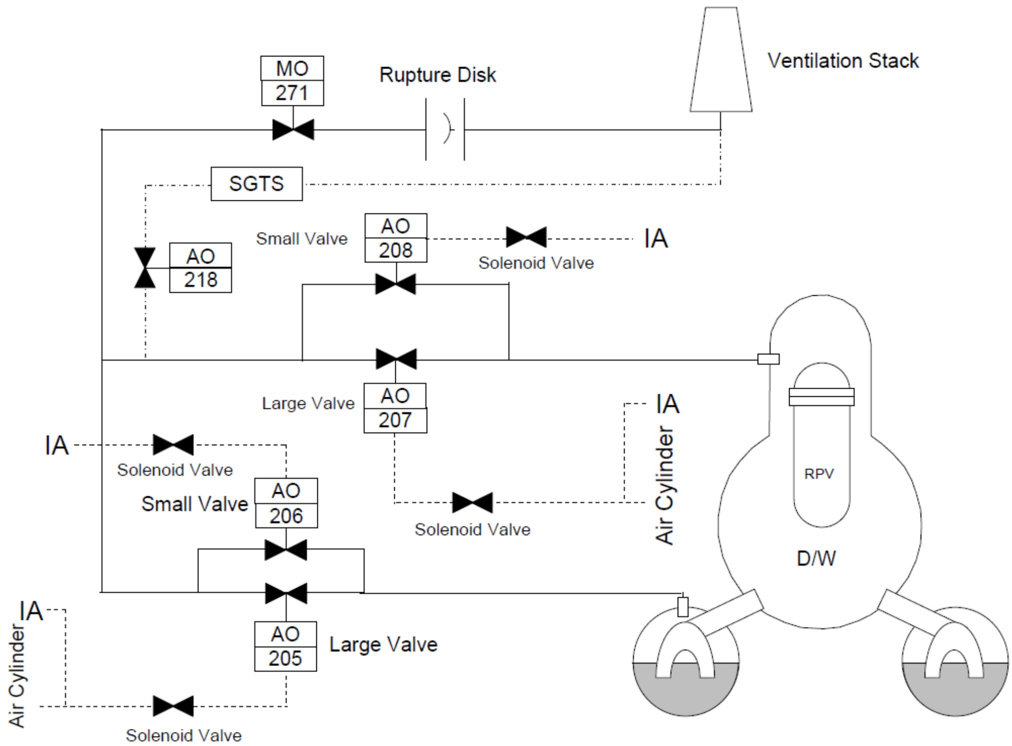


Figure IV-2-14 Overview of PCV Venting Facility (Units 2 and 3)

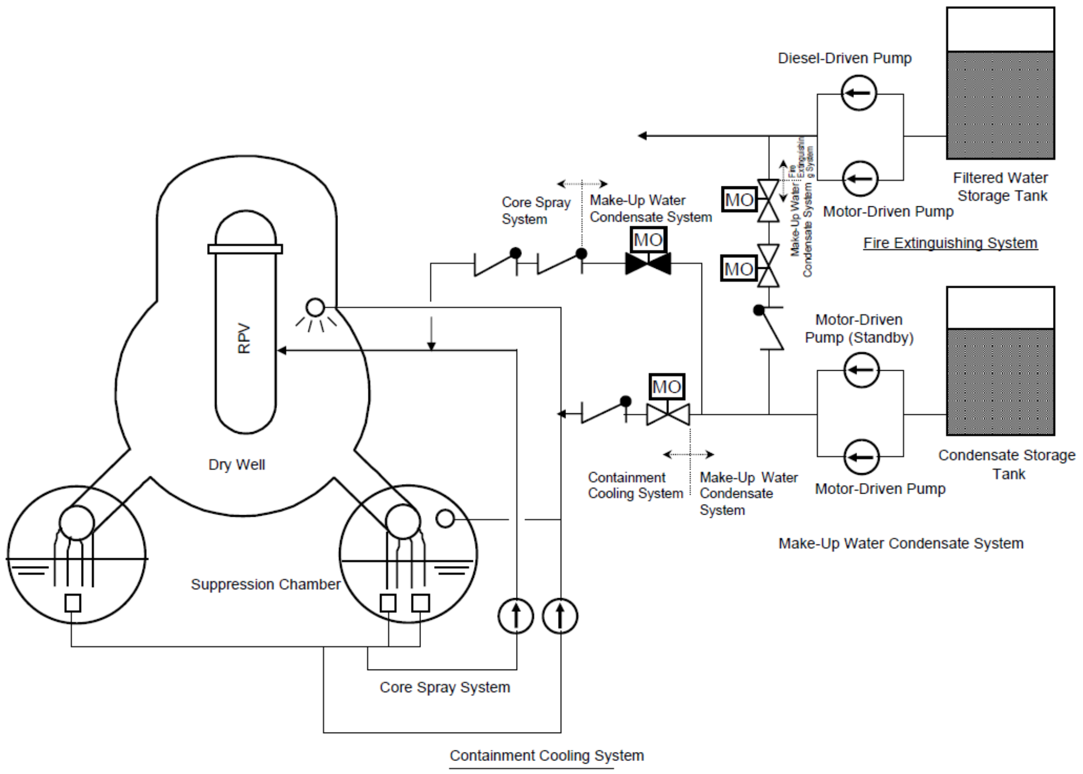


Figure IV-2-15　Overview of PCV Spray (D/W and S/C) Facility (Unit 1)

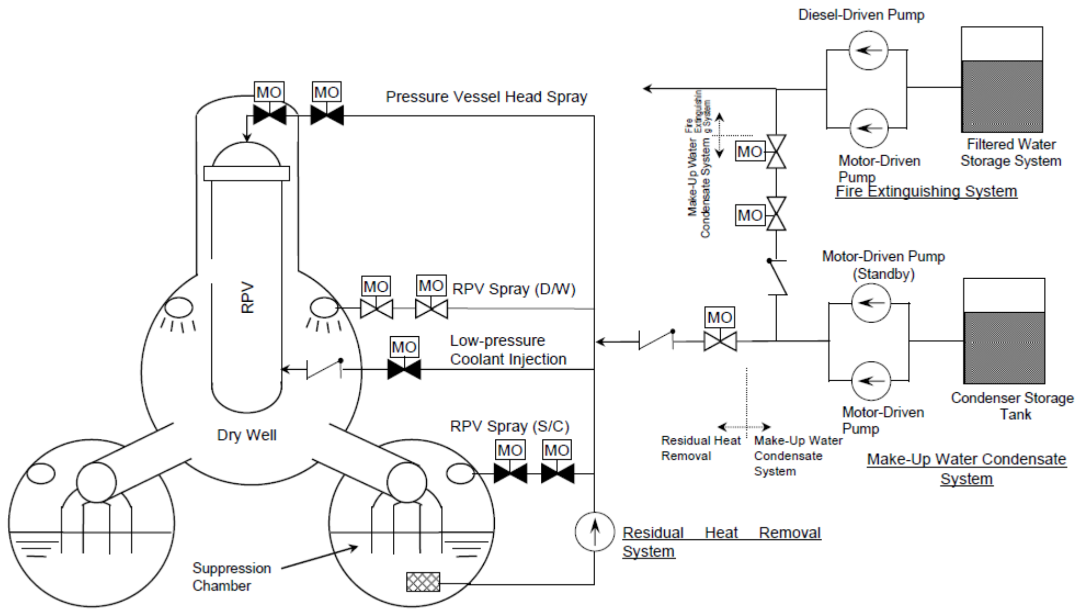


Figure IV-2-16　Overview of PCV Spray (D/W and S/C) Facility (Units 2 and 3)

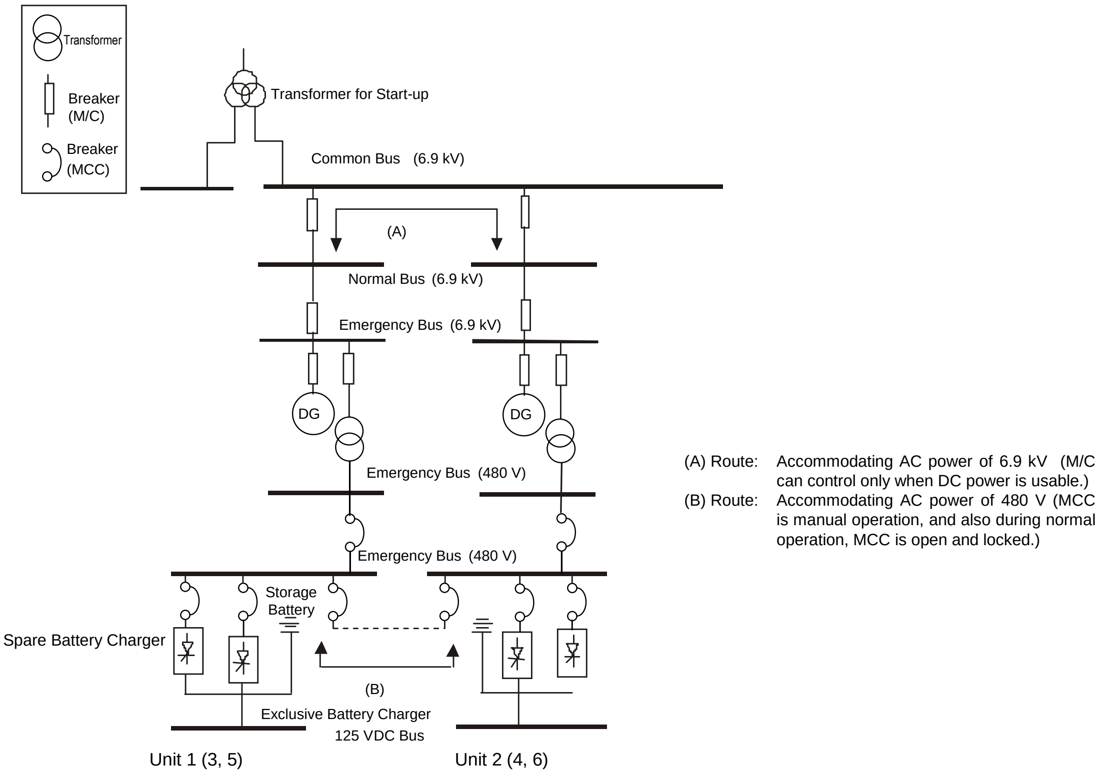


Figure IV-2-17 Conceptual Diagram of Power Supply Interchange among Units

3. Condition of the Fukushima NPSs before the earthquake

(1) Operation

On the day when the earthquake occurred, Unit 1 of the Fukushima Daiichi NPS was in operation at the constant rated electric power, and Units 2 and 3 of the Fukushima Daiichi NPS and all units of the Fukushima Daini NPS were in operation at the constant rated thermal power. The condition of the Fukushima NPSs before the occurrence of the earthquake is indicated in Table IV-3-1.

Fukushima Daiichi NPS Unit 4 was in periodic inspection outage. Large-scale repair work was under way to replace the core shroud, and all fuel assemblies had been transferred to the spent fuel pool from the reactor core with the reactor well filled with water and the pool gate closed.

Fukushima Daiichi NPS Unit 5 was in periodic inspection outage, all fuel assemblies were loaded in the reactor core and the pressure leak test for RPV was being conducted.

Fukushima Daiichi NPS Unit 6 was in periodic inspection outage, and all fuel assemblies were loaded in the reactor core that was in cold shutdown condition.

Table IV-3-1 The Condition of the Fukushima NPSs before the Earthquake

Power stations and reactor units			Condition before the occurrence of the earthquake
Fukushima Daiichi	Unit 1	Reactor	In operation (400 fuel assemblies)
		Spent fuel pool	392 fuel assemblies (including 100 new ones)
	Unit 2	Reactor	In operation (548 fuel assemblies)
		Spent fuel pool	615 fuel assemblies (including 28 new ones)
	Unit 3	Reactor	In operation (548 fuel assemblies, including 32 MOX fuel assemblies)
		Spent fuel pool	566 fuel assemblies (including 52 new ones; no MOX fuel assembly)
	Unit 4	Reactor	Undergoing a periodic inspection (disconnection from the grid on November 29, 2010; all fuel assemblies were removed; the pool gate closed; and the reactor well filled with water)
		Spent fuel pool	1,535 fuel assemblies (including 204 new ones)
	Unit 5	Reactor	Undergoing a periodic inspection (disconnection from the grid on January 2, 2011; RPV pressure tests under way; and the RPV head put in place)
		Spent fuel pool	994 fuel assemblies (including 48 new ones)
	Unit 6	Reactor	Undergoing a periodic inspection (disconnection from the grid on August 13, 2010 and the RPV head put in place)
		Spent fuel pool	940 fuel assemblies (including 64 new ones)
	Common pool		6,375 fuel assemblies (stored in each Unit's pool for 19 months or more)
Fukushima Daini	Unit 1	Reactor	In operation (764 fuel assemblies)
		Spent fuel pool	1,570 fuel assemblies (including 200 new ones)
	Unit 2	Reactor	In operation (764 fuel assemblies)
		Spent fuel pool	1,638 fuel assemblies (including 80 new ones)
	Unit 3	Reactor	In operation (764 fuel assemblies)
		Spent fuel pool	1,596 fuel assemblies (including 184 new ones)
	Unit 4	Reactor	In operation (764 fuel assemblies)
		Spent fuel pool	1,672 fuel assemblies (including 80 new ones)

(2) Connection of offsite power supply

1) Fukushima Daiichi NPS

Connection of an offsite power supply to the NPS were as follows: Okuma Lines No. 1 and No. 2 (275 kV) of the Shin-Fukushima Substation were connected to the switchyard for Units 1 and 2, Okuma Lines No. 3 and No. 4 (275 kV) were connected to the switchyard for Units 3 and 4, and Yonomori Lines No. 1 and No. 2 (66 kV) were connected to the switching yard for Units 5 and 6. In addition, the TEPCO Nuclear Line (66 kV) from Tomioka Substation of the Tohoku Electric Power was connected to Unit 1 as the spare line.

The three regular high voltage switchboards (6.6 kV) are used for Unit 1, for Unit 2, and for Units 3 and 4, respectively. The regular high voltage switchboards for Unit 1 and for Unit 2 were interconnected, and the regular high voltage switchboards for Unit 2 and for Units 3 and 4 were interconnected in a condition that enabled the electricity fed each other. When the earthquake occurred, the switching facilities for Okuma Line No. 3 in the switchyard for Units 3 and 4 were under construction, so that six lines were available for power of the NPS from offsite power supply.

2) Fukushima Daini NPS

A total of four lines of offsite power supply from the Shin-Fukushima Substation were connected to the Fukushima Daini NPS: Tomioka Lines No. 1 and No. 2 (500 kV) and Iwaido Lines No. 1 and No. 2 (66 kV).

When the earthquake occurred, Iwaido Line No. 1 was under construction, so that three lines were available for power of the NPS from offsite power supply.

4. Occurrence and progression of the accident at the Fukushima NPSs

(1) Overview of the chronology from the occurrence of the accident to the emergency measures taken

1) Fukushima Daiichi NPS

The earthquake which occurred at 14:46 on March 11, 2011 brought all of the Fukushima Daiichi NPS Units 1 through 3, which were in operation, to an automatic shutdown due to the high earthquake acceleration.

Due to the trip of the power generators that followed the automatic shutdown of the reactors, the station power supply was switched to the offsite power supply. As described in Chapter III, the NPS was unable to receive electricity from offsite power transmission lines mainly because some of the steel towers for power transmission outside the NPS site collapsed due to the earthquake. For this reason, the emergency DGs for each Unit were automatically started up to maintain the function for cooling the reactors and the spent fuel pools.

Later, all the emergency DGs except one for Unit 6 stopped because the emergency DGs, seawater systems that cooled the emergency DGs, and metal-clad switchgears were submerged due to the tsunami that followed the earthquake, and the result was that all AC power supply was lost at Units 1 to 5.

At 15:42 on March 11, TEPCO determined that this condition fell under the category of specific initial events defined in Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (hereinafter referred to as Nuclear Emergency Preparedness Act) and notified the national government, local governments, and other parties concerned.

At 16:36 on the same day, TEPCO found the inability to monitor the water level in the reactors of Units 1 and 2, and determined that the conditions of Unit 1 and 2 fell under the category of an event that is “unable to inject water by the emergency core cooling system” as defined in Article 15 of the Nuclear Emergency Preparedness Act, and at 16:45 on the same day, the company notified NISA and other parties concerned of this information.

TEPCO opened the valve of the IC System A of Unit 1 IC, and in an effort to maintain the functions of the IC, it continued to operate it mainly by injecting fresh water into its shell side. Immediately after the tsunami, TEPCO could not

confirm the operation of the RCIC system of Unit 2, but confirmed about 3:00 on March 12 that it was operating properly. Unit 3 was cooled using its RCIC system, and as a result, the PCV pressure and water levels remained stable.
In order to recover the power supply, TEPCO took emergency measures such as making arrangements for power supply vehicles while working with the government, but its efforts were going rough.

Later, it was confirmed around 23:00 on March 11 that the radiation level in the turbine building of Unit 1 was increasing. In addition, at 0:49 on March 12, TEPCO confirmed that there was a possibility that the PCV pressure of the Unit 1 had exceeded the maximum operating pressure and determined that the event corresponded to the event 'abnormal increase in the pressure in the primary containment vessel' as defined in the provisions of Article 15 of the Nuclear Emergency Preparedness Act. For this reason, in accordance with Article 64, Paragraph 3 of the Reactor Regulation Act, the Minister of Economy, Trade and Industry ordered TEPCO to reduce the PCV pressure of Units 1 and 2.

At 5:46 on March 12, the company began alternative water injection (fresh water) for Unit 1 using fire engines. (The conceptual diagram of alternative water injection using fire engines is shown in Figure IV-4-1.) In addition, TEPCO began preparations for PCV venting because the PCV pressure was high, but the work ran into trouble because the radiation level in the reactor building was already high. It was around 14:30 on the same day that a decrease in the PCV pressure level was actually confirmed. Subsequently, at 15:36 on the same day, an explosion considered as a hydrogen explosion occurred in the upper part of the Unit 1 reactor building.

Meanwhile, the RCIC system of Unit 3 stopped at 11:36 on March 12, but later, the HPCI system was automatically activated, which continued to maintain the water level in the reactor at a certain level. It was confirmed at 2:42 on March 13 that the HPCI system had stopped. After the HPCI system stopped, TEPCO performed wet venting to decrease the PCV pressure, and fire engines began alternative water injection (fresh water) into the reactor around 9:25 on March 13. In addition, PCV venting was performed several times. As the PCV pressure increased, PCV venting was performed several times. As a result, the PCV pressure was decreased. Subsequently, at 11:01 on March 14, an explosion that was considered as a hydrogen explosion occurred in the upper part of the reactor building.

At 13:25 on March 14, TEPCO determined that the RCIC system of Unit 2 had stopped because the reactor water level was decreasing, and began to reduce the

RPV pressure and inject seawater into the reactor using fire-extinguishing system lines. TEPCO continued to cool the reactor core using the fire pumps loaned by a fire department. The wet venting line configuration had been completed by 11:00 on March 13, but the PCV pressure exceeded the maximum operating pressure. At 6:00 on March 15, an impulsive sound that could be attributed to a hydrogen explosion was confirmed near the suppression chamber (hereinafter referred to as S/C), and later, the S/C pressure decreased sharply.

The total AC power supply for Unit 4 was also lost due to the earthquake and tsunami, and therefore, the functions of cooling and supplying water to the spent fuel pool were lost. Around 6:00 on March 15, an explosion that was considered as a hydrogen explosion occurred in the reactor building, damaging part of the building severely.

At 22:00 on March 15, in accordance with Article 64, Paragraph 3 of the Reactor Regulation Act, the Minister of Economy, Trade and Industry ordered TEPCO to inject water into the spent fuel pool of Unit 4. On March 20 and 21, fresh water was sprayed into the spent fuel pool of Unit 4. On March 22, a concrete pump truck started to spray seawater onto the pool, followed by the spraying of fresh water instead of seawater, which began on March 30.

On March 17, a Self-Defense Forces helicopter sprayed seawater into the spent fuel pool of Unit 3 from the air. Later, seawater was sprayed into the pool using high-pressure water-cannon trucks of the National Police Agency’s riot police and fire engines of the Self-Defense Forces. From March 19 to March 25, Tokyo Fire Department, Osaka City Fire Bureau and Kawasaki City Fire Bureau, that were dispatched as Emergency Fire Response Teams, sprayed seawater for five times by using seawater supply system against fire and squirt fire engines. In addition, Yokohama City Fire Bureau, Nagoya City Fire Bureau, Kyoto City Fire Bureau and Kobe City Fire Bureau dispatched their fire engines to Fukushima Daiichi NPS or in readiness. Niigata City Fire Bureau and Hamamatsu City Fire Bureau assisted to set up large-scale decontamination system. Later, the concrete pump truck started to spray seawater into the spent fuel pool of Unit 3 on March 27 and into the spent fuel pool of Unit 1 on March 31.

The total AC power supply for Unit 5 was also lost due to the earthquake and tsunami, resulting in a loss of the ultimate heat sink. As a result, the reactor pressure continued to increase, but TEPCO managed to maintain the water level and pressure by injecting water into the reactor by injecting water into the reactor by operating Make-Up Condensing Water Pump after the power was supplied from Unit 6. Later, the company activated a temporary seawater pump, bringing the reactor to a cold shutdown condition at 14:30 on March 20.

One of the emergency DGs for Unit 6 had been installed at a relative high location, and as a result, its functions were not lost even when the NPS was hit by the tsunami, but the seawater pump lost all functionality. TEPCO installed a temporary seawater pump while controlling the reactor water level and pressure by injecting water into the reactor and reducing the reactor pressure on a continuous basis. By doing this, the company recovered the cooling functions of the reactor, thus bringing the reactor to a cold shutdown condition at 19:27 on March 20.

After the accident, seawater was used for cooling the reactors and the spent fuel pools for a certain period of time, but the coolant has been switched from seawater to fresh water with consideration given to the influence of salinity.

2) Fukushima Daini NPS

Units 1 through 4 of the Fukushima Daini NPS were all in operation but automatically shutdown due to the earthquake. Even after the occurrence of the earthquake, the power supply needed for the NPS was maintained through one of the three external power transmission lines that had been connected before the disaster. (Incidentally, the restoration work for another line was completed at 13:38 on March 12, enabling the NPS to receive electricity through two external power transmission lines.) Later, the tsunami triggered by the earthquake hit the NPS, making it impossible to maintain reactor cooling functions because the seawater system pumps for Units 1, 2, and 4 could not be operated.

For this reason, at 18:33 on March 11, TEPCO determined that a condition had occurred that fell under the category of events specified in Article 10 of the Nuclear Emergency Preparedness Act and notified the national government, local governments, and other parties concerned of this information. Later, since the temperature of the suppression chamber exceeded 100°C, and the reactor lost its pressure suppression functions, the company determined that an event where "pressure suppression functions are lost" defined in Article 15 of the Nuclear Emergency Preparedness Act had occurred at Unit 1 at 5:22 on March 12, at Unit 2 at 5:32 on the same day, and at Unit 4 at 6:07 on the same day, and notified the Nuclear and Industrial Safety Agency and other parties concerned of this information.

Units 1, 2 and 4 of the Fukushima Daini NPS recovered their cooling functions due to the restoration work that followed the earthquake because the offsite power supply was maintained, and the metal-clad switchgears, DC power supply, and other facilities were not submerged. As a result, Unit 1 was brought to a cold shutdown condition, in which the temperature for reactor coolants goes down below 100°C, at 17:00 on March 14, Unit 2 at 18:00 on the same day, and Unit 4 at 7:15 on March 15. Unit 3 was brought to a cold shutdown condition at 12:15 on March 12 without losing reactor cooling functions and suffering other kinds of damage.

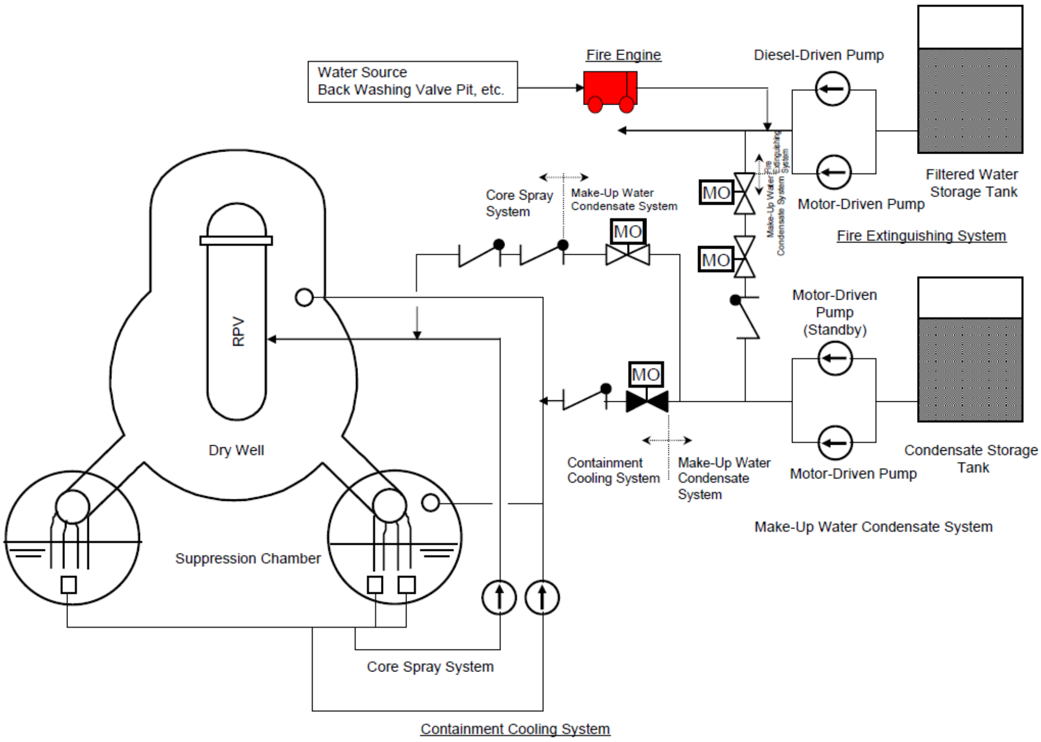


Figure IV-4-1 Conceptual Diagram of Alternative Water Injection Using Fire Engines

5. Situation of Each Unit etc. at Fukushima NPS

The outline of the accident at Fukushima NPS has been given in Chapter 4. This accident involved a total loss of the AC power supply, so after the tsunami invasion, we were only able to get extremely limited parameter information.

This section covers the parameter information we have been able to get to this point, under these very difficult conditions.

In addition, in order to supplement this limited information, TEPCO carried out analysis and evaluation of reactor situation of Unit 1, Unit 2 and Unit 3 using MAAP, which is a Severe Accident Analysis Code, based on gained operating records and parameters. The results were reported to NISA on May 23. NISA carried out a cross-check by using another severe Accident Analysis Code, MELCOR in order to conduct a cross-check for validation of TEPCO's analysis with the assistance of Incorporated Administrative Agency Japan Nuclear Energy Safety Organization in order to confirm the adequacy of the analysis and evaluation. The report of analysis and evaluation conducted by Tokyo Electric Power Company is shown in Appended Reference IV-1, and analytic results by cross-check are shown in Appended Reference IV-2.

Note that this parameter information was left behind in the Main Control Room and other areas after the accident and took some time to recover, so TEPCO made it public on May 16, along with reporting it to NISA.

In addition, based on these analysis results, we have evaluated the event progress of this accident and made some estimates in areas such as the RPV, PCV, etc. situation regarding their relationship with changes over time and the events that occurred.

Our evaluation of the development of events regarding the nuclear reactors for each unit at Fukushima NPS is written up as shown below.

(1)We sorted out the plant information we have obtained as of the current moment and summarized it in chronological order.

(2)We need to check the reliability of the parameter information etc. we obtained in order to evaluate the accident event progress, so this was considered based on the relationships with the performance of each plant operation, the overall behavior, the parameter information, and so on.

(3)Based on the conditions we considered in (2), we carried out a Severe Accident analysis, and analyzed the event development of the reactor accidents.

(4)In order to evaluate RPV, PCV, etc., we first estimated the RPV, PVC, etc. situation when they were relatively stable. Then we used the estimated event progress to estimate the RPV, PCV, etc. situation as it changed with time.

(5)We carried out a comparative consideration from the analysis in (3) and the RPV, PCV, etc. estimate results in (4). Then we evaluated how the series of events of accident progressed.

In terms of events outside the reactor, in our summary in (1) we sorted out the related situations. In addition, we also analyzed the explosion damage to the reactor building in Unit 4 of the Fukushima Daiichi NPS. We then went on to sort out and sum up separately from the listings for each unit the fuel cooling work being done in the spent fuel pool and the situation (and treatment situation) for the pool water that has been confirmed in the trenches and other areas outside the building, and in the turbine building of each unit.

Note that the estimates shown here are estimates of the possible situation based on the plant information we have been able to get at the present stage. We will need to update our deliberations as appropriate based on any supplemental information, such as details of parameter information or event information, and severe accident analysis results that reflect these.

(1) Fukushima Daiichi NPS, Unit 1

1) Chronological arrangement of accident event progress and emergency measures

a From the earthquake to the invasion of the tsunami

As shown in Chapter 3, before the earthquake the power station was operating steadily at its rated power. Immediately after the earthquake struck, at 14:16 on March 11, the reactor of Unit 1 scrammed due to the excessive earthquake acceleration, and at 14:47 the control rods were fully inserted and the reactor became subcritical, and it was shutdown normally. In addition, the earthquake damaged the power reception breakers on the NPS side of the Okuma No. 1 and No. 2 Power Transmission Lines and other areas, so there was a loss of external power. This meant that two emergency diesel generators automatically started up.

At 14:47, the loss of the power supply to the instruments due to the loss of external power caused the failsafe to send a signal to close the Main Steam Isolation Valve (hereinafter referred to as MSIV), and the MSIV was closed down. Regarding this point, since the increase in the main steam flow volume that would be measured if the main steam piping was broken, was not confirmed in the Past Event Records Device, TEPCO judged that there were no breaks in the main steam piping and NISA considers that is a logical reason to make that judgment.

The shutoff of the MSIV increased the RPV pressure, and at 14:52 the IC automatically started up. Next, in accordance with the operating manual for the IC, at 15:03 the IC was manually shut down. The manual notes that the temperature decrease rate for the RPV should be adjusted to not exceed 55°C/h. Moreover, the reactor pressure varied three times between 15:10 and 15:30, and TEPCO performed manual operations using only the A-system of the IC. Note that when the IC is operated, the steam is condensed and cooled, and is returned into the reactor as cold water through the reactor recirculation system. The records of the temperatures at the entrance to the reactor recirculation pump show three drops in temperature, so this is assumed to be the effects of the manual operation of the IC.

Meanwhile, in order to cool the S/C, at approx. 15:07 and 15:10 the B and A systems of PCV spray system were activated.

For the one hour that they remained following the earthwork, the HPCI records show no indications of any drop to the automatic activation water level (L-L) or any records of the HPCI being activated.

b Effects from the tsunami

At 15:37, the effects of the tsunami were felt, and the water, meaning that two emergency diesel generators stopped operation, and the emergency bus distribution panel was submerged, leading to all AC power being lost, affected both the seawater pump and the metal-clad switchgear of Unit 1. Unit 2 also suffered a loss of all AC power, so it was not possible to supply power from Unit 2.

In addition, the loss of DC power functions meant that it was not possible to check the parameter information. With the reactor water level no longer able to be monitored, and the water injection situation unclear, there was the possibility that no water was being injected, so at 16:36 TEPCO judged that this condition fell under the category of an event that is "unable to inject water by the emergency core cooling system as defined in Article 15 of the NEPA. Additionally, the loss of function of the component cooling system seawater pump meant that function of the component cooling system was lost, and the SHC was not able to be used, so it was not possible to relocate the decay heat of the PCV to the sea, the ultimate heat sink.

c Emergency measures

TEPCO opened the A system valve on the IC and used the diesel-driven fire pump (hereinafter referred to as D/D FP) to pump fresh water into the body of the IC etc., in an attempt to maintain the IC functions. However, according to the results from the valve circuit investigation TEPCO carried out in April, the degree the valve was open is not clear, so it is not possible to judge the extent to which the IC was functioning at this point in time (end of May). In addition, it has been confirmed that the radiation level inside the turbine building increased at around 23:00 on March 11.

TEPCO confirmed that there was the possibility that the PCV pressure had exceeded the maximum operating pressure at 00:49 on March 12, and judged that this condition fell under the category of an event that is "unable to inject water by the emergency core cooling system as defined in Article 15 of the NEPA and informed NISA. As a result, at 6:50 on March 12, the Minister of Economy, Trade and Industry ordered the suppression of the PCV pressure in Units 1 and 2, in accordance with the provisions in Article 64, Paragraph 3 of the Reactor Regulation Act.

TEPCO started pumping alternative water injection (fresh water) through fire pumps at 5:46 on March 12. Therefore, since cooling using the IC had stopped due to the failure of all AC power at 15:37 on March 11, that meant that there was a 14-hour-and-9-minute period when cooling using pumped water had stopped.

TEPCO worked to vent the PCV in order to lower its pressure. However, since radiation inside the reactor building was already at the high radiation environment level, the work proceeded with difficulty. The motor-operated valve (MO valve) in the PCV vent line was manually opened to 25% at about 9:15 on March 12. In addition, workers headed to the site to open the air-operated valve (AO valve) manually but the radiation levels were too high. As a result, a temporary air pressurization machine was set up to drive the AO valve and the PCV vent was operated. TEPCO judged that the PCV vent had succeeded since the PCV pressure had been reduced by 14:30.

d The building explosion and measures taken subsequently

At 15:36 on March 12, an explosion, thought to be a hydrogen explosion, occurred in the upper part of the reactor building. The roof, and the outer wall of the operation floor as well as the waste processing building roof, were destroyed. Radioactive materials were released into the environment during these processes, thereby increasing the radiation dose in the area surrounding the site.

According to TEPCO, the supply of 80,000 liters of fresh water ran out at around 14:53 on March 12, however it was unclear when the water injection stopped. At 17:55, in accordance with the provisions in Article 64, Paragraph 3 of the Reactor Regulation Act the Minister of Economy, Trade and Industry ordered TEPCO to take action to inject seawater to fill up the RPV. TEPCO started pumping in seawater using the fire-fighting lines at 19:04 on March 12. There was confusion in the lines of communication and command between the government and TEPCO regarding this injection of seawater. Initially, it was considered that it was suspended, but TEPCO announced on May 26 that it had not been stopped and injection had in fact continued based on a decision by the Power Station Director (in order to prevent the accident from escalating, the most important thing was to keep injecting water into the reactor).

Later, on March 25, injection returned to using fresh water from the pure water tank. As of the end of May, the total amount injected was around 10,787 m^3 of fresh water, and around 2,842 m^3 of seawater, for a total of around 13,630 m^3. In addition, water was injected using the temporary electric pump from March 29, and on April 3 it was shifted to a stable water injection system by changing the power supply for this pump from a temporary supply to a permanent supply, and by other measures.

On April 6, the Minister of Economy, Trade and Industry directed that TEPCO provide reports on the necessity of injecting nitrogen, how it would be done, and an evaluation of effects regarding safety, based on Article 67, Paragraph 1 of the Reactor Regulation Act. This was done as there was the possibility of hydrogen gas accumulating inside the

PCV. NISA accepted TEPCO's report, dated the same day, and directed them on three points, including ensuring safety through appropriate management of parameters, etc. when carrying out the nitrogen injection. TEPCO started nitrogen injection operations on April 7 and as of the end of May is still continuing them.

To restore and enhance the power supply, TEPCO completed inspections and trial charging of the power receivers from Tohoku Electric Power Co.'s Toden Genshiryoku Line on March 16, and as of March 20 had completed electricity access at the power center, ensuring an external power supply. As of March 23, cables were laid from the power center for the load needed. The connections are being established.

Main time lines are shown in Table IV-5-1. In addition, parameters for the RPV pressure etc. are shown in Figs. IV-5-1 through IV-5-3.

2) Evaluation using the Severe Accident Analysis Code

a Analysis and evaluation by TEPCO

As a result of the analysis, while it was shown that the RPV had been damaged by melted fuel, when the results of temperature measurements for the RPV were taken into account, TEPCO considered that the most of the fuel was in fact being cooled at the bottom of the RPV.

TEPCO estimated in this progress, the IC was not assumed to function following the tsunami and it was estimated that the fuel was uncovered for about three hours after the earthquake, with reactor damage starting one hour after that.

Since then there was no water being injected into the reactor, the fuel had undergone core melting, due to its decay heat, and flowed to the lower plenum, then about 15 hours after the earthquake it started to damage the RPV.

The radioactive materials contained in the fuel just before the accident were released into the RPV as the fuel was damaged and melted, and the analysis was carried out for the leakage assumed from PCV with the increase of PCV pressure, and almost all the noble gases were vented out into the environment. The ratio of released radioactive iodine to the total iodine contained (hereinafter referred to as release ratio) was approximately 1% from the analysis result, and the release of other nuclides was less than 1%.

b NISA's cross-check

In the cross-check analysis, along with carrying out an analysis using the MELCOR code with the same conditions (basic conditions) as TEPCO used, an analysis was also performed using different conditions to those TEPCO assumed. A sensitivity analysis was carried out, such that the amount of alternative water injection was estimated by the relation of the pump discharge pressure with the RPV pressure.

The cross-check of basic conditions showed largely the same trends. At around 17:00 on March 11 (two hours after the shock), the fuel began uncovered, and the core damage started within one hour. The PCV was damaged five hours after the shock, which is earlier than that of TEPCO's analysis, and the behavior of the RPV pressure was coherent with the pressure actually measured.

As for release ratio of radioactive nuclides, the analytical results show about 1% of tellurium, about 0.7% of iodine and about 0.3% of cesium. However the release ratios are affected by the infection flow rates of seawater, the results may be changed by operation condition because the operation condition was not clear.

3) Evaluation of the Status of RPV, PCV, and the Equipment

a Checking plant information

Based on the plant information during the period between March 23 and May 31, when the plant was relatively stable, the status of the RPV and PCV was evaluated. Handling of the plant data during this period was considered as shown below.

The standard water level is determined by the water level in the instrumentation piping and condensation tank in the PCV. While PCV pressure was high, there was a possibility that the reactor water level around the fuel was indicated higher than actual level, because high PCV temperature vaporize the water in the instrumentation piping and condensation tank in the PCV, hence those water level was indicated lower than actual level. This suggests that the reactor water level was indicating higher than normal. As a result of recovering and correcting the standard water level for the reactor water level gauge on May 11, the water level was confirmed to have dropped below the fuel level, so it was not possible to measure the water level inside the RPV during this period either.

The RPV pressure was considered as generally showing the actual pressure as the A and B system measurements matched until around March 26. However, after that the B system showed a rising trend, and so due to the condition estimates shown in the next section the B system was removed from evaluation consideration as it was no longer matching the D/W pressure.

The RPV temperature showed different figures for each of the two water nozzle systems, but the system that was hovering around 120°C, matching the RPV pressure, was referenced as the temperature of the atmosphere in the RPV, and the data showing the higher temperatures was referenced as the metal temperature of the RPV itself.

The plant data until March 22 was handled as follows.

The reactor water levels around the fuel may have been indicating higher reactor water levels, as noted above. It was decided that water levels would not be referenced as it was not possible to judge the point at which the indications became inaccurate.

The RPV pressure was referenced as generally showing the actual pressure for the A system, as, although both the A and B system figures matched after March 17, prior to that date the A system had also been changing continuously.

It was difficult to confirm the actual changes in the D/W pressure in the PCV as the information from TEPCO was sporadic, but it was decided to assume it based on event information such as equipment operation, etc.

b Estimates of the RPV, PCV, etc. status during the relatively stable period

-Status of the RPV boundary

The amount of water injected into the RPV by May 31 was estimated at approx. 13,700 tons based on information from TEPCO, but the total amount of steam generated from the start of water injection was approx. 5,100 tons, as the water was evaluated with a larger estimate of decay heat using the evaluation formula for decay heat. If the pressure boundary could be ensured, then at minimum there would remain a difference of approx. 8,600 tons. The capacity of the RPV, even in the larger estimates, is about 350 m^3, so it is thought that the injected water is evaporated in the RPV and that there was not only leakage of steam, but of liquid as well. The injection of water into the RPV was done using a feed water nozzle, and initially pooled up outside the shroud, then flowed into the bottom of the RPV through the jet pump diffusers. The fuel has been considered as cooled, and at the present moment it is estimated that the injected cooling water is that which has leaked to the RPV bottom.

In the present state, it is thought that steam continues to escape from the gas phase part of the RPV, but the RPV pressure is higher than the D/W pressure, so it is assumed that the opening is not large. However, the pressure changes after March 23 are changing in parallel with the changes in PCV pressure, so the possibility cannot be denied that there is a problem with the measurements.

-Status of the RPV interior (reactor status, water level)

As a result of increasing the amount of water injected when the injection was changed from the feed water line on March 23 the temperature of the RPV bottom dropped from being higher than the measurable maximum (greater than 400°C), but after the injection water amount was dropped, temperatures in some areas increased, so it is thought that the fuel is inside the RPV. As a result of recovering and correcting the standard water level for the water level gauge in the reactor on May 11, it was confirmed that the water level was lower than the fuel. Therefore, at the present moment it is estimated that the fuel has melted and an considerable amount of it is lying at the bottom of the RPV. However, there is a possibility that the bottom of the RPV was damaged and some of the fuel might have dropped and accumulated on the D/W floor (lower pedestal).

The temperature of part of the RPV (the feed water nozzles, etc.) is higher than the saturation temperature for the PRV pressure, so at the present stage it is estimated that part of the fuel is not submerged in water, but is being cooled by steam.

-PCV status

On March 12 the D/W pressure reached its highest level of approx. 0.7 MPag, exceeding the PCV maximum working pressure (0.427 MPag), and on March 23 the D/W temperature exceeded the measurable maximum (greater than 400°C). From these and other issues it is estimated at the present stage that the functions of the gasket on the flange section and the seal on the penetrating section have weakened. The inclusion of nitrogen, which started on April 7, was measured to increase the pressure by approx. 0.05 MPa, so at that stage it was estimated that the leakage rate from the D/W was approx. 4%/h. No major changes have been confirmed in the PCV status since then.

Up until the inclusion of nitrogen on April 7, the D/W pressure and the S/C pressure were almost the same, and the S/C pressure dropped from being 5 kPa higher than the D/W pressure to being the same pressure several times up until April 3.Therefore, at the present stage it is estimated that the vent pipes and the vacuum breakers between the D/W and the S/C were not submerged. At present, TEPCO is continuing with its considerations in order to estimate the water level in the D/W.

While the S/C pressure dropped after March 23, once it briefly reached approx. 0.3 MPag, a positive pressure state was measured for some time, and at the present stage it is estimated that there is no major damage to the S/C.

4) Estimation of the conditions of the RPV, PCV, and other components during times that variation with time was apparent

The basic means of cooling the reactor after the MSIV is closed are cooling via the IC and water injection via the HPCI. However, there were few records of the operating conditions of these systems following arrival of the tsunami. Furthermore, the radiation dose rose in the turbine building at around 23:00 on March 11 and there was an unusual rise in pressure in the PCV at around 0:49 on March 12. Therefore, these conditions suggest that the RPV had been damaged before 23:00 on March 11 to increase the pressure and temperature of the PCV significantly, which led to the leakage from the PCV. Similarly, the information, written on the whiteboard in the central control room, of the increased indication of the radiation monitor when the outer air lock was put on at 17:50 on March 11 suggest that core damage was then starting. Analysis is required from here on to confirm the degree to which IC and HPCI were functioning that includes detailed investigation and analysis of the conditions of each component.

Although alternative water injection was commenced at 5:46 on March 12, the RPV water level reading dropped at around 7:00 and has yet to recover. Due to poor reliability of the water gauge, analysis is required from here on by detailed investigation and analysis that covers the relationship between the water injection operations and the following pressure behavior.

As the D/W pressure in the PCV showed a tendency towards dropping slightly at around 6:00 on March 12 prior to wet vent operations, it is possible that there was a leak in the PCV. A drop in D/W pressure was also likely to have occurred after a temporary air compressor was installed to drive the pneumatic valves (AO valves) and wet vent operations were carried out at around 14:00 on March 12. However, when D/W pressure measurement recommenced at around 14:00 on March 13, the pressure has risen to 0.6 MPag and the PCV vent line had closed due to an unknown cause. Emissions may have restarted at 18:00 when pressure started dropping again.

On March 13, RPV pressure dropped to 0.5 MPag and reversed position with D/W pressure. However, detailed examinations cannot be conducted due to lack in data of both pressures.

5) Evaluation of accident event development

Regarding development of the Unit 1 accident event, from analyses conducted to date, it is likely that the IC stopped working when the tsunami hit, causing damage to the reactor from early on, and that by the time when the injection of sea water started into the reactor, the core had melted and moved to the bottom of the RPV.

From the balance of the amount of water injected and the volume of vapor generated from decay heat, it is likely that the water injected into the RPV was leaking.

Considering the results of RPV temperature measurements, it is likely that a considerable amount of the fuel cooled in the bottom of the RPV.

Concrete details of the explosion in the reactor building are unclear due to constraints in checking conditions inside the building. In addition to severe accident analysis, numerical fluid dynamics analysis was also carried out. Results of these analyses showed likelihood that gasses including hydrogen produced from a reaction inside the reactor between water and zirconium of the fuel cladding were released via leaks in the RPV and PCV, so that only hydrogen that reached the detonation zone accumulated in the space in the top of the reactor building and caused the explosion. In the waste processing building, in addition to damage caused by the blast, it is possible that there was an inflow of hydrogen via the part through which the piping runs.

At this point, the degree to which individual equipment was actually functioning is unclear, so that it is also impossible to determine the status of progress of the event. However, the results of the severe accident analysis suggests that the radioactive materials emitted to the environment by the leakage and the subsequent wet vent from the PCV on the dawn of March 12. It is currently estimated that at that time, most of the noble gases in the content within the reactors, about 0.7% of the total radioactive iodine, and about 0.3% of the total cesium were emitted.

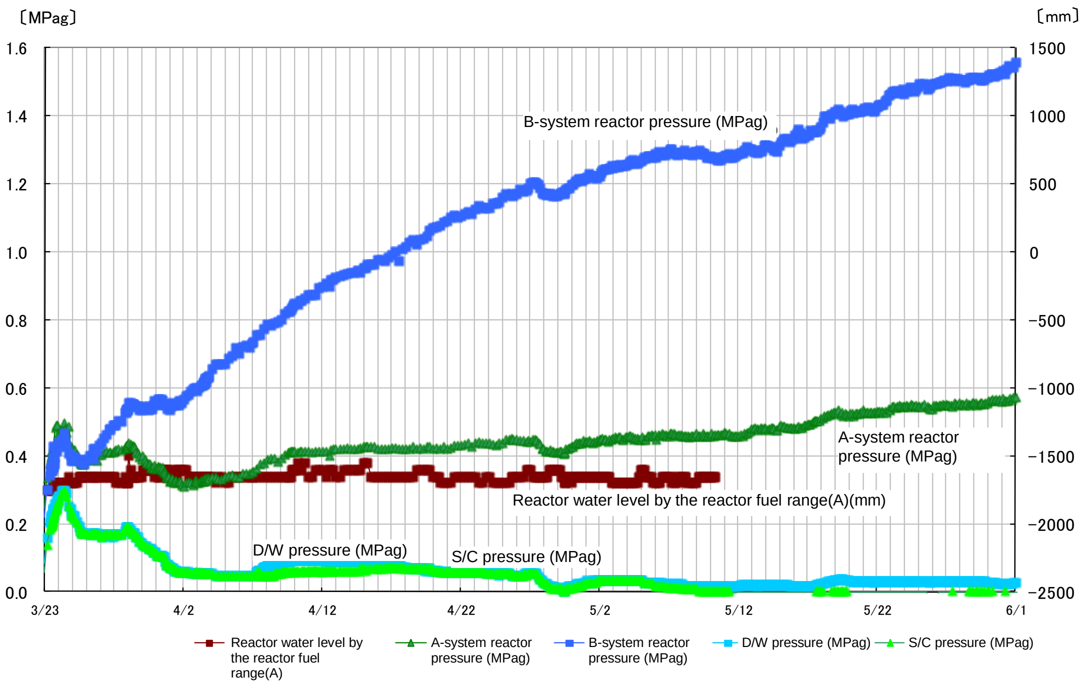
Table IV-5-1 Fukushima Daiichi NPS, Unit 1 – Main Chronology (Provisional)

* The information included in the table is subject to modifications following later verification. The table was established based on the information provided by TEPCO, but it may include unreliable information due to tangled process of collecting information amid the emergency response. As for the view of the Government of Japan, it is expressed in the body text of the report.

	Unit 1	
	Situation before the earthquake: operating	
3/11	14:46	Reactor SCRAM (large earthquake acceleration)
	14:47	All control rods were fully inserted. turbine trip loss of external power supply emergency diesel generator (emergency DG) start-up main steam isolation valve (MSIV) close
	14:52	emergency condenser (IC) automatic start-up
	around 15:03	IC shutdown and repeatedly reactuated until around 15:30 (reactor pressure was controlled by IC)
	15:07 - 15:10	reactor containment spray system pumps were started up to cool the suppression chamber (S/C).
	15:37	all AC power supplies lost
	15:42	TEPCO determined that notification event according to NEPA Article 10 (loss of all AC power supplies) had occurred.
	16:36	TEPCO, believing that it became impossible to inject water using the emergency core cooling system, determined that the event according to NEPA Article 15 had occurred.
	18:18	Opening operation was performed on IC (A) system supplying piping isolation valve MO-2A and return piping isolation valve MO-3A/steam generation was observed.
	18:25	IC (A) system MO-3A valve was closed.
	20:30	Main control room was lit (temporary facility secured)
	21:19	Line-up from diesel-driven fire pump (D/D FP) to IC was performed.
	21:30	IC 3A valve was opened/steam generation was observed.
	21:35	being supplied from D/D FP to IC.
	22:00	reactor water level: effective fuel top (TAF)+550 mm
	23:00	Radiation dosage is rising in the turbine building. (North side of the ground floor of turbine building 1.2 mSv/h. South side of the ground floor of turbine building 0.5 mSv/h.)
3/12	0:30	Water is being supplied to IC (A) body side by fire extinguishing system.
	0:49	Since there was a possibility that dry well (D/W) pressure level (maximum operating pressure in terms of design: 427 kPa gage) exceeded 600 kPa, TEPCO determined that the event according to NEPA Article 15 (abnormal rise in containment vessel pressure level) had occurred.
	1:48	D/D FP is checked and it is found that supply is shut down by pump trouble, not by running out of fuel.
	2:30	D/W pressure 0.84 MPa (840 kPa) reactor water level TAF+1,300 mm (fuel region A), reactor water level TAF+530 mm (fuel region B)
	4:15	D/W pressure 840 KPa
	5:09	D/W pressure 770 KPa
	5:14	From the rise of radiation level on site and also from a decreasing tendency of D/W pressure, TEPCO determined that radioactive material is leaking.
	5:46	Fresh water injection by fire pumps was started.
	6:30	2000 litters of fresh water had been injected. By (1000 litters/injection) fire engine, water was injected from the core spray (CS) system through the D/D FP line.
	7:55	Reactor water level decreased to 200 mm from TAF-100 (fuel region level instrument A) and 200 mm from TAF-100 (fuel region level instrument B).
	7:55	3000 litters of water (cumulative) had been injected through the FP line by fire engines.
	8:30	5000 litters of water (cumulative) had been injected through the FP line by fire engines.
	9:04	Workers left for the site for pressure venting.
	9:15	6000 litters of water (cumulative) had been injected through the FP line by fire engines.
	around 9:15	Suppression chamber vent line motor-operated (MO) valve was manually opened (25%).
	around 9:30	On site operation on the suppression chamber vent line air-operated (AO; second valve) valve was attempted but given up because of its too high radioactive dosage.
	9:40	21000 litters of water (cumulative) had been injected through the FP line by fire engines.
	10:17	Operation to open the second valve (AO valve) was performed in the main control room through remote control.
	12:55	Reactor water level: fuel region A-1700 mm, fuel region B-1500 mm, D/W pressure: 750 KPa
	around 14:00	Additional operation for the second valve (AO valve) (using air compressor).
	14:30	Pressure decrease in the containment by venting was observed.
	14:53	Fire engines completed injection of 80,000 liters of water (cumulative) using FP lines.
	around 15:36:	What was considered as a hydrogen explosion occurred in the upper part of the reactor building (Relatively strong "shake" was sensed, and around 15:40, smoke rising was observed near Unit 1).
	19:04	Injection of sea water (without boric acid) into the reactor was started.
	20:45	Injection of boric acid was started to prevent the reactor from going critical again.
3/13	3:38	Sea water was being injected by using the fire extinguishing line.

	Unit 1	
	Situation before the earthquake: operating	
3/14	1:10	Sea water injection was suspended because the remaining amount of sea water being supplied to the reactor became small. (As of 23:30, sea water was being injected into the reactor.)
3/15		
3/16		
3/17		
3/18		
3/19		
3/20	15:46	480 V emergency low-voltage switchboard (power center (P/C) 2C) received power. A temporary power supply was supplied from Tohoku nuclear power line.
3/21		
3/22		
3/23	1:40 2:33	Main bus panel for measuring received power 120 VAC In addition to the sea water injection from fire pumps using fire-extinguishing systems, water (sea water) injection from outside through the water supply system was started to add to the injection water.
3/24	around 11:30 17:10	Main control room lighting recovered. Transfer of the accumulated water from the turbine building (T/B) basement to the hot well (H/W) began.
3/25	15:37	The water injected into the reactor by fire pumps was switched from sea water to fresh water.
3/26		
3/27		
3/28		
3/29	8:32 17:30 (22:03)	For water injection into the reactor, the fire pumps were replaced with temporary motor pump. Transfer of the accumulated water from T/B to H/W was completed. Residual water in a trench was analyzed and radioactivity was detected.
3/30		
3/31	9:20 11:25 12:00 13:03 14:24 15:25 16:04	Transfer of the accumulated water from the trench to the central radioactive waste treatment facility (central R/W) pellet pool began. Transfer of the accumulated water from the trench to central R/W pellet pool was completed. Transfer of the accumulated water from condensate storage tank (CST) to the suppression pool water surge tank (SPT) began. For cooling spent fuel pool, spraying (fresh water) by using Tokyo Electric Company's concrete pump truck was started. Transfer of the accumulated water from CST to SPT was completed. Transfer of the accumulated water from CST to SPT was started. For cooling spent fuel pool, spraying (fresh water) by using Tokyo Electric Company's concrete pump truck was finished. About 90 t of water was injected.
4/1		
4/2	15:26 17:16 17:19	Transfer of the accumulated water from CST to SPT was completed. For cooling spent fuel pool, spraying was started by using Tokyo Electric Company's concrete pump truck to check the spraying position. For cooling spent fuel pool, spraying was completed by using Tokyo Electric Company's concrete pump truck to check the spraying position.
4/3	11:50 13:55	For water injection into the reactor, the power supply to the temporary motor pump was switched from the temporary power supply to the permanent power supply. Transfer of the accumulated water from H/W to CST was started.
4/4		
4/5		
4/6		
4/7	1:31	Nitrogen gas injection was started.
4/8		
4/9	3:29	For the nitrogen gas injection, all valves were temporarily closed and the operation to switch to the high purity nitrogen gas generator was started. →03:59 operation to open the injection valve was started. →04:10 Nitrogen injection to the containment vessel was switched to the high purity nitrogen generating measures (all valves were opened).
4/10	9:30	Transfer of the accumulated water from H/W to CST was completed.
4/11	around 17:16 around 17:16 17:56 18:04 23:34	Due to the earthquake, external power supplies to Unit 1 and Unit 2 (Tohoku Electric Power Line) was shut down, and the reactor injection pump was shut down. Due to the earthquake, nitrogen injection suspended. External power supply recovered. The reactor injection pump was reactivated. Nitrogen injection into the reactor containment was resumed.
4/12	14:51	It was confirmed that the nitrogen gas injection device had been working without any problem after the earthquake.
4/13		
4/14	7:45 12:20	Installation of silt fences to the front surface and curtain wall of Unit 1 and Unit 2 was started to prevent the diffusion of contaminated water. Installation of silt fences to the front surface and curtain wall of Unit 1 and Unit 2 was completed to prevent the diffusion of contaminated water.

	Unit 1	
	Situation before the earthquake: operating	
4/15	10:19	Transfer of power distribution panels and the like for injection pump of the reactor to upland as measures against tsunami was started.
		Transfer of power distribution panels and the like for injection pump of the reactor to upland as measures against tsunami was completed.
4/16		
4/17	11:30 around 17:30	In the reactor building, atmosphere investigation by using an unmanned robot was started. In the reactor building, atmosphere investigation by using an unmanned robot was completed.
4/18	11:50 12:12	Replacement of the hoses used for reactor injection with new ones was started. The injection pumps were stopped. Replacement of the hoses used for reactor injection with new ones was finished. Injection pump operation.
4/19	10:23	Nos. 1,2 - 3,4 power tie line had been laid. (both Tohoku Electric Power Line - Okuma Line can be used to each other.)
4/20		
4/21		
4/22		
4/23		
4/24		
4/25	14:10 14:44 17:38 18:25 19:10	For power supply enhancement, the nitrogen injection device was shut down. In association with the power supply enhancement (tie up Nos. 1, 2 - 5, 6 with each other), shutdown operation of Nos. 1, 2 power supply panel for 6,9 kV was started. In association with the power supply enhancement (tie up Nos. 1, 2 - 5, 6 with each other), shutdown operation of Nos. 1, 2 power supply panel for 6,9 kV was finished. The reactor injection pump recovered its state of using external power supply. The shut down nitrogen injection device was restarted.
4/26	11:35 around 13:24	Atmosphere investigation (for radiation dosage, leakage, and the like) by using an unmanned robot was started on the reactor building. Atmosphere investigation (for radiation dosage, leakage, and the like) by using an unmanned robot was finished on the reactor building.
4/27	10:02	In order to examine the injection volume sufficient to flood the fuel in the reactor, operation of gradually changing the reactor injection volume from about 6 m^3/h to the maximum about 14 m^3/h was started.
4/28		
4/29	10:14	Injection into the reactor was kept from 4/27 by the volume of 10 m^3/h, but the volume was returned to the originally planned 6 m^3/h.
4/30		
5/1		
5/2	12:58 14:53	In association with installation of an alarm device to the core injection pump, the core injection pump was switched to fire pumps. As the installation of the alarm device to the core injection pump was finished, the fire pumps were switched back to the core injection pump.
5/3		
5/4		
5/5	16:36	In order to improve the environment of the reactor building, local exhausters were installed, and then the operation of all exhausters was started.
5/6	10:01	In order to flood the reactor vessel, the injection volume to the reactor was increased from about 6 m^3/h to about 8 m^3/h.
5/7		
5/8	20:08	A duct built through the double-entry door of the reactor building was cut.
5/9	4:17	The double-entry door of the reactor building was fully opened.
5/10		
5/11	8:47 8:50 15:55 15:58	The power supply to the reactor injection pump was switched to a temporary diesel generator, and injection was performed. As Okuma line No. 2 line was restored, part of the reactor power supply was shut down and the nitrogen gas supplying equipment was shut down. The power supply to the reactor injection pump was switched from the temporary diesel generator to the reactor power supply. In association with the restoration of Okuma line No. 2 line, the shutdown operation of part of the reactor power supply finished, and then the nitrogen gas supplying equipment was reactivated.
5/12		
5/13	16:04 19:04	Spraying (fresh water) on the spent fuel pool by Tokyo Electric Company's concrete pump truck and the checking the spraying position were started. Spraying (fresh water) on the spent fuel pool by Tokyo Electric Company's concrete pump truck and the checking the spraying position were completed.
5/14	15:07	Spraying (fresh water) was started on the spent fuel pool by Tokyo Electric Company's concrete pump truck.
	15:18	Spraying (fresh water) was finished on the spent fuel pool by Tokyo Electric Company's concrete pump truck.
5/15		
5/16		



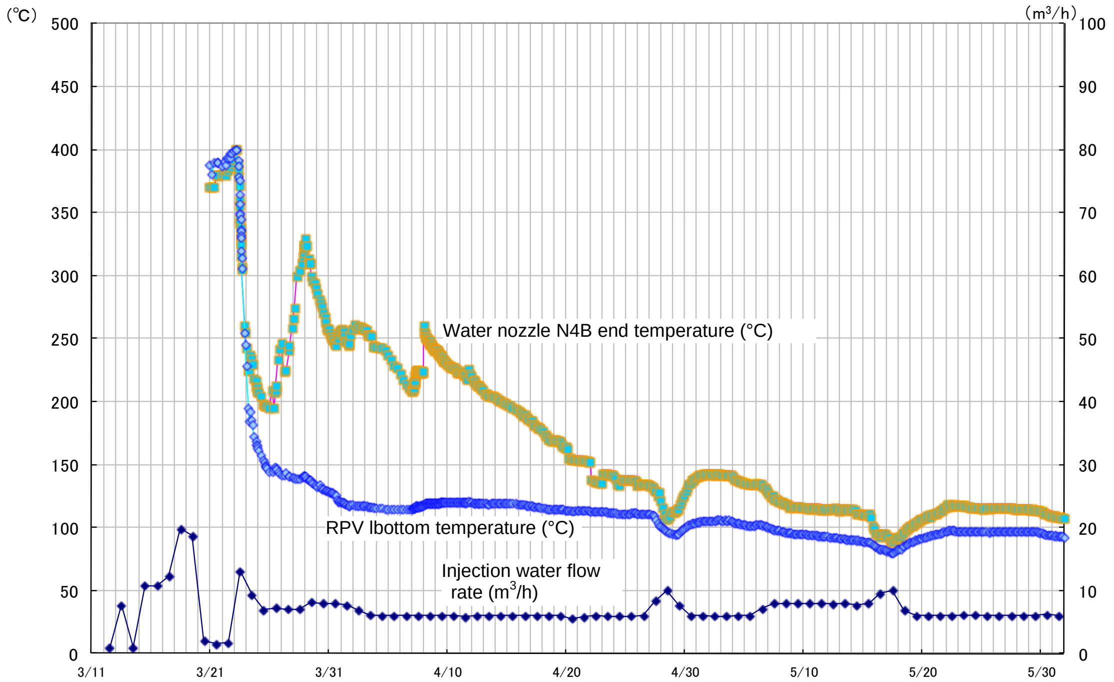
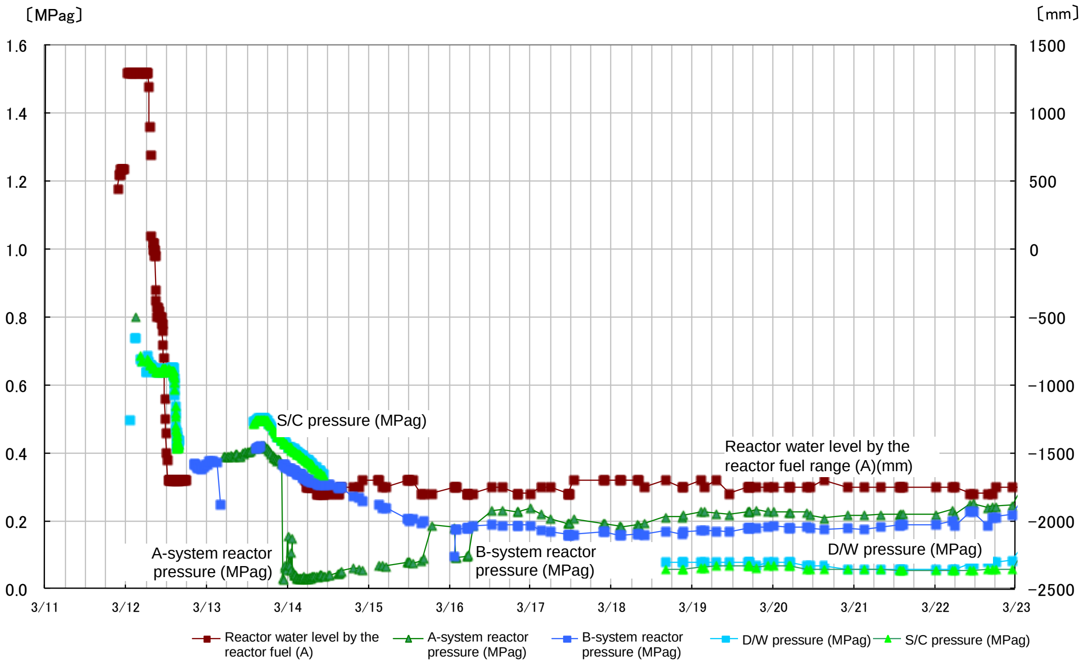


Figure IV-5-1 Changes in major parameters [1F-1] (From March 11 to May 31)



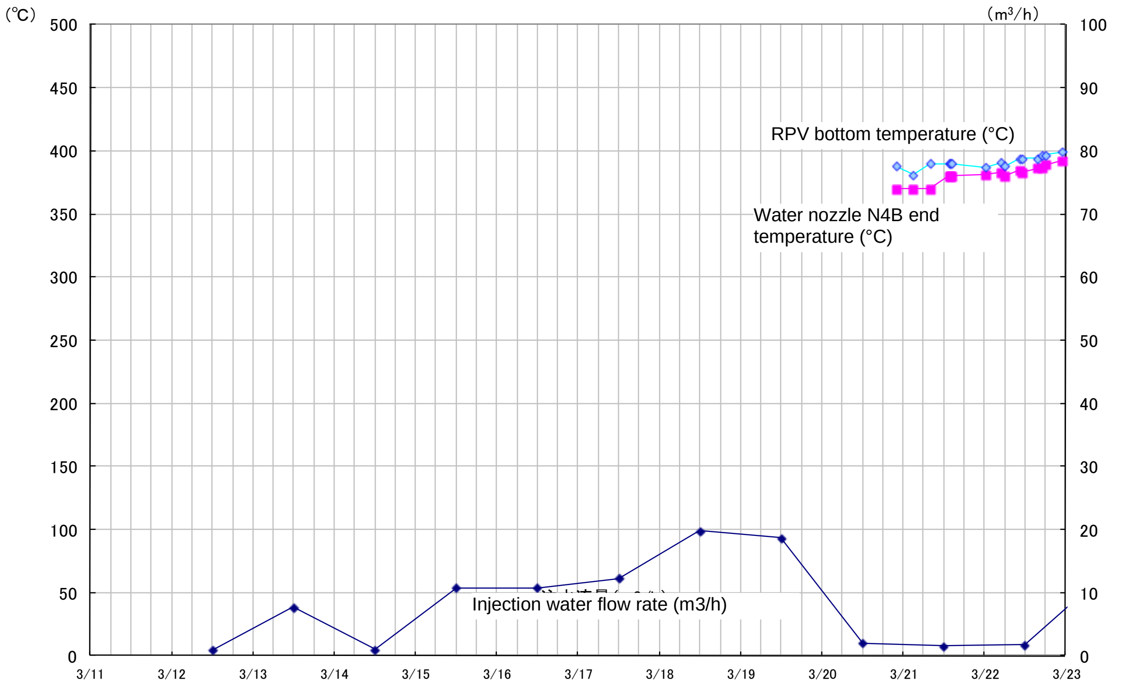
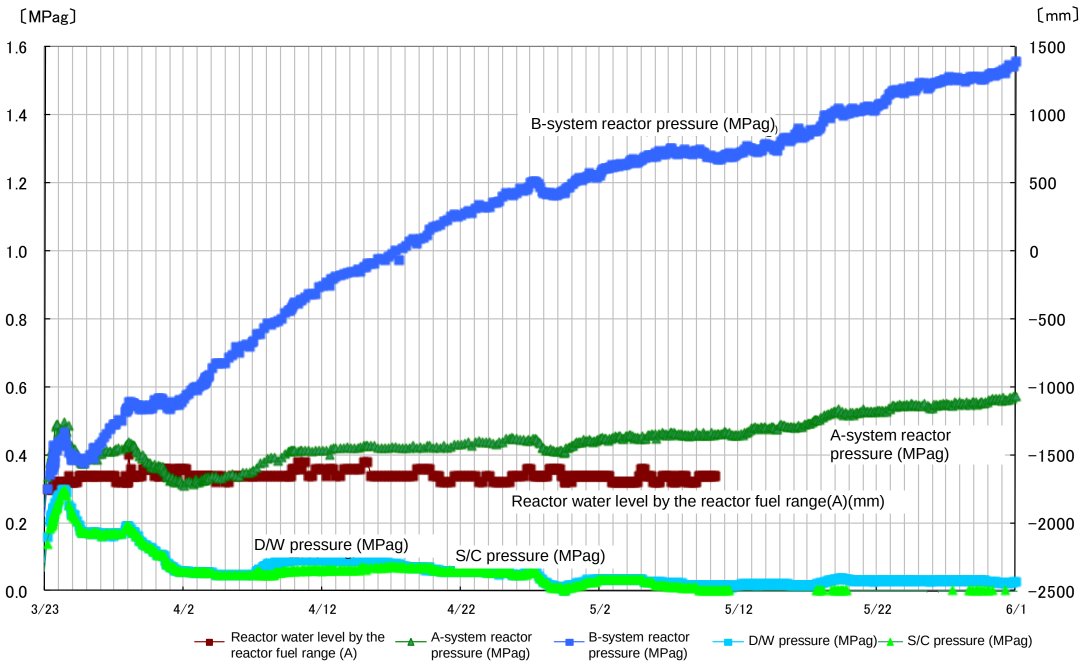


Figure IV-5-2 Changes in major parameters [1F-1] (From March 11 to March 23)



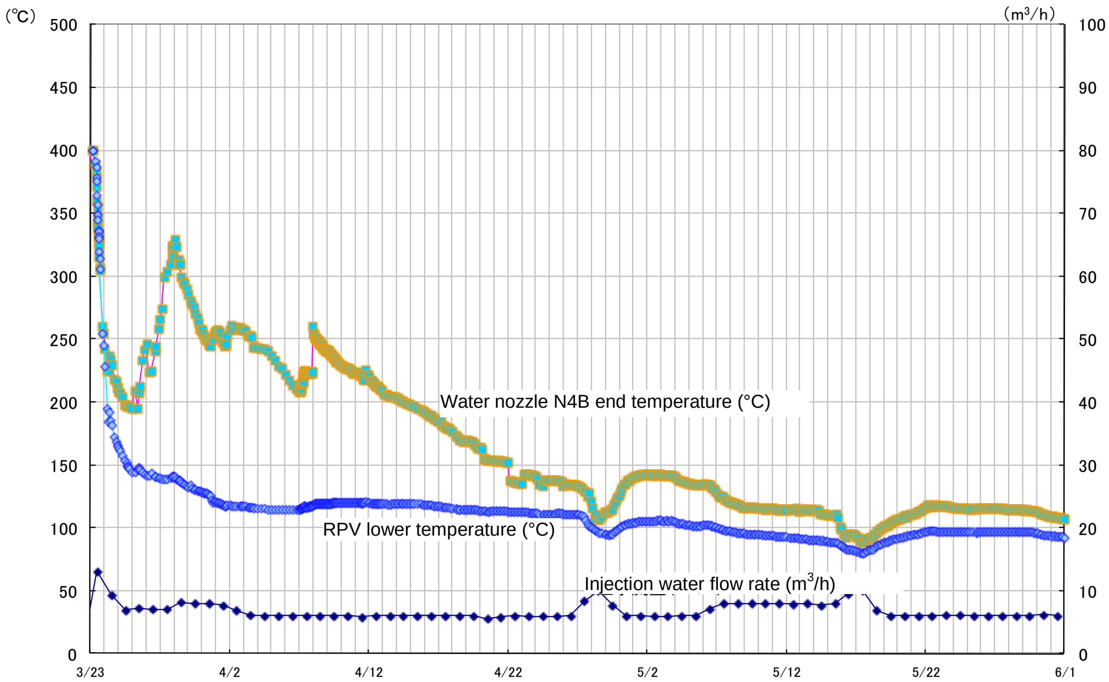


Figure IV-5-3 Changes in major parameters [1F-1] (From March 23 to May 31)

(2) Fukushima Daiichi NPS Unit 2

1) Chronological arrangement of accident event progress and emergency measures

a Between the earthquake occurrence and invasion of the tsunami

As noted in number 3 of this chapter, steady operation of rated thermal power was being carried out prior to the earthquake. At 14:47 on March 11 following the earthquake occurrence, scram (automatic shutdown) was achieved due to large earthquake acceleration. At the same time, all control rods were fully inserted, the reactor became sub-critical and normal automatic shut down was achieved. The external power supply was lost as a result of the earthquake, due to damage incurred to the receiving circuit breakers of the station at the Okuma No. 1 and No. 2 power transmission line. This resulted in automatic startup of the two emergency DGs.

At 14:47, the instrumentation lost power as a result of loss of external power supply, activating the MSIV closure signal as a fail-safe and causing the MSIV to close. Regarding closure of the MSIV, TEPCO determined that there was no rupture of the main steam piping, as we could not verify an increase in steam flow from the transient recorder records that would be have been observed if the main steam piping had ruptured. NISA considered this judgment reasonable.

Closure of the MSIV led to a rise in RPV pressure. In accordance with the Procedures, the RCIC was activated manually at 14:50, but shut down at 14:51 due to a high reactor water level. This led to a drop in the water level, but the RCIC was again manually activated at 15:02 causing a rise in the water level. A high reactor water level was achieved at 15:28 causing the reactor RCIC to shut down automatically. The RCIC was again manually activated at 15:39.

Between 22:00 on March 11 and 12:00 on March 14, the reactor water level reading (fuel range) remained stable at a level (+3000 mm or more) which maintained sufficient depth from the Top of Active Fuel (hereinafter referred to as TAF).

Reactor pressure was controlled by closing and opening of the SRV.

As operation of the SRV and RCIC led to a rise in the S/C temperature, the RHR pumps were started in succession from 15:00 to 15:07 to cool the S/C water. This is verified by suppression of the temperature rise from around 15:00 to around 15:20 on the same day as shown in the temperature chart of the S/C.

There are no records of operation of any emergency core cooling equipment aside from the activation of the RHR pumps to cool the S/C until the occurrence of the station blackout. This was likely because the reactor water level did not drop to the point (l-2) at which other equipment is automatically activated, and TEPCO state that they did not activate such equipment manually.

b Impact from the tsunami

The abovementioned S/C then showed a tendency towards a rise in temperature from 15:30, and the RHR pumps were successively shut down from around 15:36. This is thought to be due to a loss in functioning caused by the tsunami. At this time, the Unit was affected by the tsunami, the two emergency DGs stopped operating due to flooding and submergence of the seawater pump for cooling, the power distribution panel, and the emergency bus bar, and a station blackout was resulted.

Furthermore, information on parameters could not be verified due to a loss in direct electrical current functionality.

Loss in functionality of the RHR sea water pump led to a loss in RHR functionality, and the decay heat could not be transferred to the sea water that acted as the final heat sink.

c Emergency measures

At 22:00 on March 11, observation of the reactor water level was achieved. As of the day, it is presumed that the water injection was achieved by the RCIC since the water level was observed stable. However, reactor pressure is slightly lower than rated, at 6 MPa.

From 4:20 to 5:00 on March 12, as condensate storage tank water level decreased and in order to control the S/C water level increase, the water source for the RCIC was switched from the condensate storage tank to the S/C so that the RCIC could continue injecting water. The reactor water level remained stable at a level which maintained sufficient depth from the TAF by 11:30 on March 14. From that point until 13:25 on

March 14, the reactor water level began to drop, at which point the RCIC was judged to have shut down. The level dropped to 0 mm (TAF) at 16:20 on the same day. In relation to this, TEPCO verified on-site that the RCIC was operating at 02:55 on March 12, and that the RCIC water source had switched from the condensate storage tank to the S/C, and through such measures among others, the RCIC was functioning by around 12:00 on March 14 to stabilize the reactor water level. TEPCO determined that there may have been a loss in reactor cooling functionality at 13:25 on the same day and made a notification pursuant to the provisions of Article 15 of NEPA.

The RCIC is steam-driven, but the valves were operated through direct electrical currents. Although the time of RCIC functionality loss determined by TEPCO is more than 30 hours after operation start-up, given the actual constraints of battery capacity, it follows that functionality was maintained even after the battery run out.

SRV opening operations and alternative water injection operations commenced at 16:34 on March 14, and a drop in reactor pressure was confirmed at around 18:00. At this time, the reactor water level also dropped. After that point, reactor pressure began to show a tendency towards rising, which is presumed to have caused the SRV to close due to problems in the air pressure used to drive the air operated valves (AOVs) and other problems. At 19:54 on March 14, the seawater injection into the reactor using fire engines was started. Water injection was therefore suspended for six hours and 29 minutes since 13:25 when the RCIC lost functionality.

With regard to PCV vent operations to reduce pressure in the PCV, at 06:50 on March 12, TEPCO was ordered by the Minister of Economy, Trade and Industry in accordance with Article 64, Paragraph 3 of the Reactor Regulation Act to contain the PCV pressure. Based on this order, TEPCO began PCV vent operations, carrying out operations at 11:00 on March 13 and 00:00 on March 15, but a decrease in D/W pressure could not be verified.

d Explosion and actions taken afterword

At around 6:00 on March 15, the sound of an impact was heard which was considered to have resulted from a hydrogen explosion. No visible damage was observed at the reactor building, but it was confirmed that the roof of the waste processing building which is neighboring to the reactor building was damaged. During these processes, radioactive material to be released into the environment, and as a result, the radiation dosage around the premises increased.

At 10:30 on March 15, based on Article 64, Paragraph 3 of the Reactor Regulation Act, the Minister of Economy, Trade and Industry directed TEPCO to inject water into the reactor of Unit 2 as soon as possible and carry out a dry vent as it necessitates.

With regard to the alternate water injection system, until March 26, sea water was injected into the reactor, but from March 26, fresh water was injected from a temporary tank. From March 27, the fire pumps were replaced by temporary motor-driven pumps, and from April 3, the temporary power source was replaced by an external power source to ensure the stable injection of water. The total amount of water injected as of May end was approx. 20,991 m^3 (fresh water; approx. 11,793 m^3, sea water: approx. 9,197 m^3).

With regard to recovery and reinforcement of the power supply, TEPCO completed checking and the trial energizing of the facilities to receive power from the nuclear power line of Tohoku Electric Power Co., Inc. on March 16. From March 20, the Power Center received power to ensure the power supply from an external power source. On March 26, lighting in the Main Control Room was restored, and power was connected while the load soundness was being checked.

In Table IV-5-2, these major events are arranged in a time-sequences with more details. Figs. IV-5-4 to 5-6 show the plant data such as RPV pressure.

2) Assessment using severe accident analysis codes

a Analysis by TEPCO

Results of the analysis by TEPCO show that when alternate injection water flow is small, RPV will be damaged due to the fuel melting. TEPCO assessed that considering the above results and the measured RPV temperature data obtained to date, that most of the fuel actually cooled at the RPV bottom.

TEPCO judged that during this time, although RCIC operation was continued, water leakage from RPV was presumed to have occurred, based on PCV pressure behavior, that this leakage caused the RCIC to shut down. TEPCO supposed that the fuel was uncovered for five hours from 13:25 on March 14 (75 hours after the Earthquake began) and that the core damage started two hours later. After that, assuming there was an outflow of alternate injection water due to insufficient maintenance of the reactor water level in the fuel region, the core likely melted, and the melted fuel moved to the lower plenum so that the RPV was damaged 109 hours after the Earthquake began.

The leakage of radioactivity was analyzed assuming that the radioactivity contained in the fuel was released to RPV after fuel collapse and melting and that it leaked to the PCV. It is estimated that nearly all the noble gas was released to environment, and the release rates of iodine and other nuclides are less than about 1%.

b Cross check analysis by NISA

In the cross check analysis, NISA conducted analysis using MELCOR codes with the conditions that TEPCO analyzed (base case) and sensitivity analysis as a function of the injected water volume assuming the volume varies with RPV pressure in relation to the pump discharge pressure.

In the cross check analysis of the base case, the results were roughly similar to TEPCO's results. At 18:00 on March 14 (75 hours after the Earthquake began), the fuel uncovering began, and core damage commenced within two hours. The time when the RPV was damaged in the cross check analysis was earlier than the time given in the TEPCO analysis, and was about five hours after the Earthquake began, and the PCV pressure behavior results are consistent with measured data.

Results showed the release rate of radioactive materials to be about 0.4% to 7% for iodine nuclides, about 0.4% to 3% for tellurium nuclides, and about 0.3% to 6% for cesium nuclides. Release rates may change with operating conditions, as release rates vary with the sea water flow rate and the set operating conditions are unclear.

3) Evaluation of the conditions of the RPV, PCV, etc.

a Verification of plant data

First, the following studies the plant data from March 17 to May 31, during which the plant was relatively stable. Interpretation of plant data during this period is as follows:

With regard to the reactor water level around the reactor fuel, when the PCV pressure remained high, the PCV temperature was high. As a result, the water in the condensation tank and instrumentation piping in the PCV, whose water level is used as a reference water level, evaporated, causing the reference water level to drop. This may have caused the indicated reactor water level to be higher than the actual reactor water level. Since then, the reactor water level showed the same trend as that of Unit 1, and therefore, it was determined that during this period, the water level in the RPV was not measured properly.

The measured RPV pressure in system A was consistent with that in system B, and it was determined that the indicated pressure was mostly correct. For the period during which negative pressure was indicated, the pressure was out of the measurable range of the pressure meter and determined to be not measured properly.

Since March 27, the RPV temperature trend has been consistent with the amount of water injected, and it was determined that the indicated temperature was roughly correct. However, some data shows the temperature was kept constant, which is not consistent with other readings. Therefore, such data is not used for evaluation.

With regard to the interpretation of plant data up to March 17, especially from March 14 to 15, the data fluctuated significantly, and could not be used for numerical values. The data was used as a reference for the rough understanding of fluctuations, along with event information such as the operation of equipment.

b Presumed condition of the RPV, PCV, etc. when they were relatively stable

-RPV boundary condition

TEPCO estimated the amount of water injected into the RPV until May 31 to be 21,000 tons, but the amount of steam generated since the injection of water began was estimated to be about 7,900 tons although it was estimated by the decay heat evaluation method and the amount of decay heat was estimated to be a little larger than the actual amount. If the pressure boundary remains undamaged, at least about 13,100 tons of water should remain in the RPV. The volume of the RPV is estimated to be less than 500 m^3. Therefore, the injected water vaporized inside the RPV. In addition to the leakage of steam, liquid is also suspected of leaking. Water was injected into the RPV through the recirculation water inlet nozzle, and flowed to the bottom of the RPV via the jet pump diffuser. Judging from the fact that the reactor fuel was kept cool, at this point, it is presumed that the injected water had leaked from the bottom of the RPV.

From May 29 to May 30, water was injected through the recirculation water inlet nozzle and, in addition, water was injected through the feed-water nozzle. From around 17:00 on May 30, water was injected through the feed-water nozzle only.

Since March 16, the RPV pressure has been kept around the atmospheric pressure, and equal to the D/W pressure of the PCV. At this point, it is presumed that the RPV has been connected to the PCV in the vapor phase area.

-Condition of the inside of the RPV (core condition and water level)

Since March 20 the RPV temperature has been measured when the amount of water injected increased. During most of the period after the start of measurements, the temperature was stable at around 100°C, and during most of the period after March 29 when the amount of water injected was decreased, the RPV temperature was around 150°C. Accordingly, at this point, it is presumed that a significant amount of the fuel remained in the RPV. However, there is a possibility that the bottom of the RPV was damaged and some of the fuel might have dropped and accumulated on the D/W floor (lower pedestal).

Judging from the fact that the temperature in some part of the RPV is higher than the saturated temperature in relation to the RPV pressure, it is presumed that part of the fuel was not submerged and cooled by steam.

-PCV condition

On March 15, the D/W pressure exceeded the maximum useable pressure of the PCV (0.427 MPag) and increased to about 0.6 MPag. Accordingly, at this point, it is presumed that the sealing performance deteriorated at the gaskets of the flanges and the penetration parts. The D/W pressure is kept at around the atmospheric pressure (0 MPag) and it is presumed that the steam generated by decay heat is being released from D/W into the outside environment through these deteriorated parts.

Because, most of the time, the S/C pressure is not measured, at this point, it was difficult to estimate the condition of the inside of the S/C and the water level in the D/W based on the plant data. However, judging from the fact that high levels of contaminated water were found in the turbine building, at this point, it was presumed that the water injected into the RPV was leaking from the RPV through the PCV. Currently, TEPCO is studying how to estimate the water level in the D/W.

4) Presumption of the condition of the RPV, PCV, etc. as it changed with time

According to TEPCO, early on March 12, the water source was switched to the S/C and the injection of water continued by the reactor core isolation cooling system (RCIC). On the morning of May 14, the water level was above the Top of Active Fuel (TAF). Accordingly, at this point, it was presumed that at least until then, the RCIC had functioned properly. It is also presumed that because the steam for driving the turbine of the RCIC was continuously released into the S/C gas phase on the morning of March 12, the S/C pressure increased, the steam flowed from the S/C into the D/W, and at around 12:00 on March 12, the D/W pressure increased.

On the morning of March 14, the RPV pressure increased and the reactor water level dropped presumably because the RCIC malfunctioned, and the RPV pressure was about 7.4 MPag. Accordingly, it is presumed that the reactor water level further dropped after the SRV was activated. A report was received that the PCV was vented before that, but during part of the time, the PCV pressure did not decrease. There is a possibility that the RCIC did not fulfill its required function. To know to what extent the RCIC functioned, it is necessary to closely examine and analyze the condition of each component.

At around 0:00 on March 15, the S/C pressure did not increase but the D/W pressure increased, and after that, there had been a significant difference between the D/W pressure and S/C pressure for a long time and they had been inconsistent with each other. It is unknown why this happened.

In addition to these presumptions, the water level did not return to normal, and at around 0:00 on March 15, the readings on the PCV atmosphere monitoring system (hereinafter referred to as CAMS) for the D/W and S/C increased by three to four digits. Accordingly, it is presumed that the fuel was damaged at this time. In addition, TEPCO reported that from late afternoon on March 14, water was injected by fire trucks, but the water level did not rise, and there is a possibility that they did not fulfill their required function because of the reactor pressure. To know what extent they functioned, it is necessary to closely examine and analyze the condition of each component.

5) Event development analysis and summarization of the events based on the presumptions of the condition of the RPV, PCV, etc.

With regard to accident event progress in Unit 2, analyses carried out to date suggest that the loss in RCIC functionality caused damage to the reactor core, and that water injection may not have been sufficient as injection of seawater commenced at a time of high pressure in the reactor. As a result, insufficient cooling may have caused melting of the reactor core, and the melted fuel, etc, to transfer to the bottom of the RPV.

Considering the balance of volume of injected water and volume of steam generated from decay heat, it is presumed that the water injected into the RPV is leaking.

Considering the results of RPV temperature measurement, a significant amount of fuel is thought to have cooled in the bottom of the RPV.

With regard to the sounds of an impact around the S/C, we cannot say anything for sure because we are limited in checking the site where the explosion was heard. In addition to severe accident analysis, we conducted numerical fluid dynamics analysis, and at this point, it is presumed that in the reactor, the hydrogen generated when zirconium used in the fuel cladding reacted with water flowing into the S/C when the SRV was opened, leaked from the S/C, and exploded in the torus room. With regard to the waste processing building, at this point, we cannot deny the possibility that it was damaged by the blast and the hydrogen flowed into it through the pipe penetrations etc.

At this point, we cannot indentify to what extent each component functioned, and therefore, cannot determine how the events of the accident have developed. However, based on results of the severe accident analysis of the current situation, regarding the release of substances to the environment via a leak in the PCV up until the morning of March 15, it is estimated that nearly all the noble gas was released and the proportions released into the environment of iodine, cesium, and tellurium are approx. 0.4% to 7%, 0.3% to 6%, and 0.4% to 3%, respectively.

Table IV-5-2 Fukushima Daiichi NPS, Unit 2 – Main Chronology (Provisional)

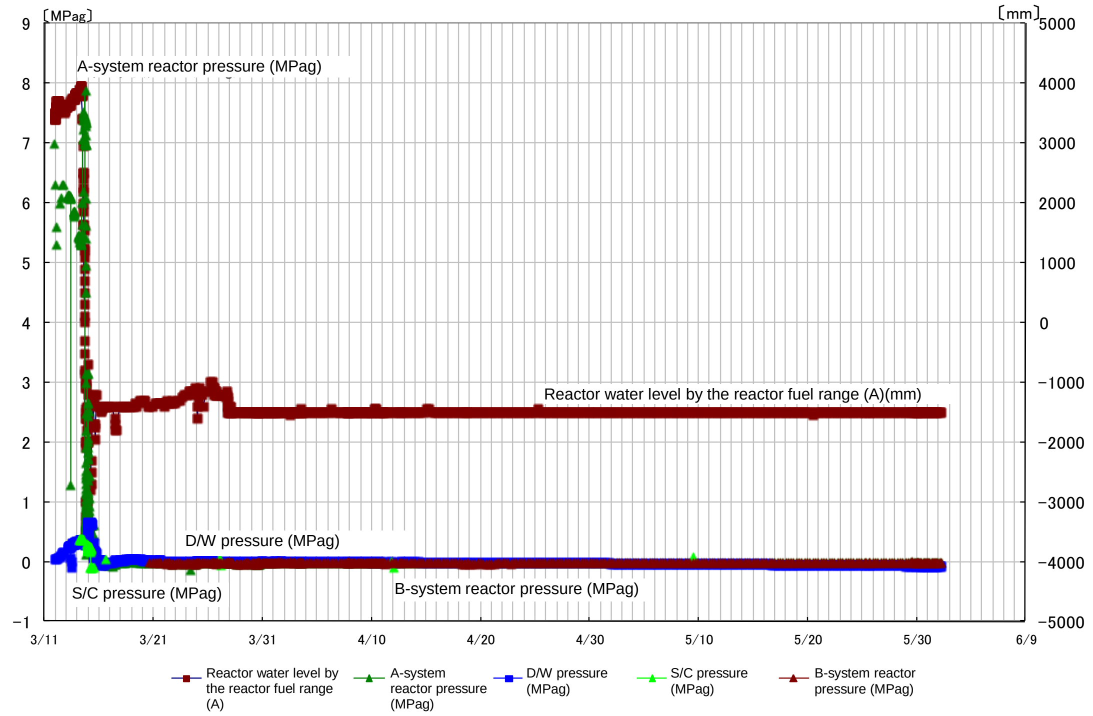
* The information included in the table is subject to modifications following later verification. The table was established based on the information provided by TEPCO, but it may include unreliable information due to tangled process of collecting information amid the emergency response. As for the view of the Government of Japan, it is expressed in the body text of the report.

	Unit 2	
	Situation before the earthquake: operating	
3/11	14:47	Reactor SCRAM (large earthquake acceleration) All control rods were fully inserted. Turbine trip Loss of external power supply Emergency diesel generator start-up Main steam isolation valve (MSIV) close
	14:50	Reactor core isolation cooling system (RCIC) was manually started up.
	14:51	RCIC trip (L-8)
	15:00	Residual heat removal system pumps were started up sequentially (for cooling the water in the suppression chamber).
	15:02	RCIC was manually started up.
	15:07	Residual heat removal system pumps were ended sequentially
	15:28	RCIC trip (L-8)
	15:39	RCIC was manually started up.
	15:41	All AC power supplies were lost.
	15:42	TEPCO determined that notification event according to NEPA Article 10 (loss of all AC power supplies) had occurred.
	16:36	EPCO, believing that it became impossible to inject water using the emergency core cooling system, determined that the event according to NEPA Article 15 had occurred.
	20:30	RCIC under shutdown Preparation for main control room illumination (temporary power).
	22:00	Reactor water level Top of Active Fuel (TAF) +3400 mm
	22:47	RCIC operation cannot be confirmed
3/12	0:30	RCIC under shutdown, water level TAF at 3500 mm (as of 0:00 on 3/12) and reactor pressure at 6.3 MPa (as of 23:25 on 3/11) Dry well (D/W) pressure at 40 Kpa (as of 23:55 on 3/11)
	2:55	The RCIC start-up state was checked
	4:20 - 5:00	RCIC water supply was switched from storage tank (CST) to suppression chamber (S/C).
3/13	3:00	D/W pressure rises (315 KPa) (40 KPa as of 0:30 on 3/12).
	11:00	The second valve was set to "open" for venting
3/14	11:01	It was confirmed that the suppression chamber (S/C) side valve was closed and also confirmed that the valve was inoperable.
	12:00	The S/C temperature (147°C) and the S/C pressure (485 KPa) were increasing. Since the reactor water level tended to decrease, sea water injection was prepared (12:00: 3400 mm → 12:30: 2950 mm (A), (12:00 3400 mm → 12:30: 3000 mm (B))
	13:25	RCIC shut down (assumed) Since the reactor water level decreased and there was the possibility that the RCIC was inoperable, the operator determined that an NEPA Article 15 event (loss of reactor cooling function) had occurred.
	15:00	The RCIC operation state was being checked.
	16:00	The operation to open the suppression chamber (S/C) side valve.
	16:20	It was confirmed that the suppression chamber (S/C) side valve was closed.
	16:34	The operation to depressurize the reactor pressure vessel (safety relief valve (SRV) open) was performed, and the sea water injection operation was started using fire engine lines.
	17:17	The water level reached to TAF.
	around 18:00	The reactor pressure decrease was observed. Thereafter, due to the problems including the air pressure for driving SRV and the maintaining excitation of the solenoid valve of the air supply line, the SRV was seemed to be closed and the reactor pressure increased.
	18:22	The reactor water level reached from TAF to -3700 mm, and it was determined that the whole of the fuel was uncovered.
	19:20	Fire pumps for sea water injection stopped due to lack of fuel.
	19:54	The sea water injection started (the first fire pump started up).
	19:57	The second fire pump started up.
	21:00	The operation of opening the pressure suppression chamber (S/C) side small valve (opening was unknown).
	21:03	The reactor pressure decreased (1418 KPa).
	21:20	By opening two safety relief valves, reactor depressurization and water level restoration were confirmed. Thereafter, due to the problems including the air pressure for driving SRV and the maintaining excitation of the solenoid valve of the air supply line, the closing operation and the opening operation of SRV were seemed to be performed.
	around 21:20	It was observed that the reactor water level tended to recover.
	22:14	The reactor water level recovered -1800 mm, the core damage was evaluated and determined as 5% or less.
	22:50	Since the D/W pressure exceeded the maximum operating pressure for design, the operator determined that an event according to NEPA Article 15 (abnormal increase of the reactor containment) had occurred. D/W pressure at 540 KPa.

	Unit 2	
	Situation before the earthquake: operating	
3/15	0:02	Valve set to "open" for dry venting
	0:45	Reactor pressure at 1823 KPa
	3:00	D/W pressure at 750 KPa
		Since the D/W pressure exceeded the maximum operating pressure for design, the depressurizing operation and the injection operation into the reactor were performed, but they were not sufficiently depressurized.
	5:00	The reactor pressure decreased (626 KPa)
	around 6:00 - 6:10	An explosion thought to be a hydrogen explosion came from near the S/C (loud explosion sound near pressure control room), and all personnel were evacuated except for those necessary for operation (the reactor water level TAF -2800 mm, the reactor pressure unknown, the S/P pressure unknown, the D/W pressure 0.73 MPa.
	8:25	White smoke (seemed to be steam) was observed near the fifth floor of the reactor building.
	15:25	The reactor pressure was lower than the containment pressure (the reactor pressure 0.119 Pa the D/W pressure 0.174 MPa gauge
	15:30	The core damage amount was changed from 14% to 35%
3/16		
3/17		
3/18		
3/19		
3/20	15:05	The sea water injection into the spent fuel pool was started by using the fuel pool cooling system (FPC) and subsequent seawater injection was done from the FPC.
	15:46	480 V low pressure board for emergency (power center P/C 2C) received power. A temporary power supply was supplied from Tohoku nuclear power line.
	17:20	Seawater injection into the spent fuel pool ends. Injected water volume approx. 40 t.
3/21	18:20	It was confirmed that the white haze mist like smoke (steam) observed in the reactor building was newly coming out from the roof at the roof floor.
3/22	7:11	The white haze mist like smoke (steam) decreased to be almost disappeared.
	16:07	Seawater injection into the spent fuel pool was started.
	17:01	Seawater injection into the spent fuel pool ends. Injected water volume approx. 18 t.
3/23		
3/24		
3/25	10:30	Seawater injection into the spent fuel pool was started.
	12:19	Seawater injection into the spent fuel pool ends. Injected water volume approx. 30 t.
3/26	10:10	Fresh water injection into the core was started by using the temporary tank with boric acid dissolved.
	16:40	Turbine building (T/B) Motor Control Center (MCC) 2A-1 received power.
	16:46	The main control room lighting recovered.
3/27	18:31	For water injection into the reactor, injection by the fire pumps was switched to fresh water injection by temporary motor pumps.
3/28		
3/29	15:30	For water injection into the spent fuel pool, injection by the fire pumps was switched to injection by temporary motor pumps.
	16:45	Transfer of pooled water from the Condensate Storage Tank (CST) to the suppression pool tank (SPT) starts
3/30	around 9:45	Malfunction of the temporary motor pump for injecting cooling water into the spent fuel pool was observed, and the temporary motor pumps were switched to the fire pumps: Injection was interrupted.
	12:30	Water injection restarted after switching the coolant water injection for the spent fuel pool to the fire pumps.
	12:47	Crack confirmed in the fire pump hose
	13:10	Fire pump hose changed
	17:05	Water injection restarted to the spent fuel pool using the fire pumps.
	19:05	For water injection into the spent fuel pool, injection by the fire pumps was switched to injection by temporary motor pumps, and the injection was restarted.
	23:50	Water injection to the spent fuel pool completed, less than 20 t
3/31	14:24	Transfer of pooled water from CST to SPT ends
	15:25	Transfer of pooled water from CST to SPT starts
4/1	11:50	Transfer of pooled water from CST to SPT ends
	14:56	Fresh water injection into the spent fuel pool through the spent fuel pool cooling system by the temporary motor pumps was started
	17:05	Fresh water injection into the spent fuel pool through the spent fuel pool cooling system by the temporary motor pumps was ended, approx. 70 t.
4/2	11:05	It was observed that water exceeding 1000 mSv accumulated in pit near the bar screen, the crack of about 20 cm on the concrete at the side of the pit, and water leakage from the pit into the sea from the crack.
	16:25	Cement was injected in a pit adjacent at the upstream side of the pit concerned.
	17:02	The cement injection into the pit concerned was started
	17:10	Transfer of pooled water from the hot well (H/W) to the Condensate Storage Tank (CST) started
	19:30	The operation to prevent water leaking from the pit into the sea was suspended since the Alarm Pocket Dossimeter (APD) on the workers exceeded the alarm set point. No significant decrease in outflow status is apparent.
4/3	11:50	The temporary motor-driven pumps used to inject water to the reactor were connected to an permanent power supply, switching from an temporary power supply.
	13:47	As a measure to stop the leak of accumulated water in a pit near the Inlet Bar Screen, 20 bags of sawdust, 80 bags of polymeric water absorbent, and 3 bags of shredded newspaper were started to be put into the water.
	14:30	As a measure to stop the leak of accumulated water in a pit near the Inlet Bar Screen, 20 bags of sawdust, 80 bags of polymeric water absorbent, and 3 bags of shredded newspaper were ended to be put into the water.

		Unit 2
	Situation before the earthquake: operating	
4/4	11:05 13:07	Fresh cooling water injection into the Spent Fuel Pool via a temporary motor-driven pump started. Fresh cooling water injection into the Spent Fuel Pool via a temporary motor-driven pump ended (about 70 t).
4/5	14:15 around 17:00	A tracer solution was injected through two holes which were made by the workers around the pit near the Inlet Bar Screen. It was confirmed that the tracer solution was observed leaking from the crack into the sea. About 1500 L of coagulant was injected. As a result, the flow rate of contaminated water outflow temporarily decreased, but then went back to the original level, and remained at that level.
4/6	5:38 13:15	It was confirmed that the outflow of contaminated water from the pit crack had stopped. A rubber board and base jacks were used to cover the crack in the pit from which contaminated water was flowing out
4/7	13:29 14:34	Fresh water injection into the Spent Fuel Pool via the Spent Fuel Cooling Line using a motor-driven pump started. Fresh water injection into the Spent Fuel Pool via the Spent Fuel Cooling Line using a motor-driven pump stopped (about 36 t).
4/8		
4/9	13:10	The transfer of held water in the condenser hot well (H/W) to the Condensate Storage Tank was completed.
4/10	10:37 12:38	Fresh cooling water injection into the Spent Fuel Pool using a temporary motor-driven pump started Fresh cooling water injection into the Spent Fuel Pool using a temporary motor-driven pump stopped (about 60 t).
4/11	About 17:16 17:56 18:04	The external power supply (Tohoku Electric Power Co. lines) to Units 1 and 2 was interrupted after an earthquake, and the pumps used for water injection to reactors stopped. External power supply restored The pumps used for water injection to reactors resumed.
4/12	19:35	Transfer of pooled water from the trench to H/W started
4/13	8:30 11:00 11:00 13:15 14:55 15:02 17:04	Installation of boards (two of the total of seven steel plates) on the ocean side of the Inlet Bar Screen of Unit 2 was started to temporarily stop water leak; and the installation work continued until 10:00. The transfer of the accumulated water in the trench of the turbine building to the Hot Well of the Condenser was temporary suspended to check for any leakage. (Amount transferred: about 600 t) Transfer of pooled water from the trench to H/W ended Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a motor-driven pump started Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a motor-driven pump stopped The transfer of the accumulated water in the trench of the turbine building to the Hot Well of the Condenser resumed after having ensured that there was no leakage. Transfer of the accumulated water in the trench of the turbine building to the Hot Well of the Condenser stopped
4/14	7:45 12:20	Installation of silt fences in front of the Inlet Bar Screens of Units 1 and 2, and at the Curtain Wall to prevent further diffusion of contaminated water started. Installation of silt fences in front of the Inlet Bar Screens of Units 1 and 2, and at the Curtain Wall to prevent further diffusion of contaminated water stopped.
4/15	10:19 17:00	As a countermeasure against possible tsunamis, transfer of the distribution boards for the water injection pumps to higher ground started. As a countermeasure against possible tsunamis, transfer of the distribution boards for the water injection pumps to higher ground ended.
4/16	10:13 11:54	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump started. Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump stopped (about 45 t).
4/17		
4/18	12:13 12:37 13:42 14:33	The work of replacing the hose that had been used for injecting water to the reactor core with a new one started. The replacement of the hose that had been used for injecting water to the reactor core with a new one was completed. The operation of the injection pump resumed. A survey by an unmanned robot to check the conditions in the reactor building started. A survey by an unmanned robot to check the conditions in the reactor building ended.
4/19	10:08 10:23 16:08 17:28	The transfer of contaminated water from the trench to the Radioactive Waste Treatment Facility started. The power supply reinforcement work for Units 1 and 2 to Units 3 and 4 was completed. (Both the Tohoku Genshiryoku Line and the Okuma Line can be used to each other.) Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump started. Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump stopped. Approx. 50 t.
4/20		
4/21		
4/22	15:55 17:40	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump started. Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump stopped. Approx. 50 t.
4/23		
4/24		

		Unit 2
	Situation before the earthquake: operating	
4/25	10:12	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump started.
	11:18	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump stopped. Approx. 38 t.
	14:44	To reinforce power supply security (connection between Units 1-2 and Units 5-6), the work to shut off the 6.9-kV power panel for Units 1 and 2 was started.
	17:38	To reinforce power supply security (connection between Units 1-2 and Units 5-6), the work to shut off the 6.9-kV power panel for Units 1 and 2 was stopped.
	18:25	The power supply for the pumps injecting water into the reactors was restored to the status in which the external power source was used.
4/26		
4/27		
4/28	10:15	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump started.
	11:28	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump stopped. Approx. 43 t.
4/29	9:16	The transfer of accumulated water in the trench of the turbine building to the Radioactive Waste Process Facility was temporary suspended due to inspection of the equipment for transferring and monitoring work.
4/30	14:05	The transfer of accumulated water in the trench of the turbine building to the Process Main Building of the Central Radioactive Waste Process Facility had been suspended due to inspection of the equipment for transferring and monitoring work; but the transfer work resumed using a pump after the completion of the inspection.
5/1	13:35	The work of blocking the trench pit with broken stone and concrete was started.
5/2	10:05	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump started.
	11:40	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a temporary motor-driven pump stopped. Approx. 55 t.
	12:53	The water injection pump was temporarily switched to a fire-engine pump in order to install an alarm device onto the pump used for injecting water into the reactor core.
	14:53	After the completion of the installation of an alarm device onto the water injection pump, the water injection pump into the reactor core was put back on; and water injection was carried out.
5/3		
5/4		
5/5		
5/6	9:36	Fresh water injection into the Spent Fuel Pool via the Spent Fuel Cooling Line using a motor-driven pump started.
	11:16	Fresh water injection into the Spent Fuel Pool via the Spent Fuel Cooling Line using a motor-driven pump stopped. Approx. 58 t.
5/7	9:22	The transfer of accumulated water in the trench of the turbine building to the Radioactive Waste Process Facility had been temporary suspended due to the work performed on the piping of the reactor feed water system for Unit 3.
	16:02	The transfer of accumulated water in the trench of the turbine building to the Radioactive Waste Process Facility had been temporary suspended due to the work performed on the piping of the reactor feed water system for Unit 3; but the transfer work resumed.
5/8		
5/9		
5/10	9:01	The transfer of accumulated water in the trench of the turbine building to the Radioactive Waste Process Facility was temporary suspended.
	13:09	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a motor-driven pump started.
	14:45	Fresh water injection into the Spent Fuel Pool started via the Spent Fuel Cooling Line using a motor-driven pump stopped. Approx. 56 t.
5/11	8:47	The pump to inject water into the reactor was connected to a temporary diesel generator; and water injection was carried out.
	15:55	The pump to inject water into the reactor was connected to an auxiliary power system, switching from temporary diesel generator; and water injection was carried out.
5/12	15:20	The transfer of accumulated water in the trench of the turbine building to the Radioactive Waste Process Facility had been temporary suspended (due to transfer piping work); but the transfer resumed.
5/13		
5/14		
5/15	13:00	Fresh water injection into the Spent Fuel Pool via the Spent Fuel Cooling Line using a temporary motor-driven pump started.
	14:37	Fresh water injection into the Spent Fuel Pool via the Spent Fuel Cooling Line using a temporary motor-driven pump stopped. Approx. 56 t.
5/16		



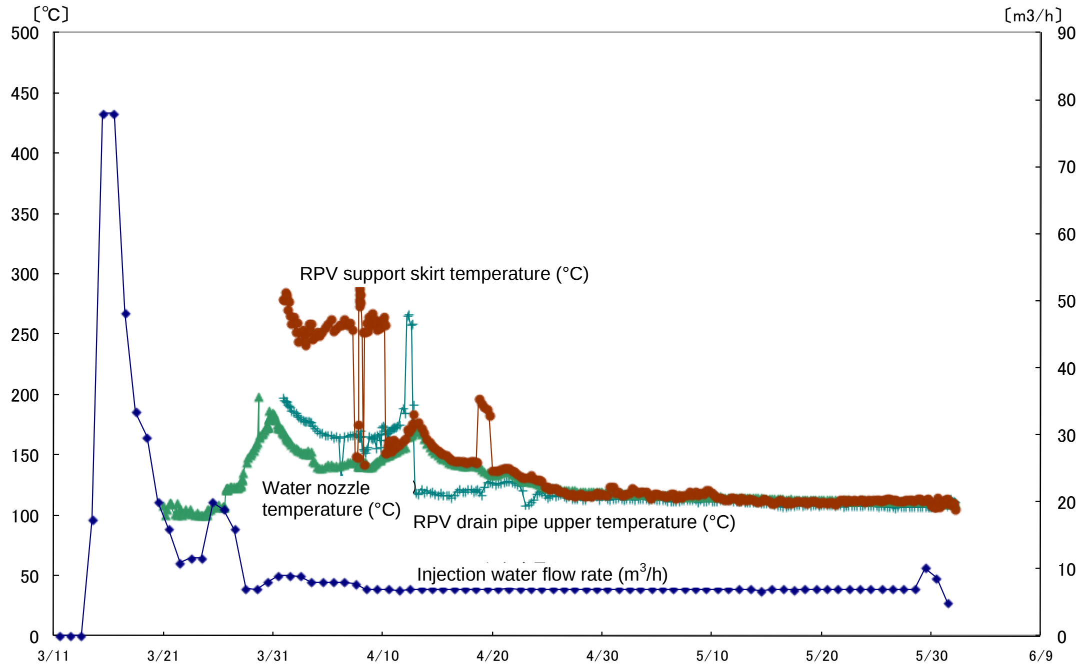
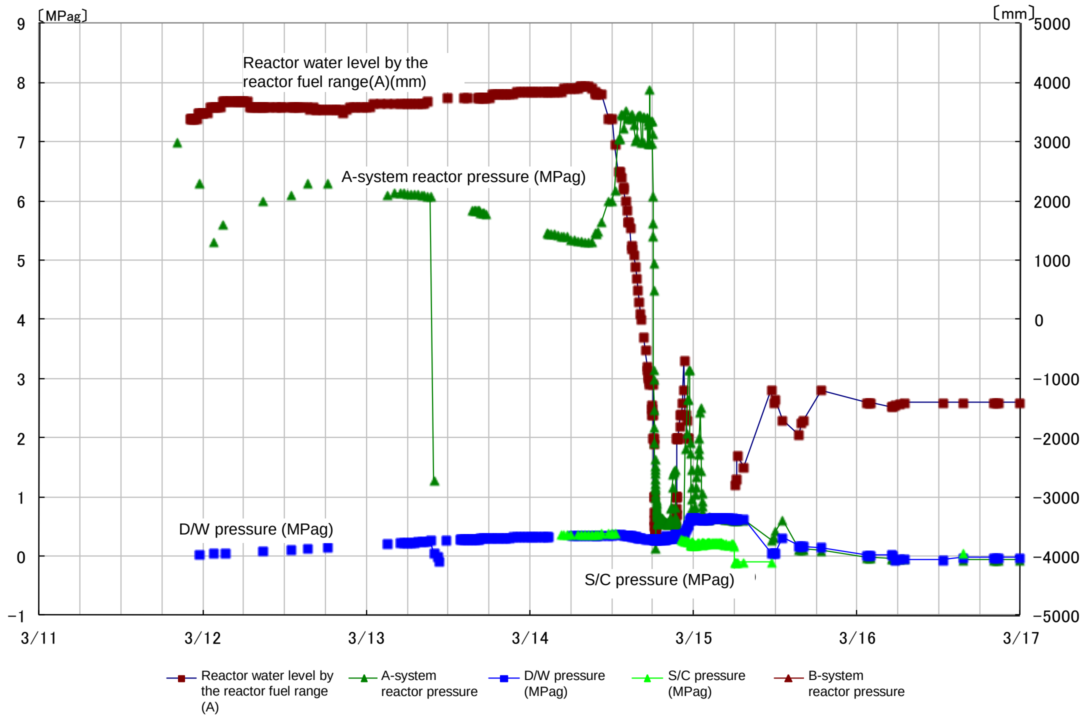


Fig. IV-5-4 Changes in key parameters [1F-2] (From March 11 to May 31)



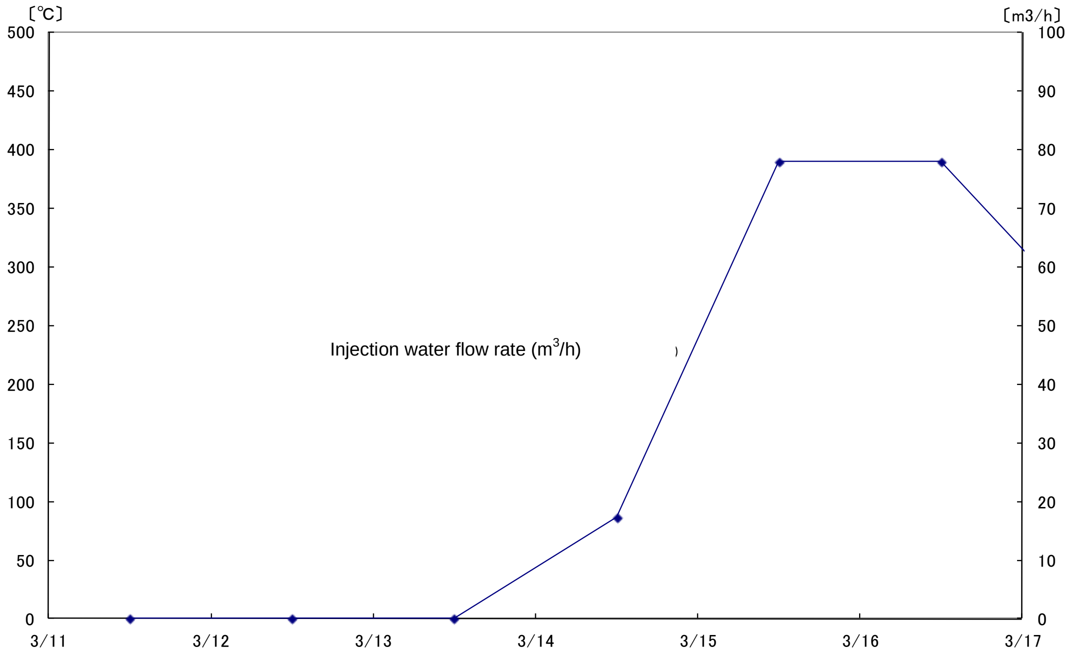


Fig. IV-5-5 Changes in key parameters [1F-2] (From March 11 to March 17)

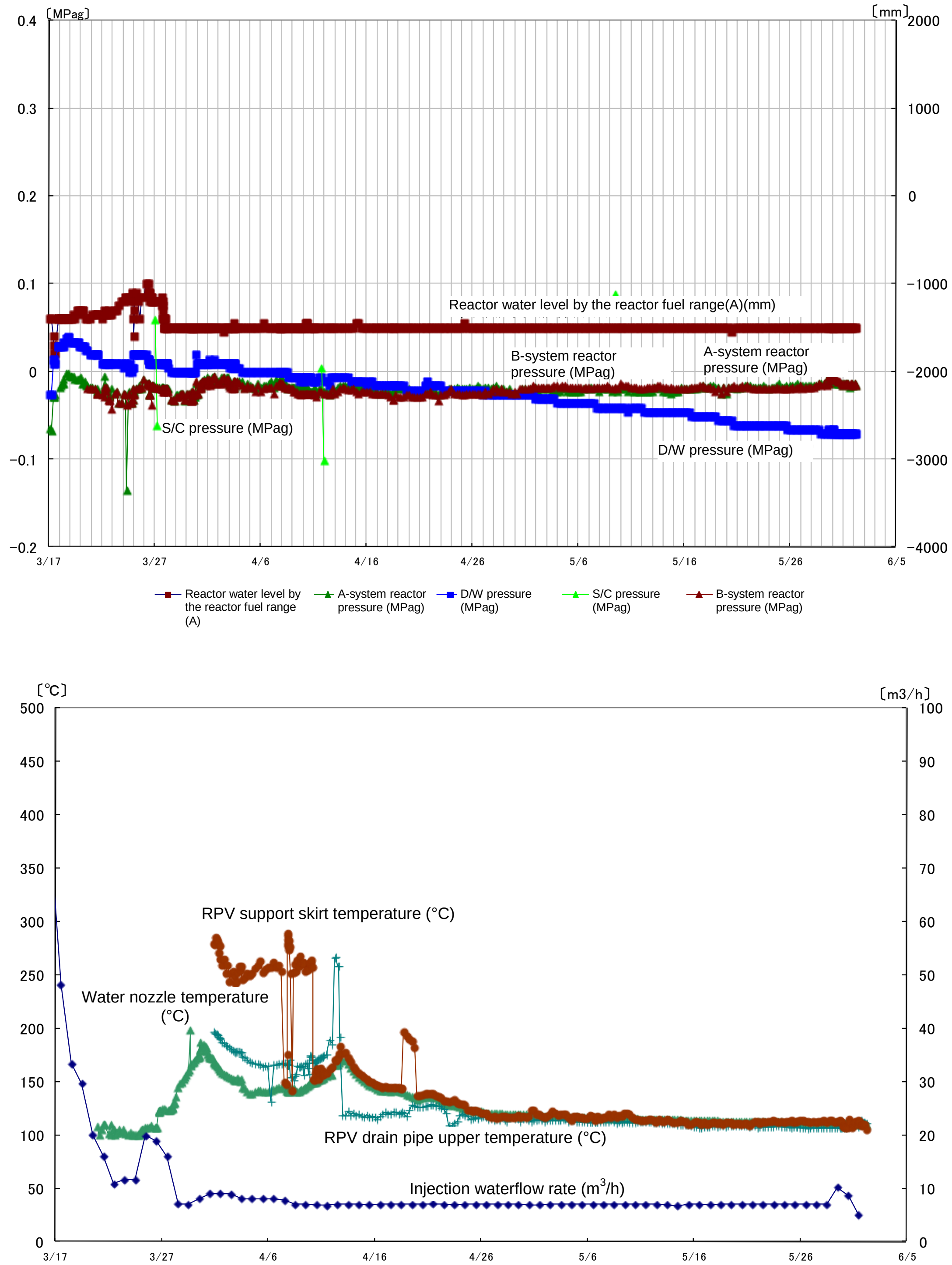


Fig. IV-5-6　Changes in key parameters [1F-2] (From March 17 to May 31)

(3)Fukushima Daiichi NPS, Unit 3

1) Order of accident progress and provisional expedient (chronological sequence)

a From the earthquake until the arrival of the tsunami

As described in Chapter 3, the plant was in full power operation before the earthquakes. After the earthquakes hit, the nuclear reactor at Unit 3 scrammed at 14:47 on March 11 due to the great acceleration of the earthquakes and automatically shut down as all control rods were inserted to bring the reactor into subcritical. In addition to Okuma Line 3, which was powered off due to repair work started before the earthquake, the breaker at Shintomioka Substation tripped and the breaker for receiving electricity at the switchyard in the power station was damaged, disrupting the power supply from Okuma Line 4. By causing the loss of external power supply, two emergency DGs started automatically.

At 14:48, the loss of power to instruments caused by the loss of external power supply triggered a closure signal at the main steam isolation valve (MSIV) in accordance with the fail-safe design. Regarding the closure of the MSIV, the Tokyo Electric Power Co., Inc. (TEPCO) considered that the main steam pipes did not rupture with the records of the flow rate of the main steam, which would be observed as the increase of the flow rate when the main steam piping breaks. The Nuclear and Industrial Safety Agency (NISA) also agrees that such a judgment would be reasonable.

The closure of the MSIV resulted in increasing of RPV pressure and at 15:05, the reactor core isolation cooling system (RCIC) was manually activated as a precautionary measure. At 15:28, the pressure increase stopped due to the high water level in the reactor.

b Effects of the tsunami

At 15:38, as a result of the impact of the tsunami, two emergency DGs stopped operating and all AC power was lost due to the drenching/submersion of the cooling seawater pumps, the metal-clad switchgear and the emergency bus of Unit 3.

The inability to use the residual heat removal system seawater pumps meant the loss of residual heat removal system (RHR) functions, resulting in a failure to shift the decay heat in the PCV to the sea, the final heat sink.

However, the DC bus of Unit 3 escaped being drenched. Power was not supplied through AC-DC transfer from the DC bus, but rather the backup storage batteries supplied power to the loads (RCIC valves, recorders, etc.) that required direct current for an extended time compared to those of other units.

Because of the drawdown resulting from the shutdown of the RCIC at 15:25, the RCIC started again at 16:03 and stopped at 11:36 on March 12.

The reason why the RCIC stopped at 11:36 on March 12 is unknown at this time, but the storage batteries for valve manipulation might have become exhausted as more than 20 hours had passed since the RCIC started operation.

Afterwards, the HPCI started automatically at 12:35 on March 12 due to the low water level of the core and stopped at 2:42 on March 13. At that time, the plant-related parameters did not indicate any water level, and so the core coolant injection system stopped as the water level in the core was unknown.

At 3:51, after more than one hour had passed since the HPCI stopped, the power was restored to the water level gauge, which showed that the water level for the reactor fuel was -1600 mm (TAF-1600 mm).

It is thought that the HPCI stopped as a result of the lower reactor pressure.

TEPCO judged that the situation corresponded to a “loss of reactor coolant functions” event stipulated according to the provisions of Article 15, NEPA for Nuclear Disaster and notified NISA and other parties in accordance with the requirements of the Act.

c Reactor pressure changes

The reactor pressure transitioned fairly stably after the scram, but at around 9:00 on March 12, the reactor pressure began to show larger fluctuations. From 12:30 to about 19:00, it decreased by more than 6 MPa.

From around 19:00 on March 12, the reactor pressure was being stable around one MPa, but from 2:00 to 2:30 on March 13, being decreased once and then increased to 7 MPa by around 4:00 on the same day. During the initial stage of this reactor pressure change, the HPCI was working. But when the HPCI stopped, the reactor pressure may have risen suddenly.

Considering that the reactor pressure dropped for more than six hours from 12:30 on March 12, it is considered unlikely that a large-scale pressure leak occurred. Steam may have leaked from the HPCI, since the pressure began to drop at around the same time as the HPCI started and the reactor pressure began rising after the HPCI stopped.

At around 9:00 on March 13, the reactor pressure dropped rapidly down to approximately 0 MPa. This may have occurred because of rapid depressurization resulting from the operation of the major steam SRV.

d Emergency measures

In order to lower the PCV pressure after the HPCI stopped at 2:42 on March 12, TEPCO carried out wet venting from 8:41 the same day. From approximately 9:25 on the same day, though TEPCO started injecting fresh water containing boric acid through the fire extinguishing system by using fire engines, the RPV water level still dropped. Even taking this injection into account, this meant that no injection had occurred for six hours and 43 minutes since the HPCI stopped. At 13:12 the same day, water injection was changed to seawater.

To reduce the PCV pressure, wet venting was carried out at 5:20 on March 14.

e Explosion at the building and subsequent measures

An explosion, which was likely a hydrogen explosion, occurred at the upper part of the reactor building at 11:01 on March 14. The explosion destroyed the operation floor and all floors above it, the north and south external walls of the floor below the operation floor, and the waste processing building. At this time, radioactive materials were released into the atmosphere and the radiation dose in the vicinity of the site increased.

On March 25, fresh water from the pure water storage tank was once again used as an alternative injection to the reactor. As of the end of May, the total injection volume had reached approx. 20,625 m^3 (approx 16,130 m^3 of fresh water and approx. 4,495 m^3 of seawater).

On March 28, reactor injection was performed by temporary motor-driven pumps, and on April 3, their power supply was switched to a permanent power supply. The injection system was thus shifted to a stable system.

While verifying the integrity of load systems through the repair of the transformer at Shin Fukushima Substation and the bypass operation between Line 1 of the Yorunomori Line and Line 3 of the Okuma Line, the power supply has been gradually restored. On March 18, power supply was restored as far as the site metal-clad switchgear, and on March 22, the lighting of the main control room was restored.

The main chronological sequence is shown in Table IV-5-3. Plant data, such as the RPV pressure, is shown in Figures IV-5-7 to IV-5-9.

2) Evaluation using severe accident analysis codes

a Analysis by TEPCO

When TEPCO's analysis showed that the flow volume of the alternative injection water was low, it resulted in damage to the RPV due to melted fuel. TEPCO has used these results in addition to the existing PRV temperature measurement results to evaluate that the greater part of the fuel has in fact been cooled at the bottom of the RPV.

TEPCO estimated that during this process the reactor fuel was exposed for about four hours from 2:42 on March 13, when the HCPI stopped (about forty hours after the earthquake hit), and two hours later, damage to the core began. Later, as the reactor water level was not able to be maintained around the fuel, flow volume for the alternative water injection was assumed. The decay heat began melting the core and the melted fuel shifted to the lower plenum and then some 66 hours after the earthquake, it started to damage the RPV.

The analysis results show that, along with the damage to the core and the core melt of reactor fuel, the embedded radioactive materials were released into the RPV and moved to the S/C, with the noble gases almost all being released into the environment through PCV vent operation, and approximately 0.5% of the radioactive iodine was released.

Note that TEPCO carried out an additional analysis, which assumed leakage from the HPCI steam system as the RPV and D/W pressures had dropped while HPCI was operating. The analysis results show that the RPV pressure changes and the D/W pressure changes were generally in alignment, but, including the problems with instrumentation, it is not possible to pinpoint the reason the RPV and D/W pressures dropped, nor their current status.

b Crosscheck by NISA

In the crosscheck analyses, NISA analyzed using the MELCOR codes based on the conditions (basic conditions) that TEPCO adopted. In addition, a sensitivity analysis and other analyses were carried out in terms of the relationship with the pump output pressure and determined that the injected water volume for the alternative water injection was in line with the RPV pressure.

The crosscheck under basic conditions indicated nearly the same tendencies as seen by TEPCO. It showed that the fuel was exposed at about 13:08 (41 hours after the earthquake) and three hours later core damage started. The time period the RPV was damaged was about 79 hours after the earthquake.

The analysis results show that the amount of radioactive materials was approx. 0.4% to 0.8% of radioactive iodine was released, and the other nuclides were approx. 0.3% to 0.6%. However, the released amount changes according to the settings for seawater injection flow amounts, etc., and the operating status is unclear, so there is the possibility that this will change depending on the operating status.

Regarding the assumption by TEPCO of operational status for the high pressure water injection system, as there is no quantitative setting basis shown, it is difficult to evaluate what exactly has happened, and further investigation is required. However, regardless of the high pressure water injection system operating status, the reactor pressure has been restored due to stopping the high pressure water injection system and if the reactor water level can be maintained, then there will be no major effects on the core status and of course no effects on the evaluation of core status.

3) Estimation of RPV and PCV situations

a Confirmation of plant information

The study was done on plant data obtained during the period from March 15 to May 31, when the plant was in a comparatively stable condition, and the plant data from this period was handled as shown below.

An instruction may have been issued to maintain a higher water level in the fuel area since the PCV temperature was high when the PCV pressure was remaining at a high level, and the normal water level dropped due to the evaporation of water in the PCV condensation tank as well as the instrumentation piping. As Unit 3 showed the same tendency that Unit 1 later showed, the water level in the RPV was considered immeasurable.

The RPV pressure was nearly equal to the measured values of the A and B systems, so it was considered to show a close approximation of the actual pressure. For the period when negative pressure was shown, it was considered to be within an error range as such pressure is immeasurable by the pressure gauge.

After March 30, the RPV temperature stayed around 100°C in connection with the RPV pressure and so it was considered to generally show an actual temperature. However, some pieces of data showing high temperature values were excluded from the evaluation as they did not meet with the trend of other measured values.

The plant data up to March 15, which is very limited, was added to the data from March 15 on, and excepting the data regarding the reactor water level, was referred to under the assumption that it reflected the actual situation.

As stated above, there may have been an instruction to keep the water level high in the reactor fuel area. As it is impossible to determine when deviation from the instruction began to occur, only the changes in the situation were referred to roughly in considering information on equipment operation and so forth.

b Estimation of RPV and PCV situations during comparatively stable period

-Situation of RPV boundary

According to the information of the Tokyo Electric Power Co., Inc. (TEPCO), the total injection amount to RPV up to May 31 is considered to be about 20,700 tons. The total amount of vapor generated from the start of injection is about 8,300 tons when the decay heat is estimated on the outside in the decay heat evaluation formulation. If the pressure boundary is secured, a difference of about 12,400 tons at least may be kept there. As the capacity of RPV is 500 m^3 at most, the injected water may not only evaporate within RPV and leak as vapor, but also may leak as water. The injection to RPV was executed through the nozzles of recirculating water inlet and water supply equipment. The water injected through the nozzle of water supply equipment would gather once in the outside of shroud (from about 17:00 May 21 to about 23:00 May 28) and then would move to the bottom of RPV via the jet pump diffuser to cool the reactor fuel. The water is very likely to leak to outside at this portion.

From about 23:00 May 29 and on, the injection was switched and continued only through the nozzle of water supply equipment.

The RPV pressure has been close to the atmosphere pressure from March 22 and similar to the D/W pressure of PCV, and so it is now estimated that RPV seems to connect to PCV through the gas phase portion.

-Situation in RPV (reactor core status and water level)

Some RPV temperatures exceeded the measurable range (higher than 400°C) due to the lower injection flow rate caused by the increase of RPV pressure on March 20, but the temperature dropped through the securing of injection flow rate on March 24 and stayed around 100°C. Accordingly a considerable amount of reactor fuel may remain within the RPV. However, there is a possibility that the bottom part of the RPV was damaged and some of the fuel might have dropped and accumulated on the dry well floor (lower pedestal).

The temperature tends to rise in general from the beginning of May. Considering that it partially exceeds 200°C and is higher than the saturation temperature for the RPV pressure, part of reactor fuel may still remain unsubmerged and be cooled by vapor.

-Status of PCV

As the pressure of D/W and S/C exceeded the maximum operating pressure (0.427 MPag) of the PCV to reach about 0.5 MPag on March 13, it is assumed at this moment that the performance of the gaskets of flanges and the seals of penetrations deteriorated. The D/W pressure is maintained around the atmospheric pressure (0 MPag). Therefore, it is assumed at this moment that the vapor generated by decay heat may be released to the outside through D/W.

As the pressure of gas phase portions of S/C stayed at a higher level than the atmospheric pressure and the D/W pressure is close to the atmospheric pressure, the temperature of water that flows from the lower part of D/W down to S/C is 100°C at a maximum. Accordingly, it is now estimated that the 0 MPag or higher pressure of the gas phase portions of S/C is due to noncondensable gasses. Right now, TEPCO is studying how to estimate the water level of D/W.

4) Estimation of situations of RPV, PCV and others at a given moment over time

After the earthquake, water injection continued through the reactor core isolation cooling system (RCIC). Around 12:00 on May 12, the RCIC stopped operation. Alternatively, water injection was made through the high-pressure coolant injection system (HPCI) but the reactor pressure decreased and thus the reactor water level is estimated to have increased. Before dawn on the morning of March 13, however, the reactor pressure dropped and HPCI stopped operation.

The stoppage of HPCI is estimated to have triggered the reactor pressure to exceed the operation pressure of about 7 MPa. But the main steam safety relief valve (SRV) is estimated to have been activated to release the vapor to S/C to maintain the pressure at around the 7 MPa level, during which time it is estimated that the reactor water dropped and the reactor fuel was damaged.

It is estimated that the main steam SRV opened to lower the reactor pressure, and at 9:25 on March 13 alternative injection was carried out and wet vent operation done in response to the increase in PCV pressure. It was reported that the alternative injection from fire engines was executed, but this measure could not demonstrate the required performance due to the relation with the reactor pressure, etc. as the water level has not been restored yet. More detailed investigations and analyses of the conditions/situations of equipment would be necessary in order to find out to what extent such measures worked.

5) Analysis of accident event progress

Regarding the progress of events in the accident at Unit 3, previous analyses showed that the RCIC and HPCI ceased to function, so PCV spraying using fire engines and wet vent operation were carried out. In addition, there is the possibility that, based on the water level situation following the start of fresh water injection and RPV pressure reduction operations, not enough water was injected and it is estimated that the lack of sufficient cooling led to core melt, with the melted fuel moving down to the bottom of the RPV.

From the balance between the injected water volume and volume of steam produced, it is estimated that the water injected into the RPV is leaking.

Based on the RPV temperature measurement results, it is considered that a considerable amount of fuel is cooling on the RPV bottom.

The situation of the reactor building after the explosion is not known in detail for certain yet due to the limited site verification. As a result of the execution of numerical fluid dynamic analysis in addition to the severe accident analysis, the release of the gas that contained the hydrogen generated through the reaction between zirconium in the clad of fuel rods and the water in the reactor might accumulate hydrogen sufficient enough to reach the detonation range in the upper space of reactor building to cause the explosion. Along with the explosion, the oil for the MG sets for the control of the rotating speed of recirculation pumps burnt concurrently at the heavily damaged west side of the 4th floor of reactor building. For the waste processing building, it cannot be denied now that it might be damaged not only by the blast waves but also by the explosion of the hydrogen that flew in through the piping penetrations. The high dose contamination that hinders works in the vicinity of the building was found on part of debris scattered by the explosion. The severe accident analysis, while it does not assume any leakage from the

PRV, suggests that it might be the result of radioactive materials that leaked from the PCV adhering to the reactor building structure, as the PCV maximum operating pressure was exceeded.

As it is impossible to identify to what extent each system functioned actually, it is also impossible to determine the event progress situation at this moment. From the results of the severe accident analysis, however, it can be estimated that radioactive materials were released into the environment by the wet vent operation starting at noon on March 13, and almost all the noble gases in the core were released, and the iodine and cesium in the core were released at ratios of approx. 0.5% to 0.8% and approx. 0.3% to 0.6% respectively.

Table IV-5-3 Fukushima Daiichi NPS, Unit 3 – Main Chronology (Provisional)

* The information included in the table is subject to modifications following later verification. The table was established based on the information provided by TEPCO, but it may include unreliable information due to tangled process of collecting information amid the emergency response. As for the view of the Government of Japan, it is expressed in the main body of the report.

	Unit 3	
	Status before the earthquake: in operation	
3/11		
	14:47	Reactor scram (high seismic acceleration) Control rods fully inserted (sub-critical) Turbine trip Loss of the external power supply
	14:48	Emergency diesel generator (emergency DG) turned on Main steam isolation valve (MSIV) closed
	14:52	Safety relief valve (SR valve) repeatedly opened and closed from this point onwards
	15:05	Reactor core isolation cooling system (RCIC) manually turned on
	15:25	RCIC trip (L-8)
	15:38	All AC power supply lost
	15:42	TEPCO judged that an event falling under Article 10 of the NEPA (loss of all AC power supplies) had occurred.
	16:03	RCIC manually turned on
	20:30	RCIC in operation Lighting in Central Operating Room (temporarily secured and in preparation)
	23:35	Water level on the decrease (400 mm at 22:58→350 mm (wide range))
3/12		
	11:36	RCIC trip
	12:35	High pressure coolant injection system (HPCI) turned on (L2)
	12:45	Reactor pressure on the decrease (7.53 Mpa at 12:10→ 5.6 MPa)
	20:15	Reactor pressure on the decrease (0.8 MPa)
3/13		
	2:42	HPCI stopped
	4:15	Reactor water level was judged to have reached the top of active fuel (TAF).
	5:10	Due to stoppage of HPCI, injection by RCIC into the reactor was attempted. As RCIC could not be turned on, the event was judged by TEPCO to fall under Article 15 of the NEPA (loss of reactor cooling function).
	6:00	Water level in the reactor: -3500 mm (wide range)
	7:39	Spraying onto the PCV began. Water level as of 7:45: TAF -3,000 mm. Reactor pressure: 7.31 MPa. DW pressure: 460 kPa. SC pressure: 440 kKPa.
	8:41	The second valve (AO valve) was set to "open" for venting.
	9:08	Operation to reduce pressure in the RPV by relief valve (SRV) It appears that some time after this point the safety relief valve (SRV) was closed and opened, due to issues with maintenance of air pressure for driving SRV and excitation on the electro-magnetic valve on the air supply line.
	About 9:20	Decrease trend of pressure inside PCV detected
	9:25	Injection of fresh water (borated) into the reactor through the Fire Extinguishing Line began.
	11:17	Vent line AO valve found closed (through loss of pressure in the tank) From this point on, it was difficult to keep the AOV open due to issues with maintenance of air pressure for driving AOV and excitation on the electro-magnetic valve on the air supply line, and the operation to open it was repeated multiple times.
	12:30	Operation to open the AO valve on the pressure chamber side.
	13:12	Fresh water injection to the reactor was switched to seawater injection.
	22:15	Diesel-driven fire pump (D/DFP) stopped (before it ran out of fuel)

	Unit 3	
	Status before the earthquake: in operation	
3/14		
	1:10	Seawater injection suspended as supply of seawater for the reactor was running low.
	3:20	Injection of seawater resumed.
		Measurement by the Containment Atmospheric Monitoring System (CAMS) was 1.4×10^3 Sv/h (DW); the core damage probability was estimated to be about 30%.
	5:20	The valve (AO valve) was set to "open" for venting.
	6:10	D/W pressure was 460 Kpa abs
	9:05	D/W pressure was 490 Kpa abs
	About 11:00	An explosion that appeared to be a hydrogen explosion occurred in the upper part of the reactor building (what appeared to be white smoke rose).
	11:25	Reactor pressure (A) was 0.185 MPa. DW pressure was 360 KPa. SC pressure was 380 KPa. Water level (A) was -1800 mm.
3/15		
	16:00	AO valve on the SC side found closed
	16:05	AO valve on the SC side opened
3/16		
	1:55	AO valve on the SC side opened
	About 8:30	A great deal of white smoke was emitted from Unit 3.
3/17		
	9:48	Seawater spraying onto the spent fuel pool by helicopter started.
	10:01	Seawater spraying onto the spent fuel pool by helicopter stopped. Approx 30 t.
	About 19:05	National Police Agency riot police started to spray water onto the spent fuel pool with a high-pressure water cannon truck.
	19:13	National Police Agency riot police stopped spraying water onto the spent fuel pool with a high-pressure water cannon truck. Approx. 44 t.
	19:35	The riot police started to spray water onto the spent fuel pool with their fire engine
	20:09	The riot police stopped spraying water onto the spent fuel pool with their fire engine. Approx. 30 t
	21:00	AO valve on the SC side found to be closed.
	About 21:30	AO valve on the SC side opened.
3/18		
	About 5:30	AO valve on the SC side found closed
	14:00	The Self-Defense Force started spraying water onto the spent fuel pool with their fire engine.
	14:38	The Self-Defense Force stopped spraying water onto the spent fuel pool with their fire engine. Approx. 40 t.
	14:42	US Armed Forces started spraying water onto the spent fuel pool with their water truck.
	14:45	US Armed Forces stopped spraying water onto the spent fuel pool with their water truck. Approx. 2 t.
3/19		
	0:30	The Tokyo Fire Department started spraying water with their fire engines onto the spent fuel pool.
	1:10	The Tokyo Fire Department stopped spraying water with their fire engines onto the spent fuel pool. Approx. 60 t.
	11:30	AO valve on the SC side found closed.
	14:10	The Hyper Rescue Unit of the Tokyo Fire Department started spraying water onto the spent fuel pool.
3/20	3:40	The Hyper Rescue Unit of the Tokyo Fire Department stopped spraying water onto the spent fuel pool. Approx. 2430 t. Radiation levels before the water was sprayed were 3417 μSv/h (at 14:10) and after water spraying were 2758 μSv/h (at 3:40)
	11:00	Pressure inside PCV rose.
	About 11:25	11:25 AO valve on the SC side opened..
	About 21:36	The Hyper Rescue Unit of the Tokyo Fire Department started spraying water to cool the spent fuel pool.
3/21	3:58	The Hyper Rescue Unit of the Tokyo Fire Department stopped spraying water onto the spent fuel pool. Approx. 1137 t.
	About 15:55	Grayish smoke rose from the south-eastern part of the rooftop of the reactor building.
3/22		
	10:36	The emergency low-pressure distribution panel (Power Center (P/C) 4D) received power.
	15:10	The Hyper Rescue Unit of the Tokyo Fire Department started spraying water to cool the spent fuel pool.
	15:59	The Hyper Rescue Unit of the Tokyo Fire Department stopped spraying water onto the spent fuel pool. Approx. 150 t.
	22:28	Main Bus Panel for measurement received power (120 VAC).
	22:46	Lighting in Central Operating Room recovered

	Unit 3	
	Status before the earthquake: in operation	
3/23	11:03	Seawater injection from the fuel pool cooling and clean-up system (FPC) to cool down the spent fuel pool started.
	13:20	Seawater injection from the fuel pool cooling and clean-up system (FPC) to cool down the spent fuel pool stopped. Approx. 35 t.
	About 16:20	Slightly blackish smoke was emitted from the reactor building.
3/24	About 5:35	Seawater injection from the FPC to cool down the spent fuel pool started
	About 16:05	Seawater injection from the FPC to cool down the spent fuel pool stopped. Approx. 120 t.
3/25	13:28	Water spraying onto the spent fuel pool by the Kawasaki City Fire Bureau supported by the Tokyo Fire Department started.
	16:00	Water spraying onto the spent fuel pool by the Kawasaki City Fire Bureau supported by the Tokyo Fire Department stopped. Approx. 450 t.
	18:02	Seawater injection into the reactor was switched to fresh water injection.
3/26		
3/27	12:34	Seawater spraying onto the spent fuel pool by TEPCO's Concrete Pump Truck (hereafter, "concrete pump truck") started.
	14:36	Seawater spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 100 t.
3/28	17:40	Transfer of pooled water from the Condensate Storage Tank (CST) to the Suppression Pool Water Surge Tank (SPT) started.
	20:30	Water injection into the reactor is switched from the fire truck pump to injection using the temporary electric pump.
3/29	14:17	Water spraying onto the spent fuel pool by the Concrete Pump Truck starts (from here, fresh water is used).
	18:18	Water spraying onto the SFP by the Concrete Pump Truck stops (from here, fresh water is used). Approx. 100 t.
3/30		
3/31	8:37	Transfer of pooled water from the CST to the SPT completed.
	16:30	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	19:33	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 105 t.
4/1		
4/2	9:52	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	12:54	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 75 t.
4/3	11:50	The power supply for the temporary motor-driven pump used for water injection into the reactor was switched from a temporary one to a permanent one.
4/4	17:03	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	19:19	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 70 t.
4/5		
4/6		
4/7	6:53	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	8:53	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 70 t.
4/8	17:06	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	About 18:30	AO valve on the SC side found closed.
	20:00	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 75 t.
4/9		
4/10	17:15	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	19:15	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 80 t.
4/11	About 17:16	As a result of an earthquake, the external power supply for Units 1 and 2 (Tohoku Nuclear Power Line) was lost, and the water injection pump for the reactor was suspended.
	18:04	The water injection pump for the reactor was restarted.

		Unit 3
	Status before the earthquake: in operation	
4/12	16:26	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	17:16	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 35 t.
4/13		
4/14	15:56	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	16:32	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 25 t.
4/15	10:19	Work began to move the power distribution panel for injection pumps and other equipment to higher ground against tsunami.
	17:00	Work completed to move the power distribution panel for injection pumps and other equipment to higher ground against tsunami.
4/16		
4/17	11:30	An unmanned robot inspection of the reactor building started.
	14:00	An unmanned robot inspected the reactor building finished.
4/18	12:38	Work began to replace the hose used to inject water into the reactor with a new one. The reactor injection pump was stopped.
	13:05	The replacement of the hose used to inject water into the core with a new one was completed. The reactor injection pump was restarted.
	14:17	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	15:02	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 30 t.
4/19	10:23	Tie line between Units 1 and 2 and Units 3 and 4 was completed. (The Tohoku Genshiryoku Line and the Okuma Line can be used interchangeably.)
4/20		
4/21		
4/22	14:19	Water spraying onto the spent fuel pool by the Concrete Pump Truck started.
	15:40	Water spraying onto the spent fuel pool by the Concrete Pump Truck stopped. Approx. 50 t.
4/23		
4/24		
4/25	18:25	The power supply for the injection pump for the reactor was restored to an external one.
4/26	12:00	Fresh water sprayed into the spent fuel pool by the Concrete Pump Truck. A water surface was detected.
	12:25	Water injection using the fuel pool cooling and clean-up system (FPC) to cool down the spent fuel pool started.
	14:02	Water injection using the FPC to cool down the spent fuel pool stopped. Approx. 47.5 t.
4/27		
4/28		
4/29		
4/30	10:31	To reinforce the external power supply for Units 3 and 4 (Okuma Line No. 3) from 6.6 KV to 66 KV, the 480 V power supply panel for Unit 4 and the 480 V power supply panel shared with the spent fuel pool were suspended.
	11:34	The 480 V power supply panel for Unit 4 and the 480 V power supply panel for the spent fuel pool were restored, and power supply reinforcement work was completed.
5/1	13:35	To prevent the stagnant water inside the sea-side shafts in the trenches of Units 2 and 3 from spilling over and seawater from coming into them as a result of tsunami, work began to fill the trench shafts with crushed stone, concrete, etc.
5/2	12:53	The pump used to inject water into the reactor core was switched to a fire engine pump in order to install an alarm system to the former.
	14:53	With an alarm system installed, the pump used to inject water into the reactor core was put back to use.
5/3		
5/4		
5/5		
5/6		
5/7		

	Unit 3
	Status before the earthquake: in operation
5/8	11:38 Measurement of water level in spent fuel pool. 12:10 Water injection to the spent fuel pool from the FPC started 14:10 Water injection to the spent fuel pool from the FPC stopped. 60 t. Measure of water level in the spent fuel pool and sampling started 14:50 Measure of water level in the spent fuel pool and sampling finished
5/9	12:14 Water injection to the spent fuel pool from the FPC started 12:39 Along with injection of water from the FPC to the spent fuel pool, injection of a corrosion inhibitor (hydrazine) is started. 14:36 Along with injection of water from the FPC to the spent fuel pool, injection of a corrosion inhibitor (hydrazine) is stopped. 15:00 Injection of fresh water using the fuel pool cooling and cleaning system to cool the spent fuel pool is stopped. Approx. 80 t. (Water level of spent fuel pool measured after water injection)
5/10	
5/11	8:47 The power supply for the pump to inject water into the reactor core was switched to a temporary diesel generator. About 12:30 It was confirmed that there was an inflow of water into the cable pit near the screen. 15:55 The power supply for the pump to inject water into the reactor core was switched back to the in-house power supply from the temporary diesel generator. 18:40 Work began to stop the inflow of water into the cable pit near the screen. 18:45 The inflow of water into the cable pit near the screen is confirmed to have stopped.
5/12	16:53 As part of the process of switching the source for the injected water from the Fire Extinguishing Line to the Feedwater System, about 3 tons/h of water was injected from the Feedwater System in addition to the 9 tons/h from the Fire Extinguishing Line.
5/13	
5/14	
5/15	
5/16	15:10 Along with injection of water using the temporary electric pump to the spent fuel pool, injection of a corrosion inhibitor (hydrazine) is started. 17:30 Along with injection of water using the temporary electric pump to the spent fuel pool, injection of a corrosion inhibitor (hydrazine) is stopped.

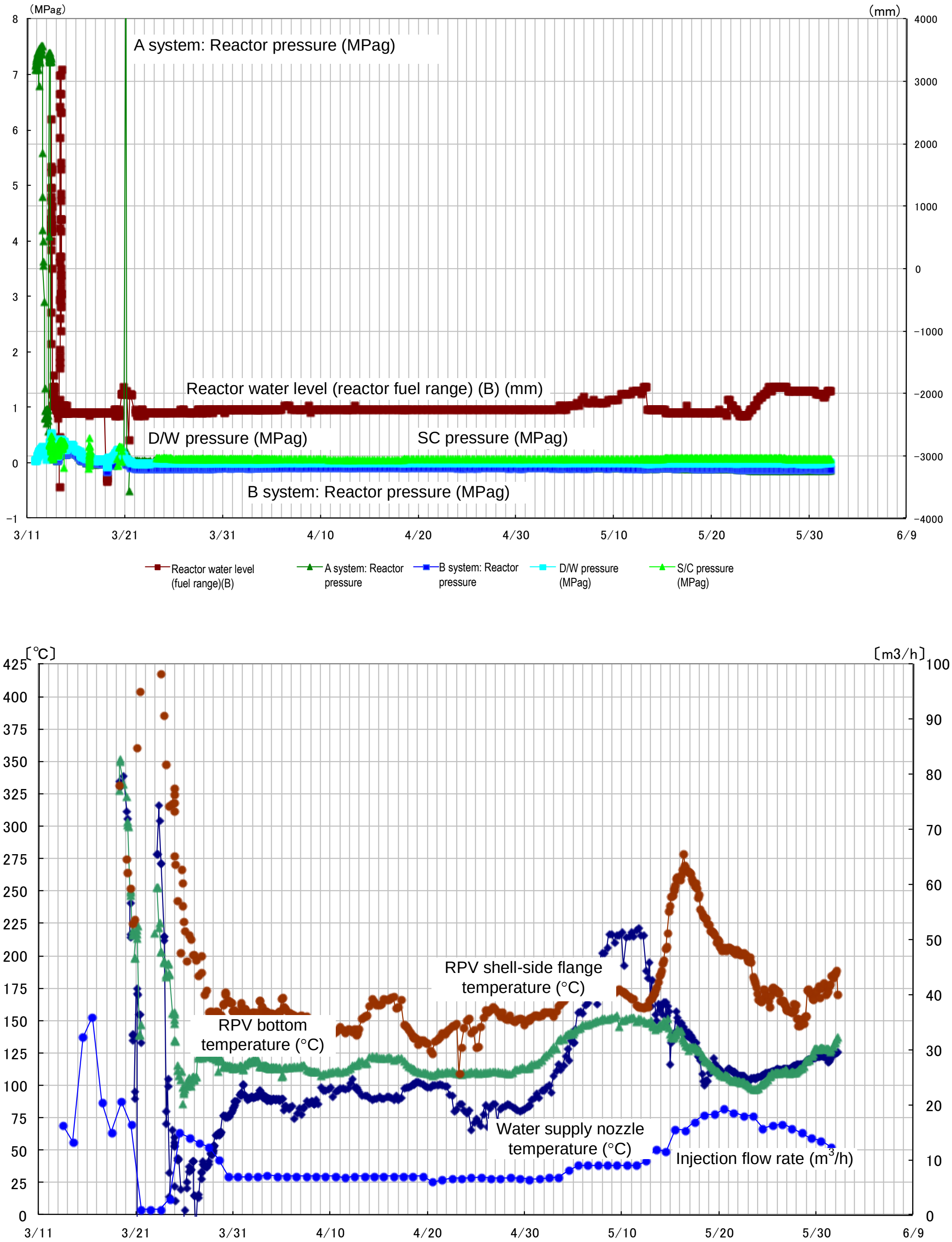
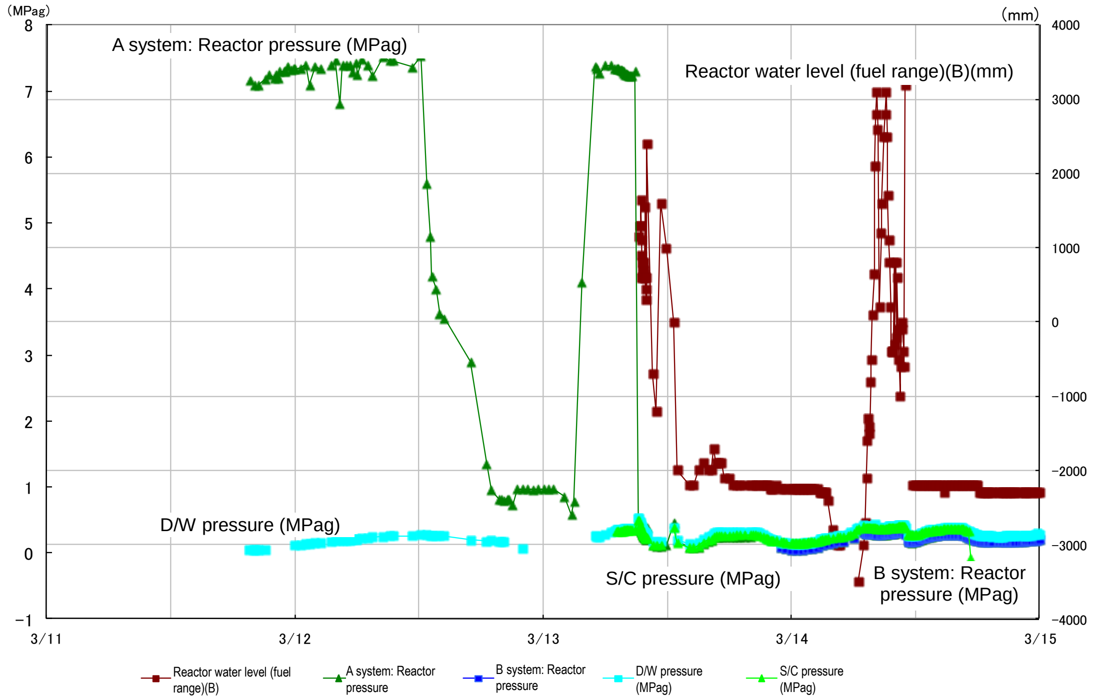


Figure IV-5-7 Changes of Main Parameters (1F-3) (March 11 to May 31)



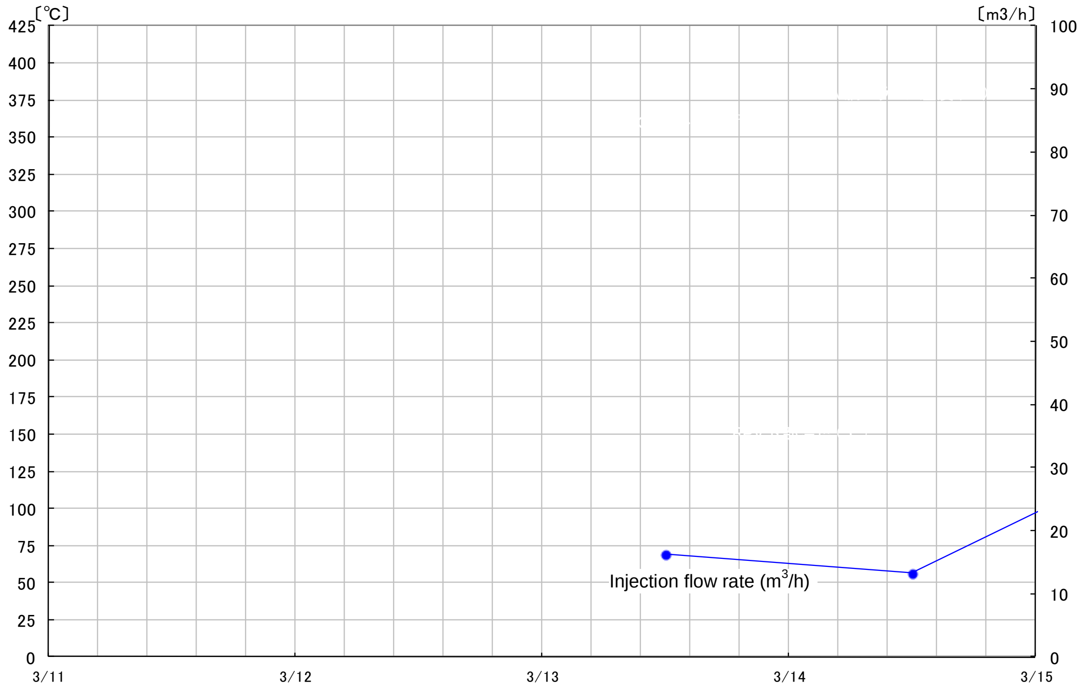
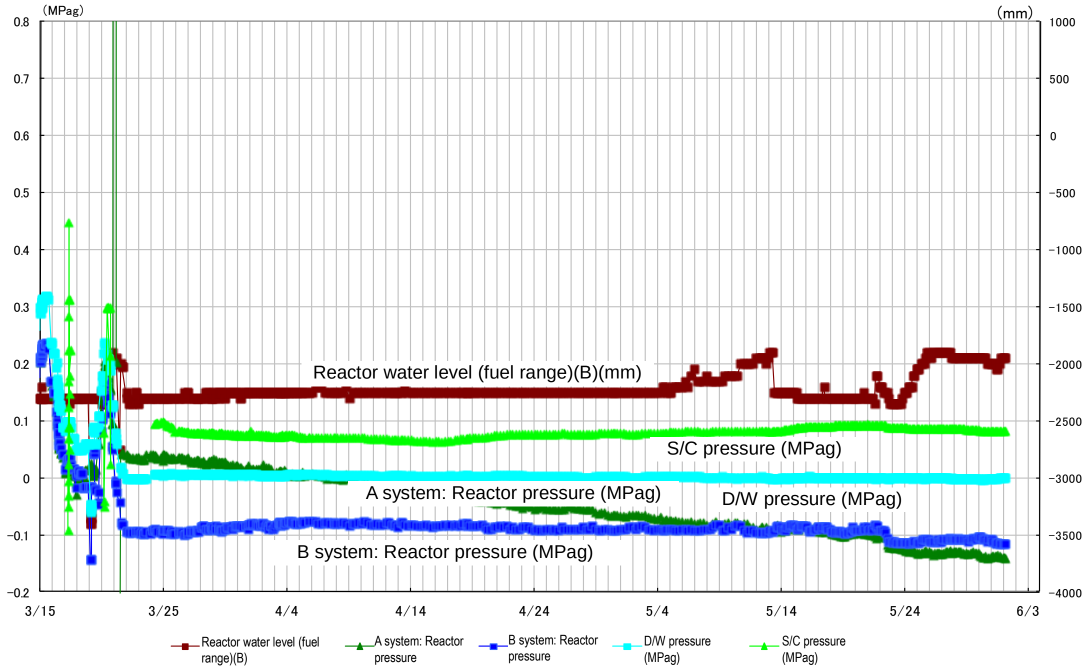


Figure IV-5-8 Changes of Main Parameters (1F-3) (March 11 to March 15)



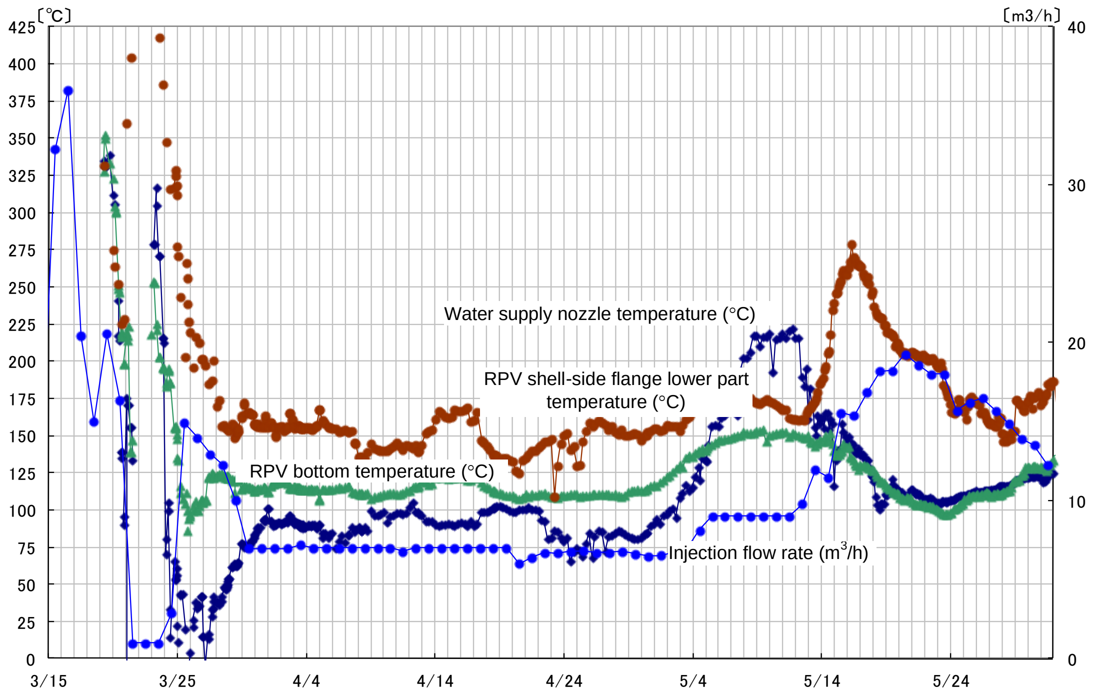


Figure IV-5-9 Changes of Main Parameters (1F-3) (March 15 to May 31)

(4)Fukushima Dai-ichi NPS, Unit 4

1) Order of accident event progress and emergency measures (chronological sequence)

a From the earthquake to the arrival of the tsunami

As described in Chapter 3, Unit 4 was in the periodic inspection and all fuel assemblies were removed from the reactor to the spent fuel pool due to the shroud replacing works of RPV. Therefore, the fuel with relatively high decay heat for one full core was stored in the spent fuel pool. 1,535 pieces of spent fuel assemblies were stored there, which amounted to 97% of its storage capacity of 1,590 pieces.

It was known that the spent fuel pool was fully filled with water as the cutting work of the shroud had been carried out at the reactor side and the pool gate (a divider plate between the reactor well and the spent fuel pool) was closed.

In addition to Okuma Line 3, to which no power was being supplied due to modification work before the earthquake, the Shintomioka Substation breaker tripped and that for receiving electricity at the switchyard in the power station was damaged by the earthquake, disrupting the power supply from Okuma Line 4 as well to cause the loss of external power supply.

As Unit 4 was undergoing periodic inspection, and its process computer and transient recorder were being replaced, the record to verify the startup of the emergency DG does not exist. Judging from the facts that the level of fuel oil tank decreased and the equipment powered by the emergency DG were operating, one emergency DG (the other was being checked) is estimated to have started.

The loss of external power supply stopped the cooling water pump for the spent fuel pool but it was possible to use the RHR system and others that would be powered by the emergency DG when the external power supply was lost.

However, such switching required on-site manual operation and so did not take place before the arrival of the tsunami.

b Effects of the tsunami

At 15:38, Unit 4 went into the situation of the loss of all the AC power supply when one emergency DG stopped its operation due to the drench of the seawater pumps and metal-clad switch gear caused by the tsunami, and the cooling and water supply functions of the spent fuel pool failed.

c Building explosion and subsequent emergency measures

At 4:08 on March 14, the cooling function of Unit 4's spent fuel pool was lost and the water temperature rose to 84°C. At around 6:00 on March 15, an explosion assumed to be a hydrogen explosion occurred in the reactor building, and the whole part upward from below the operation floor as well as the western wall and the wall along the stairs were collapsed. Furthermore, at 9:38, a fire was identified in the northwest part of the fourth floor of the reactor building, but TEPCO confirmed at about 11:00 that it had gone out on its own. A fire was also reported to have broken out in the northwest part of the third floor of the building around 5:45 on March 16, but TEPCO was not able confirm this fire on-site at around 6:15.

The cause of the explosion at the reactor building has not been clearly identified because of various limitations for confirmation at the field. For example, assuming that the stored spent fuel had been exposed because of the low water level and the raised temperature, the explosion should have been caused by the hydrogen generated through the reaction of water vapor with the zirconium in the clad of fuel rod; if so, such a phenomenon should have occurred earlier than at the stage when the temperature had risen and the water level had been lowered as estimated from the decay heat of the stored spent fuel. Therefore, at present, the following must be taken into account: cracks produced in the spent fuel pool and the additional decreases in the water level, such as the overflow caused by flushing due to the increase in temperature. As shown in Table IV-5-4 of the analysis result of nuclides in the water extracted from the spent fuel pool using a concrete pump truck, it is assumed no extensive damage in the fuel rods occurred. No damage to the pool, including water leaks and cracks, was found from visual inspections of the pool's condition. On the other hand, at the adjacent Unit 3, it is assumed that a large amount of hydrogen was generated as a result of the core damage, and a part of it was released by the PCV vent line. Also, as shown in Figs. IV-5-10 and IV-5-11, the exhaust duct of the PCV vent line is connected at the exhaust duct of Unit 4 before the exhaust pipe, and a stop valve to prevent reverse flow is not installed at the emergency gas treatment facility. Therefore, it is thought that the hydrogen discharged by venting at Unit 3 may have flowed in.

As mentioned above, the results of analyzing nuclides from the spent fuel pool and visual inspections have revealed that Unit 4's spent fuel pool remains nearly undamaged.

Subsequent water injections are described later in the section regarding the spent fuel pool.

(Currently under analysis)
The main events are described in chronological order in Table IV-5-5.

Table IV-5-4 Analysis of Nuclides from Unit 4's Spent Fuel Pool

Extracted on	Major Nuclides Detected	Concentration(Bq/cm^3)
April 12	Cesium 134	88
	Cesium 137	93
	Iodine 131	220
April 28	Cesium 134	49
	Cesium 137	55
	Iodine 131	27
May 7	Cesium 134	56
	Cesium 137	67
	Iodine 131	16

Table IV-5-5 Fukushima Daiichi NPS Unit 4 Main Chronology (Provisional)

* The information included in the table is subject to modifications following later verification. The table was established based on the information provided by TEPCO, but it may include unreliable information due to tangled process of collecting information amid the emergency response. As for the view of the Government of Japan, it is expressed in the main body of the report.

	Unit 4	
	Status before earthquake: Stopped	
3/11	14:46	Stopped for regular inspection
	15:38	All AC power supply lost
	20:30	Lighting in Central Operating Room temporarily secured
3/12		
3/13		
3/14	4:08	Spent fuel pool temperature: 84°C
3/15	6:00 to about 6:10	6:00-6:10 (approx.) A large blast is heard. Damage is discovered in the vicinity of the 5th floor roof of the reactor building.
	6:56	The roof top appears distorted.
	8:11	Damage to the reactor building is confirmed. As radiation exceeded 500 µSV/h near the main gate, the operator judged it to be a reportable event under Article 15 (Release of radioactive materials through fire or explosion)
	9:38	A fire is confirmed to have broken out in the vicinity of the north-west corner of the reactor building's third floor. The fire brigade is notified.
		Fire suppression activities are scheduled to be carried out with the US Armed Forces and the In-house Fire Brigade System.
3/16	About 11:00	When the situation with the reactor building fire is confirmed on-site it is confirmed that the fire had gone out naturally.
	5:45	Flames are confirmed to be rising from the vicinity of north area of the fourth floor of the Unit 4 building.
		The fire brigade is notified and it prepares to put out the fire.
	6:15	Reconfirmation of the reactor building fire fails to confirm any fire.
	10:43	Clouds of what appears to be white steam are coming out from Unit 3, so outside work is stopped, and workers are directed to evacuate to the Emergency Action Room (2.9 mSv/h, 10:55 at the main gate)
3/17		
3/18		
3/19		
3/20	8:21	The SDF starts spraying water into the spent fuel pool to cool it down.
	9:40	The SDF stops spraying water into the spent fuel pool to cool it down. Approx 80 t.
	18:30	The SDF sprays water into the spent fuel pool.
	19:46	The SDF sprays water into the spent fuel pool. Approx. 80 t.
3/21	6:37	The SDF starts spraying water into the spent fuel pool.
	8:38	A US Armed Forces water truck sprays water until 8:41. Approx. 2.2 t
	8:41	All 13 units stop spraying. Approx. 90 t.
3/22	10:35	The emergency low-pressure power panel (Power Center (P/C) 4D) receives electricity
	17:17	Water spraying onto the spent fuel pool by TEPCO's Concrete Pump Truck (hereafter, "concrete pump truck") starts.
	20:32	Water spraying onto the spent fuel pool by the Concrete Pump Truck stops. Approx. 150 t.
	21:52	Power reaches main bus board power for measuring
3/23	10:00	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	13:02	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 125 t.
3/24	14:36	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	17:30	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 150 t.

	Unit 4	
	Status before earthquake: Stopped	
3/25	6:05	Spraying seawater to cool the spent fuel pool using the Spent Fuel Pool Cooling and Clean-up Line (FPC) starts.
	10:20	Spraying seawater to cool the spent fuel pool using the FPC stops. Approx. 20 t.
	19:05	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	22:07	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 150 t.
3/26		
3/27	16:55	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	19:25	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 125 t.
3/28		
3/29	11:50	Power reaches the Central Operating Room lights
3/30	14:04	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	18:33	Water spraying from the Concrete Pump Truck is continued until the water level can be confirmed with the gauges. Fresh water is sprayed. Approx. 140 t (fresh water used from here on).
3/31		
4/1	8:28	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	14:14	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 180 t.
4/2	14:25	Transfer of pooled water from the Concentrated Water Processing Facility (Concentrated RW) to the Turbine Building (T/B) starts.
4/3	10:00	Number of pumps for transferring from concentrated RW to T/B increased from 1 to 5.
	17:14	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	22:16	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 180 t.
4/4	9:22	Transfer from the concentrated RW to the T/B stops to check the rise in level of the vertical shaft for Unit 3.
4/5	17:35	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	18:22	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 20 t.
4/6		
4/7	18:23	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	19:40	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 38 t.
4/8		
4/9	17:07	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	19:24	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 90 t.
4/10		
4/11		
4/12	12:00	Sampling work starts in the spent fuel pool to check the status of the fuel stored there.
	13:04	The spent fuel pool sampling work is completed.
4/13	0:30	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	6:57	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 195 t.
4/14	18:10	The results of the April 13 analysis of radioactive material nuclides on the water taken from the pool on April 12 are reported.
4/15	14:30	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	18:29	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 140 t.
4/16		
4/17	17:39	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	21:22	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 140 t.
4/18		

	Unit 4	
	Status before earthquake: Stopped	
4/19		
	10:17	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	10:23	Tie line completed between Units 1, 2 and Units 3, 4 (Can use both the Tohoku-Genshiryoku Line and the Okuma Line)
	11:35	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 40 t.
4/20		
	17:08	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	20:31	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 100 t.
4/21		
	17:14	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	21:20	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 140 t.
4/22		
	17:52	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	23:53	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 200 t.
4/23		
	12:30	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	16:44	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 140 t.
4/24		
	12:25	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	17:07	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 165 t.
4/25		
	18:15	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	0:26	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 210 t.
4/26		
	10:23	As part of the power supply reinforcement work for changing over from the Units 3 & 4 System to the Units 1 & 2 System, work starts on stopping the 480 V power panel for Unit 4.
	16:50	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	20:35	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 130 t.
4/27		
	12:18	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	15:15	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 85 t.
4/28		
	11:43	Measurement of the water level in order to spray water using the Concrete Pump Truck into the spent fuel pool starts.
	11:54	Measurement of the water level in order to spray water using the Concrete Pump Truck into the spent fuel pool stops
	11:55	Spent fuel pool sampling starts.
	12:07	Spent fuel pool sampling stops.
4/29		
	10:29	Spent fuel pool water level measured
	10:35	Spent fuel pool temperature measured
4/30		
	10:14	Spent fuel pool water level and temperature measurement started.
	10:28	Spent fuel pool water level and temperature measurement stopped.
	10:31	To reinforce the external power supply for Units 3 and 4 (Okuma Line No. 3) from 6.6 KV to 66 KV, the 480 V power supply panel for Unit 4 and the 480 V power supply panel shared with the spent fuel pool were suspended.
	11:34	To reinforce the external power supply for Units 3 and 4 (Okuma Line No. 3) from 6.6 KV to 66 KV, the 480 V power supply panel for Unit 4 and the 480 V power supply panel for the spent fuel pool were restored, and power supply reinforcement work was completed.
5/1		
	10:32	Spent fuel pool water level and temperature measurement started.
	10:38	Spent fuel pool water level and temperature measurement stopped.
5/2	10:10	Spent fuel pool water level and temperature measurement started.
	10:20	Spent fuel pool water level and temperature measurement stopped.
5/3		
	10:15	Spent fuel pool water level and temperature measurement started.
	10:23	Spent fuel pool water level and temperature measurement stopped.
5/4		
	10:25	Spent fuel pool water level and temperature measurement started.
	10:35	Spent fuel pool water level and temperature measurement stopped.

	Unit 4	
	Status before earthquake: Stopped	
5/5	11:55	Spent fuel pool water level and temperature measurement started.
	12:05	Spent fuel pool water level and temperature measurement stopped.
	12:19	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	20:46	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 270 t.
5/6	12:16	Spent fuel pool water level and temperature measurement.
	12:16	Spent fuel pool water level and temperature measurement.
	12:38	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	17:51	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 180 t.
5/7	11:00	Water level measured. Temperature measured, sampling
	14:05	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	17:30	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 120 t.
5/8	16:18	Draining of water from the condenser hot well in the turbine building in order to prepare for work on the injection line into the reactor of Unit 3 starts
5/9	16:05	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	19:05	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 100 t.
5/10		
5/11	16:07	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	19:38	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 120 t.
5/12	12:20	Reconnection of the 480 V power panel for Unit 4 and the 480 V power panel for the spent fuel pool in order to boost the external power supply (the Okuma No. 3 Line) for Units 3 and 4 from 6.6 KV to 66 KV to receive power from the TEPCO Genshiryoku Line is completed.
5/13	16:04	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	16:20	Along with spraying water into the spent fuel pool, injection of an anti-corrosion agent (hydrazine) is started.
	18:41	Along with spraying water into the spent fuel pool, injection of an anti-corrosion agent (hydrazine) is stopped. Amount of hydrazine is 0.12 m3.
	19:04	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops. Approx. 100 t.
5/14		
5/15	16:25	Spraying from the Concrete Pump Truck to cool the spent fuel pool starts.
	16:26	Along with spraying water into the spent fuel pool, injection of an anti-corrosion agent (hydrazine) is started.
	18:30	Along with spraying water into the spent fuel pool, injection of an anti-corrosion agent (hydrazine) is stopped. Amount of hydrazine is 0.3 m3.
	20:25	Spraying from the Concrete Pump Truck to cool the spent fuel pool stops.
5/16		

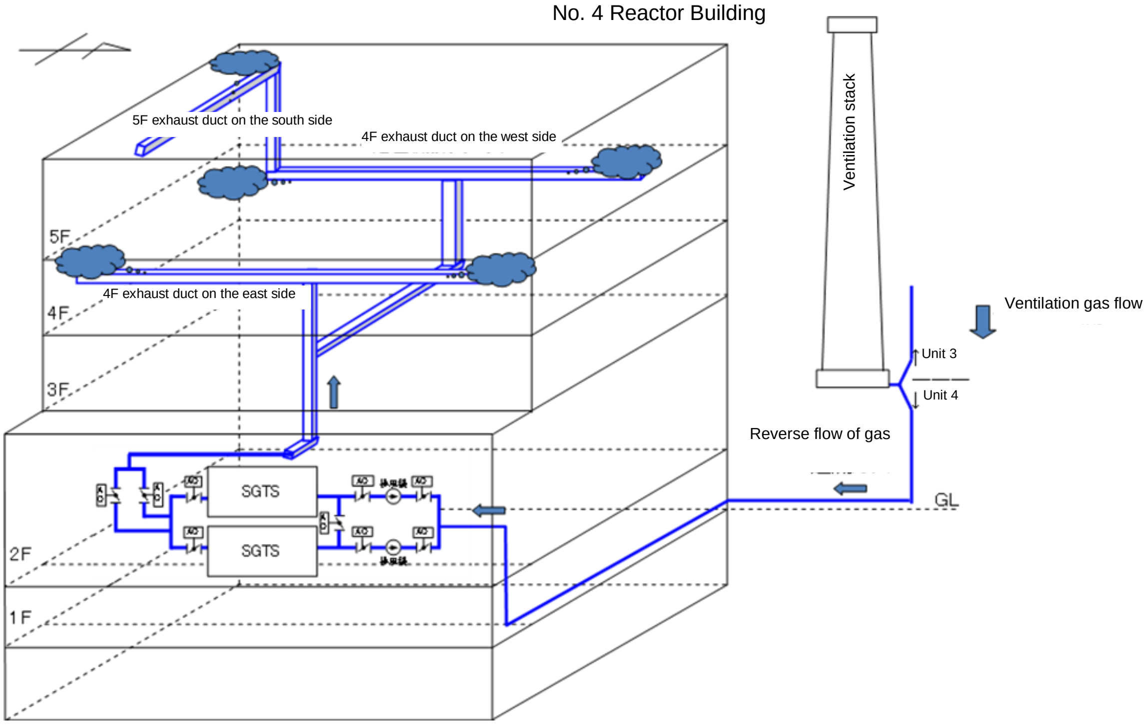
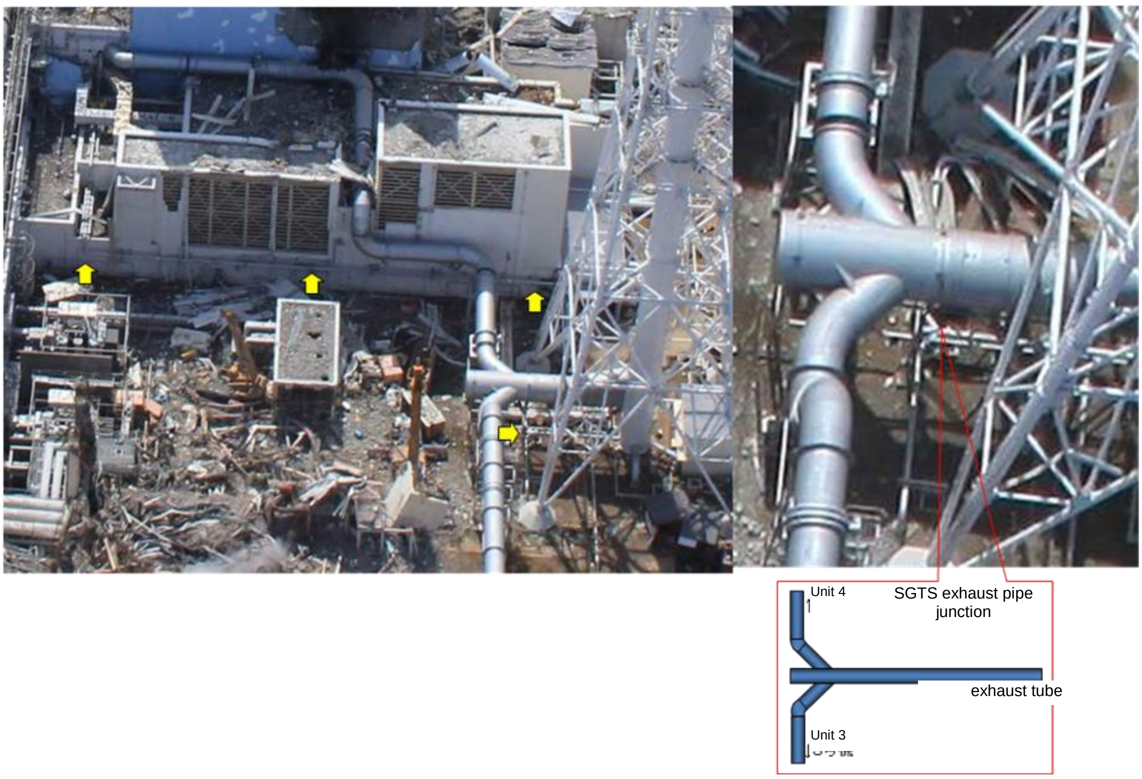


Fig. IV-5-10 Hydrogen flow route from Unit 3 to Unit 4 (estimated)

Fig. IV-5-11 Standby Gas Treatment System exhaust pipe



(5) Unit 5 at the Fukushima Daiichi NPS

1) From the outbreak of the earthquakes until the strike of the tsunami

Unit 5 had been suspended due to a periodic inspection since Jan. 3, 2011. On the day of the earthquake, RPV pressure leakage tests had been conducted with fuel being loaded in the reactor. Further, two 66-kV lines from Yorunomori 1 and 2 of were secured as an external power supply.

On March 11, the 66kV transmission line towers at Yorunomori Line 27 were collapsed when the earthquake hit them and the external power supply was lost. Thus, two emergency DGs were automatically activated.

2) Impact of the tsunami

At 15:40, AC power was totally lost because the two emergency DGs halted due to the flooding of the seawater pumps or damage to the metal-clad switch gear resulting from the tsunami. Loss of function of the seawater pumps disabled the RHR system, resulting in a failure to transfer the decay heat to the ocean, the final heat sink.

In the reactor, the pressure had increased to 7.2 MPa because of the pressure leakage test; however, the equipment that had been applying pressure on the reactor pump halted because of the loss of power supply, leading to a temporary pressure drop. Then, the decay heat caused the pressure to moderately increase, resulting in a pressure of around 8 MPa. At 6:06 on March 12, pressure reduction was performed on the RPV, but the pressure continued to increase moderately because of the decay heat.

3) Control of pressure and water level in the reactor

On March 13, water was successfully injected into the reactor using the condensate transfer pump at Unit 5, which received power from the emergency DG at Unit 6. Accordingly, after 5:00 on March 14, the reactor pressure and the water level were controlled by reducing pressure with the SRV and repeatedly refilling the reactor with water from the condensate storage tank through the condensate transfer pump in parallel.

On March 19, a temporary seawater pump was installed to activate the RHR system. The spent fuel pool and the reactor were alternately cooled by switching the components of the RHR, and the reactor achieved cold shutdown at 14:30 on March 20.

The major events that occurred are described in chronological order in Table IV-5-6.

Table IV-5-6 Fukushima Daiichi NPS, Unit 5 – Main Chronology (Provisional)

	Unit 5
	Situation before the earthquake: stopped
3/11	14:46 Stopped for periodic inspection (pressure inspection under way) 15:40 Loss of all AC power supply
3/12	6:06 Pressure reduction operation on the RPV
3/13	Condensate transfer pump started up by means of power supply from Unit 6
3/14	
3/15	
3/16	
3/17	
3/18	
3/19	5:00 Residual Heat Removal system (RHR) pump (C) started up Completed making (three) holes on the roof in order to prevent hydrogen gas from accumulating within the reactor building
3/20	14:30 Cold shutdown
3/21	11:36 Receiving electricity for metal-clad (M/C) (6C) from starter transformer 5SA (Receiving on-site electricity (for 6.9 kV control panel of power source (6C)) from Yorunomori Line)
3/22	20:13 Receiving electricity for Power Center P/C (P/C) 5A-1 from metal-clad (M/C) (6C)
3/23	17:24 As to Residual Heat Removal Seawater system operated by the temporary pump, test operation after switching its power from temporary to permanent resulted in trip.
3/24	8:48 Receiving electricity in the important seismic isolation building 16:14 The temporary seawater pump of the Residual Heat Removal Seawater system started up, Residual Heat Removal system pump started up by reactor shut-down cooling mode (SHC mode) at 16:35.
3/25	
3/26	23:30 SHC mode (reactor shut-down cooling mode)
3/27	
3/28	Pumped the accumulated water in RHR pump room and CS pump room up to the torus room (continued since March 28th) Drainage from Reactor Building (R/B) (start transfer from CS room → torus room (continued since March 28th))
3/29	
3/30	
3/31	
4/1	
4/2	
4/3	
4/4	
4/5	17:25 Accumulated water discharge to the ocean through the Sub Drain Pit started
4/6	
4/7	

4/8	12:14	Accumulated water discharge to the ocean through the Sub Drain Pit stopped. Amount of discharged water：950 m3
4/9		
4/10		
4/11		
4/12		
4/13		
4/14		
4/15		
4/16		
4/17		
4/18		
4/19		
4/20		
4/21		
4/22		
4/23		
4/24		
4/25		Implemented the tie line with Units 1 and 2 systems generating line
	12:22	Stopped Residual Heat Removal system (RHR) pump cooling the reactor for the preparation for suspension of the power supply
	16:43	Residual Heat Removal system (RHR) pump which had been stopped started up again
4/26		
4/27		
4/28		
4/29		
4/30		
5/1		
5/2	12:00	Stopped Residual Heat Removal system (RHR) pump and temporary Residual Heat Removal system (RHR) pump for the test charging of the start-up voltage regulator of Units 5 and 6 in connection with the work for recovery of the permanent power supply
	15:03	Test charging of the start-up voltage regulator of Units 5 and 6 terminated and Residual Heat Removal system (RHR) pump started up again in connection with the work for recovery of the permanent power supply
5/3		
5/4		
5/5		
5/6		
5/7		
5/8		
5/9		
5/10		
5/11		
5/12		
5/13		
5/14		
5/15		
5/16		

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(6) Unit 6 at the Fukushima Daiichi NPS

1) From the outbreak of the earthquakes until the strike of the tsunami

Unit 6 had been suspended due to a periodic inspection since Aug. 14, 2010. The reactor was in a cold shutdown condition with the fuel being loaded. Further, two 66-kV lines from Yorunomori Line 1 and 2 had been secured as an external power supply.

On March 11, the 66-kV transmission line towers at Yorunomori Line 27 collapsed when the earthquake hit them and the external power supply was lost. Thus, three emergency DGs were automatically started.

2) Impact of the tsunami

At 15:40, two emergency DGs (6A, 6H) halted due to the flooding of the seawater pumps and damage to the metal-clad switchgears resulting from the tsunami. However, one emergency DG (6B) continued to function. Because the emergency DB (6B) was installed in the DG building at a relatively high location rather than the turbine building, it remained in operation. Thus, Unit 6 did not lose AC power completely. Because of the tsunami, the seawater pumps lost their functions.

The pressure in the reactor moderately increased due to the decay heat; however, the rate of increase was more modest than that of Unit 5 because a longer period of time had elapsed after the halt.

3) Control of pressure and water level in the reactor

On March 13, water was successfully injected into the reactor using the condensate transfer pump, which received power from the emergency DG. Accordingly, after March 14, the reactor pressure and the water level were controlled by reducing pressure with the SRV and repeatedly refilling the reactor with water from the condensate storage tank through the condensate transfer pump in parallel.

On March 19, a temporary seawater pump was installed to activate the RHR system. The spent fuel pool and the reactor were alternately cooled by switching the RHR system interchangeably, and the reactor achieved cold shutdown at 19:27 on March 20.

The major events that occurred are described in chronological order in Table IV-5-7.

Table IV-5-7 Fukushima Daiichi NPS, Unit 6 – Main Chronology (Provisional)

* The information included in the table is subject to modifications following later verification. The table was established based on the information provided by TEPCO, but it may include unreliable information due to tangled process of collecting information amid the emergency response. As for the view of the Government of Japan, it is expressed in the main body of the report.

	Fukushima Daiichi Nuclear Power Station
	Unit 6
	Situation before the earthquake: stopped
3/11	14:46 Stopped for periodic inspection 15:36 2 diesel generators (DG) trip
3/12	
3/13	Condensate transfer pump started up
3/14	Decompression by the safety bypass valve
3/15	
3/16	
3/17	
3/18	
3/19	4:22 The second unit of Emergency Diesel Generator (A) started up 5:11 Fuel Pool Cooling and Cleaning System (FPC) pump started up Completed making (three) holes on the roof in order to prevent hydrogen gas from accumulating within the reactor building 21:26 Temporary Remaining Heat Removal Seawater System (RHRS) pump started up 22:14 Remaining Heat Removal System (RHR) (B) started up
3/20	19:27 Cold shutdown
3/21	11:36 Receiving electricity to metal-clad (M/C) (6C) from starter transformer 5SA (Receiving on-site electricity (6.9 kV control panel of power source (6C)) from Yorunomori Line)
3/22	19:17 Started receiving electricity from external power supply (2 systems of emergency control panel of power source (6C, 6D) of 6.9 kV on-site power supply system received electricity from the external power supply, Yorunomori Line)
3/23	
3/24	
3/25	15:38 In operation with power supply for (one) substitute pump for RHRS switched from the temporary to the permanent 15:42 In operation with power supply for (one) substitute pump for RHRS switched from the temporary to the permanent
3/26	
3/27	10:14 RHR operating, reactor shut-down cooling mode (SHC mode)
3/28	
3/29	
3/30	
3/31	

4/1	13:40	Waste Processing Facility (R/W) underground ® drainage to hot well (H/W) (13:40 April 1st to 10:00 April 2nd)
4/2		
4/3		
4/4	21:00	Accumulated water discharge to the ocean through the Sub Drain Pit started.
4/5	17:25	As for the second Sub Drain Pit and succeeding Sub Drain Pits after that, groundwater is being discharged to the ocean by means of three operational pumps.
	18:37	One Sub Drain Pump stopped operation because an unusual sound was detected.
4/6		
4/7		
4/8		
4/9	18:52	Discharge of the low-level radioactive groundwater in Sub Drain Pit stopped with approximately 373 tons of aggregate amount of discharged water
4/10		
4/11		
4/12		
4/13		
4/14		
4/15		
4/16		
4/17		
4/18		
4/19		Transfer from Turbine Building (T/B) ® hot well (H/W)
4/20		
4/21		
4/22		
4/23		
4/24		
4/25		Implemented the tie line with 1/2 systems generating line
4/26		
4/28		
4/29		
4/30		
5/1	14:00	Started the work to transfer accumulated water in the turbine building to an outside temporary tank.
	17:00	Transferred 120 m3 of accumulated water in the turbine building to an outside temporary tank.
5/2	11:03	Stopped the temporary Residual Heat Removal Seawater system (RHRS) pump (for investigation of intake channel).
	13:20	Investigation of the intake channel completed.
	15:03	Residual Heat Removal system (RHR) pump restarted.
5/3		
5/4		
5/5		
5/6		
5/7		
5/8		
5/9		
5/10		
5/11		
5/12		
5/13		
5/14		
5/15		
5/16		

(7) The spent fuel pool at the Fukushima Daiichi NPS

At the Fukushima Daiichi NPS, in addition to the spent fuel pools at Units 1 through 6, a common spent fuel pool is provided for all six reactors. Table IV-5-8 summarizes the capacity, the amount of fuel stored, and the decay heat of the spent fuel stored at these pools. In Unit 4, all fuel had been removed from the reactor because of the shroud replacement work, and the spent fuel pool was being used to store fuel from the core with a relatively high decay heat, so that pool had a higher decay heat than other pools. The condition of Unit 4's spent fuel pool is shown in Figure IV-5-12. On the other hand, because nearly one year had passed since Unit 1's last fuel removal, the decay heat had attenuated. Although the water in the spent fuel pool is usually cooled by releasing heat to the sea, which is the ultimate heat-sink, using FPC (the pool cooling and purification system), cooling failed due to the function loss of both the seawater pumps and the external power supply. In Units 1, 3 and 4, since the upper parts of their buildings were damaged, in order to tentatively secure the cooling function, efforts were made to maintain the proper water levels by external hosing, which was conducted using the Self-Defense Force's helicopters, water cannon trucks, and seawater supply system against fire and squirt fire engines of Emergency Fire Response Teams. Since Unit 4 had the greatest decay heat and the fastest decrease in water level due to evaporation, special attention was paid to it to maintain the proper water level. On the other hand, Unit 2's building remained undamaged, and this was thought to suppress the decrease in water level to some extent as evaporated steam condensed on the building's ceiling; efforts were made to recover the water supply line while maintaining the water level by hosing the opening of the building. On and after March 20, water injection began from the primary water supply line. In Units 5 and 6, the power supply was secured from Unit 6's emergency DG as mentioned above, and the cooling function was also secured using the temporary seawater pump, allowing the spent fuel pool and the reactor to be alternately cooled.

Nuclides from the water of the spent fuel pools of Units 2 through 4 were analyzed. The results of Unit 4 have already been shown in Table IV-5-4, and the analysis results of Units 2 and 3 are shown in Table IV-5-9.

It was confirmed that the common pool was almost full on March 18 and the water temperature was 55°C. On March 21, water was tentatively injected from fire engines and the power supply was restored on March 24, after which cooling was started using the common pool's cooling pump. The major events that occurred are described in chronological order in Table IV-5-10.

Table IV-5-8 Capacity of the spent fuel pool, number of stored assemblies and decay heat.

	Stored assemblies (new fuel assemblies)	Storage capacity	Decay heat	
			At the time of the accident (March 11)	3 months after the accident (June 11)
Unit 1	392 (100)	900	0.18	0.16
Unit 2	615 (28)	1,240	0.62	0.52
Unit 3	566 (52)	1,220	0.54	0.46
Unit 4	1,535 (204)	1,590	2.26	1.58
Unit 5	994 (48)	1,590	1.00	0.76
Unit 6	940 (64)	1,770	0.87	0.73
Common pool	6,375	6,840	1.13	1.12

Table IV-5-9 Nuclide analysis of Unit 2 and 3 spent fuel pools

	Date of sampling	Major nuclides detected	Concentration (Bq/cm^3)
Unit 2	April 16	Cesium 134	160,000
		Cesium 137	150,000
		Iodine 131	4,100
Unit 3	April 28	Cesium 134	140,000
		Cesium 136	1,600
		Cesium 137	150,000
		Iodine 131	11,000

Table IV-5-10 Fukushima Daiichi NPS, Common Spent Fuel Pool – Main Chronology (Provisional)

* The information included in the table is subject to modifications following later verification. The table was established based on the information provided by TEPCO, but it may include unreliable information due to tangled process of collecting information amid the emergency response. As for the view of the Government of Japan, it is expressed in the main body of the report.

	Fukushima Daiichi Nuclear Power Station	
	Common Spent Fuel Pool	
	Situation before the earthquake: stopped	
3/11		The water temperature in Common Spent Fuel Pool before the earthquake: approximately 30°C
3/12		
3/13		
3/14		
3/15		
3/16		
3/17		
3/18	0:00	The water temperature in the pool is 57°C
3/20		
3/21	10:37	Operation of water injection to Common Spent Fuel Pool by fire engines under way
3/22		
3/23		
3/24	15:37	Recovery of the temporary power supply of Common Spent Fuel Pool
	18:05	Cooling pump for the Spent Fuel Pool started up
3/25	15:20	The water temperature in the pool is 53°C
3/26		
3/27	8:00	The water temperature in the pool is 39°C
3/28		The water temperature in the pool is 53°C
3/29		
3/30		
3/31		
4/1		
4/2		
4/3		
4/4		
4/5		
4/6		
4/7		
4/8		
4/9		
4/10		
4/11		
4/12		
4/13		
4/14		
4/15		
4/16		Measures against the stagnant water in order to prevent inflow of groundwater into the building (April 16 to April 18)
4/17	14:36	Temporary power supply for Common Spent Fuel Pool stopped (14:36 to 17:30)
4/18		
4/19		
4/20		

4/21	
4/22	
4/23	
4/24	
4/25	
4/26	
4/27	
4/28	
4/29	
4/30	10:31 In order to reinforce the external power supply for Units 3 and 4 (Okuma 3 Line) from 6.6 KV to 66 KV, 480 V control panel of power source for Unit 4 and 480 V control panel of power source for Common Spent Fuel Pool stopped and recovered at 11:34 to terminate the power supply reinforcement work.
5/1	
5/2	
5/3	
5/4	
5/5	
5/6	
5/7	
5/8	
5/9	
5/10	
5/11	
5/12	
5/13	
5/14	
5/15	
5/16	

Fig. IV-5-12 Condition of the spent fuel pool (Unit 4)

(8) Status of accumulated water in the Fukushima Daiichi NPS

It is confirmed that water has accumulated in the basements of the turbine buildings of Unit 1 to 4, and such water hinders restoration work. In addition, highly concentrated radioactive material has been found existed in the stagnant water in Unit 2. Attention therefore must be paid with respect to the unintentional discharge of such radiation-tainted water into the environment.

It was decided that some of the stagnant water should be transferred to the condenser. In preparation for this, a plan to transfer the water in the condensed water storage tank to the suppression pool water surge tank and then transfer the water in the condenser to the condensed water storage tank was planned and carried out. A schematic diagram of this transfer work is shown in Figure IV-5-13. However, since the water level of the condenser is increasing in Units 1 and 3 and it is necessary to understand why this is happening, other measures are being planned. Specific details of the plan of future work are described in Section X. Measures to Bring the Accident Under Control. Cameras have been installed to monitor the water level in the turbine building basements and are remotely controlled for this objective.

It has also been confirmed that water has accumulated in the vertical shaft of the trench outside the turbine buildings. Work was carried out to transfer some of the accumulated water to the tanks in the buildings on March 31. At the same time cameras were installed in the shafts to remotely monitor water levels. The work to transfer the accumulated water in the trench in Unit 2 to the centralized waste treatment facility commenced on April 19. Prior to this work, both the low-concentration radioactive wastewater existed in the centralized waste treatment facility and the groundwater in the subdrain of Units 5 and 6 which contained radioactive materials were discharged into the sea in order to obtain some space in the treatment facility and prevent equipment important to safety of Units 5 and 6 from being submerged. Details of these operations are described in Section VI. Discharge of Radioactive Materials to the Environment.

Water samplings were carried out from the accumulated water to analyze the nuclides contained within it, and the results are shown in Table IV-5-11. The concentration detected for Unit 2 is some ten times higher than that for Unit 1 or 3. Since it is estimated that the water in the PCV that had been in contact with the damaged fuel has been directly discharged through a certain route, measures have been taken to start treatment of the accumulated water and intensively sample the groundwater and seawater to confirm the safety of environment. In addition, as water was found to be being released into the sea near the intake ports adjacent to the trenches of Unit 2 and Unit 3, the release was terminated on April 6 and on May 11. Details are described in Section VI. Discharge of Radioactive Materials to the Environment

Table IV-5-11 Nuclide analysis result of accumulated water (as of June 5)

Unit		Unit 1	Unit 2	Unit 3	Unit 4
Place of collection		Basement floor of the turbine building	Basement floor of the turbine building	Basement floor of the turbine building	Basement floor of the turbine building
Date of sample collection		2011/3/26	2011/3/27	2011/3/24 (2011/4/22)	2011/3/24 (2011/4/21)
Nuclide detected (half-life) Unit: Bq/cm^3	Molybdate-99 (about 66 hours)	Below detection limit	Below detection limit	Below detection limit (Below detection limit)	1.0×10^{0} (Below detection limit)
	Technetium-99m (about 6 hours)	Below detection limit	Below detection limit	2.0×10^{3} (Below detection limit)	6.5×10^{-1} (Below detection limit)
	Tellurium-129m (about 34 days)	Below detection limit	Below detection limit	Below detection limit (Below detection limit)	1.3×10^{1} (Below detection limit)
	Iodine-131 (about 8 days)	1.5×10^{5}	1.3×10^{7}	1.2×10^{6} (6.6×10^{5})	3.6×10^{2} (4.3×10^{3})
	Iodine-132 (about 2 hours)	Below detection limit	Below detection limit	Below detection limit (Below detection limit)	1.3×10^{1} (Below detection limit)
	Tellurium-132 (about 3 days)	Below detection limit	Below detection limit	Below detection limit (Below detection limit)	1.4×10^{1} (Below detection limit)
	Cesium-134 (about 2 years)	1.2×10^{5}	3.1×10^{6}	1.8×10^{5} (1.5×10^{6})	3.1×10^{1} (7.8×10^{3})
	Cesium-136 (about 13 days)	1.1×10^{4}	3.2×10^{5}	2.3×10^{4} (4.4×10^{4})	3.7×10^{0} (2.4×10^{2})
	Cesium-137 (about 30 years)	1.3×10^{5}	3.0×10^{6}	1.8×10^{5} (1.6×10^{6})	3.2×10^{1} (8.1×10^{3})
	Barium-140 (about 13 days)	Below detection limit	6.8×10^{5}	5.2×10^{4} (9.6×10^{4})	Below detection limit (6.0×10^{2})
	Lanthanum-140 (about 2 days)	Below detection limit	3.4×10^{5}	9.1×10^{3} (9.3×10^{4})	4.1×10^{-1} (4.8×10^{2})

(2) Transfer from condensers to condensate storage tanks		
Unit	Transfer date	Changes in the water level of condensate storage tanks
No. 1	Apr. 3 to 10	5% → 56%
No. 2	Apr. 2 to 9	4% → 88%
No. 3	Mar. 28 to 31	58.2% → 1.2%

(1) Transfer from condensate storage tanks to suppression pool water surge tanks		
Unit	Transfer date	Changes in the water level of condensate storage tanks
No. 1	Mar. 31 to Apr. 2	33% → 5%
No. 2	Mar. 29 to Apr. 1	28% → 4%

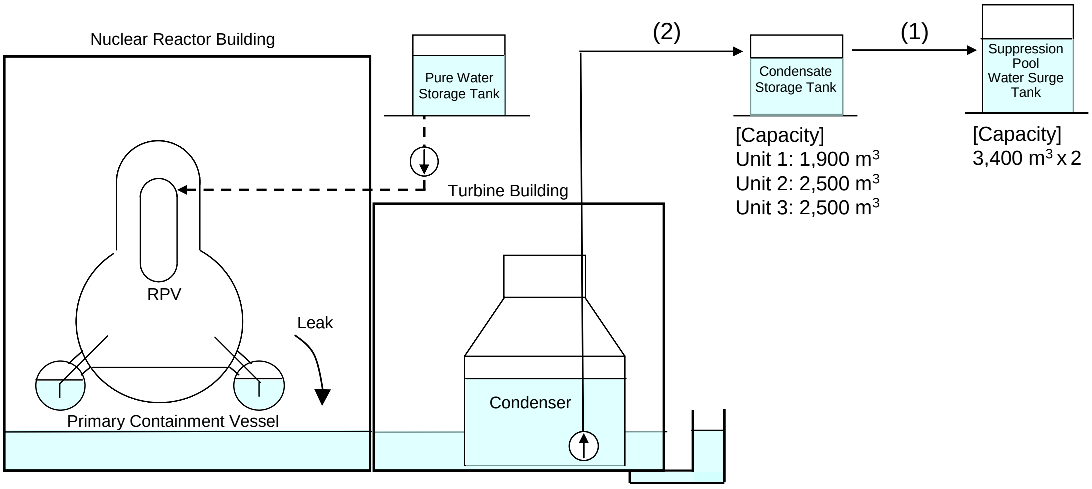


Fig. IV-5-13 Transfer of accumulated water

(9) Fukushima Daini NPS

No significant changes were recorded in the plant data of the Fukushima Daini NPS for Units 1 through 4, prior to the occurrence of the earthquake, and constant rated thermal power operations were being conducted. The live external power sources before the earthquake comprised lines 1 and 2 of the 500 kV Tomioka line and the No. 2 of 66 kV Iwaido line, making three lines in total.

The four nuclear reactors, Units 1 to 4, underwent an automatic shutdown (SCRAM) due to the great seismic acceleration at 14:48 on March 11, and control rods were inserted to the reactors to make them subcritical. The No. 2 of Tomioka line stopped supplying power because of the failure and subsequent repair process of the substation equipment, and additionally, the No. 2 of Iwaido line stopped supplying power approximately one hour after the earthquake.. So the supply of power to Units 1 to 4 was maintained through the No. 1 of Tomioka line. The No. 2 of Iwaido line was recovered from repair at 13:38 on the next day, and the power supply with two lines resumed.
At around 15:34, the tsunami attacked the site of the Daini NPS. This rendered all reactor coolant systems (excluding the RCIC system) including the RHR system for Unit 1 and 2

and all reactor cooling systems (excluding the HPCS system and the RCIC system) including the RHR system for Unit 4 out of operation. The nuclear operator therefore judged that an event defined in Article 10 of the NEPA, “The loss of reactor heat removal,” occurred at 18:33.

1) Unit 1

The reactor was being cooled and the sufficient water level of the reactor core was maintained by the RCIC system and the condensate water supply system. However, as final heat removal could not be realized and the temperature of the SC water exceeded 100°C, the nuclear operator notified the NISA and related departments that the event was judged to correspond to an event defined in Article 15 of the NEPA “Loss of reactor pressure control,” at 05:22 on March 12, and the cooling of the reactor with a drywell spray was started at 07:10 on March 12.

The motors of the RHR system cooling water pump (D) and emergency component cooling water pump (B) necessary for the RHR system (B) operation were replaced with new ones in order to maintain a means of heat removal by the RHR. In relation to the motors of the seawater pump of the cooling system (B) of the RHR system, the cooling water pump (D) of the RHR system, and the emergency component cooling water pump (B), since the power supply panels connected to those motors were rendered inoperable, the power was supplied to those motors from other available power supply panels with provisional cables. As a result, the operation of the RHR system (B) started to cool the suppression chamber at 01:24 on March 14. This continuation of cooling decreased the temperature of the suppression chamber to below 100˚C at 10:15 on March 14, and the reactor itself came into a status of cold shutdown at 17:00 of the same day.

2) Unit 2

The reactor was being cooled, and the sufficient water level of the reactor core was maintained by the RCIC system and the condensate water supply system. However, as final heat removal could not be realized and the temperature of the suppression chamber water exceeded 100°C, TEPCO notified the NISA and related departments that the event was judged to correspond to an event defined in Article 1 of the NEPA “Loss of reactor pressure control,” at 05:32 on March 12., Following this, the cooling of the reactor with a D/W spray was started at 07:11 on March 12.

As regards the motors of the seawater pump (B) of the cooling system of the RHR system, the cooling water pump (B) of the RHR system, and the emergency component cooling water pump (B), since the power supply panels connected to those motors were rendered inoperable, the power was supplied to those motors from other available power supply panels with provisional cables in order to maintain a means of heat removal by RHR. As a result, the operation of the RHR system (B) started to cool the suppression chamber at 07:13 on March 14.

Cooling continued, and the SC temperature decreased to below 100˚C at 15:52 on March 14, and the reactor itself achieved cold shutdown at 18:00 of the same day.

3) Unit 3

Although the RHR system (A) and the LPCS system of Unit 3 failed because of the tsunami damage, the RHR system (B) was not damaged and was able to continue its operation. Thus cooling by this system continued and put the reactor into a status of cold shutdown at 12:15 on March 12.

4) Unit 4

The reactor was being cooled, and the sufficient water level was maintained by the RCIC system and the condensate water supply system. However, as final heat removal could not be realized and the temperature of the SC water exceeded 100°C, the nuclear operator concluded that an event corresponding to an emergency situation defined in Article 15 of the NEPA (loss of reactor pressure control) had occurred and notified the Prime Minister at 06:07 on March 12.

In order to secure a means of heat removal by RHR, the motors of the RHR cooling water pump (B) necessary for RHR (B) were replaced. Since the power supply panels connected to the motors of the seawater pump (D) of the cooling system of the RHR system, the cooling water pump (B) of the RHR system, and the emergency component cooling water pump (B) were rendered inoperable, the power was supplied to these motors from other available power supply panels with provisional cables. As a result, the operation of the RHR system (B) started to cool the suppression chamber at 15:42 on March 14.

As cooling then continued, it decreased the SC temperature to below 100˚C and put the reactor into cold shutdown at 07:15 on March 15.

The time series of major events are shown in Table IV-5-12.

Table IV-5-12 Fukushima Daini NPS, Main Chronology (Provisional)

* The information included in the table is subject to modifications following later verification. The table was established based on the information provided by TEPCO, but it may include unreliable information due to tangled process of collecting information amid the emergency response. As for the view of the Government of Japan, it is expressed in the main body of the report.

	Overall	Unit 1	Unit 2	Unit 3	Unit 4
		Status before earthquake: Under operation	Status before earthquake: Under operation	Status before earthquake: Under operation	Status before earthquake: Under operation
3/11	14:46 Great East Japan Earthquake strikes				
		14:48 All control rods inserted (subcriticality confirmed) Automatic reactor shutdowr Automatic turbine shutdowr External power being supplie Main steam isolation valve; closed	14:48 All control rods inserted (subcriticality confirmed] Automatic reactor shutdowr Automatic turbine shutdowr External power being supplie Main steam isolation valve; closed	14:48 All control rods inserted (subcriticality confirmed] Automatic reactor shutdowr Turbine automatic shutdowr External power being supplie Main steam isolation valve; closed	14:48 All control rods inserted (subcriticality confirmed) Automatic reactor shutdowr Automatic turbine shutdowr External power being supplie Main steam isolation valve; closed
	17:35 Unit 1: Operator judges that a Specific Initial Event falling under Article 10 of the NEPA (leakage of reactor coolant) has occurred.	17:35 Operator judges that a Specific Initial Event falling under Article 10 of the NEPA (leakage of reactor coolant) has occurred. (the operator judges that there is no leakage of reactor coolant as of 19:30			
	18:33 Units 1, 2 4: Operator judges that a Specific Initial Event falling under Article 10 of the NEPA (loss of reactor heat removal function) has occurred.	18:33 Operator judges that a Specific Initial Event falling under Article 10 of the NEPA (loss of reactor heat removal function) has occurred.	18:33 Operator judges that a Specific Initial Event falling under Article 10 of the NEPA (loss of reactor heat removal function) has occurred.		18:33 Operator judges that a Specific Initial Event falling under Article 10 of the NEPA (loss of reactor heat removal function) has occurred.
		Emergency Core Cooling System (ECCS) high pressure system: not operating ECCS low pressure system: manually shut down after actuation (at 20:00)	Emergency Core Cooling System (ECCS) high pressure system: manually shut down after actuatior ECCS low pressure system: manually shut down after actuation (at 20:00)	Emergency Core Cooling System (ECCS) high pressure system: prevention of actuation beforehanc ECCS low pressure system: prevention of actuation beforehand Emergency diesel generator (D/G) (B), (H) operating with no load Residual Heat Removal (RHR) system normal	Emergency Core Cooling System (ECCS) high pressure system: prevention of actuation beforehanc ECCS low pressure system: prevention of actuation beforehand Emergency D/G (H) operating with no load. (at 20:00]
3/12	5:22 Unit 1: Operator judges that an Event falling under Article 15 of the NEPA (loss of reactor pressure suppression function) has occurred.	5:22 Operator judges that an Event falling under Article 15 of the NEPA (loss of reactor pressure suppression function) has occurred.			
	5:32 Unit 2: Operator judges that an Event falling under Article 15 of the NEPA (loss of reactor pressure suppression function) has occurred.		5:32 Operator judges that an Event falling under Article 15 of the NEPA (loss of reactor pressure suppression function) has occurred.		
	6:07 Unit 4: Operator judges that an Event falling under Article 15 of the NEPA (loss of reactor pressure suppression function) has occurred.				6:07 Operator judges that an Event falling under Article 15 of the NEPA (loss of reactor pressure suppression function) has occurred.Operator judges that an
		7:10 Dry well (D/W) spraying started			
			7:11 Dry well (D/W) spraying started		
		8:19 Control rod (DR) 10-51 drift alarm sounded			
				9:36 RHR (B) shutdown cooling mode	
		9:43 Containment Vessel (PCV) preparation started			
			10:33 Containment Vessel (PCV) preparation started		
		10:43 Control rod (DR) 10-51 drift alarm cleared			
			10:58 PCV vent preparation completed		
					11:17 HPCS system activatec
					11:44 Containment Vessel (PCV) preparation started
					11:52 PCV vent preparation complete
				12:08 Containment Vessel (PCV) preparation started	
	12:15 Unit 3: Reactor cold shutdown			12:13 PCV vent preparation complete	
				12:15 Reactor cold shutdown	
		18:30 PCV vent preparation complete			
3/13		2:03 Control rod (DR) 10-51 drift alarn Control rod (DR) 10-51 drift alarm cleared (as of 12:00)			12:43 Control rod (DR) 10-19 drift alarm sounded
3/14	1:24 Unit 1: Cooling started using Residual Heat Removal system (RHR) (B)	1:24 Cooling started using Residual Heat Removal system (RHR) (B)			
	7:13 Unit 2: Cooling started using RHR (B)		7:13 Cooling started using Residual Heat Removal system (RHR) (B)		
			7:50 Suppression Chamber (S/C) spraying (using RHR (B)) started		
	15:42 Unit 4: Cooling started using RHR (B)				15:42 Cooling started using Residual Heat Removal system (RHR) (B)
	17:00 Unit 1: Reactor cold shutdown	17:00 Reactor cold shutdown			
	18:00 Unit 2: Reactor cold shutdown		18:00 Reactor cold shutdown		
	22:07 Operator judges that a Specific Initial Event falling under Article 10 of the NEPA (increase in radiation within site limits) has occurred. (Is assumed to be the effects of Fukushima Daiichi NPS)				
3/15	0:12 Operator judges that a Specific Initial Event falling under Article 10 of the NEPA (increase in radiation within site limits) has occurred. (Is assumed to be the effects of Fukushima Daiichi NPS)				
	7:15 Unit 4: Reactor cold shutdown				7:15 Reactor cold shutdown
3/16					
3/17				9:55 Restored to normal status from PCV vent preparation completed status	
					11:24 Restored to normal status from PCV vent preparation completed status
			17:19 Restored to normal status from PCV vent preparation completed status		
		17:22 Restored to normal status from PCV vent preparation completed status			
3/18					
3/19		15:28 RHR (B) shut down (for inspection of RHRC system pump)			
		22:14 RHR pump (B) start-up			
3/20				14:36 RHR (B) shut down (to switch to Suppression Chamber (S/C) cooling)	
				15:05 RHR pump (B) start-up S/C cooling started	

	Overall	Unit 1	Unit 2	Unit 3	Unit 4
		Status before earthquake: Under operation	Status before earthquake: Under operation	Status before earthquake: Under operation	Status before earthquake: Under operation
3/21					
3/22					
3/23					
3/24					
3/25					
3/26					
3/27				10:50 RHR (B) shut down Currently switching RHR operation mode	
3/28					
3/29					10:52 RHR pump (B) shut down (for inspection of intake)
					14:00 RHR pump (B) start-up
3/30			10:25 RHR (B) shut down (for installation of temporary power system)		
		10:34 RHR (B) shut down (for installation of temporary power system)			
			14:04 RHR (B) start-up		
		14:30 Acquisition of RHR (B) back-up power (emergency power) RHR (B) start-up			
		17:56 Detection of smoke occurrence from power board located in 1F of turbine			
		18:13 After shutdown of power supply, disappearance of smoke was confirmed			
		19:15 It was concluded that smoke occurrence was caused by abnormal condition of power board and therefore not by the fire			
3/31					14:35 RHR (B) shut down (reactor shutdown cooling mode (SHC) + Suppression Chamber cooling mode (S/C)→ SHC + S/C + Fuel Pool Cooling mode (FPC)
4/1					15:36 RHR (B) activated
		13:43 RHR pump (B) shut down (for inspection of intake)			
		15:07 RHR pump (B) start-up			
4/2					
4/3					
4/4					
4/5					
4/6					
4/7					
4/8					
4/9					
4/10					
4/11					
4/12					
4/13					
4/14					
4/15					
4/16					
4/17					
4/18					
4/19					
4/20					
4/21					
4/22					
4/23					
4/24					
4/25					
4/26					
4/27					10:20 RHR (B) shut down (for switching of power system)
					17:41 RHR (B) activated
4/28					
4/29					
4/30		9:10 RHR (B) shut down (for inspection of intake waterway)			
		12:54 RHR (B) activated			
5/1					
5/2					
5/3					
5/4					
5/5					
5/6					
5/7					
5/8					
5/9				9:51 RHR (B) shut down (for inspection of intake waterway)	
				14:46 RHR (B) activated	
5/10					
5/11					
5/12			9:36 RHR (B) shut down (for inspection of intake waterway		
			12:13 RHR (B) activated		
5/13					
5/14					
5/15					
5/16					

6. Situation at Other Nuclear Power Stations

(1) Higashidori Nuclear Power Station

Unit 1 was under periodic inspection at the time of earthquake occurrence on March 11, and all the fuel in the reactor core had been taken out and placed into the spent fuel pool.

Since all of the three lines of off-site power supply had stopped due to the earthquake, off-site power supply was lost and the emergency DG (A) (the emergency DG (B) was under inspection) fed power to the emergency generating line.

After the off-site power supply was lost due to the Miyagi Earthquake occurred on April 7, emergency DGs started, and the power was securely restored. Following this, although off-site power supply was restored, the emergency DGs stopped operation in an incident, and all the emergency DGs became inoperable.

(2)Onagawa Nuclear Power Station

Units 1 and 3 were under constant rated thermal power operation at the time the earthquake occurred on March 11 and Unit 2 was under reactor start-up operation. Four out of the five lines of off-site power supply stopped as a result of the earthquake, but off-site power supply was maintained through the continued operation of one power line.

The reactor at Unit 1 tripped at 14:46 due to seismic acceleration high, and the emergency DGs (A) and (B) started automatically. Since the start-up transformer stopped due to an earth fault/ short-circuit in the high-voltage metal-clad switchgear caused by the earthquake at 14:55, this led to a loss of power supply in the station. The emergency DGs (A) and (B) fed power to the emergency generating line.

Since all feed water/condensate system pumps stopped due to loss of normal power sources, the RCIC fed water to the reactor and the Control Rod Hydraulic System fed water after reactor depressurization. Since the condenser was unavailable due to the stoppage of the circulating water pump, the MSIV was totally closed, the cooling and depressurization operations of the nuclear reactor were performed by the RHR and the SRV, and the reactor reached a state of cold shutdown with a reactor coolant temperature of less than 100°C at 0:57 on March 12. Since the reactor was in start-up operation, Unit 2 shifted promptly to cold shutdown because the reactor had stopped automatically at 14:46 as a result of the great seismic acceleration. The emergency DGs (A), (B) and (H) automatically started due to issuance of a field failure signal from the generator at 14:47. But the three emergency DGs remained in a stand-by state since off-site power source was secured.

Subsequently, because the reactor auxiliary component cooling water system B pump, reactor cooling seawater system (RSW) B pump, and the high-pressure core spray auxiliary component cooling system pumps were inundated as a result of the tsunami and lost functions, the emergency DGs (B) and (H) tripped. However, because the component cooling water system A pump was intact, there was no influence on the reactor's cooling function.

The reactor at Unit 3 tripped at 14:46 due to seismic acceleration high. The off-site power source was maintained but the turbine component cooling seawater pump was stopped due to inundation by tsunami. All the feeding water/condenser pumps were then manually stopped and the RCIC fed water to the reactor. In addition, the control rod hydraulic system and condensate water makeup system fed water to the reactor after the reactor depressurization.

Since the condenser was unavailable due to the stoppage of all circulating water pumps resulted from undertow of the tsunami, the MSIV was totally closed and cooling and depressurization operations of the reactor were performed by the RHR and the SRV, leading the reactor to a state of cold shutdown with a reactor coolant temperature of less than 100°C at 1:17 on March 12.

(3) The Tokai Daini Power Station

The Tokai-Daini Power Station was under constant rated thermal power operation at the time of earthquake occurrence on March 11. At 14:48 on the same day, the reactor tripped due to turbine trip caused by turbine shaft bearing vibration large signal due to the earthquake. Immediately after the occurrence of the earthquake, all three off-site power source systems were lost. However, the power supply to the equipment for emergency use was secured by the activation of three emergency DGs.

The HPCS and the RCIC started automatically in response to the fluctuation of the water level immediately after the trip of the reactor, and the water level of the reactor was kept at a normal level. The water level of the reactor was then maintained by the RCIC, and the pressure of the reactor was controlled by the SRV. Moreover, RHRs A and B were manually started in order to cool the S/C for decay heat removal after the nuclear reactor tripped.

Subsequently, the DG2C seawater pump for emergency use tripped as a consequence of tsunami and the DG2C pump became inoperable. But the remaining two DGs secured power supply to the emergency equipment, and the cooling of the S/C was maintained by residual heat removal system RHR (B).

One off-site power supply system was restored at 19:37 on March 13, and the nuclear reactor reached a state of cold shutdown with a coolant temperature of less than 100°C at 0:40 on March 15.

Figure IV-6-1 Map showing the Location of Nuclear Power Stations

7. Evaluation of accident consequences

In the wake of the occurrence of loss of functions in many facilities due to an extensive earthquake and a tsunami, items to be improved in the future will be identified by evaluating a variety of aspects.

(1) Causes of the accident at the Fukushima-Daiichi Nuclear Power Station

Units 1, 2 and 3 of the Fukushima-Daiichi Nuclear Power Station lost all off-site power sources immediately after the earthquake. But the emergency DGs started operation and secured on-site power supply, maintaining the normal operation of cooling systems of the RCIC and the IC.

Then, due to an attack of tsunami, the emergency DGs and the metal-clad switchgear were inundated and covered with water, resulting in loss of all AC power. The seawater cooling system was also covered with water and the function to transport heat to the sea, which is the ultimate heat sink, was lost.

Since all AC power was lost (dc power was also lost for unit 1), the IC of Unit 1 became inoperable. In addition, reactor core cooling of Units 2 and 3 also stopped following the depletion of dc power (in the form of a storage battery) and the halt of cooling water supply. Damage to the reactor began due to the lowering of the water level in the reactor core, resulting in eventual core melt.

Despite the fact that the emergency DGs and the seawater cooling system of the Fukushima-Dai-ni Nuclear Power Station were hit by the earthquake and the tsunami, continued power supply from the off-site power source maintained the water level of the reactor. Additionally, since monitoring of plant conditions was also possible, plant management was possible to control the reactor, and high temperature shutdown could be maintained in a stable way. Meanwhile, recovery efforts, such as the exchange of the electric motors of the seawater cooling system that was covered with water due to tsunami, were conducted, and the system reached a state of cold shutdown within a number of days. Similarly, the Onagawa Nuclear Power Station and the

Tokai-Daini Power Station, also hit by the earthquake and the tsunami, reached cold shutdown states since off-site or on-site power supplies were secured.

From these facts, the direct cause of the accident in Units 1, 2 and 3 of the Fukushima-Daiichi Nuclear Power Station is thought to have been the loss of all power sources, which led to the failure of cooling the reactor core, then damage to the reactor core, resulting in a core melt.

In the light of these facts, it appears that, in cases of complete loss of ac power and losses of seawater and water cooling functions, a power supply necessary for operating the cooling systems, such as the RCIC and a water supply necessary for reactor core cooling, are indispensable. Extensive measures such as prior securing of essential machines and materials and the preparation of response plans such as manuals to be used in case of emergency, were necessary for emergency measures.

(2) Evaluation from the standpoint of preventing accidents: Countermeasures for earthquakes and tsunamis

The accident was caused by the attack of an earthquake and a tsunami.

At present, damage caused by the earthquake was concerned with off-site power supply systems. Damage to safety-important systems and components was not confirmed, and the plant was in a manageable condition until the arrival of the tsunami. However, detailed nature of the destruction has not been clear and remains to be seen. In addition, it has been verified that the acceleration response spectrum of the seismic ground motion observed on the basement of the reactor building of the Fukushima-Daiichi Nuclear Power Station exceeds the acceleration response spectrum at the same location relative to standard design ground motion Ss settled on based on the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities in a part of the oscillation band. Evaluation of seismic safety by seismic response analysis for the reactor buildings and major safety-important systems is necessary in the future (units 2 and 4 will be evaluated by the middle of June and units 1 and 3 by the end of July).

As for off-site power supply systems, each unit was connected to the power system by more than one power line in accordance with Guideline 48(G48) of Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities (Electrical Systems), and the redundancy requirement was satisfied. However, the point of the Guideline is to secure a reliable off-site power supply, although this is not clearly required in the Guideline.

For instance, the following events occurred in the accident:

- Actuation of protective devices due to collapse and short-circuits of transformers at the major substations connected to the Fukushima-Daiichi Nuclear Power Station.
- The switching stations (Units 3 and 4 and Units 5 and 6) where the off-site power supply is received were damaged by the tsunami. The power receiving circuit breaker was destroyed in Units 1 and 2 due to the earthquake.

Considering these facts, the facilities were not sufficiently prepared in the context of securing resistance to earthquakes, independence, and reducing the likelihood of common cause failure.

As for tsunami, the design tsunami height at Fukushima-Daiichi NPS was O.P. + 5.7 m. But experts estimated that tsunami of 10 m or higher attacked, though no record of tide gauge readings was available as described in III 2(1). Consequently, water tightness of buildings and other facilities in some plants was insufficient for tsunami of such height, and this resulted in total loss of power, including DC power supply, which was outside the scope of design. The design tsunami height at Fukushima-Daini NPS was estimated to be O.P. + 5.2 m. As described in III 2(2), neither record of tide gauge readings nor the height estimated by experts is available, and it is not sure how high the tsunami was. Nevertheless, it is considered that the actual tsunami height exceeded the design tsunami height.

Documented procedures did not assume ingress of tsunami, but specified only operation of stopping circulating water pumps used for cooling condensers as measures against undertow. The PSA referred to in accident management survey of these units did not take into account long time loss of functions of emergency DGs and loss of ultimate heat sink, which could be caused by tsunami.

Just like other equipment, emergency DGs in most units became inoperable due to loss of the emergency DG main units, sea water pumps for cooling, and the metal-clad switchgear. On the other hand, Units 5 and 6 of Fukushima-Daiichi NPS kept operating after tsunami, and kept supplying AC power required for removing residual heat at both Units 5 and 6 through a tie line. This is because the metal-clad switchgear, and the air-cooled emergency DG(B) for Unit 6, which is installed in the emergency DG building and requires no sea water pump for cooling, escaped inundation. This indicates the importance of assuring not only redundancy but also diversity of equipment of especially high importance for safety, from the aspects of arrangements and operation methods.

It is known that Units 2 and 4 of Fukushima-Daiichi NPS are equipped with air-cooled emergency DGs in the common pool building but these units became inoperable as the metal-clad switchgear connecting the DG to an emergency bus line was inundated. This indicates that it is very important to pay close attention to securing of system diversity to eliminate common cause failures.

(3) Main factors that developed the events of accident

This accident resulted in serious core damage in Units 1 through 3 of Fukushima-Daiichi NPS. But Units 5 and 6 of Fukushima-Daiichi NPS and Units 1 through 4 of Fukushima-Daini NPS succeeded in cold shutdown without causing core damage. If any disturbance occurs in a plant during power operation, such as an event of loss of off-site power supply, the following three functions are required to shift the plant into the cold shutdown state; reactor sub-criticality maintenance, core cooling, and removal of decay heat from PCV. Figures IV-7-1 through IV-7-3 show function event trees indicating event sequences these plants followed. These function event trees develop event sequences headed by main functions, such as reactor sub-criticality maintenance, core cooling, removal of decay heat from PCV, AC power, water injection to PCV, and hydrogen control, which were caused by the earthquake and accompanying tsunami and are considered to have seriously affected the progress of events before and after core damage. Estimated event sequences of this accident are shown by thick lines. Based on the above-mentioned event sequences, whether or not a unit suffered from core damage in this accident was mainly estimated by the following events:

a) AC power was not recovered early because:
- it was impossible to interchange electricity because of simultaneous loss of AC power for neighboring units,
- metal-clad switchgear and other accessory equipment were inundated due to tsunami, and
- off-site power supply and emergency DG was not recovered early.

b) Due to accident management carried out at the time of total AC power loss, core cooling was maintained for some time but was not sustained up until recovery of power supply.

c) The tsunami caused loss of functions of the system of transporting heat to the sea, which is the ultimate heat sink.

d) There was no sufficient means to substitute for the function of removing decay heat from PCV.

Next we evaluate whether or not regulatory guides established by the NSC Japan specify safety assurance measures against events that occurred or are estimated to occur in Fukushima-Daiichi NPS and Fukushima-Daini NPS as design requirements for nuclear power stations. If regulatory guides specify such design requirements, we further evaluate whether or not each nuclear power station was designed to satisfy the requirements. We also evaluate whether PSA took these events into consideration and whether or not the accident management, which had been developed by TEPCO under the accident management guidelines, functioned effectively.

1) Tohoku District - Off the Pacific Ocean Earthquake.

It has been confirmed that acceleration response spectra of seismic ground motions caused by this earthquake and observed in the basement of reactor buildings of Fukushima-Daiichi NPS exceeded the acceleration response spectrum of the design basis earthquake ground Motion (DBEGM) Ss in the basement determined under the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities. However, damage caused by the earthquake was found in the off-site power supply system and no serious damage was found in safety-important systems and components in nuclear facilities. They were kept under control until the tsunami arrived, but detailed damage states are still unknown, requiring further investigations.

Back-check of seismic safety is being carried out for existing nuclear power reactors. Tsunami assessment was not covered in the interim reports submitted by TEPCO regarding Units 3 and 5 of Fukushima-Daiichi NPS and Unit 4 of Fukushima-Daini NPS. Reviews of tsunami were to be carried out later, though government agencies finished reviews of the earthquake. Assessment of residual risks was being carried out by licensees.

2) Loss of off-site power supply

Guideline 48 (Electrical Systems) of the Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities specifies that the external power system shall be connected to the electric power system with two or more power transmission lines. However, it did not give sufficient consideration on measures to reduce possibilities of common cause failures, for example, by using the same pylon for both lines.

On the contrary, events of loss of off-site power supply are taken as design basis events in the Regulatory Guide for Reviewing Safety Assessment of Light Water Nuclear Power Reactor Facilities. TEPCO installed at least two emergency DG for each unit, having a sufficient capacity to activate required auxiliary systems.

In the internal event PSA and the earthquake PSA, loss of off-site power supply is assessed as one of initiating events and induced events. The earthquake PSA did not sufficiently examine measures to prevent loss of off-site power supply in order to reduce occurrence of total AC power loss, with the knowledge that total AC power loss is a critical event leading to core damage.

For example, sufficient consideration was not given to the following actions required for improving reliability of off-site power supply and auxiliary power system.

- Assessment to assure reliability of supplying power to nuclear power stations if a main substation stops supply
- Measures to improve reliability by connecting external power transmission lines to units at the site
- Seismic measures for external power lines (power transmission lines)
- Tsunami countermeasures for power receiving equipment in switching stations

Considerations should also have been given to measures to prevent metal-clad switchgear, storage batteries, and other power supply equipment from being inundated.

An assessment technique for tsunami accompanying earthquake (tsunami PSA) is under development now.

3) Tsunami

TEPCO voluntarily assessed the design tsunami height based on the largest tsunami wave source in the past by using the Tsunami Assessment Method established in 2002 by the Japan Society of Civil Engineers, and took such measures as raising the installation level of pumps and making buildings and other facilities water-tight, based on the assessment results. Nevertheless, the tsunami accompanying the earthquake was higher than the design tsunami height estimated by TEPCO. The design tsunami height at Fukushima-Daiichi NPS was estimated to be O.P. + 5.7 m based on the above-mentioned tsunami assessment method. But experts estimated that tsunami of 10 m or higher arrived, though no record of tide gauge readings was available as described in III 2(1). The design tsunami height at Fukushima-Daini NPS was estimated to be O.P. + 5.2 m. As described in III 2(2), neither record of tide gauge readings nor value estimated by experts was available, and it is not sure how high the tsunami was. Nevertheless, it is considered that the actual tsunami height exceeded the design tsunami height. Documented procedures did not anticipate the ingress of tsunami, but specified only operation of stopping circulating water pumps used for cooling condensers as measures against undertow.

4) Loss of Total AC Power Supply

In the PSA referenced in deriving the level of the accident management system that has been established to date, no consideration has been given to the long-term functional loss of the emergency DGs and loss of the power supply interchange capability between adjacent nuclear reactors.

For the PSA concerning tsunami, assessment methods are under development at present, and trial assessments have been carried out as part of the method development. Such assessments recognized the importance of the above-mentioned functional losses including consideration of simultaneous functional losses of the emergency DG, metal-clad switchgear, etc. that are caused by tsunami, but never leading to reflection in the accident management system. In other words, the analysis of the threat that could cause such a situation was insufficient in considering measures against the total loss of the AC power supply.

In addition, as part of accident management, facilities are provided that ensure interchange of the power supply for the working-use AC power supply (6.9 kV) and low-voltage AC power supply (480 V) between adjacent nuclear reactor facilities, and the documented procedures for the facilities were specified. For Unit 1 through Unit 4 at Fukushima-Daiichi NPS, however, this accident management system did not function effectively since the adjacent units were also subject to the total loss of the AC power supply.

5) Securement of Alternative AC Power Supply (Power Supply Vehicle, etc.)

In the PSA referenced in deriving the accident management system that has been established to date, it was regarded that the probability leading to a serious accident would be sufficiently reduced by giving consideration to the power supply interchange, recovery of the off-site power supply and the emergency DG. For this reason, the securement of a power supply vehicle, etc. was not considered as part of accident management.

This time, as an ad hoc applicable operation, a power supply vehicle was arranged to be carried in the site. But, this could not be utilized smoothly due to the difficult access caused by defects, etc., of the heavy machinery for removing rubble and debris generated by the influence of the tsunami, and water damage of a metal-clad switchgear that was also caused by the tsunami.

6) Securement of Alternative DC Power Supply (Temporary Storage Battery, etc.)

In the PSA referenced in deriving the accident management system that has been established to date, a mechanical failure of a storage battery has been considered, and a period of time during which the DC power supply must function has been defined as 8 hours in the event tree of the off-site power supply loss event. In consideration of the presence or absence of power supply recovery within 8 hours, if the off-site power supply fails to recover during this period, it is assessed that the RCIC system could not continue running. As a result, it was assessed that the off-site power supply might be more likely to recover, and loss of the DC power supply facilities would not be an event having a significant influence on the risk. Therefore, the preparation of temporary storage batteries was not a matter to be dealt with.

In this accident, arrangements were made for carrying the storage batteries in the site. But, since carry-in works were difficult and such work was performed in the dark due to the impact of the earthquake and tsunami disasters, difficulties arose in the recovery of the operation of the equipment following the accident, and the operation of the instrumentation system for recording plant parameters. Furthermore, the plant parameters that serve as important data in developing preventive measures after termination of the accident could not be sufficiently saved.

7) Measures Against Functional Loss of Seawater Pump (Loss of Ultimate Heat Sink)

In the PSA referenced in deriving the accident management system that has been established to date, the functional loss of a seawater pump has been considered in a fault tree related to loss of the residual heat removal capability, but no consideration has been given to the simultaneous functional losses of all the seawater pumps due to tsunami.

For the PSA concerning tsunami, assessment methods are under development at present, and trial assessments have been carried out as part of the method development. Such assessments indicated that the risk sensitivity of an event in which simultaneous functional losses of all the seawater pumps are generated due to tsunami was high. However, being a result of trial assessment, this was not shared widely among those involved, which never brought the importance of this accident management to their attention.

In this accident, as an ad hoc applicable operation, the measures were taken for replacing the seawater pumps suffering from functional losses with temporary seawater pumps, but this was not intended to be provided as part of the accident management.

8) PCV Vent

The PCV venting facilities were put in place as part of accident management before and after damage of the core. In the case of this accident, venting was performed after damage of the core due to depressurization of the reactors and the delay of water injection. Because of the total loss of the AC power supply, motor driven valves had to be opened manually for the PCV venting operations. For operation of pneumatically-actuated valves, the pressurized air required for operating such valves could not be assured, and thus a temporary air compressor had to be mounted to assure the pressurized air. For such reasons, the facilities could not be operated in accordance with the documented operation procedures for severe accidents, which caused the PCV venting operation to be delayed.

9) Alternative Water Injection (Depressurization of Reactor Vessel, Alternative Water Injection Line)

The systems for alternative water injection, including depressurization operations of the reactors and the subsequent utilization of fire pumps, were put in place as part of the accident management. In this accident, depressurization and the subsequent cooling operations of the reactors were carried out using those systems. Due to the total loss of AC power supply, however, difficulties arose in assuring the air pressure for driving the SRV necessary for depressurization and maintaining the excitation of the electromagnetic valves in the air supply line, resulting in time-consuming depressurization operations. Alternative water injection into the reactors, using heavy machinery such as fire engines, was not considered as part of the accident management, but in this accident, as an ad hoc applicable operation, water injection into the reactor using a chemical fire engine that was present at the site was attempted. Nevertheless, since the reactor pressure was higher than the pump discharge pressure of the chemical fire engine, injection of freshwater into the reactor was not available in a few cases.

10) Alternative Water Injection (Water Sources)

As water sources used for alternative water injection, a condensate storage tank and a filtrate tank were considered as part of the accident management, and those tanks were practically utilized. As water sources utilized by a fire engine, a fire-prevention storage tank and seawater were used, but work was required to line up the water injection line.

11) Measures against Hydrogen Explosion at Reactor Building

The Guideline 33 (System for Controlling Containment Facility Atmosphere) of the Regulatory Guide for Reviewing Safety Design of

Light Water Nuclear Power Reactor Facilities requires the provision of functions capable of controlling the atmosphere of the containment facilities so as to ensure safety against assumed events. To meet this requirement, the FCS was installed at BWR plants along with inactivation inside the PCV. No requirements are specified for measures against hydrogen explosion at the reactor building. Also, the Common Confabulation Interim Report which deals with "beyond design basis events" does not describe such requirements.

The PSA includes a scenario in which hydrogen arising from meta-water reaction following core damage, and from the radiolysis of water, leaks from the PCV into the reactor building filled with the normal air resulting in burning inside the reactor building in a severe accident, but this is an assessment from a viewpoint of the integrity of the PCV, and no discussions were made for damage to the reactor building.
It was expected that the FCS installed to cope with the design basis events would be available under the severe accident environment as well. But, since power supplies were not available this time, this capability was not utilized.

For measures against a hydrogen explosion at the reactor building, no consideration was given to the facilities or the documented procedures.

12) Alternative Water Injection into Spent Fuel Pool and Cooling

The Guideline 49 (Fuel Storage Facilities and Fuel Handling Facilities) of the Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities requires a system capable of removing the decay heat and transfer it to the sea, the ultimate heat sink, in the spent fuel pool. However, there are no requirements for the capability to perform alternative water injection in preparation for the case of loss of ultimate heat sink. As it is considered that the risk presented by the spent fuel pool is sufficiently smaller compared to the reactor, there are fewer PSA implementation examples for the spent fuel pool. In the PSR at Unit 1 of Fukushima-Daiichi NPS that was published in March 2010, the PSA was implemented for the spent fuel pool when all of the fuel rods in the reactor were taken out into the spent fuel pool. But, since the risk was thought to be small, no consideration was given to the facilities or documented procedures related to the injection of seawater into the spent fuel pool.

13) Water Injection into D/W for Cooling Reactor or PCV

Further, in addition to installing alternative capabilities, as part of the accident management for water injection into the space of a foundation (pedestal) supporting the RPV in the D/W, TEPCO put the capability to perform water injection using the same piping as the alternative spray capability in place.

The PCV pressure increased in Unit 3 during this time. For depressurization, spray to the S/C was used, and it was confirmed that the accident management system functioned properly. In Units 1 and 2, the PCV vent was superseded, and thus the PCV spray (D/W and S/C) was not performed.

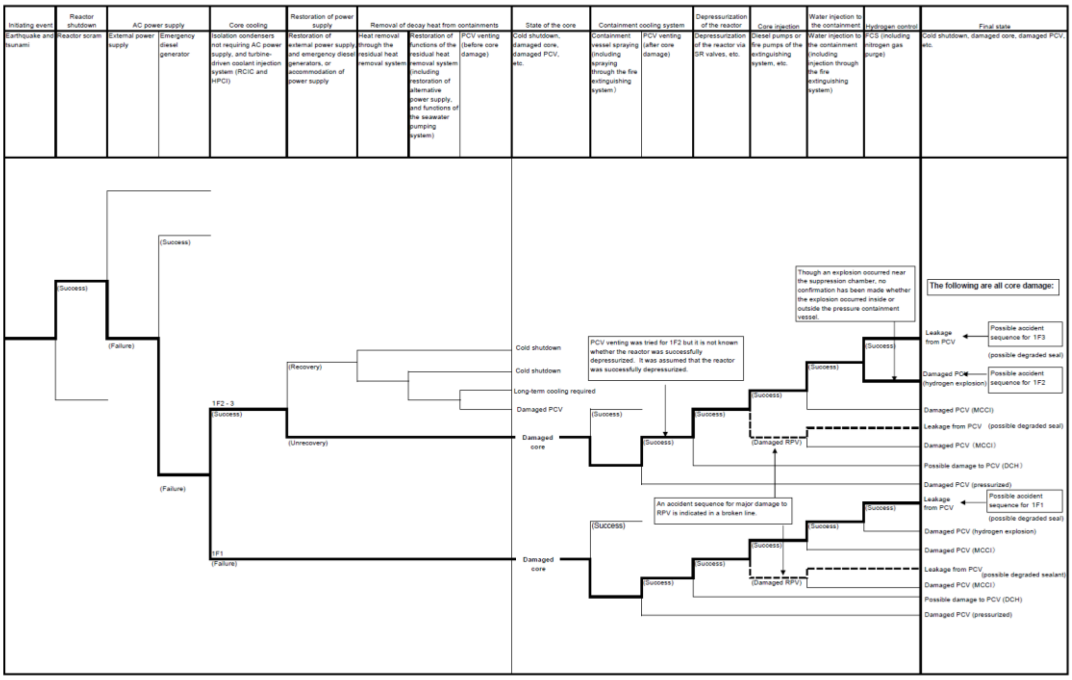


Figure IV. 7-1: Function event tree for units 1, 2 and 3 of Fukushima-Daiichi Nuclear Power Station

Figure IV-7-1 Function Event Tree of Unit 1 to Unit 3 at Fukushima-Dai-ichi NPS

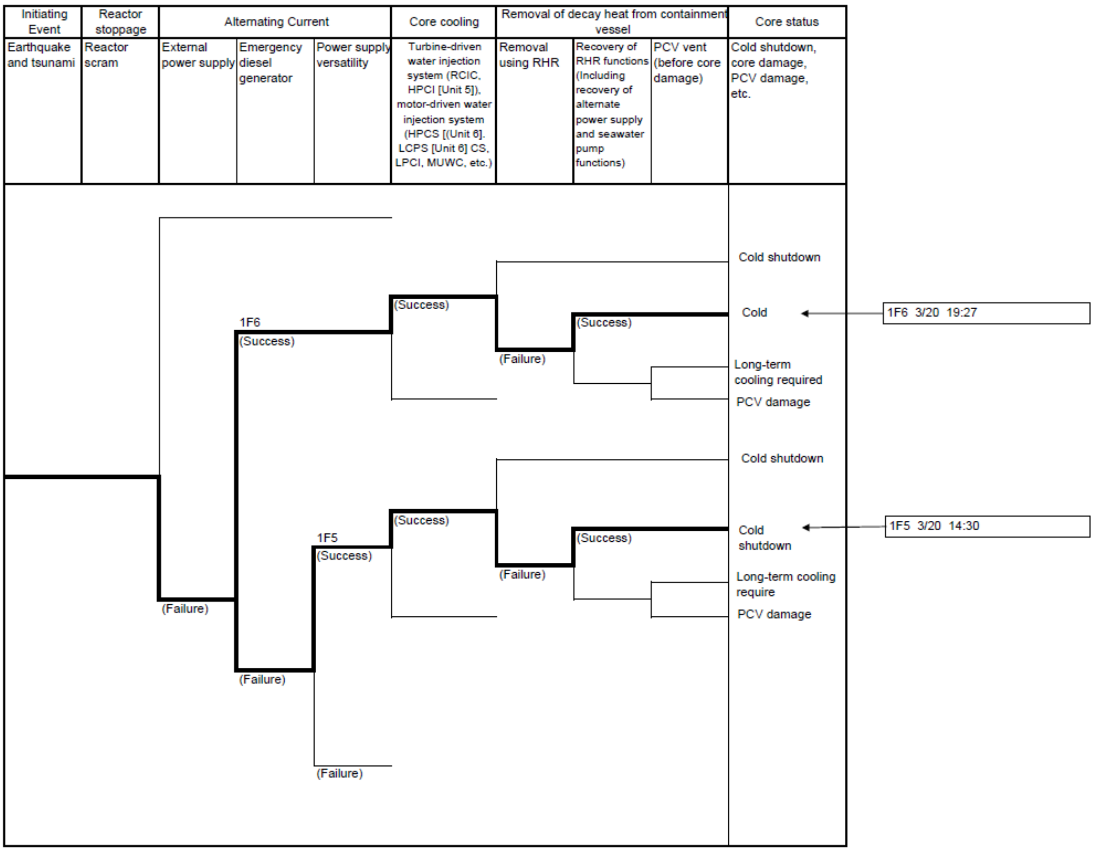


Figure IV-7-2 Function Event Tree of Unit 5 and Unit 6 at Fukushima-Dai-ichi NPS

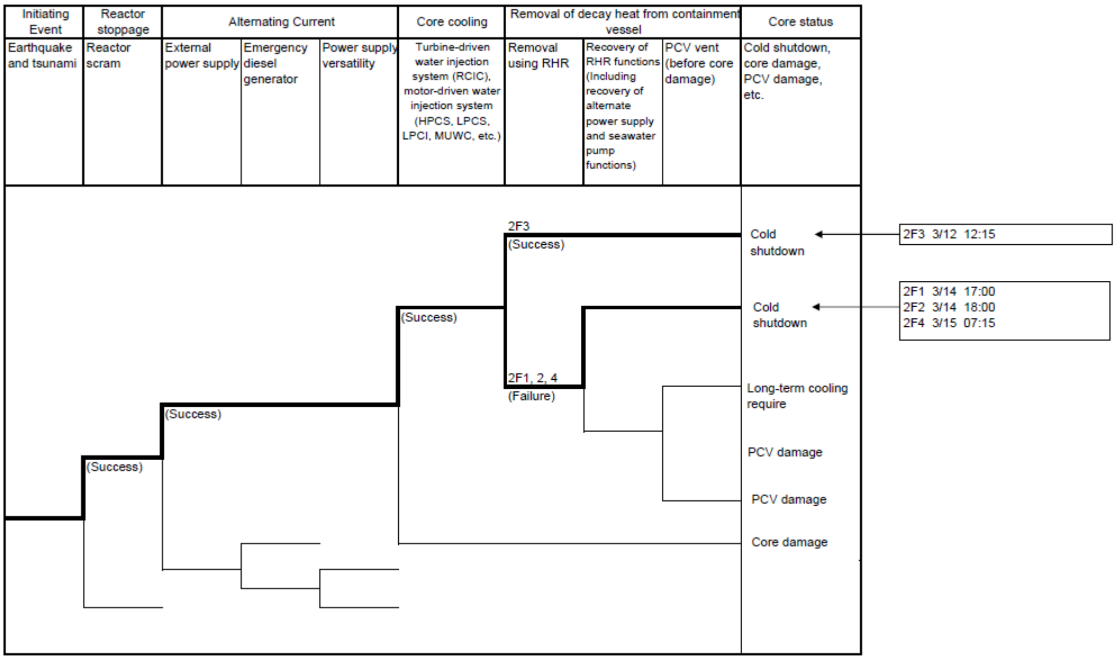


Figure IV-7-3 Function Event Tree of Unit 1 to Unit 4 at Fukushima-Dai-ni NPS

(4) Comprehensive Assessment

1) Conception for tsunami in design stage.

Tsunami Evaluation Group, Nuclear Engineering Committee, Japan Society of Civil Engineers announced in 2002 the "Tsunami Assessment Method for Nuclear Power Plants in Japan"[IV7-1] which established a deterministic tsunami water level evaluation method, triggered by the Hokkaido south-west offshore earthquake which took place in 1993. This characterizes, in setting up design basis tsunami, a consideration of tsunami of which the occurrence in the past was accurately confirmed, as well as a requirement of a method to address uncertainty (variation), accompanied during the course of setting a proper method. Based on this, each licensee voluntarily reviewed the design basis, and the Nuclear Power governmental agency was not involved in this review.

Incidentally, the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities finalized in 2006 specifies in "8. Consideration for the event accompanied by an earthquake" that "During the service period of the facilities, safety features in the facilities might not be significantly affected even by such a tsunami that could likely to occur on very rare occasions," and the guideline asks for proper design for such a assumed tsunami.

The massive tsunami of last March made it clear that an earthquake or tsunami could cause multiple common cause failures of equipment of safety significance in a nuclear power plant.

For that reason, considering the risk that may be caused by an attack on facilities by tsunami beyond assumed design basis tsunami, from now on, it is required to make efforts to reduce the risk to a level as low as reasonably attainable.

On the other hand, Tsunami Evaluation Group, Nuclear Engineering Committee, Japan Society of Civil Engineers has initiated compiling a detailed work for "a method to analyze tsunami hazard using probability theory (Draft), while recognizing that a sufficient safety level in a nuclear power plant facility cannot always be attained against an earthquake or tsunami which could cause multiple common cause failures, even after providing design measures against a presumed earthquake or tsunami."

Meantime, the Nuclear and Industrial Safety Agency (NISA) conducted back checks based on the most recent findings for all of the existing nuclear power plants under the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities revised based on the information given by the Nuclear Safety Commission. In Fukushima-Daiichi NPSs Units 3 and 5, an interim report was prepared which has been reviewed by NISA. However, any evaluation relating to tsunami and any remaining risk were left to be made later. From this it is pointed out that the persons in charge had little understanding of designs against tsunami, and that a deterministic approach will never guarantee that a tsunami exceeding the predicted strength will not occur. But, for the responsibility of attaining the targeted safety level (safety goal), they are required to prepare proper design measures and accident management taking the (target) safety level into consideration after analyzing the characteristics of the plant against the attack of an unexpected tsunami exceeding the predicted safety level, .

Background shows that the nuclear regulatory agency supposedly did not have an attitude to translate the standard of "constitute no hindrance to disaster prevention" which was expected in society as a standard of judgment into "Target Safety Level" which was commonly owed to society, nor an attitude to establish a dialogue with society over whether it is adequate or not.

2) Guidelines for accident management

Since the guidelines for accident management were established by the Nuclear Safety Commission in 1992, accident management was prepared at each nuclear power plant over ten years.

Such accident management based on PSA and an analysis of scenarios involving internal events caused by equipment failure and human error conducted in 80's. This guideline was highlighted to emphasize the effectiveness of introducing accident management, and failed to focus on the environmental conditions so as to make accident management effective.

So, the nuclear regulatory agency should have mandated the licensees that the results of PSA in relation to new findings of common cause failures and external events be referenced and training under realistic conditions be periodically implemented at the stage on which equipment and materials provided for accident management are arranged for training. Further, this guideline also should have been revised taking the experience of such efforts and the results of earthquake PSA and tsunami PSA into consideration.

However, accident management was considered to be conducted independently by each licensee and did not require a PDCA system for introducing new findings or improvements. Also, the Nuclear Safety Commission has never reviewed the accident management system.

Taking into account the importance of the role that accident management has for achieving the safety goal, the nuclear regulatory agency should have constantly reviewed the accident management guidelines by introducing new findings for effective operation.

The Fukushima-Daiichi Nuclear Power Station attacked by a large tsunami has six reactor facilities at one site and all the reactors have suffered accidents. Despite the multi-plant attributes, the accident management guidelines did not address these attributes and the licensees did not train for these attributes.

3) Diversity to important systems in safety: Preparation for commonly caused faults

The accident this time was characterized by having a lot of electrical machinery and appliances in the significant safety systems, including a metal-clad switchgear for connecting to an emergency DG and an emergency bus bar, inundated and becoming useless after the arrival of the tsunami, which resulted in the loss of final heat sink. Further, some plants lost their direct-current power source, leading to severe accidents. Namely, water supply to the nuclear reactor by using a fire fighting system maintained to use in good condition for accident management, or PVC vents, did not function immediately due to malfunctions of a pump, a solenoid valve, an air operated valve (AO valve), etc.

On the other hand, a part of the steam-driven system, such as the RCIC continued to cool the reactor core beyond eight hours and only until the battery was exhausted. An emergency DG installed at a higher level worked satisfactorily since the body of the emergency DG and its power source were free from submersion.

Beyond Design Basis Accidents (BDBE) are likely to be due to multiple failures of important facilities caused by earthquake, tsunami, fire, etc. Therefore, in order to limit the occurrence of Beyond Design Basis Accidents (BDBE) and the influences exerted by it, some good ideas are essential to convert or modify a plant to comply with such severe conditions caused by such external events. Also for the preparation of such accident management to work effectively under such severe conditions, some method to avoid simultaneously occurring malfunctions of the facilities is needed.

Therefore, the Nuclear Power governmental agency should have emphasized the necessity of insuring a diversity of facility installation sites, power sources and support systems, from the view point of minimizing the possibility of common cause failures together with water, vibration and sufficient protection against fire. Also, for the accident management of licensees to install a nuclear power plant, training should have been required to ensure that accident management should work effectively under the severe conditions in mind, and reviewing its effectiveness should also have been required.

4) Design pressure of PCV and vent system.

As the loss of PCV functions due to an accident will provide a direct adverse effect on the surrounding environment, the soundness of the PVC should be maintained even when multiple malfunctions, such as those in the Fukushima-Daiichi power plant, occurs. For this purpose designed temperatures and pressures should be determined in consideration of the occurrence of core damage. At the same time a vent system to be free from damage by emergent excess pressure should be kept in good condition as part of accident management. Judging from the accident this time, it should have been assumed that the radiation level adjacent to the PCV would increase after the core was damaged.

From this the vent system should have been remotely controllable even when AC power source was lost. The PCV vent system should have been equipped with a filter with sufficient radiation decontamination capability. Since temperature and pressure are possibly routed, in the occurrence of core damage, through a system connecting to the PCV vent line, the common use of the system should be minimized as much as possible so as to avoid the leakage of hydrogen or radioactive substances from the building. Further, special attention to design allowances in pressurized equipment for continuous parts, or apparatus sealed by packing, should have been taken so that no leakage would occur in the liquid layers even when the designed pressure is exceeded.

5) Hydrogen explosion in nuclear reactor building.

In the accident this time, a hydrogen explosion in the nuclear reactor building had greatly impeded actions to resolve the situation. In the BWR plant as a countermeasure to the hydrogen explosion, all eyes were focused on activation and installation of the FCS in the PCV. This was considered effective even after the core was damaged. This time the generation of hydrogen was contained to some extent, but while paying attention to the loss of the power source and fixing it, hydrogen leaked from a pressurized PVC exploded in Fukushima-Daiichi NPS 1 and 3. In Fukushima-Daiichi Nuclear power plant No.4, an explosion is supposed to have occurred due to an inflow of hydrogen from the PCV vent in Fukushima-Daiichi Nuclear power plant No.3.

From this, for accident management after the occurrence of core damage, ventilation facilities to prevent an explosion in the nuclear reactor building due to hydrogen leakage from the PCV, and some measures of equipment to prevent the collection of hydrogen should have been provided, including an independently-driven power source.

6) Risks relating to the spent fuel pool

In this accident, the cooling function for the spent fuel pool was lost due to a loss of power supply. Notably, because of reactor core internal shroud replacement work at Fukushima Daiichi Nuclear Power Station, Unit 4, there was one reactor core's worth of fuel with relatively high levels of decay heat being stored. As well as dealing with the accident in terms of the reactor core, it also became necessary to quickly carry out measures to introduce an alternative cooling function for the spent fuel pool.

However, as the embedded radioactive inventory is low compared to the reactor core, even though the radioactivity containment function is inferior to that of the reactor core, a definitive decision was made that there was only a small possibility of risks originating from the spent fuel pool, and as such, no particular accident management was considered.

7) PSRs and PSAs

Since 1992, PSRs, that evaluate the overall safety of existing nuclear plants based on the latest technological knowledge, have been carried out as a voluntary security measure by the licensees approximately every 10 years. One of the items in the PSR is to carry out a PSA, and to come up with measures to deal with the results of the assessment. Reviews on the appropriateness of these actions have been carried out by the nuclear regulatory authorities.

However, during the review of the PSR carried out in 2003, other requirements were made operational safety program requirements based on the Reactor Regulation Act, while the PSA remained at the discretion of the licensees, and reviews by nuclear regulatory agency ceased to be carried out. PSAs make known the risk structure that is subject to regulations for risk management for the people, and the nuclear regulatory authorities were somewhat lax in managing quality, in having the licensees carry out PSAs, and in using those results to make regulatory decisions. As a result, there was ambiguity in distinguishing what is significant and what is not significant in achieving the required safety standards. This may have led to deterioration in nuclear safety culture.

The nuclear regulatory agency should have considered it their mission to act on the people's behalf to investigate whether the risks at nuclear reactors were being kept to a minimum and to provide explanations. They should have had the licensees evaluate internal and external risks of each plant and enforce appropriate accident management based on that. This should have then been reviewed and enhanced based on the latest knowledge.

8) Effects of ageing

Data acquired from surveys on equipment operation following the earthquake and the intensity of the shaking showed there had been no effect on important safety related equipment and devices in the reactor. As such, it is thought that the accident was not caused directly by deterioration due to ageing (embrittlement of the reactor, cyclic fatigue, pipe damage, heat ageing, cable deterioration, etc.), but instead was caused largely by insufficient cooling of the reactor, or a halt in cooling of the reactor, resulting in damage to one of the reactor cores and core melt.

In addition, it is necessary to examine in detail from now on whether the reactor systems were vulnerable to such an earthquake and tsunami because of their age. Through PSRs, mentioned above, or by other means, such factors should be investigated thoroughly and, where necessary, safety systems and equipment renewed or upgraded.

9) Environments for dealing with accidents

It is clear that at the time of the accident poor habitability of the main control room and inadequacies in accident clocking devices led to delays in making operational decisions. This stems from the fact that a prolonged loss of AC power supply was not considered as a design standard, and was not also considered as part of accident management.

In the future, for accident management to be effective against prolonged losses of AC power supply, stipulations should have been made on maintaining the habitability of the main control room and surrounding routes following damage to the reactor core. Stipulations should also have been made on ensuring the reliability of instrumentation and a stable direct current power supply to run such instruments if an accident occurs.

In addition, for twin plants with a common main control room, or where plants are adjacent to each other, accidents at the adjacent plant should have been considered as external factors affecting the plant. In the same way, it should also have been a requirement to ensure the necessary habitability for continued operation at the adjacent plant.

Such requirements also are also applicable for on site emergency stations.

When the accident occurred and operators from the main control room took shelter, the on site emergency station became the plant's main means for assessing the situation at the plant. But, poor habitability hampered work to swiftly implement accident management. In consideration of such events, in order to enable accident management to be carried out effectively even in difficult accident environments, detailed investigation should have been carried out into creating emergency stations with all the necessary requirements, including dedicated ventilation and air conditioning systems.

Following damage to the emergency station at the Kashiwazaki Kariwa Nuclear Power Station during the Niigataken Chuetsu-oki Earthquake in July 2007, an independent decision was made at the Fukushima Daiichi Nuclear Power Station to make its emergency station earthquake-proof. It can be said that this measure was of benefit during the earthquake. Investigation should be carried out to determine whether it is necessary to make such functions a regulatory requirement at other nuclear power stations' on site emergency stations as well.

10) Reactor building requirements

One of the difficulties hindering restoration efforts following this accident is the fact that the damaged section of the PCV is positioned low down. Water injected into the nuclear reactor is leaking out into the turbine building, as much electrical conduit and piping runs through the lower levels of the reactor building, and these sections are not water-proofed. As flooding can be considered as a factor of accident management, it would have been advisable to ensure that the lower sections of the nuclear reactor building were water-proof as a measure against flooding and to ensure external cooling of the PCV could be carried out.

In addition, in light of the fact that the presence of ground water is hindering the management of contaminated water, accident management activities should have included investigations into the detrimental effects caused by ground water, and measures such as positioning important sections of the reactor above ground water level or siting the building on premises with water shielding should have been taken.

11) Independence from adjacent plants

One of the difficulties hindering restoration efforts following this accident is the fact that there are underground connections to adjacent plants through which contaminated water runs. Although it is more economically efficient to construct plants adjacent to each other so that facilities and control can be shared, it is important to ensure that the detrimental effects of an accident at one plant can be kept isolated from the adjacent plant. As such, investigation should have been carried out to plan the physical separation of adjacent plants or to make it possible to plan the physical separation of adjacent plants.

V. Response to the nuclear emergency

1. Emergency response after the accident occurred

(1) Establishment of organizations and instruction for evacuation etc.

1) Initial response etc. pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness

At 15:42 on March 11, the Ministry of Economy, Trade and Industry (METI) in charge of safety regulation of nuclear power plants received a report from a nuclear operator pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness (Total loss of AC power during operation) and established the Nuclear Emergency Preparedness Headquarters and the On-site Headquarters.

At 16:00 on the same day, the Nuclear Safety Commission of Japan (NSC Japan) held an extraordinary meeting and decided to organize an Emergency Technical Advisory Body.

At 16:36 on the same day, in response to the report as of 15:42 pursuant to the provisions of Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness, the Deputy Chief Cabinet Secretary for Crisis Management established Emergency Response Office for the nuclear accident at Prime Minister's Office.

At 19:03 on the same day, the Prime Minister declared the nuclear emergency and established the Nuclear Emergency Response Headquarters and the Local Nuclear Emergency Response Headquarters.

In parallel, other ministries and agencies established organizations to respond to the emergency.

2) Identifying current status of the emergency incidents

The Emergency Response Support System (ERSS), which monitors status of reactors and forecasts progress of the accident in a nuclear emergency, got errors in the data transmission function of the system right after the occurrence of the accident. Therefore, necessary information from the plant could not be obtained and the intended functions of the system could not be utilized.

Regarding the System for Prediction of Environmental Emergency Dose Information (SPEEDI), which quickly predicts atmospheric concentration of radioactive materials and radiation dose in the surrounding area in an emergency situation when a large amount of radioactive materials is or might be released from reactor facilities, Ministry of Education, Culture, Sports, Science and Technology (MEXT) instructed the Nuclear Safety Technology Center at 16:40 on March 11, to shift SPEEDI to emergency mode as specified in the Basic Disaster Prevention Plan. The SPEEDI forecasted distribution of gamma radiation dose rate (absorbed dose in the air) from radioactive noble gas on the ground and temporal variation of concentration distribution of radioactive iodine in the air under the assumption of the release of 1 becquerel (Bq) of radioactive noble gas or iodine per hour continues. SPEEDI normally calculates forecast data by inputting the release source information comprised of radiation monitoring data transmitted from reactor facilities, meteorological conditions provided by the Meteorological Agency and topographical data. However, it could not conduct its primary functions to quantitatively forecast atmospheric concentration of radioactive materials and air dose rate because source term information through ERSS could not be obtained in this accident.

Operational procedure of SPEEDI has been partially reviewed as the initial response to this accident as follows.

The terminals of SPEEDI operated by MEXT are located in MEXT, NISA, NSC Japan, Local Nuclear Emergency Response Headquarters (hereinafter referred to as “Local Headquarters”) and Fukushima prefecture. Also, staff of Nuclear Safety Technology Center who operates the system was assigned to NISA and MEXT. On the other hand, staff of Nuclear Safety Technology Center was not assigned to NSC Japan because it was to request calculation by SPEEDI to the Nuclear Safety Technology Center through MEXT when NSC Japan needed such calculation.

On March 16, after roles and responsibilities of each ministry were realigned, MEXT became responsible for controlling the implementation of environment monitoring and publicizing the results. NSC Japan became responsible for evaluating monitoring information etc. MEXT also instructed the Nuclear Safety Technology Center to facilitate SPEEDI analysis by NSC Japan and dispatched the staff of the Nuclear Safety Technology Center to the Secretariat of NSC Japan. This enabled NSC Japan to directly request the staff of the Nuclear Safety Technology Center for estimation.

3) Establishment of the Local Headquarters and relocation of the headquarters to Fukushima prefectural office

On March 11, the staff of Fukushima Dai-ichi Nuclear Safety Inspector's Office in charge of Fukushima Dai-ichi NPS were on duty for operational safety inspection, excluding a part-time clerk working at the office. After the quake occurred, three office staff including the Office Manager returned to the Off-site Center, around 5 km west of the NPS, and the remaining 5 nuclear safety inspectors stayed at the NPS to collect information.

At 15:42 on March 11, the Local Nuclear Emergency Preparedness Headquarters was established at the Off-site Center immediately after receiving a notification pursuant to the provisions of Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. Local Nuclear Emergency Response Headquarters (Local Headquarters) was also established at 19:03 on the same day after the occurrence of emergency incidents pursuant to the provisions of Article 15 of the same Act. The head of the Nuclear Safety Inspector's Office temporarily acted as the head of the headquarters until the Vice Minister of METI arrived pursuant to the provisions of Nuclear Emergency Response Manual.

However, in addition to blackout due to the earthquake, all power sources were lost due to malfunctions of emergency power source and no communication tools were available at the Off-site Center. Therefore, the head and other staff had to move temporarily to the neighboring Environmental Radioactivity Monitoring Center of Fukushima, where they used the satellite phone installed in the Center to secure external communication.

The Vice Minister of METI, Director-General of the Local Headquarters, immediately departed for the Off-site Center with NISA staff and Secretariat of NSC Japan from the Ministry of Defense (MOD) by helicopter of SDF etc. at 17:00 on March 11 following the occurrence of emergency situation prescribed in Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. They arrived at the Environmental Radioactivity Monitoring Center of Fukushima at 0:00 on March 12. Around the same time, the staff of the MEXT also arrived separately. In and after the night of March 11 to the next day, officials and staff of SDF, Fukushima Prefecture including Vice Governor, Japan Atomic Energy Agency (JAEA) and National Institute of Radiological Sciences and others arrived. However, the initial mobilization of staff and specialists of relevant ministries and agencies originally expected as members of the local headquarters was generally slow. In addition, the responsible NSC commissioner and the members of the Emergency Response Investigation Committee were not dispatched immediately to the site, as specified in the Basic Disaster Prevention Plan. The earthquake occurred earlier seems to have affected the mobilization.

After the emergency power supply for the Off-site Center was recovered and satellite communication system became available, operation of the Local Headquarters resumed at the Off-site Center again at 3:20 on March 12.

Meanwhile the head of the Local Headquarters directed the heads of relevant local governments to confirm the evacuation status, give publicity to local residents, prepare for potassium iodide and conduct emergency monitoring, screening and decontamination etc. as the activities at the Off-site Center.

Plant information, ERSS, SPEEDI and others were still unavailable at the Off-site Center for some period of time. Subsequently, with high radiation dose due to the progress of nuclear emergency and lack of fuel, food and other necessities due to congested transportation around the site, it became difficult for the Local Headquarters to continue effective operation at the Off-site Center.

Alternative facilities are required to be prepared for such a case pursuant to the provisions of the Act on Special Measures Concerning Nuclear Emergency Preparedness. Minami-soma City Hall originally selected as an alternative location for the Off-site Center was already used as a place for responding to the earthquake and tsunami disaster.

After rearranging an alternative facility for the Off-site Center, the Local Headquarters was moved to Fukushima Prefectural Building on March 15.

4) Initial operations of environment monitoring

The Basic Disaster Prevention Plan provides that in light of evaluating the effect to the surrounding area of released radioactive materials or radiation from nuclear facilities in the event of an emergency and based on the guideline established by the Nuclear Safety Commission, local governments are required to maintain their emergency monitoring system including developing emergency monitoring plan, installing and maintaining monitoring posts and securing monitoring personnel…" and "…after the state of nuclear emergency is declared, local governments are required to gather emergency monitoring results including information from relevant organizations and communicate with the staff dispatched to the emergency response facilities." Thus, local governments are responsible for implementing and managing emergency monitoring.

The idea that the local governments are responsible for environment monitoring is based on the fact that since the local governments have more information about residents' situation and geography of each municipality, they would be more suitable to implement evacuation and to escort the residents than the national government.

In Fukushima Prefecture, the prefectural government personnel got together during this accident and started conducting emergency monitoring activities together with relevant authorities. However, it was quite difficult for Fukushima Prefecture to implement sufficient environment monitoring activities because unexpected events occurred. For example, equipment and facilities of Fukushima Prefecture were damaged by the earthquake and tsunami and affected by blackout; the local government itself had to take disaster response to widely-spread damage by the earthquake and tsunami; and the Local Nuclear Emergency Response Headquarters was relocated from the Off-site Center to Fukushima Prefectural office, as mentioned before.

MEXT dispatched monitoring cars from a major nuclear emergency prevention facility in Ibaraki prefecture, bordering Fukushima prefecture, to the Off-site Center near the NPS as the first dispatch (two owned by MEXT and one by JAEA) and to Fukushima City, where Fukushima prefectural office is located, as the second dispatch (two owned by MEXT and two by JAEA).

The initial response to environment monitoring on the requests just after the earthquake was limited because relevant ministries and agencies which are responsible for implementing and supporting monitoring upon request as provided in the Basic Disaster Prevention Plan, were engaged in other disaster response measures such as searching for missing many people in the wide disaster area.

The information of the first environmental radiation monitoring conducted on March 13 was made public by NISA at 7:30 on March 14. This monitoring observed radiation dose rate higher than 30 μSv/h in some area.

Environment monitoring conducted from 20:40 to 20:50 on March 15 at 3 locations by a monitoring car travelling around Namie Town, 20 km northwest of Fukushima Dai-ichi NPS observed 330 μSv/h at maximum outside of the car. This data was made public by MEXT at 1:05, March 16.

High level of radioactive iodine and radioactive cesium were detected on March 15, from sampled topsoil and plants. As the plume path areas would presumably continue to have high radiation dose rate and high concentration of radioactive materials, NSC Japan proposed to conduct early monitoring of milk, drink water and agricultural products at a conference with emergently called up team at Prime Minister's office.

During this time, although MEXT dispatched monitoring cars, due to the impact of the earthquake on roads and the progress of the disaster event in the reactor facilities, the Local Nuclear Emergency Response Headquarters was unable to conduct sufficient monitoring activities.

Under these circumstances, roles and responsibilities within the government were realized and MEXT became responsible for managing implementation of environment monitoring and publicizing the results. Since 1:05 on March 16, environment monitoring results have been announced daily by MEXT. NSC Japan also requested MEXT through the Nuclear Emergency Response Headquarters to install cumulative dosage meters at a certain location (Point 32) or increase frequency of measurement there etc., because values higher than 100 μSv/h had been detected for 2 consecutive days since March 17, as publicized in "Monitoring results beyond 20 km from Fukushima Dai-ichi NPS" by MEXT. (March 18)

5) How evacuation area and "stay in-house" area were established

a. Instruction regarding Fukushima Dai-ichi NPS

At 20:50 on March 11, the Governor of Fukushima Prefecture instructed Okuma Town and Futaba Town to evacuate their residents and others within 2 km radius from Fukushima Dai-ichi NPS .

At 21:23 on the same day the Director-General of the Nuclear Emergency Response Headquarters (Prime Minister) issued instruction to the heads of Fukushima Prefecture, Okuma Town, Futaba Town, Tomioka Town and Namie Town pursuant to the provisions of the Act on Special Measures Concerning Nuclear Emergency Preparedness. This instruction was to evacuate the residents and others within 3 km radius from Fukushima Dai-ichi NPS and order the residents and others within 10 km radius from the NPS stay in-house. Responding to the situation that the reactor unit 1 has not been cooled, these evacuation instructions were provided to prepare just in case for such situation to continue.

At 5:44 on March 12, the Director-General of the Nuclear Emergency Response Headquarters instructed residents within 10 km from the NPS who were originally instructed to stay in-house to evacuate to outside of the evacuation area. This instruction was issued because the pressure in the Primary Containment Vessel could possibly be increasing.

At 18:25 on the same day, responding to an explosion at Unit 1 of Fukushima Dai-ichi NPS and the related emergency measures etc., the Director-General of the Nuclear Emergency Response Headquarters issued a new instruction to the heads of relevant municipalities, which included Fukushima Prefecture, Okuma Town, Futaba Town, Tomioka Town, Namie Town, Kawauchi Town, Naraha Town, Minamisoma city, Tamura city and Katsurao Village. This instruction is to evacuate the residents within 20 km radius. It was issued to prepare for any possible risks which would occur simultaneously at multiple reactors including the Units other than Unit 1.

From March 12 onward, various incidents at multiple units occurred including explosions which appeared to have been caused by hydrogen at Units 1 and 3 on March 12 and 14 respectively, an explosion incident and smoke at Unit 2 and an explosion and a fire at Unit 4 on March 15. At 11:00 on March 15, the Director-General of the Nuclear Emergency Response Headquarters issued a new instruction to the heads of relevant local governments including Fukushima Prefecture, Okuma Town, Futaba Town, Tomioka Town, Namie Town, Kawauchi Town, Naraha Town, Minamisoma City, Tamura City, Katsurao Village, Hirono Town, Iwaki City and Iitate Village. The instruction is to order residents within radius between 20 km and 30 km from Fukushima Dai-ichi NPS to “stay in-house.” (Lifting the instruction to “stay in-house” will be mentioned below.)

b. Instructions to Fukushima Dai-ni NPS

At 5:22 on March 12 and onward, a nuclear emergency of losing pressure-control function in multiple units of Fukushima Dai-ni NPS occurred. The Prime Minister declared the state of nuclear emergency pursuant to the provision of the Act on Special Measures Concerning Nuclear Emergency Preparedness at 7:45. (Note: Simultaneously with the declaration of the state of nuclear emergency, the Nuclear Emergency Response Headquarters and the Local Headquarters for Fukushima Dai-ni NPS were established, and then they were integrated into those of Fukushima Dai-ichi NPS. As a result, the Prime Minister became the Director-General of the Nuclear Emergency Responses Headquarters for both Fukushima Da-ichi and Dai-ni NPSs.)

At the same time, the Director-General of the Nuclear Emergency Response Headquarters also instructed the residents and others within 3 km radius from Fukushima Dai-ni NPS to evacuate, and ordered the residents and others within 10 km radius from Fukushima Dai-ni NPS to stay in-house. The relevant local governments include Fukushima Prefecture, Hirono Town, Naraha Town, Tomioka Town and Okuma Town.

At 17:39 on the same day, responding to the explosion at Unit 1 of Fukukshima Dai-ichi NPS, the Director-General of the Nuclear Emergency Response Headquarters instructed the residents and others within 10 km radius from Fukushima Dai-ni NPS to evacuate. Those who were instructed to evacuate was originally instructed to stay in-house.

Regarding this instruction of evacuation, on April 21, the Director-General of the Nuclear Emergency Response Headquarters issued an instruction to the heads of local governments to change the evacuation area to within 8 km radius from Fukushima Dai-ni NPS. The relevant local governments include Fukushima Prefecture, Hirono Town, Naraha Town, Tomioka Town and Okuma Town. This instruction change was issued based on the judgment that risks of serious accidents have been considerably reduced from the time when the state of nuclear emergency was declared at 7:45 on March 12 and certain safety measures have been taken since then.

The Director-General of the Nuclear Emergency Response headquarters changed the instruction on the instruction on the evacuation area after hearing the opinions of the Nuclear Safety Commission pursuant to the provisions of Article 20 (5) of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (Refer to Appendix V-1 for “evacuation instruction by the Director-General of the Nuclear Emergency Response HQs” etc.)

c. Communication channels and status of evacuation instruction

In the initial stage of the accident, the Director-General of the Nuclear Emergency Headquarters determined the evacuation area and instructed evacuation in order to ensure the safety of the residents and others as soon as possible. After such instructions were issued, the Administration of the Nuclear Emergency Response Headquarters called the On-site Headquarters and Fukushima Prefecture to deliver evacuation instructions and “stay in-house” instructions, and relevant municipalities received calls on such instructions through the On-site Headquarters and Fukushima Prefecture. Additionally, the Nuclear Emergency Response Headquarters directly called those local governments. However, because communication services including telephone lines were heavily damaged by the great earthquake, not all the direct calls reached the relevant local governments. Advance notice to local governments was not satisfactorily delivered. On the other hand, the police communicated the evacuation instruction to the local governments using police radio. Furthermore, in order to swiftly convey the evacuation instruction to residents, they used police vehicles such as patrol cars to inform the public and guided the residents in the evacuation process. In order to promptly communicate the evacuation instructions, the Chief Cabinet Secretary held press conferences to announce the instructions immediately after they were issued and mass media such as television and radio were fully utilized. Actual evacuation was promptly conducted with the cooperation of the relevant local governments, the police and the local residents, etc.

6) Responses of national and local governments after evacuation and “stay in-house” instructions

a. Overview of evacuation area etc.

The population of the evacuation area (within 20 km radius from Fukushima Dai-ichi NPS and 10 km radius from Fukushima Dai-ni NPS), where instructions was issued by March 15, was approximately 78,200 and that of “stay in-house” area (between 20 km and 30 km radius from Fukushima Dai-ichi NPS) was approximately 62,400. (Source: Flash report of National Census of 2010)

At 23:30 on March 15, NISA announced that evacuation of the residents out of 20 km radius from Fukushima Dai-ichi NPS and 10 km radius out of Fukushima Dai-ni NPS had already been implemented as of 19:00 on March 15.

b. Responses of national and local governments after instructions are issued

In addition to residents who follow evacuation and "stay in-house" instructions issued by the local governments, some residents who were instructed to stay in-house voluntarily evacuated from their home. The situation of the "stay-in-house area" was as follows: The number of residents who wish to voluntarily evacuate was increasing, it became more difficult to maintain social life due to stagnant business and distribution etc. and evacuation instruction could also be issued in such zones with increased radiation dose depending on the future progress of the plant situation. Based on the situation, the Government recognized the necessity of actively providing life support with goods like gas, food and medicines and encouraging voluntary evacuation for residents in "stay in-house" area as well as accelerating preparation for the future issuance of evacuation instruction in such area. On March 25 at the press conference, the Chief Cabinet Secretary encouraged the relevant local governments to voluntarily evacuate residents and be ready for taking appropriate measures promptly when evacuation instruction is issued.

Regarding evacuation of people who need care in emergency, for those who were hospitalized and lived in nursing homes within 20 km radius from the NPS, was completed after evacuation instruction without delay. 700 residents who were hospitalized between 20 km and 30 km from the NPS were transferred to 6 hospitals by March 21 after Fukushima Prefecture and other prefectures cooperated with the collaboratioon of relevant ministeries and agencies. 18 facilities with capacity of approximately 980 residents who lived in nursing homes between 20 km and 30 km from the NPS were transferred to appropriate facilities by March 22.

The "stay in-house" instruction to residents between 20 km and 30 km radius from Fukushima Dai-ichi NPS was lifted simultaneously with specifying Deliberate Evacuation Area and Emergency Evacuation-Prepared Area. (Refer to 4. for details of the establishment of Deliberate Evacuation Area and Emergency Evacuation-Prepared Area.)

7) Establishment of Restricted Area and temporary access to the area

a. Background of the temporary access

With the prolonged evacuation and "stay in-house," some residents entered the evacuation area for such reason as bringing out daily commodities from home and other reason. Around the end of March, the Local Headquarters and the Fukushima Prefectural Emergency Response Headquarters requested the relevant local governments to prohibit any access to the evacuation area within 20 km radius from Fukushima Dai-ichi NPS because of residents' safety risks. The Chief Cabinet Secretary also announced that off limits to evacuation area will be strictly enforced and a possibility of temporary access is under review in response to the requests by the residents from the Restricted Area.

b. Establishment of Restricted Area

Even though off-limits to the Restricted Area was communicated, considerable residents' safety risks were a matter of concern because the authority continuously recognized that some residents actually entered such area. On the other hand, as for making a shift from the evacuation area to legally enforceable Restricted Area, the need of such change and the limited rights of the residents had to be carefully weighed and whether effectiveness of such enforcement can be assured had to be considered fully. The Nuclear Emergency Response Headquarters coordinated with relevant local governments which were authorized to establish such Restricted Area.

On April 21, based on opinions of the Nuclear Safety Commission, the Director-General of the Nuclear Emergency Response Headquarters issued an instruction to the heads of relevant local governments pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness. This instruction was intended to establish the Restricted Area in the area originally specified as the evacuation area within 20 km radius from the NPS pursuant to the provisions of Disaster Countermeasure Basic Act 223 (enacted 1961) replaced with the Act on Special Measures Concerning Nuclear Emergency Preparedness. In response to this instruction, the heads of relevant local governments established the Restricted Area on April 22. Establishment of the Restricted Area is intended to limit access to the area in order to prevent risks of residents and others entering the evacuation area, other than those engaged in emergency response measures (Emergency response to prevent expansion of the nuclear accidents) and the cases approved by the heads of local governments. After the establishment of Restricted Area, legal penalties are to be imposed on a person who enters the Restricted Area, and any access to such area is to be physically limited in principle.

c. Overview of temporary access

On April 21, the Nuclear Emergency Response Headquarters announced the basic viewpoints of temporary access concurrently with establishment of the Restricted Area. Temporary access is allowed within 20 km radius from Fukushima Dai-ichi NPS excluding 3 km radius from the NPS and high risk area. The residents are allowed to enter the area temporarily for a few hours and carry the minimum necessary goods out from there while ensuring safety. Also, corporate bodies, etc., whose inability to access the area is expected to cause serious loss of public interest shall be permitted access by the heads of relevant local governments after consultations with the head of the Local Nuclear Emergency Response Headquarters. On April 23, the Director-General of the Headquarters announced the Permission Criteria for temporary access to Restricted Area (Eligibility, conditions and procedures, etc.). On May 9, NSC Japan provided technical advice on “Implementation of temporary access” upon request of the Nuclear Emergency Response Headquarters. The temporary access of residents was sequentially implemented pursuant to the permission criteria from May 10 onward, after coordination of relevant local governments, Fukushima prefecture and others. One of the 9 eligible local governments, Kawauchi Village, was allowed temporary access on May 10 and May 12. Later, temporary access was implemented for Katsurao Village on May 12, Tamura City on May 22, Minamisoma City on May 25 and 27, Tomioka Town on May 25, Futaba Town on May 26 and 27, and Namie Town on May 26 and 27.

(2) Efforts on nuclear emergency preparedness

1) Ensuring the safety and security of the residents and others

Based on the “Roadmap for Immediate Actions for the Assistance of Nuclear Sufferers” (May 17, refer to Appendix X-1), various actions are being taken under the lead of the Nuclear Sufferers Life Support Team to provide life support to nuclear sufferers. As a part of these actions, the following efforts are taken to ensure safety and security of residents and others concurrently with emergency measures.

・General information on nuclear emergency is provided at the press conferences and by press releases as well as on websites from the Nuclear Emergency Response Headquarters (NISA, Prime Minister’s Office, etc.), the Local Headquarters, NSC Japan, and Tokyo Electric Power Co., Inc. (hereinafter referred to as TEPCO) accordingly.

・ Regarding health information related with radiation, MEXT has provided the Health Counseling Hotline and the National Institute of Radiological Sciences (NIRS) has opened a health counseling contact to respond to the requests for consultation from the public. Information on the safety of food and tap water is available on the website of Ministry of Health, Labor and Welfare (MHLW). In addition, in response to requests from the local governments, specialists, etc. from universities nationwide and the National Institute of Radiological Sciences have conducted explanatory meetings to residents regarding the health effect of radiation, etc.

・ As for the mental healthcare, MEXT opened the "portal site for mental care" on its website to provide information on contacts that provide counseling services for anxiety and distress of the residents of the disaster affected area as well as on children's mental care.

・ Also, MHLW opened a special page on its website to support the affected workers and their families as well as those who support them on its mental health portal called "Koroko-no-mimi (ear of the heart)." The website also posts, "How to protect your mental health" which gives some clues to protect mental health of the affected staying at shelters and other places. Incorporated Administrative Agency National Center of Neurology and Psychiatry (NCNP) also opened a webpage to provide information for healthcare professionals and those who support the affected.

・ Furthermore, "mental care teams" comprised of healthcare personnel etc. were dispatched to 3 prefectures affected by the disaster upon request of MHLW to work with health nurses to provide mental care to the affected as well as those who support them such as the employees of the local governments. (There are 24 persons in 6 teams in Fukushima Prefecture as of May 27)

・ The affected who evacuated from the evacuation area surrounding the NPS were not able to obtain sufficient information, which placed them in a situation where it was concerned that their anxiety over radiation-related issues which are difficult to understand, could be amplified. In order to ensure the delivery of readily understandable information to the affected, Local Headquarters published newsletter to post in shelters of the suffering areas (5 editions to date) and broadcasted radio programs featuring Q&A session at two local radio stations (AM and FM) everyday since April 11. These contents are posted on METI website to allow the affected including those who evacuated out of Fukushima Prefecture to have access to them.

・ On May 7, upon request of the Nuclear Emergency Response Headquarters, NSC Japan delivered its view in light of radiation protection and safety that fishing by those engaging in fishery in the sea area beyond 30 km radius from Fukushima Dai-ichi NPS was permissible. In addition, NSC Japan advised the Nuclear Emergency Response Headquarters to continue monitoring and report to NSC Japan as appropriate and make efforts to mitigate radiation exposure. On the same day, the Ministry of Agriculture, Forestry and Fisheries (MAFF) communicated this information to those related with fishery industry.

・ Fukushima Prefecture decided to conduct extensive medical checks to estimate radiation dose to date from the accident occurrence and survey the effect on health of 2 million citizens of the prefecture, which will start from some area in the prefecture in late June. On May 27, the first meeting of "Fukushima Prefecture Health Monitoring Survey Research Committee" was held. The details of the survey will be discussed in that committee in advance.

2) Organization structure for the emergency response and other matters in this disaster (Appendix V-2)

a. Overall governmental structure for the emergency response to the earthquake and the nuclear accident

・ As, in the East Japan Great Earthquake, as a nuclear accident occurred after large-scale earthquake and tsunami, the Government of Japan established two central headquarters; Emergency Disaster Response Headquarters and Nuclear Emergency Response Headquarters, pursuant to the provisions of the Disaster Countermeasures Basic Act and the Act on Special Measures Concerning Nuclear Emergency Preparedness respectively. Local Headquarters (Government Local Liaison Disaster Response Office in Fukushima and Iwate Prefectures as well as Local Headquarters in Miyagi Prefecture, under the Disaster Countermeasures Basic Act) were established for each of those two Headquarters. Life support teams were bolstered by establishing the teams as follows: the Headquarters for Special Measures to Assist the Lives of Disaster Victims as for Emergency Disaster Response Headquarters (currently renamed as the Team in charge of Assisting the Lives of Disaster Victims) and the Team in charge of Assisting the Lives of Victims around the Nuclear Power Station as for Nuclear Emergency Response Headquarters.

The two Headquarters are jointly operating to conduct some of the activities where possible, such as joint holding of Headquarters meetings and arrangement of procurement and transportation of relief supplies for affected. The two Headquarters are also sharing information and making operational coordination, etc at meetings of Emergency Operations Team, with the participation of Director-General level and other officials from relevant ministries and agencies.

・ With regard to the identification of the actual status of emergency incidents at reactor facilities, emergency measures to be taken to control the incidents, and other matters, the Government and the nuclear operator established Integrated Headquarters for the Response to the Incident at the Fukushima Nuclear Power Stations (currently renamed as Government – TEPCO Integrated Response Office) (in operation from March 15 at Head Office of TEPCO) for the purpose of working together, sharing information, making decisions and issuing instructions on necessary responses.

・ In the above stated organizational structure, the NSC, supported by members of the Emergency Technical Advisory Body and other experts and upon request by the Nuclear Emergency Response Headquarters and Local Headquarters, has provided technical advice for prevention of expansion of the accident and reduction of public exposure and other matters pursuant to the provisions of the Act on Special Measures Concerning Nuclear Emergency Preparedness (Refer to Appendices V-3 – V-5.). NSC's basic views on radiation protection are listed in Appendix V-6.

・ Two months after the occurrence of the Great East Japan Earthquake, the Government carried out reorganization to be based on three headquarters comprising headquarters for post-disaster reconstruction in addition to the above-mentioned two Headquarters with a view to clearly defining the role of each organization, renaming the organizations and for other purposes (from May 9).

As an immediate response, based on the discussion made at the Headquarters for the Response to the Incident at the Fukushima Nuclear Power Stations (currently renamed as Government – TEPCO Integrated Response Office), the nuclear operator developed the "Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station" (announced on April 17, revised on May 17, Refer to Chapter X.) Also, based on the efforts made by the Team in charge of Assisting the Lives of Victims around the Nuclear

Power Plant, the Nuclear Emergency Response Headquarters developed “Plan of Immediate Actions for the Assistance of Nuclear Sufferers” (May 17). The post-nuclear disaster responses are currently implemented based thereon.

b. On-site organizational structure and other matters

・ The Local Headquarters was established pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness at Off-site Center, but it was moved to Fukushima Prefectural Office (Refer to (1) above).

・ Meetings of the Joint Council for Nuclear Emergency Response have been held pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness at the Local Headquarters, but the relevant municipalities, members of this Council, have not participated in it. This is because it was difficult to get all the relevant members together to hold a meeting of the Joint Council after the residents in the vicinity of the NPS had evacuated to other areas. As an alternative response, staffs of the Local Headquarters have visited relevant municipalities individually. As the municipalities under the regulation of food-related restriction expanded across the prefectural borders, Nuclear Emergency Response Headquarters in Tokyo, instead of Local Headquarters, has directly provided and exchanged information with them.

2. Implementation of environmental monitoring

(1) Environmental monitoring system

1) Environmental monitoring system

According to the Basic Disaster Prevention Plan, local governments are responsible for environmental monitoring after the occurrence of nuclear accidents and the subsequent establishment of the Nuclear Emergency Response Headquarters. The Ministry of Education, Culture, Sports, Science and Technology (MEXT), designated public institutions such as the National Institute of Radiological Sciences and Japan Atomic Energy Agency (JAEA), nuclear operators related to the accidents and nuclear operators other than the afore-said are supposed to assist local governments in their environmental monitoring activities. In addition, nuclear operators are supposed to keep measuring radioactive dose, etc. on site boundaries and notify Local Nuclear Emergency Response Headquarters of information on the current condition and forecast of the discharge of radioactive materials, etc.

The accident at Fukushima Dai-ichi NPS occurred simultaneously with the occurrence of natural disasters of the earthquake and tsunami. Consequently, 23 out of 24 monitoring posts in Fukushima prefecture became unavailable so that communication became very difficult. In addition, since Fukushima prefectural government and others including Ministry of Defense and Japan Coast Guard providing support in response to requests had to focus also on response to seismic disasters. On March 15, staff of the Off-site Center which was the nuclear accident response center of Fukushima Prefecture came to leave there. In this circumstance, MEXT assumed the responsiblity for environmental monitoring on and after March 16 as a result of the coordination among relevant organizations within the Government regarding their respective roles.

The NSC Japan provided technical advice on monitoring to MEXT on a timely manner to improve the monitoring performed by MEXT, etc., while requesting MEXT to collect and measure dust in order to improve the accuracy of preliminary calculation by SPEEDI, the result of which was reflected in that calculation. In addition, NSC Japan evaluated monitoring results by MEXT, etc. and released the evaluation results on the web page and explained to media from March 25.

2) Operator's monitoring system

The NPS radiation control division of TEPCO, during its normal operation, monitors radioactive dose rate, radioactive material concentration and weather condition at the monitoring posts installed in surrounding monitoring areas, the discharge monitoring system for air/liquid radioactive waste, and weather observation facilities. Furthermore, TEPCO, periodically on and off the site, collects samples from the ground and the sea, and monitors radioactive material concentration in the surrounding environment (Attachment V-7 Normal monitoring system)

In case of emergency, TEPCO is supposed to have its on-site organization for nuclear emergency preparedness and response under the Nuclear Operator Emergency Action Plan to undertake activities including prediction of radiation-affected areas by measuring radioactive dose rate in and outside the NPS and concentration of radioactive materials . (Attachment V-8 Emergency monitoring system)

(2) Monitoring condition after the accidents

1) Monitoring condition in the NPS site

a. Air dose monitoring

After the earthquake, measured values of GM counters were higher than usual values in reactor facilities, while values measured at monitoring posts installed in the surrounding monitoring areas of Fukushima Dai-ichi NPS showed no anomaly. (Attachment V-9 Measured results of monitoring posts)

After the loss of external power supply on March 11, TEPCO became unable to measure at monitoring posts and, since that day, they started environmental radiation monitoring using a monitoring car . External power supply was restored on March 25 and TEPCO became able to measure at monitoring posts again. It has been continuing with measurement by installing three temporary monitoring posts on the site since March 23.

While monitoring data is usually released automatically on the operator’s web page in real time, only limited contents compiled to the extent possible through manual work by personnnel were initially released because measuring at monitoring posts became impossible after the accident. The monitoring car used for radiation measurement this time can obtain data every 2 minutes. However, the nuclear operator continued to use only the values measured every 10 minutes same as before in releasing the monitoring data. The operator later checked the data and released all the measured values on May 28.

b. Discharge monitoring

Immediately after the Tohoku District - Off the Pacific Ocean Earthquake, no abnormal values were measured by the air stack monitor of each unit in Fukushima Dai-ichi NPS. (Attachment V-10：Measured results of monitor)

However, after the loss of external power supply on March 11, the operation of the heating and ventilation system and the sampling system were suspended and therefore discharge monitoring became impossible. Although measured results of the air stack monitoring in some units were recorded until March 12, it is presumed that those results were caused by an increase in the level of radioactivity outside measuring system, given the suspension of the operation of the sampling system.

c. Weather observation

Direction and speed of wind and atmospheric stability, etc. are monitored by common observation facilities in Fukushima Dai-ichi NPS. However, measurement in these facilities became impossible due to the loss of external power supply on March 11. TEPCO therefore started using a monitoring car for weather observation on March 11. TEPCO has still used it because it cannot perform inspection and calibration although power supply for the said system was restored on April 9.

d. Radioactivity analysis on soil

In terms of radioactivity analysis on soil of the site of Fukushima Dai-ichi NPS, soil samples were taken on March 21 and 22 at five points on the site and plutonium analysis was performed. It is presumable that, in light of the radioactive ratio of the detected plutonium isotopes, the plutonium may have been released due to the accident of this time, not due to the past atmospheric nuclear testing. Regarding detected concentration, when compared against the fallout, from the past atmospheric nuclear testing, observed in Japan (1978-2008), Pu-239 and Pu-240 were within the range of the observed values while Pu-238 was slightly above those values. Later, samples are taken on a regular basis and analyses on plutonium, gamma nuclide and strontium are being performed. (Attachment V-11: Nuclide analysis results of radioactive materials in the soil)

e. Radioactivity analysis on seawater and ocean soil

Regarding radioactivity analysis on seawater near the Water Discharge Canal of Fukushima Dai-ichi NPS, TEPCO started taking seawater samples at the Southern Water Discharge Canal and performed radioactivity analysis from March 21, as peripheral environmental monitoring. Because radioactive materials were detected as a result of the analysis, TEPCO has continued with radioactivity analysis by increasing sampling locations and its frequency since March 22. As stated below, after observing the water outflow from a pit to the sea on April 2, TEPCO takes samples from seawater in the pit and in front of bar screen near the pit to perform radioactivity analysis.

As of May 8, TEPCO adds sampling locations such as North Water Discharge Canal, shallow draft quay, the Intake Channels (north and south), Unit 2 screen (inside and outside of silt screen) one after another and takes seawater samples to perform radioactivity analysis. (Attachment V-12: Seawater analysis results)

In terms of radioactivity analysis on ocean soil offshore of Fukushima Dai-ichi NPS, TEPCO took samples from ocean soil at two locations (3km offshore of Kodaka ward and Iwasawa coast) on April 29 and performed radioactivity analysis and detected higher values of iodine and cesium than usual.

2) Situation of monitoring outside the NPS site

a. Overland monitoring around Fukushima Dai-ichi NPS

(a) Air dose rate beyond 20km from Fukushima Dai-ichi NPS

MEXT, with the cooperation of JAEA, has been measuring air dose rate since March 15, using up to 15 monitoring cars in liaise with Fukushima Prefecture, the National Police Agency, the Ministry of Defense and electric power companies, in order to figuring out the condition of dispersal and diffusion of radioactive materials in the overland area beyond 20km from Fukushima Dai-ichi NPS (12 points such as Kawauchi Village, Futaba Country, etc. by the National Police Agency, and four points such as army posts in Fukushima Prefecture, etc. by the Ministry of Defense). The measurement results are released by MEXT every day. In addition, MEXT estimated the cumulative dosage for one year after the occurrence of the accident based on the observed values of air dose rate, etc., and reported the contour line map to NSC Japan on April 10, which was released by the Nuclear Emergency Response Headquarters on April 11 and used as discussion data contributing to establishment of the Deliberate Evacuation Area (Attachment V-13-1).

(Measurement details)

・ MEXT has been measuring the air dose rate beyond 20km from Fukushima Dai-ichi NPS on and after March 15. The Ministry of Defense has been measuring the air dose rate at four points such as army posts in the Prefecture twice a day on and after March 27, and MEXT has been releasing its results.

・ At first, MEXT measured at various points extensively and comprehensively in order to obtain an indication of the condition of dispersal and diffusion of radioactive materials. Based on the results and in consideration of wind direction and topographical features, MEXT selected main points in each direction and measures at the same points periodically since then.

・ MEXT released a plan to improve monitoring activities on March 21 and performs monitoring of 24 hour cumulative dose using portable type dose counters at 15 poinmts since March 23.

・ MEXT started to release the results of the air cumulative dosage measurement in Fukushima Prefecture measured by the Prefecture since April 12.

・ MEXT released the results of the investigation mesh-wise conducted by Fukushima Prefecture from April 12 to 16.

・ With regard to the travelling monitoring conducted by MEXT, JAEA and Fukushima Prefecture, MEXT released the travelling monitoring results of Minamisoma City, Iitate Village, Namie Town, Katsurao Village, Tamura City, Kawauchi Village, Hirono Town and Iwaki City on April 13. In addition, MEXT released the traveling monitoring results of Kawamata Town on April 18.

・ Following the Environmental Monitoring Enhancement Plan established by the Government Nuclear Emergency Response Headquarters on April 22, MEXT created the “dosage measurement map” with cooperation of JAEA to figure out the current distribution condition of radioactive materials and also the “cumulative dosage estimation map” to estimate the amount of the cumulative dosage for a year and both of which were released them on April 26. After that, MEXT announced the policy to release the “dosage measurement map” and the “cumulative dosage estimation map” reflecting the latest data approximately twice a month, and made the second release including the data within 20km on May 16 (Attachment V-13-2).

(Measurement method)

・ The air dose rate measurement by monitoring car has been conducted by more than one monitoring car from morning till evening every day since March 15. The GM (Gerger-Muller) counter, ionization chamber and NaI scintillation detector are used as detectors.

(Measurement results)

・ Among the points periodically measured, relatively high values (highest value: 170μSv/h at【32】on March 17) are detected at five points (【31】,【32】,【33】,【81】 and【83】) located 30 km northwest from the NPS so far.

・ Moreover, the highest value 330μSv/h was observed at the point located approximately 20 km northwest from Fukushima Dai-ichi NPS from 20:40 to 20:50 on March 15.

・ As to the cumulative dosage, relatively high values (35,720μSv at【32】(cumulative value from 12:14 on March 23 to 10:24 on May 30) and (20,230μSv at【33】(cumulative value from 12:32 on March 23 to 10:08 on May 30)) were detected in the northwest direction.

(b) Air dose rate, soil radioactivity concentration, etc. within 20km from Fukushima Dai-ichi NPS

As information for discussing how to meet the requests for temporary-home-visit from residents evacuated from the evacuation zone (restricted area from April 22), MEXT measured the air dose rate and soil radioactivity concentration within 20km from Fukushima Dai-ichi NPS in cooperation with electric power companies from March 30 to April 19. In addition, the measurement has been continued in consideration of utilizing to grasp the whole picture of accident condition and lift the zones, etc. since May 6. The analysis of soil radioactivity concentration is conducted by JAEA, TEPCO and the Japan Chemical Analysis Center (hereinafter referred to as "JCAC") (Attachment V-13-3).

(Contents of measurement)

・ The air dose rate was measured from March 30 to April 2, and April 18 and 19, and MEXT released the results on April 21. The measurement results of radioactive materials in air and soil radioactivity concentration conducted on April 2 and 18 were released by the Ministry on April 25. After that, the Ministry releases the results sequentially on and after May 12.

(Measurement method)

・ The air dose rate is measured using more than one monitoring car. The GM (Geiger-Muller) counter, ionization chamber and NaI scintillation detector are used as detector. The soil radioactivity concentration is measured using germanium semiconductor detector for 1,000 or 3,600 seconds per sample (which varies by sample).

(Measurement results)

・ As to the air dose rate within 20km from Fukushima Dai-ichi NPA, relatively high dose rate (highest value: 124μSv/h at【44】on April 2) was detected in the northwest direction.

(c) Monitoring of the dusts in the atmosphere, environmental samples, and soils (Measurement started from samples taken from March 18)

MEXT has started measurement of radioactivity concentration in the dusts within the atmosphere, environmental samples (weeds, water in ponds), and soils taken since March 18 in order to use them to figure out distribution and accumulation status of radionuclides on and beyond 20km from Fukushima Dai-ichi NPS and for establishing the Deliberate Evacuation Area. Analysis was made by JAEA, JCAC and Fukushima Prefecture (Appendix V-13-4).

(Contents of measurement)

・ Radioactive materials (Bq/㎥) in the atmosphere as well as concentration of radioactive materials (Bq/kg) in soils and weeds 20km or more away from Fukushima Dai-ichi NPS were measured.

(Measurement method)

・Dusts in the atmosphere and environmental samples are measured with the use of Germanium semiconductor detector for 1000sec. or 3600sec. per sample (which varies by sample).

(Measurement results)

・ High level concentration of radioactive materials were detected in the soils and weeds taken in Iidate village (40km northern west from said NPS) on March 20. (soil :Iodine 131; 1.17MBq/kg Cesium 137 ; 0.163MBq/kg. weeds: Iodine 131; 2.54MBq/kg Cesium 137; 2.65MBq/kg)

・ On April 1 MEXT announced analysis results of Pu and U in the soil samples at three points 20km or more away from Fukushima Dai-ichi NPS. According to the results, Pu was not detected and U was detected at the rate equivalent to the rate in the natural world. On April 26 MEXT also announced analysis results of Pu in the soil samples at four points.

Those results show that it seems that scattering of Pu was not caused by the accidents this time. (Appendix V-14).

・ On April 12 and May 31, MEXT furher announced the analysis results of radio strontium in the land soils and plants. (Appendix V-14).

(d) Offshore area monitoring (Measurement starts from samples taken on March 23)

MEXT started measurement of concentration of radioactive materials in dusts within the atmosphere above the sea, seawater, and soils at the sea bottom, and air dose rate above the sea in the sea area off the coast of Fukushima Prefecture and Ibaraki Prefecture, etc. in concert with Fisheries Agency, Japan Coast Guard, Independent Cooperation Japan Agency for Marine-Earth Science and Technology (hereinafter referred to as JAMSTEC), JAEA, and TEPCO from March 23 in order to use them to figure out contaminated degree in the sea area and evaluate the establishment of a warning zone, etc.. (Appendix-V-5)

(Contents of measurement)

・ In order to measure radioactivity concentration in the seawater of the sea area and dusts above the sea, seawater (from March 28 adding the sampling of water in lower layer to the sampling of surface water) and dusts in the sea area off the coast of Fukushima Prefecture and Ibaraki Prefecture have been collected with the use of research vessel of JAMSTEC and analyzed in JAEA. MEXT made an announcement on May 3 in terms of radioactivity concentration in the soil at the sea bottom collected on April 29, and is making further announcements after that.

・ Responding the discharge of stagnant water etc. with low-level radioactive materials as measures in emergency conducted by TEPCO on April 4, MEXT announced to enhance the sea area monitoring on April 5.

・Responding to the “Plan to enhance environmental monitoring” developed by Government Nuclear Emergency Response Headquarters on April 22, MEXT made an announcement about enhancement of sea area monitoring on April 25. Furthermore, considering that scattering of radioactive materials in sea area is predicted and also wide ranging sea area monitoring needs to be implemented, MEXT announced on May 6 that it would widen the area for sea area monitoring with cooperation from concerned ministries and agencies.

・ Fisheries Agencies drew up “Basic Policy for Inspections on Radioactive Materials in Fishery Products” and notified relevant prefectures etc. of it on May 2.

・ MEXT made public on and after April 29 the results analyzed by TEPCO in respect of the seawater samples collected by “Meiyou”, a survey vessel of Japan Coast Guard, in the coast of Ibaraki Prefecture.

(Measurement method)

・ In terms of seawater, 0.5 litter of water has been taken once per four days at 16 points (12 points till April 21) from surface layer (nearly 1 to 2m below surface), middle layer (between surface and sea bottom) and lower layer (approximately 10m above sea bottom) with the use of CTD water sampler from March 28 to May 7. (sampling from middle layer and from lower layer started from April 25 and from March 28, respectively)

・ From March 23 to 27, the water samples were taken every two days from surface layer at eight points, and analyzed.

・ Dusts above the sea and seawater are measured in JAEA with Germanium semiconductor detector.

(Measurement results)

・ Measurement results are shown in the Appendix 16.

・ Incidentally, the sea diffusion simulation is on-going based on the results of sea area monitoring. (Refer to Chapter II (3)).

(e) Aircraft monitoring (starting with sampling on March 25)

In order to contribute to figuring out the status of the accumulation of radioactive materials on the ground surface, and evaluating the establishment of the planned evacuation zone, etc., the MEXT, in cooperation with the Ministry of Defense, TEPCO, and the U.S. Department of Energy (hereinafter referred to as “U.S. DOE”), etc. measured radioactive materials accumulated on the ground extensively and promptly.

(Contents of measurement)

・ From March 25, in order to find the situation of radioactive materials in the atmosphere from the Fukushima Dai-ichi NPS, MEXT, with assistance from the Japan Aerospace Exploration Agency, independent administrative institution (hereinafter referred to as "JAXA") and civil small aircrafts, used the aircrafts with radiation measuring instruments on board to conduct monitoring in the air above the site.

・ Along with the above, from March 24, in order to three-dimensionally find the diffusion situation of the radioactive materials in the atmosphere from the Fukushima Dai-ichi NPS, including vertical altitude, on the request of MEXT, the Ministry of Defense conducted measurement, by altitude, of nuclides and radioactive concentration of radioactive materials contained in dust in the air over Japan by aircrafts with dust measuring instruments on board.

・ Later, since the abovementioned two airborne monitorings found that air dose rates and radioactive concentrations in the air were not high, the measurement was suspended. Meanwhile, from April 6, in order to recognize extensive impact of radioactive materials, and to evaluate radiation dose and the accumulation of radioactive materials in the evacuation areas, etc. in the future, MEXT and U.S. DOE worked together to conduct airborne monitoring, finding air dose rates on the level of 1m high above the ground and the accumulation situation of radioactive materials on the ground surface within 80km radius from the Fukushima Dai-ichi NPS.

・ From May 18, MEXT conducted the 2nd airborne monitoring within 80 to 100km radius from the Fukushima Dai-ichi NPS. Currently, the results of measurements are being analyzed. Also, from May 31, MEXT has been conducting the 3rd airborne monitoring within 80km radius from the Fukushima Dai-ichi NPS, with assistance from the Ministry of Defense. MEXT is working together with U.S. DOE and to analyze the monitoring data.

(Measuring method)

・ Radiation dose rates in the air were measured beyond 30km from the Fukushima Dai-ichi NPS, using a JAXA's small aircraft on Mon/Wed/Fri from March 25 to April 4 and a TEPCO helicopter on Tue/Thur/Sat from March 31 to April 21, respectively on an every other day basis, with radiation measuring instruments of the Nuclear Safety Technology Center on board.

・ From March 24 to April 1, an aircraft of the Ministry of Defense with dust samplers on board conducted measurement of concentration of radioactive materials in dust in the air at

5,000 feet high above from Ibaraki Prefecture to Niigata Prefecture, and off the coast of Fukushima.

・ From April 6 to 29, MEXT and U.S. DOE, working on the air zone allocated for each, measured air dose rates on the level of 1m high from the ground surface, using NaI scintillator radiation detectors on aircraft and helicopter, flying over 150m to 300m high within 80km radius from the Fukushima Dai-ichi NPS. Along with that, using NaI gamma-ray spectrometers on the same aircraft, energy of spectra specific to each nuclide was analyzed, and based on the analysis results of nuclides of gamma-ray observed on the ground with energy analysis equipment (in-SITU analyzer), the accumulation of radioactive cesium on the ground surface was found. These results were disclosed to the public on May 6.

(Measurement results)
・ The two airborne monitorings by MEXT as mentioned above in which JAXA , TEPCO and the Ministry of Defense worked together, found that radiation dose rates and radioactive concentrations in the air were not high, resulting in these measurements being suspended.

・ Meanwhile, on May 6, based on a joint airborne monitoring with the U.S. DOE, MEXT created a map showing radiation dose rates on the level of 1m high above the ground surface and the accumulation of the radioactive materials on the ground surface, in order to complement monitoring on the ground (Attachment V-17).

b. Survey on environmental radioactivity conducted nationwide

(a) Survey on environmental radioactivity level by Prefecture

In order to obtain the picture of the environmental radioactivity level nationwide, the monitoring posts for measuring radiation dose in the air installed in each prefecture and have been in operation since March 12.

(Contents of measurement)
・ Radiation dose rate in Prefectures (Fukushima Prefecture measures independently and make the dose rates open to the public; Miyagi Prefecture was not able to measure due to damage caused by the earthquake, but started from March 28 using alternate equipment).

・ With assistance from universities, etc., simple cumulative dosemeters are installed, measuring cumulative radiation dose for 24 hours from 14:00 on a daily basis (On April 12, 28 measuring points were added, helped by universities, etc. in western Japan, amounting to 54 measuring points in total).

(Measuring method)

・ Radiation dose rates in each prefecture are continuously measured, using NaI scintillation detectors every hour, and disclosed the dose rates twice a day.

・ For measurement with assistance from universities, etc., cumulative dosemeters are installed to measure cumulative dose rates of 24 hours, and the dose rates are disclosed once a day.

(Measurement results)

・ Radiation dose rates in each prefecture are available on the MEXT website, with the tables and the figures of the diose rates.

(b) Fallout at the fixed time

In order to figure out the level of environmental radioactivity nation wide, radioactive concentrations in dust in the air in each prefecture are measured, starting with the sampling on March 18.

(Contents of measurement)

・ Radioactive concentrations (MBq/m^2) of fallouts from the air in each prefecture (except Miyagi Prefecture, where it is unable to measure due to the damage caused by earthquake) are measured (for 24 hours).

・ In Fukushima Prefecture, where measurements of radioactive nuclides contained in drinking water and suspended dust in the air, etc. are the first priority, fallouts were not measured due to unavailability of equipment for analysis, but the prefectrure started to analyze them with sampling on March 27 and 28 (for 24 hours).

(Measurement method)

・ Measurements are carried out on fallout for the period of 24 hours by germanium semiconductor detector (it takes approximately six hours), and the results are disclosed to the public once a day.

(Contents of measurement)

・ The overall trend is that high radioactivity was detected in Tohoku and Kanto districts during the period from March 20 to 24, but it drastically decreased later. In addition, as mentioned above, note that measurement of fallout could not be conducted in Fukushima Prefecture (Fukushima City), which was directly affected by the disaster, and had prioritized the analysis on radioactive nuclide contained in drinking water, atmospheric air borne dust, etc. soon after occurrence of the disaster.

・ In the samples in Ibaraki Prefecture (Hitachinaka City) on March 20 and 21, Iodine-131 of 93 G Bq/k ㎡ and Cesium-137 of 13 GBq/k ㎡ were detected.

・ In the samples in Fukushima Prefecture (Fukushima City), Iodine-131 of 23GBq/k ㎡ and Cesium-137 of 790MBq/k ㎡ were detected. (The readings drastically decreased later.)

(c) Drinking water (tap water)

With an aim to figure out the nation-wide radioactivity concentration level, the radioactivity concentration contained in tap water in each prefecture is measured for samples on and after March 17.

(Contents of measurement)

・ The radioactivity concentration (Bq/kg) contained in tap water in each prefecture is measured. (However, Fukushima Prefecture measures and the data measured is disclosed to the public independently; and Miyagi Prefecture was not able to measure due to damage caused by the disaster.)

(Contents of measurement)

・ Measurement is carried out on two liters of tap water by germanium semiconductor detector (it takes approximately six hours), and the results are disclosed to the public once a day.

(Measurement results)

・ The readings are as per Attachment V-18.

・ Although Iodine-131 and Cesium-137 were detected in all prefectures in Tohoku and Kanto districts (except for Aomori), Niigata Prefecture and Yamanashi Prefecture, all the results were below the guideline on intake of food and drink (Iodine-131: 300 Bq/kg and Cesium-137: 200Bq/kg).

3. Measures for agricultural food stuffs and drinking water, etc.

(1) Measures for agricultural food stuffs, etc.

Regarding food stuffs including agricultural ones, because of the radioactivity detected from surrounding environments of Fukushima Dai-ichi NPS after the NPS accidents, the Ministry of Health, Labor and Welfare (MHLW) notified to each prefecture on March 17, based on technical advice from NSC Japan, that "Guideline values for food and drink intake restrictions" provided by NSC Japan should be provisional limit values for radioactive materials contained in food stuffs and that any food stuffs that contains radioactive materials exceeding these values should not be consumed pursuant to Item 2, Article 6 of the Food Sanitation Law.

MHLW has collected and disclosed the results of inspection findings transffered from local governments. In addition, in terms of items exceeding the provisional limit values, if their foodstuffa are thought to have covered wide areas, the Prime Minister, the Director-General of the Nuclear Emergency Response Headquarters, issued instructions on March 21 to relevant governors of prefectures about distribution restrictions, based on advice from the NSC Japan, under the provisions of Paragraph 3, Article 20 of Act on Special Measures Concerning Nuclear Emergency Preparedness (especially for items with very high detection values, intake restrictions have also been issued). (Attachment V-19: Instructions on food stuffs pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness {List of instructions on distribution and intake restrictions})

In addition, the Ministry of Agriculture, Forestry and Fisheries (MAFF) notified related parties of how to dispose of vegetables and raw milk (including distribution-restricted vegetables, etc.), from which radioactive materials were detected, based on technical advice from Emergency Technical Advisory Body of the NSC on March 25, April 26, and May 6.

After setting provisional limit values under the Food Sanitation Law, the Nuclear Emergency Response Headquarters reviewed an inspection plan and how to set and lift these restrictions to determine the necessity of food distribution restrictions, etc. based on accumulated inspection findings. Specifically, based on technical advice from NSC, the Headquarters decided the following and announced it on April 4: 1) the borders of distribution-restricted areas should be basically the same as those of prefectures, while the areas can be divided if prefectural and/or municipal governments can keep management on these areas; and 2) weekly inspections should be conducted in the distribution-restricted areas (these inspections should be conducted basically in multiple cities, towns and villages) and the restrictions can be lifted if inspection findings continue to be below provisional limit values three consecutive times. Subsequently, after April 8, distribution restrictions on items and areas that have met the instructions have been lifted.

In addition, regarding radioactive iodine in fishery products on which NSC Japan has decided no guideline values, no provisional limit values were set either, immediately after the accident. However, based on case reports on a considerable amount of radioactive iodine detected from fishery products, MHLW decided to use the same provisional limit values for radioactive iodine in vegetables as for fishery products as well, referring to technical advice from the NSC Japan, and notified of the decision each prefecture, etc.

In terms of rice, before the arrival of period for planting, the Nuclear Emergency Response Headquarters announced its thoughts on rice planting based on technical advice from NSC Japan on April 8. Based on the Headquarter’s thoughts, the Prime Minister, the Director-General of the Nuclear Emergency Response Headquarters, issued instructions on April 22 about rice planting restrictions to relevant prefectural governors, under the provisions of Paragraph 3, Article 20 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

(2) Measures for drinking water

In terms of drinking water, MHLW issued a notice to the waterworks office of the each prefectural government and waterworks operators of each prefecture, etc. on March 19 and 21 that drinking tap water that contains radioactive materials exceeding the guideline values etc. set by the NSC should be avoided, and MHLW has publicized the measurement readings by related local governments, etc. MHLW requested water operators, etc. to implement intake restrictions and notify the relevant residents of the restrictions if the radioactive materials that is contained in tap water has exceeded the guideline values, etc.

MHLW takes more general safety measures, for example, by developing the “Future monitoring policy on radioactive materials in tap water” on April 4 in which MHLW requests local governments to carry out the inspection of tap water mainly in Fukushima Prefecture and its neighboring ten prefectures more than once per week, while daily inspection should be conducted if the readings exceed the guideline values, etc. or they are likely to exceed them, because MHLW thinks it desirable to inspect radioactive materials in tap water on a frequent basis to confirm the safety of tap water.

As stated above, MHLW promptly makes public the results of the inspection of radioactive materials in food products, including agricultural ones, and tap water, properly sets and announces regulation values and issues relevant instructions on distribution and intake restrictions.

4. Measures for additional protected areas

(1) Background of setting Deliberate Evacuation Areas and Emergency Evacuation Preparation Areas

1) Environmental monitoring and its evaluation

After the accident occurred, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) continues conducting environmental monitoring around Fukushima Dai-ichi and Dai-ni NPSs and NSC Japan continuously evaluates monitoring results. It was thought that the integrated dose in the areas where the air radiation dose rate of over 100μSv/h was measured may reach the guideline values for in-house evacuation (10 to 50 mSv) based on “Disaster prevention measures for nuclear facilities, etc. (developed by NSC Japan in June, 1980)” (hereinafter referred to as “Disaster prevention guide”), however, it was found that only a limited area was in such a state. Based on this fact, NSC Japan requested the Nuclear and Industrial Safety Agency (NISA) on March 18 to check the existence of houses, etc. and MEXT to install integrating dosimeters and observe the readings carefully (Note 1). Based on the readings of the dose rate etc., NSC Japan expressed its view on March 25 that the situation was not such that change of in-house evacuation areas is necessary at present while giving technical advice to the Nuclear Emergency Response Headquarters to request residents to voluntarily evacuate from areas where relatively high dose was expected. However, in the “Evaluation on environmental monitoring findings” on March 26, NSC Japan announced its views and requests it made after March 18 and it also announced that weight coefficient 0.6 of the value multiplied by reduction coefficient 0.4 (Note 2) was used for calculating the accumulated dose in 16 hours of in-house evacuation. From March 25 to April 4, NSC Japan maintained its view that the situation was not such that change of in-house evacuation areas is necessary, but after April 5 it changed its view that it was now organizing necessary technical data for future measures, considering the readings of dose rate, etc.

(Note 1) http://www.nsc.go.jp/ad/pdf/20110318_1.pdf
http://www.nsc.go.jp/nsc_mnt/110325.pdf

(Note 2) reduction coefficient 0.4 of wooden houses in the Table 2 of Appendix 8 to “Disaster prevention measures for nuclear facilities, etc.”

2) NSC Japan’s views

On April 7, the Chief Cabinet Secretary announced that the Government was reviewing the handling of areas where accumulated dose was on an increase and expressed its opinion that it would seek technical advice from NSC Japan while referring to opinions of IAEA and ICRP.

Outside the evacuation area in 20km radius of Fukushima Dai-ichi NPS, there were places with a possible increase in accumulated air dose. In this situation, the Director-General of the Nuclear Emergency Response Headquarters sought opinions of NSC Japan on the following matters: In the situation that there were places with a possible increase in accumulated air dose outside 20km radius of Fukushima Dai-ichi NPS, what the concept should be on the areas that required the implementation of emergency response measures, as well as what should be notified to residents within the areas. In addition, amid unsettled condition of the NPS accident, the other matters that required consideration were how to decide the areas that required the implementation of emergency response measures within in-house evacuation areas in the 20-30km radius, as well as what should be notified to residents within the areas. Regarding the abovementiond matters, NSC Japan acknowledged as follows: On March 15, the Fukushima Dai-ichi NPS had events such as a possible damage to the pressure suppression chamber of Unit 2 in the Fukushima Dai-ichi NPS, and the release of a considerable amount of radioactivity was probable. The radioactive cloud released, then moved in the northwest direction and rainfall occurred. This caused a considerable amount of radioactive materials to deposit on the land surface of the areas, which was considered to be the primary cause of continued relatively high air dose rate in the said areas. On the other hand, guideline values for protective measures under the disaster prevention guide of NSC Japan were set in a possible short-period case of about one week or so. From the perspective of keeping the exposure level low as long as reasonably achievable, NSC Japan made a judgment that 20mSv/yr, which was the lowest of the reference 20-100mSv (acute or annual) range for protecting the public in the emergency exposure condition at the accident specified by ICRP's advise given in 2007, should be the proper standard for protection measures. NSC Japan proposed that an area with the possibility of accumulated dose reaching 20mSv within one year after the accidents was regarded as "Deliberate Evacuation Area." In addition, among "In-house Evacuation Area" as of April 10, areas other than those falling under the "Deliberate Evacuation Area" were proposed as "Evacuation-Prepared Areas in Case of Emergency" because in these areas there may be necessity of an urgent response due to unsettled condition of the NPS accident. Furthermore, NSC Japn also proposed that a review on setting of the "Deliberate Evacuation Preparation Area" and "Evacuation-Prepared Areas in Case of Emergency" was necessary at the point when radioactive materials discharged from the NPS are judged to have became basically manageable. For these proposals, standard values (20 to 100 mSv/yr) of radiation protection in the emergency exposure condition of ICRP and IAEA were considered.

Attachment V-20 summarizes the concept and basis for dose standards of radiation protection. On April 10, NSC Japan received the reports on "Estimating Accumulated Dose in Surrounding Areas Outside 20km Radius of Fukushima Dai-ichi NPS" and "Accumulated External Exposure Dose (SPEEDI trial calculation values from March 12 to April 5)." These data were used when deliberate evacuation areas were actually designated. (Attachment V-21)

3) Basic concept of Deliberate Evacuation Areas and Emergency Evaluation Preparation Areas

The Chief Cabinet Secretary announced the basic concept for establishing the Deliberate Evacuation Area and the Evacuation-Prepared Areas in Case of Emergency on April 11. According to the basic concept, areas where accumulated dose was likely to reach 20mSv within a year after the accidents were designated as "Deliberate Evacuation Areas", while those other than the Deliberate Evacuation Preparation Areas in the In-house Evacuation Zone were designated as "Evacuation-Prepared Areas in Case of Emergency" because emergency responses were may be required due to unsettled situation of the accident at the NPS. The Deliberate Evacuation Preparation Areas are Katsurao Village, Namie Town, Iitate

Village, part of Kawamata Village and part of Minamisoma City except for Evacuation Areas. The Evacuation-Prepared Areas in Case of Emergency are Hirono Town, Naraha Town, Kawauchi Village, part of Tamura City and part of Minamisoma City except for Evacuation Areas.

Establishment of the Deliberate Evacuation Areas and Emergency Evacuation Preparation Areas will be reviewed when discharge of radioactive materials from Fukushima Dai-ichi NPS has become considered as bacically manageable.

(2) Background to establishment of Deliberate Evacuation Area and Evaluation-Prepared Areas in Case of Emergency

The Director-General of the Nuclear Emergency Response Headquarters issued the instructions on April 22 according to the abovementioned basic concept under ASMCNE. According to the instructions, residents etc. in the Deliberate Evacuation Areas were basically required to move out of these areas for evacuation within about a month after the instructions were issued. Residents etc. in the Emergency Evacuation Preparation Areas were required to keep prepared for moving out of the areas or in-house evacuation. In addition, voluntary evacuation continues to be requested for residents of the areas.

The instruction to stay in-house issued to residents within 20km-30km radius of Fukushima Dai-ichi NPS was lifted when Deliberate Evacuation Areas and Emergency Evacuation Preparation Areas were established.

Before establishing these areas, the government discussed with relevant local governments regarding specific areas by explaining these plans to relevant cities, towns, and villages that can become included in either of these areas, and established these areas as a judgment of the natonal government.

5. Assessment of nuclear emergency response

Regarding response to the NPS accidents, as a result, rapid progression could not be prevented and the release of radioactive materials to outside, which is essentially impermissible, affected extensively and for a long period. To the extent of knowledge obtained at this point, understanding on current situation mainly from technical standpoint is reviewed below.

(1) General

As an emergency response after occurrence of disaster, basic procedures were implemented such as declaration of the Nuclear Emergency, establishment of the Nuclear Emergency Response Headquarters, etc., direction of evacuation, etc. pursuant to the provisions of the ASMCNE.

As to protective activities for residents, etc., in an environment that available plant information are limited due to influence of earthquake and tsunami, under the severe circumstances that release of radioactive materials, explosion of the reactor buildings, etc. occurred in succession within a few days, the responses including establishment of evacuation area, etc. were carried out.

Moreover, at the same time, the efforts on ensuing confidence and safety of residents are being promoted such as environment monitoring, ingestion limit of food or beverage, health consultation, mental healthcare, etc.

On the other hand, in the responses, call up personnel to establish the initial system was small due to influence of earthquake disaster, the Off-site Center (OFC) was forced to be moved, emergency response measures implementation area was expanded to the area exceeding 10-kilometer radius from the NPS, and evacuation of residents, etc. is prolonged, and as a result, it needed to amend, strengthen, etc. the existing framework. Moreover, it is considered that the advance preparation was not adequate for a series of responses from establishment of initial responses to measures for restoration.

As background against it, because we have not experienced the disasters subject to the ASMCNE since it was established in the wake of the JCO criticality accident, it is thought that the effectiveness of the emergency preparedness has not been fully verified with considering occurrence of severe accident into reality

In addition, in the past operation of the nuclear emergency response drill, etc., it is thought in some aspects that the failure of safety function was assumed to be restored relatively early during the assumed severe accident. The details and the system of emergency response have been developed and managed in some aspects on the presumption that if the nuclear disaster has occurred by any cause, the situation is ceased in a relatively short time with emergency measures by the nuclear operator using the existing facilities, etc. and providing technical instruction and advice and coordination by the Nuclear and Industrial Safety Agency in the local range with a central focus on the said facilities.

Moreover, assumption has not been made secifically about the situation where a nuclear accident occurs in combination with earthquake, tsunami, etc.

On the basis of the disaster, it is requested to restore, etc. the functions of damaged the Off-site Center (OFC) and to improve the management of the emergency measures immediately in cooperation among related ministries and agencies, related local governments, the nuclear operator, etc. as well.

It is also required to conduct a review of system, structure, etc. thoroughly and continue to improve them as well in order to secure the rapid and adequate emergency response and smoothly to take measures focusing on post-event response against any kind of situation, including a disaster which occurs with combination of an earthquake and tsunami.

(2) Particular items

1) Assessment and prediction of the situation concerning disaster events.

Since the information on situation of reactors were not available due to breakdown of communication system by earthquake, the information on amount of radioactive materials released form the facilities were not obtained. As a result, the prediction of the effects of radioactivity, SPEEDI's original function, was unavailable. Under such situation, ERSS and SPEED was used to calculate the estimation with various assumptions for the internal examination of the situation by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Nuclear and Industrial safety Agency (NISA) and the Nuclear Safety Commission (NSC) Japan. For this purpose, MEXT made some estimation at every hour after 16:00 on March 11, which are the airborne concentration of radioactive materials and air absorbed dose rate in the surrounding environment for the reference amount or 1 Bq released from Fukushima Dai-ichi NPS. The estimation was not disclosed at the early stage of the accident, because the calculated results of SPEEDI are supposed to be shared by the parties involved in the nuclear emergency preparedness activities and it was also feared that the disclosure of the estimation may bring unnnecessary confusion, as the estimations at that time were very different from that calculated based on the actual readings. In addition, these early estimations were not shared with other governmental agencies.

After that, the Nuclear Safety Commission Japan estimated release source in combination with dust sampling results and diffusion simulation by SPEEDI from the NPS to the measurement point, and calculates concentration of radioactive materials and air dose rate around the facilities retroactively by entering the estimated release source data into SPEEDI, and estimate the cumulative dose of internal exposure and external exposure from the time of the accident based on those data, and the results are released on and after March 23. Incidentally, this prediction method is was not assumed in using SPEEDI in the Basic Plan for Disaster Preparedness.

・ In this way, the calculation results of SPEEDI were not released at first when the accident occurred, but MEXT, the NISA and NSC Japan release the results of initial internal discussion sequentially on their websites on and after May 3. From the standpoint of contributing to evacuation of residents, etc., the results of utilization of SPEEDI should have been released and information should have been provided to related local governments at the early stages of the accident.

・ In terms of crisis management, the concrete methods of data utilization, information sharing and release, etc. should have been fully prepared including the estimation results on the certain assumption like this, etc., with the prospect that the larger the disaster, it may be more difficult to obtain information, as a general trend at disaster.

2) Emergency response measures for disaster events

a. Handling obstructive factors for on-site activities

In the emergency response, the dose limit for personnel engaged in radiation work have been raised, and radiation constitutes barriers to personnel activities. Long-term personnel work under the influence of radiation might not have been concretely assumed, and deployment of equipment for radiation protection, development and instruction of remotely-operable equipments and facilities, etc. might not have been prepared adequately.

Earthquake and tsunami have a significant impact on the factors for restricting on-site activities, and it’s necessary to carry out activities while bewaring earthquake and tsunami, securing the power supply and doing provisional works in consideration of these influence, eliminating traffic barriers on and outside the site, etc. It is thought that in the event of complex disasters like this, the secondary effect caused by surrounding damage should be considered as well as direct influence on site.

Moreover, in addition to explosion, fire or smoking that may be associated with it occurred at Units 3 and 4, and personnel working on site had to take shelter and work had to be interrupted. For this reason, it is considered to be important to enhance the fire protection response, such as reduction of quantity of combustibles on a normal basis.

b. Information provision to related institutions

We needed to receive support from related institutions for emergency cooling of reactors and we should have provided information on current situation and outlook of disaster events, details necessary for receiving support, information necessary for on-site safety management, etc. adequately from the stage when requesting to the related institutions as a nuclear operator.

Moreover, although the on-site arrangement center was placed on the gathering spot of dispatched personnel (J Village) by direction of the Prime Minister this time, the secretariat should have prepared the coordination scheme among parties engaged in the wotk at site from the early stage of dispatching.

3) Protective action for residents, etc.

The existing framework of the Act on Special Measures Concerning Nuclear Emergency Preparedness generally assumes, based on the emergency preparedness guidelines of the NSC Japan, to implement in a step-by-step manner defining a certain scope in consideration of scale of abnormal event, climate condition, etc. in the event of actual application of the protection response including evaluation and sheltering. In addition, based on the indices provided in the emergency preparedness guidelines, in the national and local plan for disaster preparedness, it assumed to set the Emergency Planning Zone (EPZ) within approximately 10 kilometers of the NPS, use 10mSv for sheltering and 50mSv for evacuation (external exposure) as an indicator for the protective measures for residents, etc. These measures for resident protection based on the emergency preparedness guidelines of the NSC Japan might have been developed so far with the main aim of protecting and reducing the influence around the NPS relatively in a short term.

Since the original functions of SPEEDI were unavailable to be utilized in this response, concentric zone was set for direction of evacuation and sheltering provided on March 11, 12 and 15 on the assumption that large amount of radioactive materials or radiation, etc. were released around, and the zone was expanded in stages depending on progress of disaster events. Even under such restriction, we should have estimated the diffusion trend of radioactive materials, etc. by SPEEDI based on climate data, etc. on a certain assumption, and utilized as reference of evacuation activities, etc. As to cooperation and coordination with related local governments with regard to the zone setting, in evacuation direction on March 11 and 12, the national government partially arranged candidate refuges, prepared transportation, etc., and as a result residents, etc. could move to outside the evacuation area relatively smoothly. On this occasion, although adequate response was not taken to prior communication because it was emergency response in the situation that communication and transportation were stopped due to the disaster, on the other hand, in order to promote awareness of evacuation direction promptly, the Chief cabinet Secretary held an interview soon after each direction and made an announcement about the details of direction, and information was transmitted utilizing television, radio, etc. In addition, information on the accident outline, the results of monitoring, etc. were not fully provided to the related local governments and residents due to the reasons mentioned in the above 1. (1) 2).

After that, based on that the radioactive materials released from the NPS were accumulated locally and cumulative dosage was high in some areas, the DeliberateDeliberate Evacuation Area was set in the shape different from concentric circle on April 22 according to the view newly shown in Attachment V-20 from a long-term standpoint. The Evacuation-Prepared Areas in Case of Emergency were also set at the same time and the previous sheltering was lifted. Setting the Deliberate Evacuation Area and the Evacuation-Prepared Areas in Case of Emergency, setting the alert zone and implementation of temporary access to the evacuation zone were carried out after arranging details and steps with the related local governments. In addition, sheltering is originally positioned as a tentative averted measure, but it took more than one month till lift this time. Against it, based on the actual conditions that many residents evacuated voluntarily after providing direction of sheltering on March 15 and it became difficult to maintain the social life due to decrease in commerce, logistics, etc. in the zones, the government took the response of voluntary evacuation promotion and life support on March 25, and as a result the next step on assumption of lengthening of the nuclear disaster should have been considered immediately.

Based on the responses mentioned above, it is thought to consider the framework of the Act on Special Measures Concerning Nuclear Emergency Preparedness, measures on the emergency preparedness guidelines, etc. On this occasion, it is necessary to organize concrete views and measures about setting the zones in the event when the nuclear disaster may influence widely in the long term, evacuation preparation for people requiring assistance during a disaster from the early stages, relation between emergency evacuation and prior announcement in the event when disaster events drastically make progress, requirements for change, release, etc. of the resident protection measures, etc.

4) Implementation structure for emergency response

a. Structure of the whole government

While response needs in disaster countermeasures are varied in response to manners of disasters so that desirable implementation structure is varied case by case, it is contemplated that the implementation structure adopted this time should be utilized in establishing future structures for nuclear emergency preparedness as an example of actions to an actually-occurred nuclear disaster and a complex disaster. This time, Integrated Headquarters for the Response to the Incident at the Fukushima Nuclear Power Stations (Government-TEPCO Integrated Response) was established in a situation where there was restriction in grasping a current state of reactor facilities and so on, and it has been contributing to facilitate information exchange, etc.

In order to promote a variety of actions based on the structure of the whole government (see 1.(2) 3)a above), Secretariat of the Nuclear Emergency Response Headquarters has been set up in Emergency Response Center (ERC) of NISA at the working level. Substantially, it was established and has been operated based on the emergency measures by nuclear operator and NISA so far.

Recently, crisis management structure in Japan has been enhanced with a focus on the Office of the Prime Minister, and actions in this time pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness such asa sharing general information in the initial stage and coordinating roles, etc. were conducted via the emergency team convened at the Office and liaison members of each ministry or agency in addition to actions for the earthquake and tsunamis pursuant to the said Act. Also, regarding the matters required for focused actions such as livelihood support, etc., the organizations in charge have engaged in communication and coordination after they were enhanced.

In relation with the Local Nuclear Emergency Response Headquarters, since the accident events rapidly proceeded in a situation where communication with the Off-site center was difficult due to the disaster, the initial collection of information and communication were conducted mainly by ERC. Also, as the disaster affected a broad range of area, more municipalities other than Fukushima Prefecture were related to restriction of food, etc., communication and coordination should have been performed by the Director-General of Local Nuclear Emergency Response Headquarters as a member of the Joint Council under normal conditions, but they have been done by the headquarters in Tokyo as an exception.

Based on the above situation, it is deemed to be important that we will operate the function in a quick and smooth manner through reviewing a function we should serve as a bureau in the whole with a use of functional teams and systems of ERC, and a way of communication and coordination with members, and related ministries and agencies, etc..

Also at disaster, since the government organization related to Nuclear Emergency Preparedness is divided into such as Nuclear Industry and Safety Agency, a primary regulatory body, NSC Japan which gives an advice from outside, and local governments and related Office and ministries which perform environmental monitoring for example, their roles and responsibilities are unclear, there are aspects that we could not responsively act to such a massive nuclear accident. It is necessary to review the total structure relating to the above crisis management as well as the implementation structure of safety regulation at normal times.

b. Local Nuclear Emergency Response Headquarters

(a) General situation

As preparation for earthquakes and tsunamis, etc. in power supplies, communication and reserves, etc. was not sufficient at the Off-site Center (OFC) where the Local Nuclear Emergency Response Headquarters was set up, and also, as enough information on the plant was not obtained as an external factor, expected function of information gathering and communication was not performed from the beginning.

Also, effect of radiation had not been considered specifically regarding, locations, architectural structures, and facilities, etc. responding to a situation like this time in the conventional framework, which consequently prevented continuing activities at OFC.

Meanwhile, convening related parties and dispatching them to the site planned in the framework of the Act on Special Measures Concerning Nuclear Emergency Preparedness was also insufficient in the initial startup stage. This was partly because advanced notices and the register of members to be convened was not fully performed and is to be improved. There is also a background factor that many of current members are planned to be convened from a long distance and improvement should be made for realistic response to a case in which a disaster event proceeds rapidly as in this time. Also engagements in preceded earthquake disaster measures, influence on communication and transportation means by the earthquake disaster should be considered as the points to be noted in a complex disaster.

This time it is contemplated that OFC failed to effectively function under such combined conditions leading to a delay in full-fledged operation of the Local Nuclear Emergency Response Headquarters. Also, following the subsequent relocation of the Local Nuclear Emergency Response Headquarters, the major responsibilities for emergency measures related to control disaster events shifted to Fukushima Nuclear Power Station Integrated Headquarters for Accident Countermeasures.

This time, accidents occurred at multiple units so that commands from the Nuclear Emergency Response Headquarters were important. Meanwhile, based on the JCO Criticality Accident, it is planned that the Director-General of Local Nuclear Emergency Response Headquarters sets evacuation area through sharing information and consulting with related cities, towns and villages at Joint Council for Nuclear Emergency Response, but the Council could not play an intendedl role due to the restrictions as in 1(2)b. above.

As an operational problem for the Local Nuclear Emergency Response Headquarters, in the case that a disaster influences on a broad area and lasts long period as in this time, it is necessary to pay a special attention on safety management of people going in and out of OFC including media relations conducted by OFC as planned in the Basic Plan of Disaster Countermeasures, for example. Also, while Directors-General of Emergency Preparedness Headquarters of related local governments (governors, and mayors of cities, towns and villages) are among the members of the Joint Council, buildings of a related local governments or their neighborhood facilities seem to be realistic as places for continued coordination of protection activities for residents and measures for restoration, etc. (cf. the local response headquarters for natural disasters are like this in many cases.). It is deemed to be important to review functions to be secured at OFC and alternative facilities, and members to be convened at the assigned place, noting on these points in order to have more responsive operation to a progression and scale of a disaster event, and phase of disaster countermeasures.

(b) Restoration of OFC affected in the East Japan Great Earthquake Disaster, etc.

Affected OFCs in the East Japan Great Earthquake Disaster were not only in Fukushima but also in Onagawa, where buildings were damaged by tsunamis, and human damages on personnel also occurred.

Regarding the affected facilities, it is necessary to immediately restore their functions. In doing this, it is necessary to determine a location of the Off-site Center (OSC) facilities, architectural specifications, communication means with resistance to disaster, reserved materials and equipment, and requirements for alternative facilities, considering direct impacts on the subject facilities by the earthquake and tsunamis, secondary effects associated with the affected neighborhood area, and effect of radiation in the time of nuclear disaster ,etc.

Also, it is necessary to review other OSCs from the same viewpoint and take required measures.

5) Nuclear Disaster Countermeasures Drill

Considering emergency responses for this time, thorough review on Nuclear Disaster Countermeasures Drill will be necessary, including a startup of an initial system in a case of a rapid progression of a disaster event, a series of responses in a case where it leads to a severe accident and an emergency response covers a broad area and extends for a long time, and responses in a case in complex with natural disasters such as earthquakes and tsunamis, in addition to plans and guidelines, etc. as the basis of the responses.

VI. Discharge of Radioactive Materials to the Environment

1. Evaluation of the amount of radioactive materials discharged to the air

(1) Discharge of radioactive materials to the air

In this nuclear accident, along with the development of events, incidents such as the pressure venting of PCVs, explosions at reactor buildings and others resulted in radioactive materials being discharged to the air.

On May 5, TEPCO installed four ambient air filtration systems to reduce the concentration of radioactive materials in the reactor building, and also partly opened the double doors on the north side from May 8 to 9 to ventilate the building, to improve the working environment of the reactor building of Unit 1. As this raised the possibility of charges of small amounts of radioactive materials, environmental monitoring was strengthened both in and outside the site, but no change was detected in the either radiation dose rate or the concentration of radioactive materials in the air.

(2) Estimation of the discharge of radioactive materials to the air

1) Analysis-based estimation

In order to conduct an INES estimation, NISA conducted an estimation using the result of an analysis on the reactor situation, etc. by the Incorporated Administrative Agency Japan Nuclear Energy Safety Organization (JNES) and estimated that the total discharge amounts from the reactors of Fukushima Dai-ichi NPS were approx. $1.3\text{x}10^{17}$Bq for Iodine 131, and approx. $6.1\text{x}10^{15}$ Bq for Cesium 137. Later, when JNES conducted another analysis of the reactor situation, etc. as described in Chapter IV, using the plant data, etc. obtained immediately after the earthquake, which NISA collected from TEPCO in a report on May 16, NISA estimated that the total discharge amounts from the reactors of Fukushima Dai-ichi NPS were approx. $1.6\text{x}10^{17}$Bq for Iodine 131 and approx. $1.5\text{x}10^{16}$Bq for Cesium 137.

This chapter, compares these estimated values compared with mainly monitoring data obtained from the site of Fukushima Dai-ichi NPS, and how radioactive materials discharged from the reactors were dispersed and how they had an impact on the surrounding environment.

After earthquake, the discharge of radioactive materials became evident early on the morning of March 12 when the air dose rate measured by a monitoring car near

MP-6(monitoring post No. 6 in the site of Fukushima Dai-ichi NPS) increased. It can be estimated that there was a leakage of radioactive materials from the PCV and a discharge of such materials to the air, as a slight decrease in the PCV pressure was observed in Unit 1 after an abnormal rise at this point. According to an analytical result, that fuel meltdown had already started.

Monitoring measurements performed afterwards at the same point found that the dose rate had increased until the noon of March 12, and D/W pressure had not significantly decreased until around 14:00 despite the venting operation that continued in Unit 1. It could be considered that non-condensable gases, such as noble gases, continued to be discharged from the melted fuel in the reactor into the environment through the S/C.

TEPCO judged at 14:30 on March 12 that D/W pressure decreased and venting succeeded. At this point, it is believed that radioactive materials including iodine, which was neither deposited on the reactor vessel and others, nor absorbed by the S/C, were discharged to the air and, as a result, due to a plume effect, a reading of about 1 mSv/h was observed from a measurement made near MP-4. In addition, a reading of 20 μSv/h was observed from a measurement made at the joint government building of City of Minami Soma by the Fukushima prefectural government that started in the evening, and it is believed that the plume was first blown south by a weak northerly wind and then diffused to the north by a strong southerly wind.

From 08:00 to 09:00 on March 13, the dose rate near MP-1, 4 and 6, increased significantly, and it is estimated that this was caused by the vent operation of Unit 3 performed after its fuel was exposed due to a decrease in the reactor water level. Also, this plume is assumed to have spread to the north under the weather conditions prevailing during this period, in which a weak westerly wind turned southerly. A measurement by Minami-soma City indicated a rise of about 1 μSv/h in the dose rate. A significant rise in the dose rate was confirmed near MP-1, 4 and 6 corresponded to the multiple decreases in the D/W pressure of Unit 3.

A rise in multiple dose rates was confirmed in the morning of March 14, but no information was obtained on events that might have been related to the discharges from each plant. For this reason, although causes of the dose rate increases are uncertain, it is plausible to consider that one of the causes can be the re-floating of deposited radioactive materials because the background dose rate increased at each measuring point due to radioactive materials discharged up to March 13.

An air dose rate of about 3 mSv/h was measured near MP-6 at 21:00 on March 14. This rate decreased once but increased again after 06:00 on March 15, and a dose rate of about 12 mSv/h was measured at 09:00 on the same day. In Unit 2, a decrease in D/W pressure was observed due to a wet venting at 21:00 on March 14, and it is estimated that radioactive materials were discharged from Unit 2 because of a blast sound from the unit at around 06:00 on March 15 and a subsequent S/C pressure decrease. At around the same time, however, an explosion occurred in the reactor building of Unit 4, thus a clear distinction cannot be made between them. Since wind often blew from the north in this period, the plume was very likely to have blown to the south, and agencies including the Japan Atomic Energy Agency (JAEA) in Tokai village, Ibaraki prefecture observed a rise in the dose rate and detected radioactive iodine, etc. in the atmosphere.

In addition, an increase in the air dose rate was observed near MP-6 at 23:00 on March 15 and at 12:00 on March 16. D/W pressure decreases were observed in Unit 3 and Unit 2 at respective times. It is estimated, therefore, that discharges occurred from Unit 3 and Unit 2 at these respective times.

2) Estimation by SPEEDI

Regarding the accident, the System for Prediction of Environmental Emergency Dose Information (SPEEDI) was unable to be utilized for some time to calculate the concentration of radioactive materials or air dose rates around the power station because information about the discharge sources was not obtained through measurements performed at reactor facilities. From March 16, the Nuclear Safety Commission of Japan (NSC Japan) considered an alternative method for measuring at reactor facilities through trial and error with assistance from researchers of JAEA, the independent administrative institution that had developed SPEEDI, and dispatched staff from the Nuclear Safety Technology Center under the instructions of MEXT. The NSC Japan combined the measurement (dust sampling) results of radioactive materials concentration in the environment with diffusion simulations by SPEEDI from the power station to measuring points, which enabled it to perform with a certain degree of reliability an inverse estimation on discharge source information as of the time the radioactive materials caught by dust sampling were discharged. The NSC Japan entered such estimated discharge source information into SPEEDI to obtain prior radioactive material concentrations and air dose rate distributions, and on March 23, April 11, 25 and 27 it announced the trial results of accumulated internal and external exposure doses from the time the accident occurred. (See Attachment VI-1: SPEEDI trial estimation of total discharge of radioactive nuclides.)

2. Evaluation on the amount of radioactive materials discharged to the sea

(1) Leakage of radioactive materials from the power station

In Fukushima Dai-ichi NPS, the water containing dissolved radioactive materials that were released from inside the RPV leaked into the PCV. In addition, as a result of injecting water from outside in order to cool the reactors and Spent Fuel Pools, some of the injected water leaked out of the PCV and accumulated inside the reactor buildings and the turbine buildings. The management of the contaminated water in the reactor and turbine buildings became an important issue from the viewpoint of workability inside the buildings, and the management of contaminated water outside the buildings became an important issue from the viewpoint of preventing the release of radioactive materials into the environment.

TEPCO found at around 09:30 on April 2 that water with a reading of over 1,000 mSv/h had accumulated in a pit storing electric cables near the Intake Channel of Unit 2 and that there was a crack (about 20 cm) on the lateral surface of the pit, from which water was flowing out into the sea. From this reason, TEPCO took some measures such as pouring concrete, etc. and injecting soluble glass to stop water discharge and confirmed that the water outflow stopped at 05:38 on April 6.

TEPCO evaluated the amount of contaminated water that had flowed into the sea from Unit 2, including highly-concentrated radioactive materials (hereinafter referred to as “contaminated water”) and the Nuclear and Industrial Safety Agency (NISA) also confirmed it. (See Attachment VI-2: Outflow of radioactive water off the site near water intake of Unit 2 at Fukushima Daiichi Nuclear Power Station.)

On April 1, the day before the outflow was detected, the air dose rate near the sea surface around Unit 2 screen was confirmed as 1.5 mSv/h, which was the same as the surrounding background level. Immediately after the outflow was confirmed, the air dose rate measured at almost the same place was 20 mSv/h. This makes it reasonable to assume that contaminated water flowed out in a period from April 1 to 6. The outflow rate was calculated as about 4.3 m^3/h based on photos, etc. The total amount of radioactive materials contained in the outflow of the contaminated water can be estimated at 4.7×10^{15} Bq using measured values obtained via sampling.

TEPCO confirmed that the outflow from a pit near the Intake Channel of Unit 3 into the sea at 16:05 on May 11 and that it stopped around 18:45 on the same day.

TEPCO evaluated the amount of contaminated water that flowed out to the sea from Unit 3 and the NISA also confirmed it. (See Attachment VI-3: Outflow of radioactive water off the site near water intake of Unit 3 at Fukushima Daiichi Nuclear Power Station.)

As a result of the evaluation, the amount of radioactive materials discharged from Unit 3 was calculated as 250 m^3 in an outflow period of 41 hours (from 02:00 on May 10 till 19:00 on May 11). As for the concentration of contaminated water that flowed out into the sea, the total amount of radioactive materials contained in the outflow of contaminated water can be estimated at 2.0×10^{13} Bq using a measured value of water that flowed into the pit.

To prevent further leakage of radioactive materials, TEPCO is taking measures such as securing storing places for waste water and installing treatment facilities for removing radioactive materials from waste water, closing off possible leaking places, and improving reactor cooling methods to reduce waste water.

(2) Discharge of radioactive materials to the sea from the power station

Because of a possible leakage of highly-concentrated radioactive waste water accumulated in the basement floor of the turbine building of Unit 2, TEPCO decided to discharge the low-level radioactive water accumulated in the Radioactive Waste Treatment Facilities to transfer the highly-concentrated radioactive waste water as an emergency measure, pursuant to Article 64 paragraph 1 of the Nuclear Regulation Act. In addition, to protect important equipment from the subsurface water entered into the building, TEPCO also discharged such subsurface water, including low-level radioactive waste water accumulated in the sub-drains of Units 5 and 6. Therefore, NISA requested TEPCO to report on the facts, and draw up an impact assessment and TEPCO’s view related to the discharge to the sea, pursuant to Article 67 paragraph 1 of the above Act. NISA confirmed the report details and obtained technical advice on the discharge to the sea from NSC Japan as an emergency measure.

TEPCO discharged about 10,393 tons from the Radioactive Waste Treatment Facilities and sub-drains of Units 5 and 6 from April 4 to 10. The total amount of radioactive materials is estimated at about 1.5×10^{11} Bq based on the amount discharged during this period. (See

Attachment VI-4: Result of discharge of low level radioactive accumulated water from Fukushima Daiichi Nuclear Power Station to the sea.)

To check the environmental impact of the above (1) and (2), TEPCO carried out some measures including strengthening coastal sea area monitoring and installing silt screens (leakage protective fences). (See Attachment VI-5: Countermeasures for preventing diffusion of liquid containing radioactive material.)

Regarding the above, the Japanese government deeply regretted that there was no choice but to discharge water that contained radioactive materials despite their low concentration. (Refer to Chapter IX. 4. (3).)

(3) Sea diffusion simulation

MEXT performed predictive calculations on the diffusion of radioactive materials using the supercomputer at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) based on prior measured values of coastal water monitoring performed on April 12, 16, 29, and on May 9 and 24, and announced the outcome of a simulation of the radioactive concentration distribution from the Fukushima Dai-ichi NPS for the coming 2 months or so.

The model used for the simulation calculates the way each floating particle given under initial conditions is diffused on the sea-surface divided into grids, each with the area of 8 km square, by tides and winds using a diffusion formula, which uses estimated data on tides for about the following two months from the day before a predictive calculation is made and forecast data of winds for a week from the day before the predictive calculation is made, as well as the average wind data of a period from a week after the day before the predictive calculation is made until two months after that week. In other words, the distribution of the radioactive concentration is estimated based on the estimated diffusion of floating particles on the sea surface.

It estimated that the distributed radioactive concentration in all sea areas in mid-May was below the initial detection limit (about 10 Bq/L for both radioactive iodine and cesium) (There would be no sea area where the distribution of radioactive concentration exceeded 10Bq/L.)

For this reason, to understand the distribution of radioactive concentration in more detail, MEXT decided to analyze a wider area with lower detection limits and selected new sampling points based on the above estimation. This “wider sea area monitoring” was announced on May 6.

The distribution of the concentration of the radioactive area after widening the sampling area was almost as estimated, and the detected radioactive concentration announced by MEXT on May 20 for the first time after widening fell almost between the old detection limit (10 Bq/L) and the new detection limit (6 Bq/L of cesium 134).

However, the simulation does not always guarantee the actual measured values of concentration themselves because it is a model that predicts distribution, not one that predicts the level of the concentration itself. In addition, differences between the distribution and the actually measured values are caused by that fact that errors become bigger as the predictive time gets longer, due to multiple restrictions including the impossibility of thorough reproduction of the actual flow even by incorporating observed values into the model, together with the generation of errors by using average winds of the period after using winds for estimation for about a week only. There is a need to perform constant reviews to realize estimates that are far closer to the real values, checking actually measured values of the latest monitoring results and obtaining a mutual evaluation on simulations by other calculation codes, too.

VII. Situation regarding Radiation Exposure

1. Situation of radiation exposure concerning radiation workers and other related workers

(1) Dose limit for radiation workers

1) Provision of dose limit prior to the accident

Regarding the dose limit, etc., the Radiation Review Council established in the Ministry of Education, Culture, Sports, Science and Technology (MEXT) has studied recommendations made by the International Committee on Radiation Protection (ICRP) and its possible application in Japan, in which it has recommended its views. Under the relevant laws, based on the ICRP 1990 Recommendations (Pub. 60), the dose limit for radiation workers is set at an effective dose of 100 mSv over 5 years and 50 mSv per year. In addition to this limit, the dose limit for women is regulated at 5 mSv over 3 months.

The dose limit for radiation workers engaged in emergency work is regulated by the relevant laws at 100 mSv for an effective dose, at an equivalent dose of 300 mSv for optic lenses, and at an equivalent dose of 1 Sv to the skin.

2) Revision of dose limit in emergencies based on the accident

In consideration of the situation of this accident, the dose limit for radiation workers in emergencies has been revised due to the need for work in preventing further worsening of the nuclear disaster. In the areas where emergency measures to combat the nuclear emergency were implemented from the day when the Declaration of a Nuclear Emergency was issued according to the Act on Special Measures Concerning Nuclear Emergency Preparedness until the day when the Declaration of Cancellation is issued, the effective dose of 100 mSv was raised to 250 mSv in the event of an unavoidable emergency, which took effect on March 14. In determining the basis for the 250 mSv dose limit, the ICRP 1990 Recommendations (Pub. 60) that stipulate a dose limit of 500 mSv for persons voluntarily engaged in emergency rescue operations in order to avoid definitive impact, a primary objective of radiation protection, was taken into consideration.

In revising the dose limit, the President of the National Personnel Authority, the Minister of Health, Labour and Welfare, and the Minister of Economy, Trade and Industry consulted the Radiation Review Council established in MEXT on the revision of the dose limit, based on the Act on Technical Standards for the Prevention of Radiation Disasters, and obtained the opinion that such a revision was appropriate.

Furthermore, the Ministry of Health, Labour and Welfare (MHLW) has issued documents for administrative guidance on radiation doses for workers previously engaged in emergency work and have hence been engaged in other work than that of emergency work which nevertheless exposes them to radiation. (Attachment VII-1)

(2) Radiation control measures in nuclear power stations

1) Radiation control measures by the operator (Tokyo Electric Power Co. Inc. (TEPCO)) prior to the accident:

TEPCO had been performing radiation control measures for the purpose of minimizing radiation doses received by workers by assessing the radiation levels in the “radiation controlled areas” such as the reactor buildings and turbine buildings, and by confirming individual radiation operational plans for each operation. In addition, only personnel confirmed by TEPCO as being designated and registered as radiation workers and granted proper permits were able to work in the controlled areas.

Normally, at Fukushima Dai-ichi NPS, a system was established and employed so that each worker was provided with an Alarm Pocket Dosimeter (APD) and wore it to measure radiation doses at work and ensured that each worker was identified when entering a control area. The dose of the APD was read after completion of the work and was automatically recorded, so that calculations for a worker’s individual daily dose, or doses by an individual company, or by total individual doses per month, per year, etc. could be obtained.

Furthermore, when entering and leaving a controlled area (in each building), dose readings were taken in the building next to the entrance of each building, as well as when putting on protection equipment and an APD just before entering a controlled area.

Regarding internal exposure control, TEPCO conducted measurements and evaluated all workers using a whole body counter (WBC) when they first entered the radiation controlled areas and also once every three months.

2) Radiation control measures by the operator after the accident

a. Measures to control individual external exposure:

a) System of radiation control measures at Fukushima Dai-ichi Nuclear Power Station:

In this accident, tsunamis reached buildings facing the sea coast which provide access to the controlled areas as described in (2), depriving the function of the control system, and rendering many of the APDs and dose reading devices unusable as they became submerged in seawater.

Also, due to the increase of radiation and contamination levels in the power station site, it was decided that workers should conduct all operations in TEPCO’s response headquarters established in the quake-proof building, and that distribution of APDs and recording of doses were performed in the quake-proof building.

From March 11, shortly after the earthquake, dose management for workers had to be performed manually by recording the names of individuals and their daily dose values on paper to accumulate data. Moreover, such daily individual doses which were manually recorded were and are manually input into PCs (using Excel sheets) and saved in a database.

Since many APDs became unusable for the reasons described above, not every worker was able to wear an APD and TEPCO has thus been managing radiation doses of all the personnel by making leaders of operational groups wear APDs on behalf of the entire group. As controlling workers’ radiation exposure is extremely important to ensure safety on the site, the Nuclear and Industrial Safety Agency (NISA) gave oral instructions to TEPCO to make every effort to manage its workers’ radiation exposure and dose. After receiving these instructions, TEPCO procured the necessary dosimeters by April 1 so that all the workers conducting operations were able to carry portable dosimeters.

Furthermore, the evaluation of external exposure during work in the quake-building was based on the length of period of stay because workers didn’t wear APDs when working inside the building. Moreover, shortly after the earthquake, appropriate protection equipment such as protective masks were not worn even though the calculation of radioactive materials within the air of the quake-proof building exceeded the allowable limits of radioactive concentration in the air, resulting in workers staying in the building inhaling radioactive materials.

On April 14, about one month after the accident occurred, radiation control measures similar to that of the previous dose management (the system in which individual names and dose readings are automatically recorded) became available since the system of radiation control measures was nearly completely restored.

b) System of radiation control measures in J Village

Shortly after the accident from March 17, J Village, a soccer training facility located at a point about 20 km south of Fukushima Dai-ichi NPS, was utilized as a place for preparing workers for entry into Fukushima Dai-ichi NPS, where they put on their protective equipment, and performed decontamination tests when leaving, etc.

A system was established for radiation workers in Fukushima Dai-ichi NPS who don't go through the quake-proof building to attach ADPs (there are several kinds of dosimeters due to hasty procurement and assistance received from a variety of organizations) at J Village before going to work at the site in Fukushima Dai-ichi NPS, and to record doses for the day when returning dosimeters upon finishing work for the day. For this reason, dose readings in J Village continue to be manually calculated since the beginning of the accident. TEPCO is planning to introduce an individual recognition system using bar codes in J Village from early June.

b. Wearing of radiation protection equipment, work management, etc.

Due to the high concentration of radioactive materials over the entire site of Fukushima Dai-ichi NPS, TEPCO requires workers to wear Tyvek and other protection clothes, gloves, and protection masks. It also requires appropriate protective clothes (anoraks, etc.), rubber gloves, and shoe covers taking into consideration weather conditions and contamination levels of the work sites.

As for the quake-proof building, it was difficult to prevent the inflow of radioactive materials because the entrance door was not an airtight structure, and the door was slightly damaged by the hydrogen explosions of Units 1 and 3, leaving a gap by the hydrogen explosions of Units 1 and 3, and as there no particular protective equipment installed in the building in the event of such an accident, the inhalation of radioactive materials by workers occurred. Countermeasures were taken to decrease the concentration of radioactive materials in the air of the building such as connecting a unit house installed with an ambient air filtration system with charcoal filters at the entrance of the quake-proof building. As a result, the concentration of radioactive materials has been kept at low levels to the extent that it has been unnecessary to implement further protective measures.

In addition, a preliminary survey is conducted so that workers are informed of the situation in developing a work plan in areas such as high radiation areas.

(3) Status of radiation exposure

The status of exposure doses for the workers engaged in emergency work at Fukushima Dai-ichi NPS as of May 23 is that there were approximately 7,800 people who entered the site and were exposed to approximately 7.7 mSv on average. Thirty people were recorded as receiving doses over 100 mSv. The compiled results of exposure doses are as shown in Attachment VII-2.

In this accident, there are cases where exposure doses exceed the limit dose stipulated in the law, and the details are as follows.

On March 24, it was confirmed that two out of three workers involved in work for laying electric cables on the 1st and basement floors of the turbine building of Unit 3 had radioactive materials attached to the skin of their feet when stepping into puddles of radioactive water wearing low-cut shoes. Although TEPCO decontaminated their exposed skin, it decided that there was a possibility of beta ray burns, and the two workers were transported to Fukushima Medical University Hospital. After examination on March 25, all three workers including the two that were exposed to the puddle were transported to an independent administrative institution, the National Institute of Radiological Sciences (NIRS). Immediately after their arrival, NIRS performed checkups, etc. The workers were also re-examined on April 11 for follow-ups and it was confirmed that these three workers were not suffering any health issues. From the results of the evaluations of the equivalent doses of their skin, it is estimated that they were exposed to less than 2 to 3 Sv.

Moreover, on April 27, in the course of confirming radiation exposures over a period of three months, TEPCO confirmed that a female employee had been exposed to more than 5 mSv over a period of 3 months, which is above the legally stipulated dose limit. Meanwhile, some of the people engaged in work were not designated as radiation workers.

For this reason, NISA gave a strict warning to TEPCO, and instructed it to investigate the cause of the exposure, to develop measures to prevent any recurrence, to verify the system of radiation control measures in Fukushima Dai-ichi NPS, and to develop appropriate countermeasures based on their findings. Following the instruction on May 2, TEPCO submitted a report. NISA received the report, and responded with a view to implement appropriate radiation control measures for radiation workers to ensure their occupational safety and health management, by issuing an instruction to TEPCO on May 25 ordering it to strive to further improve its measures and to perform appropriate radiation control measures for radiation workers and observe safety regulations at Fukushima- Dai-ichi NPS and Fukushima Dai-ni NPS. (Attachment VII-3)

Also, the government has issued instructions to TEPCO regarding (i) exposure dose management for workers, including internal exposure, thorough implementation of temporary health examinations, etc. as decided in the “Policy for Immediate Actions for the Assistance of Nuclear Sufferers” by the Nuclear Emergency Response Headquarters on May 17, and has made it a rule to require it to periodically report its implementation status. In addition, (ii) certain emergency operational works are required to be reported in advance to the Labor Standards Inspection Office to have their exposure control for workers, etc. confirmed.

Moreover, the policy requires (iii) creating a database capable of tracking exposure doses , etc. over the long-term for all the workers engaged in emergency work even after they leave their current jobs, and conducting long-term health management. On May 20 the MHLW established the “Promotion office for the measures for the health management etc. of workers of Fukushima Dai-ichi Nuclear Power Station” to promote the measures from (i) to (iii).

Besides radiation control measures, as it is important to establish and maintain the working environment of workers, TEPCO is working to improve the occupational safety, health management and the living environment for workers at Fukushima Dai-ichi NPS and Fukushima Dai-ni NPS.

(4) Radiation control measures for employees of the national government engaged in restoration works, etc.

1) Radiation control measures for the Self-Defense Forces of Japan

Self-Defense Force members working within 30 km of Fukushima Dai-ichi NPS estimate their expected exposure dose in advance from the latest monitoring results in the planned activity area or neighborhood and planned time of the activity, and take necessary appropriate measures such as wearing simple protection clothes (Tyvek) and so on.

The SDF members also monitor their exposure using dosage meters and confirm their cumulative dose during their active duty. The upper limit of the cumulative exposure dose for an individual member is 50 mSv (the limit for exposure of radiation workers), but for female members, it is 5 mSv over a 3-month period, and if there is a possibility that exposure will exceed 30 mSv (or 3 mSv for female members) during their activity, members temporally suspend their activity considering a turn back dose for returning (a dose capable of returning within the limit of cumulative exposure dose).

For emergency and other unavoidable lifesaving operations, the upper limit of the cumulative dose is 250 mSv (excluding female members).

As of May 31, there is no SDF member whose exposure exceeds the above mentioned limit.

2) Radiation control measures for fire fighting teams

Fire fighting team members working within 20 km of Fukushima Dai-ichi NPS put on equipment such as simple protection clothes, and measure the air dose rate and cumulative dose during their operations to minimize the exposure doses as much as possible, with the upper limit having been decided by individual Firefighter Headquarters, taking into account the exposure dose limit in the Operation Measure Manual of the Fire and Disaster Management Agency.

The Manual sets the exposure dose limit as 100 mSv for emergency operations such as lifesaving (alarm is set at ranges from 30 to 50 mSv), and 100 mSv over five years for those who repeatedly engage in the operations (it should not exceed 50 mSv in any given year).

Fire fighting team members working within 20 km of Fukushima Dai-ichi NPS have their exposure doses measured after the operations, and as of May 31, there is no member whose exposure exceeds the limit.

2. Response to radiation exposure of residents in the vicinity and the overall situation

(1) Distribution of stable iodine, etc.

1) Situation of acquiring stable iodine

Fukushima Prefecture distributed necessary iodine (pills: about 1.51 million pills (for about 0.75 million people), powder: about 6,100 g (for about 0.12 to 0.18 million people)) to cities, towns and villages with administrative districts within 50 km of the Fukushima Dai-ichi NPS.

This amount exceeds the need for 0.69 million people, or the population equivalent (of those under 40 years old) to the cities, towns and villages within the 50 km radius of Fukushima Dai-ichi NPS.

2) Policy for distribution to evacuated residents and their administration of stable iodine

The Director-General of Nuclear Emergency Response Headquarters will, on receiving advice from the Nuclear Safety Commission of Japan (NSC Japan), give instructions to the related cities, towns and villages on the dose of stable iodine for evacuated residents, although the designated cities, towns and villages will distribute stable iodine to residents in the presence of medical experts. This is due to concerns of side effects associated with administration, such as iodine allergies.

Stable iodine is stored in the offices of cities, towns and villages and it is necessary to decide on the procedure to precisely distribute the stable iodine to residents in the event of a real evacuation. In this case, because the preliminary distribution of stable iodine to residents is not appropriate, the cities, towns and villages are to adopt necessary measures so that they can securely distribute iodine to their residents according to various types of evacuation scenarios as described below. In addition, the local governments are requested to take note so that they will not unnecessarily cause anxiety among residents, while keeping them fully informed.

(Evacuation patterns)

i. Residents using evacuation buses:
Distributed and administrated at the evacuation site or in the buses

ii. Hospitalized and bed-ridden residents:
Distributed and administered in a hospital, etc. or a bus

iii. Residents evacuating on their own:
Distributed and administered at a doctor’s discretion (age and evacuation time, etc. are considered) in an evacuation site or at a screening point

3) Situation of responses regarding directions on the administration of stable iodine

On March 12, instructions were given by the Director-General of the Nuclear Emergency Response Local Headquarters to the Governor of Fukushima Prefecture and 43 surrounding towns to evacuate residents from within 20 km. In the process of evacuation, the possibility of radiation dose increase among the people being evacuated became undeniable due to the hydrogen explosion at Unit 3 (March 14), etc. For this reason, on March 16, the Director-General of the Nuclear Emergency Response Local Headquarters instructed the Governor of Fukushima Prefecture and others to have residents take stable iodine when evacuating from within the 20 km radius of the nuclear power plant, taking into account the technical advice from NSC Japan recommending that stable iodine be administered to residents remaining in the area (within 20 km) upon evacuation. Although the completion of evacuation was acknowledged, this instruction was given as a cautionary measure assuming there might be cases in which residents who couldn’t evacuate were left behind. But as a matter of fact no residents took stable iodine based on this instruction because the evacuation had already been completed at the time the instruction was issued. Also, on March 21, the Director-General instructed the Governor on precautions necessary in administering stable iodine.

(2) Standards and methods of screening and decontamination

On March 13, Fukushima Prefecture determined the screening level in the case of decontaminating the whole body at 100,000 cpm and that partial decontamination by wiping would be performed in case of detection of numerical values greater than 13,000 cpm but less than 100,000 cpm, based on the opinions of experts in radiation medicine dispatched from MEXT, and doctors and others from the National Institute of Radiological Sciences, and guidelines of Fukushima Medical University.

Meanwhile, on March 19, NSC Japan determined the screening level for decontamination at 100,000 cpm. The revised screening level of 1 μSv/h (dose rate at a distance of 10 cm) is a standard of decontamination for contamination on the surface of the body for general residents as stipulated by the International Atomic Energy Agency (IAEA) in the *Manual for First Responders to a Radiological Emergency* (VII 2-1).

Note: Measured values are those measured using Type TGS-136 GM Survey Meter (5cm bore).

(3) Status of radiation exposure for residents in the vicinity

With regard to the contamination of residents, Fukushima Prefecture has been implementing screening surveys for residents in the prefecture including people evacuated from within the 20 km radius of the power plant in cooperation with the Nuclear Emergency Response Local Headquarters. Most of the 195,354 people checked as of May 31 were under the 100,000 cpm limit. Decontamination was performed for 102 people exceeding 100,000 cpm but their contamination levels fell to levels of no concern after such decontamination.

In addition, from March 26 through March 30 the Nuclear Emergency Response Local Headquarters implemented a survey on thyroid exposure for infants in Iwaki City, Kawamata Town and Iidate Village in cooperation with Fukushima Prefecture in order to understand more precisely the current exposure dose, particularly the health effects to infants who are highly-sensitive. In its implementation, exposure of infants was measured in areas where residents were instructed to stay in-house, or in areas whose equivalent dose in thyroid glands was rated as high by the estimation derived by SPEEDI (announced on March 23). Technical advice was received from NSC Japan for the method. From the results among the 1,080 children from 0 to 15 years old that were surveyed for thyroid exposure, there were no children who exceeded the screening level of 0.2 μSv/h (an equivalent to a thyroid gland equivalent dose of 100 mSv for a one-year-old baby)

3. Evaluation of the status of radiation exposure

The purpose of radiation protection is to prevent the occurrence of a deterministic effect on an individual, and unfailingly take all reasonable measures to limit the occurrence of stochastic effects.

(1) Evaluation of the status of radiation exposure by operators

Operators are responsible for the appropriate performance of radiation control measures for radiation workers based on a predetermined plan. In this accident, tsunamis rendered APDs unusable and the functionality of radiation control measures was lost. Moreover, the radiation and contamination levels not only within the nuclear power station facilities but also on the site increased as the accident progressed.

Performing precise control of dosages is the basis of performing appropriate radiation control measures for radiation workers. However, because of the insufficient number of dosimeters for the above reasons, actions such as equipping only work unit leaders in relatively low environmental doses were taken. TEPCO should have acted promptly to make it possible to equip every person with a dosimeter.

Moreover, since evaluations of individual doses rely upon manual recording due to a loss of the functionality of the system, and evaluations are based on behavior record because measuring the doses of each individual by an APD was impossible, it took considerable time to establish a system for radiation control measures equivalent to the system which was in place before the tsunamis.

Moreover, the delay in management to prevent radioactive materials from entering the quake-proof buildings and that of measuring the concentration of radioactive materials in the air within the building resulted in increasing the risk of internal exposure.

At Fukushima Dai-ichi NPS, whole body counters (WBC) became unusable due to the increase of the background level. Therefore, vehicle-mounted WBC were borrowed and have been used for measurement while WBC measurement is being performed at another power station, where internal exposure is being evaluated. However, there are too many people to be measured. Thus, WBC measurement is performed at different power stations and internal exposure is assessed, however, a sufficient measurement system has not been established.

For this reason, TEPCO performed WBC measurement and evaluated dose rates preferentially to workers with high external exposure doses and to those who were engaged in emergency operations in March. However, at present, two workers were confirmed to have high internal radiation doses (iodine 131) in their thyroid glands in the evaluation of internal exposure doses. Currently, dose evaluation has been performed on those two workers and there is a possibility that their dose limit may exceed 250 mSv, the dose limit for working in emergency operations. Furthermore, there is a possibility that some workers engaged in emergency operations right after the accident in March may be evaluated as having doses close to the limit or doses that may exceed the limit in line with the progress of internal exposure dose evaluation. TEPCO is planning to evaluate the internal exposure of the workers engaged in emergency operations in March immediately.

Meanwhile, after July, TEPCO will transfer the WBC at Fukushima Dai-ichi NPS and Fukushima Dai-ni NPS to J Village, and plans to coordinate a measurement system at J Village by purchasing a new WBC and taking other suitable steps.

At Fukushima Dai-ichi NPS, along with the increase of the radiation dose, the non-controlled area was required to be controlled as a controlled area. Against this backdrop, workers who were not designated as radiation workers worked in places where it should have been controlled as the same level as the controlled area, and resulted in the exposure exceeding one mSv per year, the yearly dose limit for the public. This is because the initial individual dose control was not appropriate in line with the enlargement of target area for radiation control measures.

(2) Evaluation of the situation of radiation exposure of residents in the vicinity

Regarding the evaluation of radiation doses received by residents, Fukushima Prefecture will hereafter conduct surveys in target areas in cooperation with related government offices and the independent administrative institutions, NIRS and others, and will estimate and evaluate the radiation dose received by each resident by comparing it to the results of the situation for the release of radioactive materials separately surveyed, etc.

There are estimated to be about 2 million residents of Fukushima Prefecture to be surveyed and the survey would be conducted as part of the health management survey of Fukushima Prefecture. Since the evacuated people have been dispersed by the earthquake and accident, the survey plans to start with people who have a high viability to receive a survey such as current residents, and in principle, evacuated people whose residence after their evacuation is easily tracked

(3) Evaluation of emergency medical system for exposures

As a precaution, there were some cases, in which some people engaged in emergency work for this accident at Fukushima Dai-ichi NPS, etc. were transported to an independent administrative institution, NIRS, which is a tertiary emergency medical institution for exposure, but there were no cases serious enough to be treated as tertiary exposure.

As this nuclear disaster caused by the Great East Japan Earthquake, was a disaster beyond the assumptions of conventional nuclear disaster countermeasures that required responses to earthquakes and tsunamis at the same time, the local governments first strengthened their systems by coordinating with medical institutions such as university hospitals nationwide on such issues as how to cope with the high numbers of injured or sick patients.

As such, Fukushima Medical University, an institution for secondary exposure, and other medical institutions in the prefecture, were obliged to work under complex emergency conditions such as simultaneously performing disaster medical measures including dispatching on-site disaster medical care. Therefore there is a possibility that these institutions could not sufficiently respond when emergency response against radiological exposure was really needed compared to the anticipated response in the field by the regional disaster prevention plans, which were planned in advance.

However, as the Nuclear Emergency Response Local Headquarters led the immediate restructuring of the medical system for exposure and strengthened the response system in cooperation with related institutions such as university hospitals including tertiary medical institutions for exposure, the medical system for exposure is considered to be performing its necessary functions.

VIII. Cooperation with the International Community

Introduction

Japan has placed emphasis on the following points in relation to the international community over the accidents of Fukushima Dai-ichi Nuclear Power Station (NPS) of Tokyo Electric Power Co. Inc. (TEPCO).

Firstly, the Japanese Government has made efforts, as a matter of top priority, to keep transparency by providing the international community with the information it has obtained as quickly and accurately as possible. Some of the communications, including delays of notification to neighboring countries and regions on the discharge of low-level radioactive accumulated water into the sea, have had to be improved. Subsequently, however, the Japanese Government has been improving its ways for communication delivery. (Please refer to IX below)

Regarding assistance from other countries around the world, Japan has recognized the necessity of bringing to bear the knowledge and experience accumulated within the global community on the accident, and Japan has worked closely together with those countries and has received supplies, equipment and expertise provided by them. The Japanese Government sincerely appreciates the kind and generous assistance offered by so many countries around the world. Initially, it took some time for the Japanese Government to identify the demand for such assistance within Japan, but the Japanese Government brought about solutions by building a collaborative structure within the Government and with those countries providing assistance.

From the standpoint that Japan puts emphasis on cooperation with international organizations, the Japanese government has worked closely with international organizations including the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency of the Organization for Economic Co-operation and Development (OECD/NEA), the Food and Agriculture Organization (FAO), and the World Health Organization (WHO). A summary of the assistance received from other countries and collaborative activities with international organizations is listed below.

1. Assistance from other countries

Facing the unprecedented scale of the accidents that befell the NPS, utilization of the accumulated experience and knowledge of the countries that operate NPSs is a very important constituent of the efforts being taken to stabilize and settle the situation from the accidents. Japan has actively utilized assistance from other countries including the provision of supplies and equipment, as well as experts.

(1) Utilization of expert knowledge

After the accident occurred, many experts visited Japan from such countries as the United States, France, Russia, the Republic of Korea, China and the United Kingdom to discuss the relevant issues with the Japanese governmental agencies and TEPCO. The Japanese side has received much advice especially on how to stabilize the reactors and spent fuel pools, how to prevent diffusion of radioactive materials and how to cope with radioactive accumulated water.

(2) Supplies and equipment from other countries

Japan has actively received supplies and equipment based on proposals offered by other countries, as the introduction of such special supplies and equipment and others was required for stabilization and settlement measures of the situation, evacuation of the residents and so on. Pumps and fire engines to be used by TEPCO for cooling the nuclear reactors and other facilities and barges for transferring fresh water and such were provided to stabilize nuclear reactors and spent fuel pools, which was an urgent issue in the early stages of the accident. Remote control robots were provided to be used in places where workers' safe access was difficult due to high levels of radiation. Japan has received dosimeters, protection suits, protection masks and such for individual workers to protect them from radiation, and photos of reactors and such taken from aircraft and such to explore effective measures. Japan also received supplies and equipment needed to process massive amounts of water containing radioactive materials. Dosimeters and protection suits for individual residents were also provided to support residents evacuated from the evacuation area, and germanium semiconductor detectors and other tools to analyze the radiation impact on the soil, water, and agricultural products. Nearly 30 countries and international organizations offered such assistance. After considering their necessity in our emergency response efforts, Japan received supplies and equipment from 10 countries and 2 international organizations in total.

2. Cooperation with international organizations

The Japanese Government has cooperated with international organizations to utilize their expertise and experience with a view to promptly stabilizing and settling the situation. From

March 18 onward, the IAEA sent to Japan the radiation measurement expert teams including a marine expert, the food monitoring team jointly with the FAO, and boiling water reactor (BWR) experts. (Please refer to Attachment VIII-1) Based on the agreement between the Japanese Government and the IAEA, the Japanese Government accepted the International Fact-Finding Expert Mission. Experts of the Nuclear Energy Agency (NEA) of the Organization for Economic Co-operation and Development (OECD) and other organizations related to nuclear energy have visited and advised Japan.

Also, international organizations such as the IAEA, the WHO, the ICAO (International Civil Aviation Organization), the IMO (the International Maritime Organization), as well as the International Commission on Radiological Protection (ICRP) have provided, from technical standpoints, timely and correct information to the global community, which, for example, showed that radiation levels in and around airports and seaports in Japan did not present health or transportation safety hazards, and provided appropriate advice to those who travel to Japan.

3. Evaluation of cooperation with the international community

(1) As mentioned in the 1 above, supplies and equipment provided from many countries to Japan to respond to the accident at Fukushima Dai-ichi NPS played an extremely important role in stabilizing the situation of reactors and other facilities.

(2) When receiving supplies and equipment, the main reason for taking some time to identify such needs within Japan initially was that we did not have a specific structure in the Japanese Government to accommodate such assistance offered by other countries with the domestic needs. Hence, Ministry of Foreign Affairs had to communicate with relevant ministries and agencies for each of the offer to ask them consider whether the offer matches their needs or not.

(3) In conjunction with the provision of various kinds of supplies and equipment to the sites, in many cases, information regarding those supplies and equipment, not only their names but also their specifications, such as the arm length of pump trucks, quantity and length of time required to deliver them, etc., were very important. Initially, we occasionally had difficulties in obtaining such information.

(4) Regarding the abovementioned issues, the IAEA established the Response Assistance

Network (RANET) for emergencies to provide an important framework for offering assistance during nuclear emergencies and recommends member countries to register the names of organizations that can provide support and their fields of expertise that they can contribute to. The Japanese Government assumes the RANET would be able to respond to any accident more quickly and effectively if more specific information were registered such as the specifications of supplies and equipment which can be provided and their quantity. Although the Japanese Government itself has registered only three organizations specialized in radiotherapy and other fields so far, the Japanese Government hopes to contribute to the further development of the RANET by further promoting and expanding the scope of it.

IX. Communication regarding the Accident

1. Communication with residents in the vicinity and the general public in Japan

(1) Expectations for communication

Information on any accident provided in emergency is unavoidable to be one-way communication. However, in the stage when the emergency has been reduced in some degree, two-way communication is necessary to appropriately provide information which meets the need of the receivers. In addition, all of transparency, accuracy and promptness are important in the communication on any accident with people.

For the current accident, we have taken communication opportunities such as press releases and provided press conferences to provide information necessary for the receivers. Some improvements have been made during the process, as in the case of the joint press conferences to be mentioned below. However, we need to continue to make every effort in the process by exploring how to make the contents of communication easier to be understood.

Communicating the progress of the accident and the view of the government with general public, etc. through press releases and press conferences is only one way of the two-way communication in a sense. Only when absorbing the feedback and reflect it in the activities of the government and other organizations, communication will be established. In this context, questions and answers at such press conferences, inquiries from press at the Emergency Response Center (hereinafter referred to as “ERC”) and general counseling service (hereinafter referred to as “counseling service”) for general public to be mentioned below are prerequisite for such two-way communication.

Overall evaluation whether communication has been sufficiently made has not been implemented yet, but by examining the comments and feedback from experts and citizens delivered to counseling service, a certain level of review is stated below.

(2) Press release and press conference

1) Since the occurrence of the accident, the Chief Cabinet Secretary has provided information on the accident status and the government views on the accident directly to the general public at the press conferences. Questions on the accident have been asked at almost every

press conference, if including those related to support for accident sufferers and delivered the views at each time.

2) The Nuclear Inspection and Safety Agency (hereinafter referred to as “NISA”) distributed “Regarding the Impact on Nuclear Facilities by the Earthquake (1st release)” via “Mobile NISA” at 15:16 on March 11 (Japan time; the same shall apply hereinafter), 30 minutes after the occurrence of Tohoku Region - Off the Pacific Ocean Earthquake. Subsequently, the first release of “Seismic Damage Information” was released and press conference was conducted by a spokesman of NISA.

The press releases and press conferences have continued after the occurrence of a nuclear accident at Fukushima Dai-ichi NPS. We sent out 155 press releases and held 182 press conferences by NISA spokespersons as of May 31, 2011. We held a daily average of seven press conferences over three days after the occurrence of the accident. As the situation stabilized, the frequency was decreased to the current once or twice a day.

These press conferences are a precious tool to directly communicate with citizens using visual images. It is necessary to use more audience-friendly ways of communication than the materials used for press releases to be mentioned below. A considerable number of experts and callers to the counseling service said that creative efforts were not made sufficiently.

Also, some criticized that the briefings have focused on incidents of the accident and very few explanation about “Things to keep in your mind for evacuation,” which is extremely important for securing safety in the suffered area and citizens.

3) The Ministry of Education, Culture, Sports, Science and Technology (hereinafter referred to as “MEXT”) has conducted an environmental radioactivity survey in all the prefectures of Japan and has worked with Fukushima Prefecture, the Japan Atomic Energy Agency, power operators and other organizations to conduct comprehensive monitoring including surveys of air dose rates, dust in the atmosphere and soil in the surrounding area of Fukushima Dai-ichi NPS. Such information has been shared at press conferences and other occasions.

4) The Nuclear Safety Commission (hereinafter referred to as “NSC Japan”) held press conference every day for 31 days from March 25 to April 24, and NSC Japan themselves including the Chairman of NSC Japan provided an explanation on advice made by NSC

Japan and assessment of environmental monitoring results conducted by MEXT. Moreover, press conference is held after NSC Japan meeting eight times in total from April 25 (as of May 19).

5) Also, the nuclear operator, Tokyo Electric Power Co. Inc. (hereinafter referred to as “TEPCO”) has held press conferences on the current nuclear accidents. Daily press conferences by NISA and TEPCO held at different timings and other reasons made the press think that some discrepancies appeared in the information and comments delivered at the conferences of both organizations. To respond to this issue, joint press conferences participated by NISA, TEPCO and other relevant organizations have been held at the Joint Headquarters of Fukushima NPS Emergency Reponse since April 25 in order to share comprehensive and detailed information related to the current accidents uniformly and consistently and to increase accuracy and transparency. (This headquarters was renamed as the Government - TEPCO Integrated Response Office on May 9.) The joint press conferences have been participated by Special Advisor to Prime Minister Hosono, NISA, TEPCO, NSC Japan and MEXT and other organizations.

Among the opinions received at hotlines and counseling services, they pointed out that the government and the nuclear operator held press conferences separately and their views were different. Similarly, experts suggested that a significant problem is that “One Voice,” the principle of emergency publicity, was not thoroughly communicated in the initial stage.

6) When developing the press release materials, graphs and pictures have been used to help non-specialists more easily understand technical and specialized information on reactors and radiation status. Some people calling the counseling services suggested they would welcome materials that are easy-to-understand for laypeople, which means the materials did not meet the needs of diverse types of readers. It would be endless task to pursue ways to make easy-to-understand material to a satisfactory extent, but it is necessary to make continuous efforts.

As it is also applicable to the briefing at press conferences, experts suggested that information on anticipated and future risks and scenarios was mostly missing. Such feedback has been received at the counseling services. However, the government, which is accountable for the accuracy of the statements, usually hesitates to comment on uncertain things about the future except for definite and certain incidents, but it’s important to try to provide information publicly required.

The ERC of NISA can be accessed by those related to the press, which followed up some technical issues insufficiently explained by released materials and some points difficult to thoroughly communicated.

As the views of the media side have been expressed through their media, how the news on the accident is reported should be followed. Based on it, we need to increase briefing opportunities to cover the missing parts in the previous briefings or change the way of explanation. Also, they should be reflected in the policy making process to come up with specific actions.

The Nuclear Emergency Response Headquarters (hereinafter referred to as “NERHQs”) summarize related information on situation of the accident at Fukushima Dai-ichi NPS and the governmental responses in an integrated fashion as needed from the initial stage of the accident, and provide information extensively and generally on the Cabinet website. Press releases have been posted on respective websites of the Ministry of Economy, Trade and Industry (hereinafter referred to as “METI”), MEXT and NSC Japan and other agencies. The website of METI covers comprehensive information on the Great East Japan Earthquake, for example, allowing people to access monitoring data conducted by agencies of MEXT and local governments.

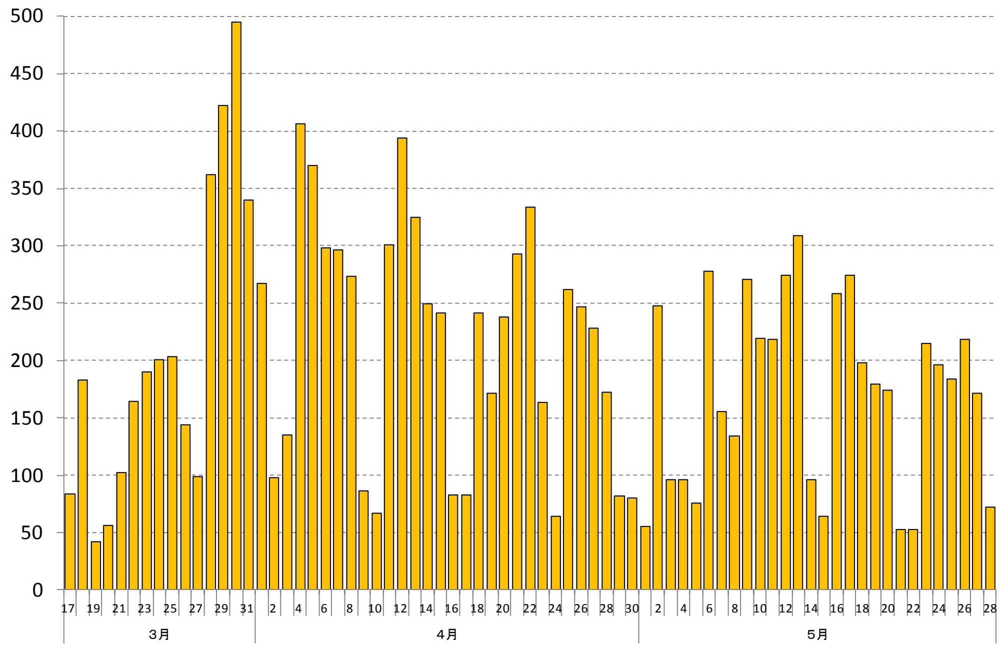
(3) Inquiries from general public

1) Inquiries on the above-mentioned press releases, etc. from the general public were responded to by NISA staff in charge around the clock since the occurrence of Fukushima NPS accidents. In response to development of nuclear accidents and the occurrence of various incidents regarding radiation safety, the number of staff was increased, supported by the Japan Nuclear Energy Safety Organization (hereinafter referred to as “JNES”), and also the number of telephone lines grew (to 13 lines from 5 during the daytime) on March 17. This service has been sequentially reinforced with the support of JNES. We received a total of 15,000 calls and inquiries between March 17 and May 31. Currently, the number of calls has been decreasing compared with the number received when the service started, but a considerable number of inquiries are still being received.

   The comments and feedback on public relations among all the inquiries increased in May from the initial stage of the accident. This might be related with the change in interests from simple questions and complaints to public relations due to the stabilized progress of the plant incidents, but the verification will be implemented later on.

The percentage of publicity-related feedback among the total inquiries has been small. This might be explained that there have been more simple questions and complaints because the press releases and conferences were involved with progress of incidents at NPS are not well understood and related to daily life and, once an accident occurs, such events became closely related to daily life.

Figure IX-1-1 Number of inquiries to NISA's counseling service



(Period: March 17 to May 31)

2) On March 17, MEXT cooperated with the Japan Atomic Energy Agency (hereinafter referred to as "JAEA") to open a health counseling hotline to provide health counseling and disseminate correct information. It has received a total of 17,500 calls as of May 18. The National Institute of Radiological Sciences (hereinafter referred to as "NIRS") has opened a hotline to provide medical information on radiation exposure and health counseling to the general public, which had received a total of 7,800 calls as of May 18.

3) The parties concerned to academies such as the Atomic Energy Society of Japan also

provide explanation and information with the public actively.

4) The Fukushima Prefectural Government supported by the national government opened counseling service on radiation in the Fukushima Prefectural Office. More than 14,000 inquiries have been received there since the opening.

(4) Public relations activities of the Local Nuclear Emergency Response Headquarters

The residents around NPS including evacuees are the most important target for communication.

Regarding public relations of the Local Nuclear Emergency Response Headquarters (hereinafter referred to as the "Local NERHQs"), considering the criticality of the incidents, press conferences by spokespeople of the Local NERHQs have been held and materials released. Some of the handout materials have been independently developed by the Local NERHQs.

As different radiation protection measures should be taken depending on suffering areas, and also because many of those live in shelters, they need more detailed information on radiation safety as well as daily life, etc. Also, it's necessary to note the situation that in many disaster areas the media such as television and the Internet are not available. To respond to their needs, since March 29, the Local NERHQs published a newsletter and distribute to each evacuation site, and since April such information has been periodically broadcasted through local radio stations (Five editions of newsletters and 62 radio broadcasting as of May 10).

Materials regarding instructions under the name of the Director-General of Nuclear Emergency Response Headquarters, press releases on monitoring data of MEXT, monitoring data by geographic area and materials on support measures for local business corporations are provided to local municipalities depending on their need. Such information is immediately released to the local media through press conferences, etc.

(5) Publicity to local residents on evacuation zones

In the initial stage of the accident occurrence, the Director-General of Nuclear Emergency Response Headquarters determined evacuation areas and instructed evacuation in order to ensure the safety of the residents and other citizens as soon as possible.

After such instructions were issued, the secretariat of NERHQs called the Local NERHQs and

Fukushima Prefecture to deliver evacuation instructions and stay indoors instructions. Relevant municipalities received calls on such instructions through the Local NERHQs and Fukushima Prefecture. Additionally, the NERHQs directly called those municipalities. However, since communication services including telephone lines were heavily damaged by the massive earthquake, not all the direct calls reached the affected municipalities. Prior notification to local governments was not satisfactorily delivered because some municipalities did not receive evacuation instruction either directly or indirectly.

The police transmitted direction to evacuate to the local governments through police radio. In order to promptly publicize evacuation instructions right after they were issued, the Chief Cabinet Secretary has announced the details of each instruction at press conferences as well as using television and radio to spread out the information.

2. Communication with international community

(1) Communication with international organizations such as the IAEA

The accident at the nuclear power plant is a concern of the entire global community. The Japanese government made every effort to provide information promptly and accurately to the IAEA, the most important international organization dealing with nuclear safety issues. Since 16:45 on March 11 (Japan time; the same shall apply hereinafter), two hours after 14:46 when the earthquake occurred, pursuant to the Convention on Early Notification of a Nuclear Accident, NISA has notified the IAEA periodically on incidents occurred and how Japan is coping with them as much as possible. As of May 31, a total of some hundreds reports including press release, plant parameter and monitoring results were sent to the IAEA and approximately 100 individual inquiries from the IAEA were answered. Information was also provided from the Japanese Government through diplomatic channels of the Permanent Mission of Japan to the International Organizations in Vienna shared information with the IAEA pursuant to the same Convention as needed. The IAEA has provided information to the press and the general public based on the gathered information.

The Japanese government has provided information to the World Health Organization (hereinafter referred to as “WHO”) pursuant to the International Health Regulations (hereinafter referred to as “IHR”) when needed.

In addition, at various international conferences held after the accident occurred, officials and staff related to the Japanese Government explained the status of the accident and how Japan has coped with it and answered questions from the participants. (Please refer to Attachment IX-1 for dates, names and overviews of briefings, etc. at international conferences.) Responding to import restrictions of exported goods from Japan, we have requested the international community to take action based on a scientific basis.

(2) Communication with governments of other countries

The Japanese Government has highly emphasized information provision to countries and regions around the world including neighboring countries and regions. Hence, after the occurrence of the accident, 46 briefings to diplomats in Tokyo as of May 11 were held daily from March 13 to May 18, 3 days a week from May 19 onward in principle. (Please refer to Attachment IX-2 for the list of briefing dates, speakers, and contents.) In addition, simultaneous emergency notices were released as needed (Refer to Attachment IX-3 for the dates and contents of emergency notices) and individual communication on such emergency notices was made with neighboring and other countries in principle from April 6 onward. The Japanese Government has explained against the imposition of import restrictions of export goods from Japan to diplomats in Tokyo and to governments of other countries through the diplomatic missions in their countries assigned and requested them to take actions based on scientific basis.

(3) Communication with foreign media and citizens whose mother language is not Japanese

From March 13 onward, joint press conferences by relevant ministries and agencies for foreign media on the accident status and actions taken by the Japanese government (Refer to Attachment IX-4 for dates, places, speakers and contents of the press conference. Japanese-English simultaneous interpreters have been introduced to the press conferences of the Chief Cabinet Secretary in addition to those of Prime Minister. Videos of press conferences have been posted on websites of Japanese Government Internet TV and the Foreign Press Center Japan.), interviews with ministers and officials with foreign media (Refer to Atatchment IX-5 for dates, interviewees, and media name of the interviews), the contribution to major foreign media by the Prime Minister and the Foreign Minister (Refer to Attachment IX-6 for the posted article) were conducted. When apparent factual errors and fear-mongering were identified in earthquake-related coverage by foreign media, the Japanese Government has promptly addressed them and encouraged such media to place the counterarguments of Japan.

On March 12 onward, websites of the Japanese governmental organizations posted relevant information in English, Chinese and Korean. (Refer to Attachment IX-7 for the list of posted dates and contents.)

In addition, the Prime Minister of Japan and His Cabinet created Twitter and Facebook accounts under the name of Kantei to send summaries of the press conferences of the Prime Minister and Chief Cabinet Secretary to a wide range of audience as needed.

Along with information provision from the diplomatic missions of Japan to their countries assigned as needed, the diplomatic missions posted related information on websites of the diplomatic offices in a total of 29 different languages. (Refer to Attachment IX-8 for the list of diplomatic offices, dates and contents of the postings) This websites are accessible to everyone through the Internet.

Japan has held briefings to businesses of overseas both in Japan and overseas.

3. Provisional evaluations based on rating of International Nuclear Events Scale (INES)

Japan has used INES since August 1992. When any trouble occurs at any nuclear power plant, NISA issues provisional evaluation and investigated the cause, and after the reoccurrence preventive measures is established, the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy of METI validates them from a technical point of view and then formally evaluates them.
Based on the development of the accident at Fukushima Dai-ichi NPS, provisional evaluation was updated in reports from 1st to 4th. (Please refer to the Appendix IX-9 for details of provisional evaluation)

1) The first report

A provisional evaluation of Level 3 was issued based on the fact that the emergency core cooling system for water injection became unusable at 16:36 on March 11, because motor operated pumps were disabled due to total power loss at Unit 1 and Unit 2 of Fukushima Dai-ichi NPS.

2) The second report

On March 12, an explosion of the vent of reactor containment and reactor building of Unit 1 of Fukushima Dai-ichi NPS occurred. Based on environmental monitoring, NISA confirmed the emission of radioactive iodine, cesium and other radioactive materials, and a provisional evaluation of Level 4 was announced because we suspected the emission of over 0.1 % of radioactive materials from fuel assemblies in the reactor core inventory. As the incidents have not been restored, “People and the environment” in the INES User’s Manual Edition 2008 is to be evaluated.

3) The third report

On March 18, as some incidents to cause fuel damage were identified at Unit 2 and Unit 3 of Fukushima Dai-ichi NPS as well as judging from all the information obtained at the moment including the status of Unit 1, NISA announced the provisional evaluation Level 5 because we suspected the release of several percent of the core inventory.

The cooling and water supply system of spent fuel pit did not work in Unit 4. Due to explosion and damage to the reactor building, we suspected no safety equipment remains in it and we announced provisional evaluation of Level 3.

4) The fourth report

On April 12, regarding the estimated amount of radioactive materials released in the atmosphere from the reactors of Fukushima Dai-ichi NPS, NISA announced the estimate at 370,000 TBq of radioactivity in iodine equivalent from analytical results of the reactor status and others by JNES. The NSC also estimated the total amount of radioactive materials released in the atmosphere from Fukushima Dai-ichi NPS based on the monitoring results by the same day. Based on these results, NISA announced provisional evaluation of Level 7 on the entire site of Fukushima Dai-ichi NPS, on the same day.

4. Evaluation on communication regarding the accident

(1) How information should be provided to residents in vicinity and general public in Japan and international community

1) The main channel of information provision has been through the mass media, which has transmitted press conferences and press releases to residents in the surrounding area, general public in Japan and international community. Hence, it is important to identify the

needs of the mass media in addition to adequately communicate what people want to know. For example, when a hydrogen explosion occurred at reactor building of Units 1 and 3, television broadcast it almost real-time. The mass media strongly requested the ERC right after the explosion for an explanation of the accident by someone with appropriate knowledge in front of the camera about what really happened there and how the explosions would affect the reactors and so on. However, because it took time to verify the related facts, their needs were not always satisfied. As this issue is liable to be involved with trade-off between swiftness and accuracy, it would have been appropriate to develop a manual to respond to such situations in advance.

2) As mentioned above, it is true that the Japanese government made all kinds of efforts to help non-specialists understand technical and detail information in developing materials for press releases. However, visually-effective materials were not always developed at time-pressing occasions such as immediately after new facts were identified.

From the perspective of encouraging residents in the surrounding area, general public and international community to understand the situations, it would be effective to use information technology and graphs, pictures and other visual support both in Japanese and other languages which are prepared regularly in advance.

3) As mentioned above, communication and prior notification to local municipalities as well as industry organizations about outflow of water with high-level radioactivity and discharge of stagnant water with low-level radioactivity to the sea by TEPCO were delayed. Above all, communication and notification to such organizations are required to be conducted in a timely manner and thoroughly by taking every possible measure.

4) Japan has been making efforts to share information with the international community promptly and accurately, but it will be adequate to further promote approaches for information provision to the international community keeping pace with information provision in Japan, and so it is desirable to consider utilizing simultaneous interpretation at press conferences. Moreover, as this accident received remarkable attention from overseas, news reports different from the fact were sometimes made by foreign news media who do not have accurate knowledge about general information on Japan or actual condition about the accident. Therefore it’s desirable to actively provide opportunities that foreign news media learn our actual conditions more widely and adequately.

(2) What information provision in power outage should be

While monitoring data has been quickly publicized, we need to come up with some ways to promptly communicate necessary information to the sufferers who want to obtain information but do not have access to the Internet due to power failure in such a case as combined emergency with natural disaster.

(3) Importance of communication closely with neighboring countries and regions

1) Although the Japanese Government has made every effort to share information promptly and accurately, looking at some individual cases, initially information was not always fully shared in advance especially with neighboring countries and regions. Although communication was not intentionally delayed, the Japanese Government could not identify part of actual status of the accident after it occurred; as a result information was not always provided in a timely manner.

   For instance, TEPCO discharged stagnant water with low-level radioactivity to the sea in order to prevent water with higher-level radioactivity from outflowing to the sea on April 4. NISA notified the IAEA of the discharge in advance. However, since the development of the situation was very urgent and information was not fully shared among the relevant government authorities, this urgent measure was taken before the neighboring countries and regions were fully notified through diplomatic channels.

   The Japanese government sincerely regrets that we had to discharge stagnant water, even though with low-level radioactivity, to the sea, and recognized that much needs to be improved regarding the communication with neighboring countries on this discharge. Therefore, we reviewed the communication channels in the governmental organizations and explained to individual countries and areas about the background of the discharge, the relevant data and other information. Also, we identified a contact point where the Japanese government can maintain around-the-clock communication with the neighboring countries and regions. Subsequently, prior notification on specific areas of interest for the neighboring countries and regions such as shift of INES level, establishment of restricted zone, evaluation of contaminated water and opening of the airlock (Please refer to the above 2. (2)).

(4) What accident notification should be

1) The Japanese government, as mentioned in the above 2, has continuously provided necessary information on the status of nuclear reactor facilities in Japan pursuant to the Convention on Early Notification of a Nuclear Accident. The Japanese government recognizes that maximum level of information required by the Convention has been provided to IAEA and all the relevant countries through IAEA since the occurrence of the accident.

2) Generally speaking, it would not be always easy to determine whether the current accident is applicable to “the event of any accident from which a release of radioactive material occurs or is likely to occur and which has resulted or may result in an international transboundary release that could be of radiological safety significance for another State” as stipulated in the Convention on Early Notification of a Nuclear Accident immediately after occurrence of a nuclear accident. It would be more difficult especially for a country like Japan surrounded by the sea on all sides. The Japanese government considers that, for the purpose of ensuring smooth and steady international communication when nuclear accident occurs, it is adequate to discuss establishment of an international process for notification to the IAEA, whenever a certain level of accident occurs, regardless of resulting in an international transboundary release of not.

(5) Import restriction of export goods, etc. from Japan

The Japanese government understands the global concerns about the possibility of impact on exported goods from Japan by radioactive materials released by the current accident. However, the Japanese government considers it is important to use scientific data when taking any action toward this issue. It cannot be denied that such cases, where information was not fully provided, have led to unduly concerns in the international community.

From these perspectives, we have continuously held briefings to diplomats in Tokyo, shared information and explanation with relevant governments and international organizations and explained to the countries, etc. which are taking such measures because the Japanese government considers necessity of such measures are to be reexamined on scientific grounds. Some of those countries etc. have eased such restrictions.

X. Future Efforts to Settle the Situation regarding the Accident

1. The current status of reactors etc. of Fukushima Dai-ichi NPS

In reactors of Fukushima Dai-ichi NPS in Units 1, 2 and 3, fresh water has been supplied to RPV through a feed-water system and have been continuously cooled the fuel in RPV. This helped the temperature around the RPV stay at 100 to 120 degrees Celsius at the lower part of the RPV. Due to the concern over the increase of the accumulated water, review and preparation for circulation cooling system including the process of draining accumulated water has been underway. Although the RPV and the PCV of Unit 1 has been pressurized to some extent, steam found in some units such as Units 2 and 3 seems to be caused by leakage from the RPV and the PCV, which is condensed to accumulations of water found in many places including reactor buildings and some steam has been released to the atmosphere. To respond to this issue, the status has been checked by dust sampling etc. in the upper part of the reactor buildings and discussion and preparation for covering the reactor buildings has been underway.

Cold shutdown of Units 5 and 6 has been maintained using residual heat removal systems with temporary seawater pumps and their reactor pressure has been stable in between 0.01 ~ 0.02 MPa.

Status of Each Unit of Fukushima Dai-ichi NPS(As of May 31st)

Unit No.	Unit 1	Unit 2	Unit 3	Unit 5	Unit 6
Situation of water injection to reactor	Injecting fresh water via the Water Supply Line. Flow rate of injected water : 6.0 m^3/h	Injecting fresh water via the Fire Extinguish and Water Supply Line. Flow rate of injected water: 7.0m^3/h(via the Fire Protection Line)，5.0m^3/h(via the Feedwater Line)	Injecting fresh water via the Water Supply Line. Flow rate of injected water : 13.5 m^3/h	Water injection is unnecessary as cooling function of the reactor cores are in normal operation.	
Reactor water level	Fuel range A : Off scale Fuel range B : -1,600mm	Fuel range A : -1,500mm Fuel range B : -2,150mm	Fuel range A:-1,850mm Fuel range B:-1,950mm	Shutdown range measurement 2,164mm	Shutdown range measurement 1,904mm
Reactor pressure	0.555MPag (A) 1.508MPa g(B)	-0.011MPa g (A) -0.016MPa g (B)	-0.132MPag (A) -0.108MPag (B)	0.023 MPag	0.010 MPag
Unit No.	Unit 1	Unit 2	Unit 3	Unit 5	Unit 6
Reactor water temperat-ure	(Collection impossible due to low system flow rate)			83.0°C	24.6 °C
Tempera-ture related to Reactor Pressure Vessel (RPV)	Feedwater nozzle temperature: 114.1 °C Temperature at the bottom head of RPV: 96.8 °C	Feedwater nozzle temperature: 111.5 °C Temperature at the bottom head of RPV: 110.6 °C	Feedwater nozzle temperature: 120.9 °C Temperature at the bottom head of RPV: 123.2 °C	(Monitoring water temperature in the reactor.)	
D/W Pressure, S/C Pressur	D/W: 0.1317 MPa abs S/C: 0.100 MPa abs	D/W: 0.030 MPa abs S/C: Off scale	D/W: 0.0999 MPa abs S/C: 0.1855 MPa abs	-	
Status	We are working on ensuring the reliability of cooling function by installing temporary emergency diesel generators and sea water pumps as well as receiving electricity from the external power supplies in each plant.				

2. Response to the “Roadmap towards restoration from the accident by the nuclear operator”

(1) Announcement of “Roadmap towards restoration from the accident” (April 17, 2011)

An accident releasing radioactive materials outside the plant occurred at Fukushima Dai-ichi Nuclear Power Station (NPS) as a result of the Great East Japan Earthquake which occurred off the Pacific coast of the Tohoku region of Japan on March 11.

Since then, Fukushima Dai-ichi NPS has made every effort to cool each plant from Unit 1 to Unit 4, to achieve the cold shutdown and to swiftly mitigate the release of radioactive materials from the plant to the surrounding environment.

The residents in the municipality where the NPS is located and those in the surrounding municipalities, were forced to evacuate or stay indoors, etc., due to the release of radioactive materials.

The issue with the highest priority under this condition was to achieve cold shutdown quickly and to enable evacuees to return to their homes. Although TEPCO announced the status of the plants at each occasion from the occurrence of the accident on March 11, the company considered that there was a need to make public what are the challenges to be tackled, targets to be achieved and measures to be taken in the future.

Furthermore, Prime Minister Kan instructed TEPCO on April 12 to present a future plan for restoration from the accident.

In response to the instruction, TEPCO announced on April 17 the “Roadmap towards restoration from the accident,” which was drafted by the government and TEPCO under the Response Headquarters for the Accident in Fukushima NPS.

1) Basic policy

By bringing the reactors and spent fuel pools to a stable cooling condition and mitigating the release of radioactive materials, we will make every effort to enable evacuees to return to their homes and for all citizens to be able to secure a sound life.

2) Targets

Based on the basic policy, the following two steps have been set as targets:

Step 1: “Radiation dose in steady decilne”

Step 2: Release of radioactive materials is under control and radiation does is being significantly exposure.

Note: Issues after Step 2 will be categorized as “Mid-term issues“.

Areas	Issues	Targets and Countermeasures	
		Step 1	Step 2
I . Cooling	(1) Cooling the Reactors	① Maintain stable cooling ・Nitrogen gas injection ・Flooding up to top of active fuel. ・Examination and implementation of heat exchange function. ② (Unit 2) Cool the reactor while controlling the increase of accumulated water until the PCV is sealed	③ Achieve cold shutdown condition (sufficient cooling is achieved depending on the status of each unit.) ・Maintain and reinforce various countermeasures in Step 1.
	(2) Cooling the Spent Fuel Pools	④ Maintain stable cooling ・Enhance reliability of water injection. ・Restore coolant circulation system. ・(Unit 4) Install supporting structure.	⑤ Maintain more stable cooling function by keeping a certain level of water ・Remote control of coolant injection. ・Examination and implementation of heat exchange function.
II x Mitigation	(3) Containment, Storage, Processing, and Reuse of Wafer Contaminated by Radioactive Materials (Accumulated Water)	⑥ Secure sufficient storage place to prevent water with high radiation level from being released out of the site boundary ・Installation of storage/ processing facilities. ⑦ Store and process wafer with low radiation level ・Installation of storage facilities/ decontamination processing.	⑧ Decrease the total amount of contaminated wafer ・Expansion of storage/processing facilities. ・Decontamination/ Desalt processing(reuse), etc.

<table>
<tr><td></td><td>(4) Mitigation of Release of Radioactive Materials to Atmosphere and from Soil</td><td colspan="2">⑨ Prevent scattering of radioactive materials on buildings and ground</td><td>⑩ Cover the entire buildings (as temporary measure)</td></tr>
<tr><td></td><td></td><td colspan="3">• Dispersion of inhibitor
• Removal of debris
• Installing reactor building cover</td></tr>
<tr><td rowspan="2">Ⅲn Monitoring/Decontamination</td><td rowspan="2">(5) Measurement, Reduction and Announcement of Radiation Dose in Evacuation Order/ Planned Evacuation/ Emergency Evacuation Preparation Areas</td><td colspan="2">⑪ Expand/enhance monitoring and inform of results fast and accurately
・Examination and implementation of monitoring methods.</td><td>⑫ Sufficiently reduce radiation dose in evacuation order/ planned evacuation/ emergency evacuation preparation areas
・Decontamination/ monitoring of homecoming residences.</td></tr>
<tr><td colspan="3">(Note) With regard to radiation dose monitoring and reduction measures in evacuation order/ planned evacuation/ emergency evacuation preparation areas, we will take every measure through thorough coordination with the national government and by consultation with the prefectural and municipal governments.</td></tr>
</table>

Table X2-1 Immediate Actions for the Roadmap

Timeline for achieving targets is set, in spite of various uncertainties and risks, as follows:

Step 1: Approximately 3 months

Step 2: Approximately 3 to 6 months (after completing Step 1)

Note: As soon as each step is achieved and quantitative forecasts are made, they will be publicized. When the original targets and their timeline for achievement must be revised, they will also be announced in due course.

3) Immediate Actions

In order to achieve the above targets, immediate actions were divided into three groups, namely, “I. Cooling”, “II. Mitigation”, “III. Monitoring and Decontamination.” Furthermore, targets were set for each of the following five issues and various measures will be implemented simultaneously— “Cooling the Reactors,” “Cooling the Spent Fuel Pools,” “Containment, Storage, Processing, and Reuse of Water Contaminated by Radioactive Materials (Accumulated Water) ”, “Mitigation of Release of Radioactive Materials to Atmosphere and from Soil,” and “Measurement, Reduction and Announcement of Radiation Doses in Evacuation Order/Planned Evacuation/ Emergency Evacuation Preparation Areas.” (Please refer to the chart)

(2) Announcement of the status of progress regarding “Roadmap towards restoration from the accident” (May 17), on May 17, one month after the announcement of the “Roadmap towards restoration from the accident”, TEPCO announced its progress status.

1) Basic policy and targets

No change from the previous announcement.

2) General overview on the progress made in the past month and further actions

Major changes from the previous announcement are indicated below:

a. Added areas and issues

The previous roadmap set three areas (“Cooling,” “Mitigation,” and “Monitoring and Decontamination”) as well as five issues (“Cooling the Reactors,” “Cooling the Spent Fuel Pools,” “Containment, Storage, Processing, and Reuse of Water Contaminated by Radioactive Materials (Accumulated Water),” “Mitigation of Release of Radioactive Materials to Atmosphere and from Soil,” and “Measurement, Reduction and Announcement of Radiation Doses in Evacuation Order/Planned Evacuation/ Emergency Evacuation Preparation Areas,”) .

Reflecting progress made in the past month, two areas (“Countermeasures against aftershocks” and “Environment improvement”) and three issues (“Groundwater ,” “Tsunami, reinforcements, etc.” and “Life/work Environment”) were newly added to the list, resulting in 5 areas and 8 issues.

Accordingly, the number of countermeasures relating to the recovery efforts has increased to 76 from 63.

b. Issue (1) Cooling of reactors: <Revision of prioritized countermeasures due to coolant leakage>

Workers entered the reactor building in Unit 1 after improving work environment, i.e. removing rubble and mitigating radiation exposure, calibrated instrumentation (reactor water level, etc.) and confirmed reactor building status.

As a result, they found that the coolant leakage from primary containment vessel (PCV) occurred in Unit 1 as well as in Unit 2, which suggests Unit 3 may have had the same risk.

Hence, flooding operations to fill PCV with water to cover the exposed fuel rods were postponed and due consideration was given to leakage sealing.

Accordingly, as a major countermeasure to achieve “cold shutdown” in Step 2, revision was made prioritize the establishment of “circulating injection cooling,” where contaminated water accumulated in buildings and other places is reused to be injected into the PCV after being processed.

c. Issue (2) Cooling of spent fuel pool (SFP): <Implementation ahead of schedule>

Progress has been made in a relatively smooth manner. A measure to reduce radiation dose, remote controlled operation of concrete pump trucks called “Giraffe” and others to inject water into the fuel pools of Units 1, 3 and 4, etc were implemented ahead of schedule Installation of heat exchanger in SFP scheduled in Step 2 is expected to be implemented in Step1.

d. Issue (3). Containment, Storage, Processing, and Reuse of accumulated water

< Accumulated water increases until operation of processing facilities is commenced>

Accumulated water increased as new water was found in reactor building of Unit 1. While additional storage for accumulated water was secured as a tentative measure, starting the operation of processing facilities and the prompt establishment of “circulating injection cooling” became important in controlling accumulated water.

In parallel, countermeasures to prevent contamination spreading into the sea was reinforced. A silt fence was installed in the port, and progress was also being made on the initial construction necessary to install a circulating decontamination system in the port.

Furthermore, mitigation of groundwater contamination was set as a new issue.

New measures such as “Sub-drain management” and “shielding method of underground water were added.”

e. Issue (7) Aftershocks and Tsunami <Countermeasures are reinforced.>

Potential aftershocks and tsunami were explicitly designated issues.

“The instllation of temporary tide barriers” was set as a countermeasure for the roadmap, in addition to “adding redundancy of power source,” “transfer of emergency power source to up ground,” and “adding redundancy of water injection line.

Furthermore, in addition to SFP of Unit 4, reinforcement of each unit was under consideration.

f. Issue (8) Life/Work environment <Progress is being made step by step>

Reflecting the fact that improvement of Life/Work environment of workers in summer season has been initiated, new areas and issues were added.

Furthermore, necessary measures will be taken in addition to previously implemented “improvement of meal,” “maintenance” of accommodation,” and “installation of rest station,” which have already been implemented, progress has been made on necessary additional measures such as “installation of temporary dormitories,” and “additional installation of onsite rest facilities/restoration of current facilities.”

2. Measures taken by the Japanese Government

When "Roadmap towards restoration from the accident" by TEPCO was announced on April 17, the Japanese Government announced the statement by the Minister of METI, including the following views:.

1) The Government will request TEPCO to ensure the implementation of this roadmap steadily and as early as possible. To this end, the Nuclear and Industrial Safety Agency and other bodies will undertake regular follow-up, monitoring of the progress of the work, and necessary safety checks;

2) The Government will request TEPCO to ensure the mobilization and deployment of workers, the procurement and preparation of equipment and materials, and the arrangement of accommodation and other facilities, which are necessary to ensure the implementation of the roadmap;

3) At the end of Step 2, the release of radioactive materials is expected to be under control. At this stage, the Government will, following the advice of the Nuclear Safety Commission of Japan, review promptly the planned evacuation areas and emergency evacuation preparation areas. By the time of reviewing, criteria on which to base a judgment for those evacuation areas will be considered and decontamination will be carried out in these areas as wide as possible.
By implementing these countermeasures, the Japanese Government would like to inform the residents of some of the areas within a target of 6 to 9 months, whether they will be able to return to their homes.

Additionally, based on progress made for this period, on May 17, future actions to be taken by the Japanese Government were announced as follows:

(1) Support to nuclear operator and confirmation of safety

1) The government requests TEPCO to ensure the steady implementation of the roadmap as early as possible, the undertaking of regular follow-up, monitoring of the progress of the work, and necessary safety checks.

2) The government will conduct the collection of reports on the necessary measures taken by TEPCO pursuant to the provisions of Article 67 of the Act on the Regulation of Nuclear Source Materials, Nuclear Fuel Materials and Reactors, and subsequently evaluate and confirm its necessity, safety, environmental impact, etc.

(2) Support until lifting of the evacuation order

1) In order to identify precisely the needs of suffering local governments and residents, support will be provided by dispatching national government employees, and the environment which maintains communication among the relevant organizations and individuals will be improved.

2) In order to ensure the security and safety of the residents and public security in the area, the best possible efforts will be made to enforce security in the evacuation area.

(3) Support until lifting of deliberate evacuation order

1) A on-site government response office will be established to precisely identify the needs of suffered local governments and residents while the both relevant local and national governments will work closely together to smoothly provide various supports for sufferers to implement "stay in-doors" and evacuation in an emergency. Moreover, the ability to maintain communication among relevant organizations and individuals will be improved.

2) Municipal offices, prefectural and the national governments will work closely together. Moreover, the ability which maintains communication among relevant organizations and individuals will be improved.

3) Safety and security of residents will be ensured in the area by working with relevant local governments.

(4) Support until lifting of evacuation-prepared area in case of emergency

1) Both local and national governments will work closely together to implement "stay indoor" and evacuation in emergency. Moreover, the ability to maintain communication among relevant organizations and individuals will be improved.

2) Taking every possible measure to prevent crime within such areas.

(5) Ensuring safety and security of suffering residents

1) Sustainment of local community

When prefectural governments and municipalities guide the evacuees to move from primary shelters to secondary shelters and temporary housing, necessary support will be provided, while considering sustainment of the local community.

2) Ensuring healthcare, nursing and other care, and response to health concerns

a. Based upon the actual situation of each evacuation area, those who need nursing care or have disabilities or other problems will definitely be taken care of by working with relevant local governments.

b. In order to allay health concerns of the residents, screening and decontamination of the residents will definitely be implemented. A health counseling hotline was opened and on-site health counseling, and mental care is provided to ensure that residents' health is properly managed.

c. The National Institute of Radiological Science will cooperate with the relevant organizations and individuals in their efforts related to evaluating radiation exposure of the residents.

3) Educational support

a. As nursery schools, kindergartens, primary/secondary/high schools in the evacuation areas, deliberate areas, evacuation areas and evacuation prepared areas are currently closed, every measure will be taken to ensure educational opportunities for those children will be provided in and around their shelters and other places.

b. How to handle the soil and such at educational facilities in Fukushima prefecture will be promptly addressed based on the results of environmental monitoring.

4) Reinforcement of environmental monitoring (Plan for Reinforcing Environmental Monitoring)

a. Comprehensive radiation monitoring of the status of radioactive materials released from TEPCO Fukushima Dai-ichi NPS will be implemented with close cooperation with relevant organizations including Department of Energy of the United States based on "Plan for Reinforcing Environmental Monitoring."

b. Furthermore, "Radiation Exposure Distribution Maps" and such were developed and publicized, and radiation exposure is measured mainly in the deliberate evacuation areas to identify a comprehensive view of the accident status and to utilize the data for lifting of the evacuation order for the deliberate evacuation areas etc.

c. In conjunction with conducting environmental monitoring of farms and educational and other facilities, the sites for analyzing radioactive concentration of food products mainly in Fukushima and samples of environmental monitoring will be improved.

5) How to handle rubble and sewage sludge

Regarding how to deal with rubble and sludge from sewage treatment, in addition to conducting onsite investigation, the criteria and disposal methods of the disaster waste possibly contaminated with radioactive materials will be promptly addressed based on monitoring and other results.

6) Enhancement of publicity to nuclear sufferers

a. Press conferences have been held daily in order to provide citizens accurately and promptly with information regarding the accident.

b. In order to ensure that necessary, easily understood information is communicated to evacuees, a public-service program is broadcasted through local radio stations, while newsletters have been published and posted in shelters and other places.

c. Furthermore, the Internet and nationwide radio broadcasting will be used to provide information for residents evacuated to other prefectures.

XI. Responses at Other Nuclear Power Stations

1. Emergency safety measures at other NPSs in light of the accident at Fukushima Dai-ichi and Fukushima Dai-ni NPSs

Although the frequency of the occurrence of an extremely large tsunami caused by massive earthquake is deemed to be substantially small, the impact of such a tsunami on NPSs may be extensive. Hence, based on our newfound knowledge, we have decided to take emergency safety measures first to minimize as much as possible the release of radioactive materials as well as to restore cooling functions at all NPSs, other than Fukushima Dai-ichi and Fukushima Dai-ni NPSs. We have decided to prevent the occurrence of reactor core damage, etc. due to loss of all AC power, etc. and the occurrence of a nuclear emergency because of such damage, by ensuring that nuclear operators and other organizations are appropriately committed to implementing emergency safety measures and that the Nuclear and Industrial Safety Agency (NISA) confirms such measures through inspections, etc.

NISA is committed to improve the reliability of emergency safety measures continuously by ensuring that such measures are appropriately taken through conducting inspections and other measures, encouraging nuclear operators to undertake necessary improvements, and incorporating newfound knowledge in the future, etc.

(1) Details of emergency safety measures

The following issues, which were caused by the massive tsunami accompanying the earthquake, seem to be the direct causes for expansion of the Fukushima Dai-ichi NPS accident, the occurrence of the nuclear emergency and the expansion of the scale of the emergency:

1) The loss of the external power supply as well as the inability to secure emergency power supply.

2) The loss of the function of the seawater system to finally discharge to the sea the heat of the reactor cores after the shutdown of the reactors.

3) The inability to flexibly supply cooling water when water for cooling the spent fuel pool and usual on-site water supply into the pool stopped.

On March 30, 2011, NISA amended its ministerial ordinance (Requirements of Safety Regulations) and took other measures, to request all nuclear power stations (other than Fukushima Dai-ichi and Dai-ni NPSs) to enhance their safety measures as follows. The implementation status of these measures (including future plans) were requested to be submitted to NISA within about one month (by the end of April 2011).

a. Regulatory requirements

Even if all three major functions (all AC power supply, seawater cooling function and spent fuel pool cooling function) are lost due to a tsunami, damage to the reactor core and the spent fuels should be prevented and cooling functions should be restored along with controlling the release of radioactive materials.

b. Specific requirements

(a) Implementation of emergency checking
Emergency checking of equipment and facilities to be used for tsunami-related emergencies should be implemented.

(b) Checking of emergency response plans and implementation of training
Checking of emergency response plans and training assuming that all AC power supply, the seawater cooling function and the spent fuel pool cooling function are lost should be implemented.

(c) Securing emergency power supply
When the on-site power supply is lost and the emergency power supply is not available, an alternative power supply should be secured to flexibly provide the necessary power.

(d) Securing final heat removal functions in an emergency
Preparation for measures to flexibly restore heat removal functions under the assumption, that the seawater system and/or its functions were lost should be implemented.

(e) Ensuring the cooling of the spent fuel pool in an emergency
Measures to flexibly supply cooling water should be implemented when cooling the

spent fuel pool as well as when on-site water supply into the pool stopped.

(f) Implementation of immediately necessary measures based on the structure, etc. of each site.

(2) Confirmation, etc. by NISA

On May 6, 2011, NISA confirmed by on-site inspection, etc., that emergency safety measures have been appropriately implemented, except at Onagawa NPS, Fukushima Dai-ichi NPS and Dai-ni NPS.

On May 18, 2011, NISA received an implementation status report from Onagawa NPS, where work for taking measures against tsunami was delayed after suffering from the tsunami.

On April 21, 2011, implementation of emergency safety measures was directed to Fukushima Dai-ni NPS because it reached a stable status after cold shutdown. On May 20, 2011, NISA received a report on this implementation status. On-site Nuclear Safety Inspectors from NISA check whether supplies and equipment for emergency safety measures are deployed and such training is implemented. In the future, the inspectors will review the appropriateness and effectiveness, etc. of the content of the report and will strictly implement on-site inspections and review how supplies and equipment are deployed as well as how the implementation manual is developed.

2. Shutdown of Hamaoka NPS

In light of the accident at Fukushima Dai-ichi NPS, NISA directed on March 30, 2011, Chubu Electric Power Co., Inc. (Chubu Electric Power) and other electricity utilities, etc. to immediately work on emergency safety measures that would prevent reactor core damage etc., even if all three functions (all AC power supply, seawater cooling function and spent fuel pool cooling function) are lost due to a tsunami, and to promptly report the implementation status of these measures.

Following these instructions, Chubu Electric Power improved its operational safety programs and documented its procedure manual at Hamaoka NPS, installed the necessary equipment there and even adjusted its measures through drills. NISA performed an on-site inspection to ascertain that these measures have been implemented appropriately and, as a result, evaluated on May 6 that appropriate measures are in place.

However, Hamaoka NPS is located close to the source area of the anticipated Tokai Earthquake, which is considered to be an extremely imminent danger as indicated by the evaluations of the Headquarters for Earthquake Research Promotion of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), which anticipates an 87 percent probability of a magnitude 8-level earthquake occurring in the region within 30 years. Given the high possibility of Hamaoka NPS being hit by a major tsunami following this earthquake, NISA has requested Chubu Electric Power to surely put the plans stated in its report into practice, taking protective measures against tsunami, securing reserve seawater pumps and installing air-cooling type emergency generators, etc., and to shut down all the reactors at Hamaoka NPS until these measures are completed, as well as ascertained and evaluated by NISA.

On May 9, 2011, Chubu Electric Power announced its acceptance of this official request to shut down the Hamaoka NPS and submitted a report “Regarding Suspension of Operations at Hamaoka NPS” to the Minister of Economy, Trade and Industry. In response, the Ministry of Economy, Trade and Industry (METI) issued a ministerial statement on the same day to Chubu Electric Power. Accordingly, Chubu Electric Power decided to suspend resumption of operation of Unit 3 of Hamaoka NPS, and to shut down Unit 4 as of May 13, 2011 and Unit 5 as of May 14, 2011.

XII. Lessons Learned From the Accident Thus Far

The Fukushima NPS accident has the following aspects: it was triggered by a natural disaster; it led to a severe accident with damage to nuclear fuel, Reactor Pressure Vessels and Primary Containment Vessels; and accidents involving multiple reactors arose at the same time. Moreover, as nearly three months have passed since the occurrence of the accident, a mid- to long-term initiative is needed to settle the situation imposing a large burden on society, such as a long-term evacuation of many residents in the vicinity, as well as having a major impact on industrial activities including the farming and livestock industries in the related area. There are thus many aspects different from the accidents in the past at the Three Mile Island Nuclear Power Plant and the Chernobyl Nuclear Power Plant.

The accident is also characterized by the following aspects. Emergency response activities had to be performed in a situation where the earthquake and tsunami destroyed the social infrastructure such as electricity supply, communication and transportation systems across a wide area in the vicinity. The occurrence of aftershocks frequently impeded various accident response activities.

This accident led to a severe accident, shook the trust of the public, and warned those engaged in nuclear energy of their overconfidence in nuclear safety. It is therefore important to learn lessons thoroughly from this accident. We present the lessons classified into five categories at this moment bearing in mind that the most important basic principle in securing nuclear safety is having defenses in depth.

Thus the lessons that have been learned to date are presented as classified in five categories. We consider it inevitable to carry out a fundamental review on nuclear safety measures in Japan based on these lessons. While some of them are specific to Japan, these specific lessons have been included regardless, from the standpoint of showing the overall structure of the lessons.

The lessons in category 1 are those learned based on the fact that this accident has been a severe accident, and from reviewing the sufficiency of preventive measures against a severe accident.

The lessons in category 2 are those learned from reviewing the adequacy of the responses to this severe accident.

The lessons in category 3 are those learned from reviewing the adequacy of the emergency responses to the nuclear disaster in this accident.

The lessons in category 4 are those learned from reviewing the robustness of the safety infrastructure established at nuclear power stations.

The lessons in category 5 are those learned from reviewing the thoroughness in safety culture while summing up all the lessons.

Lessons in category 1

Strengthen preventive measures against a severe accident

(1) Strengthen measures against earthquakes and tsunamis

The earthquake was an extremely massive one caused by plurally linked seismic centers. As a result, at the Fukushima Dai-ichi Nuclear Power Station, the acceleration response spectra of seismic ground motion observed on the base mat exceeded the acceleration response spectra of the design basis seismic ground motion in a part of the periodic band. Although damage to the external power supply was caused by the earthquake, no damage caused by the earthquake to systems, equipment or devices important for nuclear reactor safety at nuclear reactors has been confirmed. However, further investigation should be conducted as the details regarding this situation remain unknown.

The tsunamis which hit the Fukushima Dai-ichi Nuclear Power Station were 14-15m high, substantially exceeding the height assumed under the design of construction permit or the subsequent evaluation. The tsunamis severely damaged seawater pumps, etc., causing the failure to secure the emergency diesel power supply and reactor cooling function. The procedural manual did not assume flooding from a tsunami, but rather only stipulated measures against a backrush. The assumption on the frequency and height of tsunamis was insufficient, and therefore, measures against large-scale tsunamis were not prepared adequately.

From the viewpoint of design, the range of an active period for a capable fault which needs to be considered in the seismic design for a nuclear power plant is considered within 120,000-130,000 years (50,000 years in the old guideline). The recurrence of large-scale earthquakes is expected to be appropriately considered. Moreover, residual risks must be considered. Compared with the design against earthquake, the design against tsunamis has been performed based on tsunami folklore and indelible traces of tsunami, not on adequate consideration of the recurrence of large-scale earthquakes in relation to a safety goal to be attained.

Reflecting on the above issues, we will consider the handling of plurally linked seismic centers as well as the strengthening of the quake resistance of external power supplies. Regarding tsunamis, from the viewpoint of preventing a severe accident, we will assume appropriate frequency and adequate height of tsunamis in consideration of a sufficient recurrence period for attaining a safety goal. Then, we will perform a safety design of structures, etc. to prevent the impact of flooding of the site caused by tsunamis of adequately assumed heights, in consideration of the destructive power of tsunamis. While fully recognizing a possible risk caused by the flooding into buildings of tsunamis exceeding the ones assumed in design, we will take measures from the viewpoint of having defenses-in-depth, to sustain the important safety functions by considering flooded sites and the huge destructive power of run-up waves.

(2) Ensure power supplies

A major cause of this accident was the failure to secure the necessary power supply. This was caused by the facts that power supply sources were not diversified from the viewpoint of overcoming vulnerability related to failures derived from a common cause arising from an external event, and that the installed equipment such as a switchboard did not meet the specifications that could withstand a severe environment such as flooding. Moreover, it was caused by the facts that battery life was short compared with the time required for restoration of the AC power supply and that a time goal required for the recovery of the external power supply was not clear

Reflecting on the above facts, Japan will secure a power supply at sites for a longer time set forth as a goal even in severe circumstances of emergencies, through the diversification of power supply sources by preparing various emergency power supply sources such as air-cooled diesel generators, gas turbine generators, etc., deploying power-supply vehicles and so on, as well as equipping switchboards, etc. with high environmental tolerance and generators for battery charging, and so on.

(3) Ensure robust cooling functions of reactors and PCVs

In this accident, the final place for release of heat (the final heat sink) was lost due to the loss of function of the seawater pumps. Although the reactor cooling function of water injection was activated, core damage could not be prevented due to the drain of the water source for injection and the loss of power supplies, etc., and furthermore, the PCV cooling functions also failed to run well. Thereafter, difficulties remained in reducing the reactor pressure and, moreover, in injecting water after the pressure was reduced, because the water injection line into a reactor through the use of heavy machinery such as fire engines, etc. had not been developed as measures for accident management. In this manner, the loss of cooling functions of the reactors and PCVs aggravated the accident.

Reflecting on the above issues, Japan will secure robust alternative cooling functions for its reactors and PCVs by securing alternative final heat sinks for a durable time. This will be pursued through such means as diversifying alternative water injection functions, diversifying and increasing sources for injection water, and introducing air-cooling systems.

(4) Ensure robust cooling functions of spent fuel pools

In the accident, the loss of power supplies caused the failure to cool the spent fuel pools, requiring actions to prevent a severe accident due to the loss of cooling functions of the spent fuel pools concurrently with responses to the accident of the reactors. Until now, a risk of a major accident of a spent fuel pool had been deemed small compared with that of a core event and measures such as alternative means of water injection into spent fuel pools, etc. had not been considered.

Reflecting on the above issues, Japan will secure robust cooling measures by introducing alternative cooling functions such as a natural circulation cooling system or an air-cooling system, as well as alternative water injection functions in order to maintain the cooling of spent fuel pools even in case of the loss of power supplies.

(5) Thorough accident management (AM) measures

The accident reached the level of a so-called "severe accident." Accident management measures had been introduced to the Fukushima NPSs to minimize the possibilities of severe accidents and to mitigate consequences in the case of severe accidents. However, looking at the situation of the accident, although some portion of the measures functioned, such as the alternative water injection from the fire extinguishing water system to the reactor, the rest did not fulfill their roles within various responses including ensuring the power supplies and the reactor cooling function, with the measures turning out to be inadequate. In addition, accident management measures are basically regarded as voluntary efforts by operators, not legal requirements, and so the development of these measures lacked strictness. Moreover, the guideline for accident management has not been reviewed since its development in 1992, and has not been strengthened or improved.

Reflecting on the above issues, we will change the accident management measures from voluntary safety efforts by operators to legal requirements, and develop accident management measures to prevent severe accidents, including a review of design requirements as well, by utilizing a probabilistic safety assessment approach.

(6) Response to issues concerning the siting with more than one reactor

The accident occurred at more than one reactor at the same time, and the resources needed for accident response had to be dispersed. Moreover, as two reactors shared the facilities, the physical distance between the reactors was small and so on. The development of an accident occurring at one reactor affected the emergency responses at nearby reactors.

Reflecting on the above issues, Japan will take measures to ensure that emergency operations at a reactor where an accident occurs can be conducted independently from operation at other reactors if one power station has more than one reactor. Also, Japan will assure the engineering independence of each reactor to prevent an accident at one reactor from affecting nearby reactors. In addition, Japan will promote the development of a structure that enables each unit to carry out accident responses independently, by choosing a responsible person for ensuring the nuclear safety of each unit.

(7) Consideration of NPS arrangement in basic designs

Response to the accident became difficult since the spent fuel storage pools were located at a higher part of the reactor buildings. In addition, contaminated water from the reactor buildings reached the turbine buildings, meaning that the spread of contaminated water to other buildings has not been prevented. .

Reflecting on the above issues, Japan will promote the adequate placement of facilities and buildings at the stage of basic design of NPS arrangement, etc. in order to further ensure the conducting of robust cooling, etc. and prevent an expansion of impacts from the accident, in consideration of the occurrence of serious accidents. In this regard, as for existing facilities, additional response measures will be taken to add equivalent levels of functionality to them.

(8) Ensuring the water tightness of essential equipment facilities

One of the causes of the accidents is that the tsunami flooded many essential equipment facilities including the component cooling seawater pump facilities, the emergency diesel generators, the switchboards, etc., impairing power supply and making it difficult to ensure cooling systems.

Reflecting on the above issues, in terms of achieving the target safety level, Japan will ensure the important safety functions even in the case of tsunamis greater than ones expected by the design or floods hitting facilities located near rivers. In concrete terms, Japan will ensure the water-tightness of important equipment facilities by installing watertight doors in consideration of the destructive power of tsunamis and floods, blocking flooding routes such as pipes, and installing drain pumps, etc.

Lessons in Category 2

Enhancement of response measures against severe accidents

(9) Enhancement of measures to prevent hydrogen explosions

In the accident, an explosion probably caused by hydrogen occurred at the reactor building in Unit 1 at 15:36 on March 12, 2011, as well as at the reactor in Unit 3 at 11:01 on March 14. In addition, an explosion that was probably caused by hydrogen occurred at the reactor building in Unit 4 around 06:00 on March 15, 2011. Consecutive explosions occurred as effective measures could not be taken beginning from the first explosion. These hydrogen explosions aggravated the accident. A BWR inactivates a PCV and has a flammability control system in order to maintain the soundness of the PCV against design basis accidents. However, it was not assumed that an explosion in reactor buildings would be caused by hydrogen leakage, and as a matter of course, hydrogen measures for reactor buildings were not taken.

Reflecting on the above issues, we will enhance measures to prevent hydrogen explosions such as by installing of flammability control systems that would function in the event of a severe accident in reactor buildings, for the purpose of discharging or reducing hydrogen in the reactor buildings, in addition to measures to address hydrogen within the PCVs.

(10) Enhancement of containment venting system

In the accident, there were problems in the operability of the containment venting system. Also, as the function of removing released radioactive materials in the containment venting system was insufficient, the system was not effective as an accident management countermeasure. In addition, the independence of the vent line was insufficient and it may have had an adverse effect on other parts through connecting pipes, etc.

Reflecting on the above issues, we will enhance the containment venting system by improving its operability, ensuring its independence, and strengthening its function of removing released radioactive materials.

(11) Improvements to the accident response environment

In the accident, the radiation dosage increased in the main control room and operators could not enter the room temporarily and the habitability in the main control room has decreased, as it still remains difficult to work in that room for an extended period. Moreover, at the on-site emergency station, which serves as a control tower for all emergency measures at the site, the accident response activities were affected by increases in the radiation dosage as well as by the worsening of the communication environment and lighting.

Reflecting on the above issues, we will enhance the accident response environment that enables continued accident response activities even in case of severe accidents through measures such as strengthening radiation shielding in the control rooms and the emergency centers, enhancing the exclusive ventilation and air conditioning systems on site, as well as strengthening related equipment, including communication and lightening systems, without use of AC power supply.

(12) Enhancement of the radiation exposure management system at the time of the accident

As these accidents occurred, although adequate radiation management became difficult as many of the personal dosimeters and dose reading devices became unusable due to their submergence in seawater, personnel engaged in radiation work had to work on site. In addition, measurements of concentration of radioactive materials in the air were delayed, and as a result the risk of internal exposure increased.

Reflecting on the above issues, we will enhance the radiation exposure management system at the time of an accident occurs by storing the adequate amount of personal dosimeters and protection suits and gears for accidents, developing asystem in which radioactive management personnel can be expanded at the time of the accident and improving the structures and equipment by which the radiation doses of radiation workers are measured promptly.

(13) Enhancement of training responding to severe accidents

Effective training to respond to accident restoration at nuclear power plants and adequately work and communicate with relevant organizations in the wake of severe accidents was not sufficiently implemented up to now. For example, it took time to establish communication between the emergency office inside the power station, the Nuclear Emergency Response Headquarters and the Local Headquarters and also to build a collaborative structure with the Self Defense Forces, the Police, Fire Authorities and other organizations which played important roles in responding to the accident. Adequate training could have prevented these problems.

Reflecting on the above issues, we will enhance training to respond to severe accidents by promptly building a structure for responding to accident restoration, identifying situations within and outside power plants, facilitating the gathering of human resources needed for securing the safety of residents and collaborating effectively with relevant organizations.

(14) Enhancement of instrumentation to identify the status of the reactors and PCVs

Because the instrumentation of the reactors and PCVs did not function sufficiently during the severe accident, it was difficult to promptly and adequately obtain important information to identify how the accident was developing such as the water levels and the pressure of reactors, and the sources and amounts of released radioactive materials.

In respond to the above issues, we will enhance the instrumentation of reactors and PCVs, etc. to enable them to function effectively even in the wake of severe accidents.

(15) Central control of emergency supplies and equipment and setting up rescue team

Logistic support has been provided diligently by those responding to the accident and supporting affected people with supplies and equipment gathered mainly at J Village. However, because of the damage from the earthquake and tsunami in the surrounding areas shortly after the accident, we could not promptly or sufficiently mobilize rescue teams to help provide emergency supplies and equipment or support accident control activities. This is why the on-site accident response did not sufficiently function.

Reflecting on the above issues, we will introduce systems for centrally controlling emergency supplies and equipment and setting up rescue teams for operating such systems in order to provide emergency support smoothly even under harsh circumstances.

Lessons in Category 3

Enhancement of nuclear emergency responses

(16) Responses to combined emergencies of both large-scale natural disasters and prolonged nuclear accident

There was tremendous difficulty in communication and telecommunications, mobilizing human resources, and procuring supplies among other areas when addressing the nuclear accident that coincided with a massive natural disaster. As the nuclear accident has been prolonged, some measures such as the evacuation of residents, which was originally assumed to be a short-term measure, have been forced to be extended.

Reflecting on the above issues, we will prepare the structures and environments where appropriate communication tools and devices and channels to procure supplies and equipment will be ensured in the case of concurrent emergencies of both a massive natural disaster and a prolonged nuclear accident. Also, assuming a prolonged nuclear accident, we will enhance emergency response preparedness including effective mobilization plans to gather human resources in various fields who are involved with accident response and support for affected persons.

(17) Reinforcement of environmental monitoring

Currently, local governments are responsible for environmental monitoring in an emergency. However, appropriate environmental monitoring was not possible immediately after the accident because the equipment and facilities for environmental monitoring owned by local governments were damaged by the earthquake and tsunami and the relevant individuals had to evacuate from the Off-site Center Emergency Response Center. To bridge these gaps, MEXT has conducted environmental monitoring in cooperation with relevant organizations.

Reflecting on the above issues, the Government will develop a structure through which the Government will implement environmental monitoring in a reliable and well-planned manner during emergencies.

(18) Establishment of a clear division of labor between relevant central and local organizations

Communication between local and central offices as well as with other organizations was not achieved to a sufficient degree, due to the lack of communication tools immediately after the accident and also due to the fact that the roles and responsibilities of each side were not clearly defined. Specifically, responsibility and authority were not clearly defined in the relationship between the NERHQs Nuclear Emergency Response Headquarters and Local NERHQs Headquarters, between the Government and TEPCO, between the Head Office of TEPCO and the NPS on site, or among the relevant organizations in the Government. Especially, communication was not sufficient between the government and the main office of TEPCO as the accident initially began to unfold.

Reflecting on the above issues, we will review and define roles and responsibilities of relevant organizations including the NERHQs, clearly specify roles, responsibilities and tools for communication while also improving institutional mechanisms.

(19) Enhancement of communication relevant to the accident

Communication to residents in the surrounding area was difficult because communication tools were damaged by the large-scale earthquake. The subsequent information to residents in the surrounding area and local governments was not always provided in a timely manner. The impact of radioactive materials on health and the radiological protection guidelines of the ICRP, which are the most important information for residents in the surrounding area and others, were not sufficiently explained. Japan focused mainly on making accurate facts publicly available to its citizens and has not sufficiently presented future outlooks on risk factors, which sometimes gave rise to concerns about future prospects.

Reflecting on the above issues, we will reinforce the adequate provision of information on the accident status and response, along with appropriate explanations of the effects of radiation to the residents in the vicinity. Also, we will keep in mind having the future outlook on risk factors is included in the information delivered while incidents are still ongoing .

(20) Enhancement of responses to assistance from other countries and communication to the international community

The Japanese Government could not appropriately respond to the assistance offered by countries around the world because no specific structure existed within the Government to link such assistance offered by other countries to the domestic needs. Also, communication with the international community including prior notification to neighboring countries and areas on the discharge of water with low-level radioactivity to the sea was not always sufficient.

Reflecting on the above-mentioned issues, the Japanese Government will contribute to developing a global structure for effective responses, by cooperating with the international community, for example, developing a list of supplies and equipment for effective responses to any accident, specifying contact points for each country in advance in case of an accident, enhancing the information sharing framework through improvements to the international notification system, and providing faster and more accurate information to enable the implementation of measures that are based upon scientific evidence.

(21) Adequate identification and forecasting of the effect of released radioactive materials

The System for Prediction of Environmental Emergency Dose Information (SPEEDI) could not make proper predictions on the effect of radioactive materials as originally designed, due to the lack of information on release sources. Even under such restricted conditions, it should have been utilized, as a reference of evacuation activities and other purposes by presuming diffusion trends of radioactive materials under certain assumptions. Although the results generated by SPEEDI are now being disclosed, disclosure should have been conducted from the initial stage.

The Japanese Government will improve its instrumentation and facilities to ensure that release source information can be securely obtained. Also, it will develop a plan to effectively utilize SPEEDI and other systems to address various emergent cases and disclose the data and results from SPEEDI, etc. from the earliest stages of such cases.

(22) Clear definition of widespread evacuation areas and radiological protection guidelines in nuclear emergency

Immediately after the accident, an Evacuation Area and In-house Evacuation Area were established, and cooperation of residents in the vicinity, local governments, police and relevant organizations facilitated the fast implementation of evacuation and “stay-in-house” instruction. As the accident became prolonged, the residents had to be evacuated or stay within their houses for long periods. Subsequently, however, it was decided that guidelines of the ICRP and IAEA, which have not been used before the accident, would be used when establishing Deliberate Evacuation Area and Emergency Evacuation Prepared Area. The size of the protected area defined after the accident was considerably larger than a 8 to 10 km radius from the NPS, which had beendefined as the area where focused protection measures should be taken.

Based on the experiences gained from the accident, the Japanese Government will make much greater efforts to clearly define evacuation areas and guidelines for radiological protection in nuclear emergencies.

Lessons in Category 4

Reinforcement of safety infrastructure

(23) Reinforcement of safety regulatory bodies

Governmental organizations have different responsibilities for securing nuclear safety. For example, NISA of METI is responsible for safety regulation as a primary regulatory body, while the Nuclear Safety Commission of the Cabinet Office is responsible for regulation monitoring of the primary governmental body, and relevant local governments and ministries are in charge of emergency environmental monitoring. This is why it was not clear where the primary responsibility lies in ensuring citizens' safety in an emergency. Also, we cannot deny that the existing organizations and structures hindered the mobilization of capabilities in promptly responding to such a large-scale nuclear accident.

Reflecting on the above issues, the Japanese Government will separate NISA from METI and start to review implementing frameworks, including the NSC and relevant ministries, for the administration of nuclear safety regulations and for environmental monitoring.

(24) Establishment and reinforcement of legal structures, criteria and guidelines

Reflecting on this accident, various challenges have been identified regarding the establishment and reinforcement of legal structures on nuclear safety and nuclear emergency preparedness and response, and related criteria and guidelines. Also, based on the experiences of this nuclear accident, many issues will be identified as ones to be reflected in the standards and guidelines of the IAEA.

Therefore, the Japanese Government will review and improve the legal structures governing nuclear safety and nuclear emergency preparedness and response, along with related criteria and guidelines. During this process, it will reevaluate measures taken against age-related degradation of existing facilities, from the viewpoint of structural reliability as well as the necessity of responding to new knowledge and expertise including progress in system concepts. Also, the Japanese Government will clarify technical requirements based on new laws and regulations or on new findings and knowledge for facilities that have already been approved and licensed, in other words, it will clarify the status of retrofitting in the context of the legal and regulatory framework. The Japanese

Government will make every effort to contribute to improving safety standards and guidelines of the IAEA by providing related data.

(25) Human resources for nuclear safety and nuclear emergency preparedness and responses

All the experts on severe accidents, nuclear safety, nuclear emergency preparedness and response, risk management and radiation medicine should get together to address such an accident by making use of the latest and best knowledge and experience. Also, it is extremely important to develop human resources in the fields of nuclear safety and nuclear emergency preparedness and response in order to ensure mid-and-long term efforts on nuclear safety as well as to bring restoration to the current accident.

Reflecting on the above-mentioned issues, the Japanese Government will enhance human resource development within the activities of nuclear operators and regulatory organizations along with focusing on nuclear safety education, nuclear emergency preparedness and response, crisis management and radiation medicine at educational organizations.

(26) Ensuring the independence and diversity of safety systems

Although multiplicity has been valued until now in order to ensure the reliability of safety systems, avoidance of common cause failures has not been carefully considered and independence and diversity have not been sufficiently secured.

Therefore, the Japanese Government will ensure the independence and diversity of safety systems so that common cause failures can be adequately addressed and the reliability of safety functions can be further improved.

(27) Effective use of probabilistic safety assessment (PSA) in risk management

PSA has not always been effectively utilized in the overall reviewing processes or in risk reduction efforts at nuclear power plants. While a quantitative evaluation of risks of quite rare events such as a large-scale tsunami is difficult and may be associated with uncertainty even within PSA, Japan has not made sufficient efforts to improve the reliability of the assessments by explicitly identifying the uncertainty of these risks.

Considering knowledge and experiences regarding uncertainties, the Japanese Government will further actively and swiftly utilize PSA while developing improvements to safety measures including effective accident management measures based on PSA.

Lessons in Category 5

Thoroughly instill a safety culture

(28) Thoroughly instill a safety culture

All those involved with nuclear energy should be equipped with a safety culture. “Nuclear safety culture” is stated as “A safety culture that governs the attitudes and behavior in relation to safety of all organizations and individuals concerned must be integrated in the management system.” (IAEA, Fundamental Safety Principles, SF-1, 3.13) Learning this message and putting it into practice is the starting point, the duty and the responsibility of those who are involved with nuclear energy. Without a safety culture, there will be no continual improvement of nuclear safety.

Reflecting on the current accident, the nuclear operators whose organization and individuals have primary responsibility for securing safety should look at every knowledge and every finding, and confirm whether or not they indicate a vulnerability of a plant. They should reflect as to whether they have been serious in introducing appropriate measures for improving safety, when they are not confident that risks concerning the public safety of the plant remain low.

Also, organizations or individuals involved in national nuclear regulations, as those who responsible for ensuring the nuclear safety of the public, should reflect whether they have been serious in addressing new knowledge in a responsive and prompt manner, not leaving any doubts in terms of safety.

Reflecting on this viewpoint, Japan will establish a safety culture by going back to the basics, namely that pursuing defenses-in-depth is essential for ensuring nuclear safety, by constantly learning professional knowledge on safety, and by maintaining an attitude of trying to identify weaknesses as well as room in the area of safety.

XIII. Conclusion

The nuclear accident that occurred at the Fukushima Nuclear Power Station (NPS) on March 11, 2011 was caused by an extremely massive earthquake and tsunami rarely seen in history, and resulted in an unprecedented serious accident that extended over multiple reactors simultaneously. Japan is extending its utmost efforts to confront and overcome this difficult accident.

In particular, at the accident site, people engaged in the work have been making every effort under severe conditions to settle the situation. It is impossible to resolve the situation without these contributions. The Japanese Government is determined to make its utmost effort to support the people engaged in this work.

We take very seriously the fact that the accident, triggered by a natural disaster of an earthquake and tsunamis, became a severe accident due to such causes as the losses of power and cooling functions, and that consistent preparation for severe accidents was insufficient. In light of the lessons learned from the accident, Japan has recognized that a fundamental revision of its nuclear safety preparedness and response is inevitable.

As a part of this effort, Japan will promote the “Plan to Enhance the Research on Nuclear Safety Infrastructure” while watching the status of the process of settling the situation. This plan is intended to promote, among other things, research to enhance preparedness and response against severe accidents through international cooperation, and to work to lead the results achieved for the improvement of global nuclear safety.

At the same time, it is necessary for Japan to conduct national discussions on the proper course for nuclear power generation while disclosing the actual costs of nuclear power generation, including the costs involved in ensuring safety.

Japan will update information on the accident and lessons learned from it in line with the future process of restoration of stable control and also further clarification of its investigations. Moreover, it will continue to provide such information and lessons learned to the International Atomic Energy Agency as well as to countries around the world.

Moreover, we feel encouraged by the support towards restoration from the accident received from many countries around the world to which we express our deepest gratitude, and we would sincerely appreciate continued support from the IAEA and countries around the world.

We are prepared to confront much difficulty towards restoration from the accident, and also confident that we will be able to overcome this accident by uniting the wisdom and efforts of not only Japan, but also the world.

Summary of Laws and Regulations for Nuclear Emergency Preparedness

[Reactor Regulation Act]
○ Prevention of disasters by regulations for operation, etc. of reactors and securing of public safety

- Order of Article 64 of the Reactor Regulation Law

↔

[Basic Act on Disaster Control Measures]
- ○ Basics of emergency preparedness mainly for natural disaster and promotion of comprehensive and planned disaster management by government
- ○ Preparation of disaster prevention plan
- ○ Disaster prevention measures, disaster emergency countermeasures (mainly by municipal and prefectural administrations), disaster recovery measures

[Special Law of Nuclear Emergency Preparedness]
- ○ Clarification of responsibility and liability of licensees
- ○ Clarification of the role and response in emergency of the national government
- ○ Stipulation of special provisions considering the particularity of nuclear disaster (establishment of Offsite Center, etc.)

Emergency Preparedness Guides
(Nuclear Safety Commission)

technical items

Basic Plan for Emergency Preparedness (Volume on nuclear disaster countermeasures)

○ Basic plan for emergency preparedness
(Stipulates specific operation of the Basic Act on Disaster Control Measures)

Licensee's Emergency Preparedness Action Plan
○ Preventive measures, emergency countermeasures and follow-up measures by **licensees**

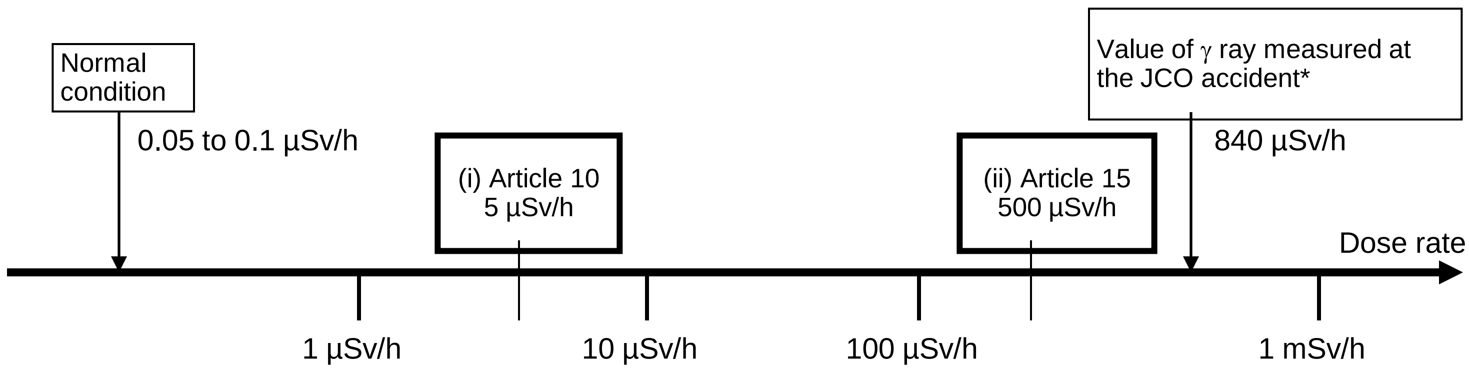
Emergency Preparedness Action Plan
○ Plans of **related government ministries and agencies** for emergency

Regional Plan for Emergency Preparedness
○ Plans of **prefectural and municipal administrations** for emergency

* Reinforcement of ability to respond to nuclear emergency by coordination of related agencies through emergency drills and other activities

Dose rate standard and response to progress of the situation based on the Special Law of Nuclear Emergency Preparedness (after accident)

(Articles 10 and 15 of the Special Law of Nuclear Emergency Preparedness)



(Unit) Sievert (Sv)
The energy absorbed by human body when radiation hits a material object calculated by multiplying correction coefficient according to the radiation type.

(Effect to human body (acute disorder))

100% Death	7,000 mSv
Nausea	1, 000 mSv
Temporal decrease of lymph cell	250 mSv

(Reference)
Fluctuation of dose rate around the site boundary

(1) In rain:	About 0.2 µSv/h
(2) In lightning:	100 µSv/h (momentary)
(3) Passing of container:	About 20 µSv/h (few minutes)
(4) Others (Passing of a person who received RI):	About 100 µSv/h (momentary)

* Measurement value of γ ray detected simultaneously as the emission of neutron ray.

Emergency Preparedness for Nuclear Facilities (Emergency Preparedness Guide)

Volume on Nuclear Emergency Preparedness of Basic Plan for Emergency Preparedness (excerpt)

- ○ **<u>The emergency preparedness guide "Emergency Preparedness for Nuclear Facilities", defined by the Nuclear Safety Commission should be fully respected</u>** for technical items.
- ○ The area to establish the Volume on Nuclear Emergency Preparedness of Regional Emergency Plan should be stipulated considering the surrounding natural and social conditions to have **<u>"areas with intensified emergency preparedness centering on nuclear installations" described in the abovementioned guides</u>**.

Items to be stipulated on the Emergency Preparedness Guide

- ○ Areas with intensified emergency preparedness (EPZ)
- ○ Guides for implementation of
- ○ immediate actions (Protective measures)
- ○ Environmental radiation monitoring in emergencies
- ○ Emergency medical treatment for radiation exposure and others

Background of preparation of Emergency Preparedness Guide

- ○ Summarized results of studies of technical items prompted by the accident of the Three Mile Island Nuclear Power Station in March 1979 to smoothly implement emergency preparedness in the vicinity of nuclear power stations focusing on the events unique to nuclear emergency.
- ○ Revisions have been made since then. (Below are major revisions)

May 2000	- - -	Addition and revision based on the Special Law on Nuclear Emergency Preparedness established after JCO accident in September 1999
June 2001	- - -	Revision for effective emergency medical treatment for radiation exposure learned from the emergency medical treatment for radiation exposure provided to exposed patients by the JCO accident
April 2002	- - -	Revision for protective measures related to preventive dose of stable iodine tablet
November 2002	- - -	Revision for mental health measures in nuclear emergency
July 2003	- - -	Revision for setting regional system for emergency radiation exposure medical treatment

“Emergency Preparedness for Nuclear Facilities” Nuclear Safety Commission

Areas with intensified emergency preparedness : EPZ (Emergency Planning Zone)

Facility type		Approx. distance of EPZ (radius)
Nuclear power plants, reactors in research and development stage and nuclear reactors for purposes of testing and research that are larger than 50 MW		Approx. 8 to 10 km
Nuclear fuel reprocessing facilities		Approx. 5 km
Nuclear reactors for purposes of testing and research (50MW or less)	Thermal output ≤ 1 kW	Approx. 50 m
	1 kW < Thermal output ≤ 100 kW	Approx. 100 m
	100 kW < Thermal output ≤ 10 MW	Approx. 500 m
	10 MW < Thermal output ≤ 50 MW	Approx. 1500 m
	Facilities with special facility conditions, etc.	Decided individually
Fabricating facilities and facilities using nuclear fuel materials for the amount of critical mass or more	Facilities that use nuclear fuel materials (exclude those stored statically in conditions with strict criticality prevention measures of mass control, shape control, geometrically safe placement and others) for the amount of critical mass or more and are of either shape described below ● Facilities that handle material in indeterminate form (solution, powder, gas) and indefinite form (physical and chemical processes) ● Facilities that handle uranium with enrichment of 5% or more ● Facilities that handle plutonium	Approx. 500 m
	Other facilities	Approx. 50 m
Disposal facilities		Approx. 50 m

"Emergency Preparedness for Nuclear Facilities" Nuclear Safety Commission

Guidelines for staying in-house and evacuation

Predicted dose (unit: mSv)		Content of protective measures
Effective dose by external exposure	Equivalent dose by internal exposure ● Equivalent dose to infantile thyroid by radioactive iodine ● Equivalent dose to bone surface and lung by uranium ● Equivalent dose to bone surface and lung by plutonium	
10 to 50	100 to 500	Residents should stay in-house or in a building and keep air tightness by closing windows and other openings. However, take shelter in a concrete building or evacuate when neutron ray or gamma ray is emitted directly from a facility following the direction if any.
50 or more	500 or more	Residents should stay in a concrete building or evacuate following the direction.

Reactor Core Conditions of Units 1 to 3 of Fukushima Daiichi Nuclear Power Station

* This part is a preliminary translation of a part of a report submitted by Tokyo Electric Power Company.

Table of Contents

1. Introduction

Due to the Tohoku-Chihou-Taiheiyou-Oki Earthquake centered off the coast of Sanriku, which occurred on March 11, 2011, Units 1 to 3 of Fukushima Daiichi Nuclear Power Station experienced accidents that not only went significantly beyond design basis, but also exceeded the extent of multiple breakdowns assumed in the preparation for accident management measures, such as the malfunction or loss of all Emergency Core Cooling Systems (ECCS) combined with the extended loss of all AC power sources. In order to stabilize and restore the accident in the future, it is important to understand the event progression of the plants since the earthquake and the current condition of the plants.

On April 25, 2011 TEPCO received an instruction from Nuclear and Industrial Safety Agency (NISA) titled “Collection of Report on Section 1 of the Article 67 of Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors” (April 24, 2011 NISA No.1). On May 16, 2011, based on the instruction, we collected as many plant data as possible at the time of the earthquake, sorted them and reported to NISA. Based on the above mentioned information on equipment status and operations at the early period when the earthquake occurred, we have evaluated plant status and sorted the information by means of Modular Accident Analysis Program (MAAP).

As this analysis was based on limited amount of information obtained at the time of preparing this report and adopted various estimates and assumptions for conditions necessary to run the analysis, there is extremely great uncertainty in the results. Therefore, as we proceed with investigation of causes, we may find the conclusion to be widely different from the analysis results.

2. Summary of Evaluation Results

As a result of an analysis by means of MAAP code, we have obtained an analysis result showing that after an isolation condenser system (IC) of Unit 1 of Fukushima Daiichi Nuclear Power Station (Unit 1) was assumed to stop, reactor core damage began at a relatively early stage, followed by a breach of the reactor pressure vessel.

At Unit 2 of Fukushima Daiichi Nuclear Power Station (Unit 2) and Unit 3 of Fukushima Daiichi Nuclear Power Station (Unit 3), though reactor core damages began as water levels of reactors decreased due to decline in a function of Reactor Core Isolation and Cooling System (RCIC) and High Pressure Coolant Injection System (HPCI), analysis results show that reactor cores in the reactor pressure vessels are maintained. However, in case the actual water levels were lower than the measured values and were below the bottom of active fuel, core damages will further propagate, leading to a breach of reactor pressure vessels.

According to current plant parameters of Units 1 to 3, such as temperatures of their reactor pressure vessels, as those behavior indicate that most of the heat source (fuels) is located in the reactor pressure vessels, even if reactor pressure vessels were to be breached, it is assumed not to be as significant as shown by the analysis. Therefore, we consider the analysis result to be more severe than in reality.

Hence, based on these analysis results together with consideration of plant parameters, we have evaluated that for all plants, significant amount of pellets has melted and the geometry and location of reactor cores have changed substantially.

According to current temperatures of reactor pressure vessels periphery, as reactor cores are being sufficiently cooled, by continuing the current injection of water, such events as large release of fission products (FP) will not occur in the future.

3. Analysis and evaluation regarding condition of reactor core

3.1 Unit 1 of Fukushima Daiichi Nuclear Power Station

3.1.1 Analysis condition

Principal conditions of analysis regarding Unit 1 of Fukushima Daiichi Nuclear Power Station are shown in Tables 3.1.1 and 3.1.2.

We implemented the analysis with the following assumptions regarding leakage from the primary containment vessel (PCV) and operation of the IC.

① Assumption of the gas-phase leakage from Primary Containment Vessel

In the analysis, it was presumed that a leak (about ϕ 3 cm) from gas phase of PCV (Dry Well (D/W)) occurred at about 18 hours after the earthquake, in order to match the actually measured pressure of PCV, to a certain extent. A leak expansion (about ϕ 7 cm) was assumed at about 50 hours after the earthquake.

However, these assumptions were made for the sole purpose of analysis, and it is currently unclear whether a leak from D/W actually occurred or it is a mismatch of measured figure and analyzed figure caused by the problem of the instrument.

② Observation of the operating condition of IC

As the operating condition of IC after Station Black Out (SBO) is still unclear, we did not presume the operation of IC after SBO in the analysis. In addition, we also analyzed the case that IC temporary operated after SBO as a sensitivity analysis.

We presumed that one side of the system of IC has operated intermittently before SBO, as reactor pressure had been fluctuating below the set pressure level (about 7.4MPa[abs]) for operation of Safety Relief Valve (SRV).

Table 3.1.1 Plant Conditions

Items	Conditions
Initial reactor output	1380 MWt (rated power output)
Initial reactor pressure	7.03MPa[abs] (normal operation pressure)
Initial reactor water level	Normal level
Open space volume of PCV	D/W open space : 3410m^3 S/C open space : 2620m^3
Suppression pool water volume	1750m^3

Table 3.1.2 Events

Explanatory notes ○ : Records available △ : Estimates based on records □ : Assumption used on analysis

Analysis Condition				Classification	Notes	In case of ○ : Referred part of the records In case of △ or □ : Estimated, presumed reasons etc.
No	Time and Date		Analyzed Events			
1	May 11th	2:46 pm	Earthquake occurred	○	—	
2		2:46 pm	Reactor scram occurred	○	Report on May 16th, 4. Operation daily, Handover diary of shift supervisor	
3		2:47 pm	MSIV closed	○	Report on May 16th, 4. Operation daily, Handover diary of shift supervisor	
4		2:52 pm	IC(A) (B) activated automatically	○	Report on May 16th, 3. Data of records on alarm generation, Alarm timer	
5		Around 3:03 pm	IC(A) stopped	△	It is assumed that IC stopped based on 6.The record of transient recorder described in the report on May 16th.	
6		Around 3:03 pm	IC(B) stopped	△	Same as above	
7		3:17 pm	IC(A) restarted	△	Estimated behavior of IC based on the transition of reactor pressure (described in 2.Record of the chart in the report on May 16th) ※1	
8		3:19 pm	IC(A) stopped	△	Same as above	
9		3:24 pm	IC(A) restarted	△	Same as above	

10		3:26 pm	IC(A) stopped	△	Same as above
11		3:32 pm	IC(A) restarted	△	Same as above
12		3:34 pm	IC(A) stopped	△	Same as above
13		3:37 pm	SBO occurred	○	Report on May 16th, 4. Operation diary, Handover diary of shift supervisor
14		6:10 pm	IC(A) system 2A, 3A valve opened, and steam generation was confirmed	□	It is described in 7.operation record in the report on May16, however, we presumed in the analysis that the function of IC had been lost since SBO ※2
15		6:25 pm	IC(A) system 3A valve was closed	□	Same as above
16		9:19 pm	The lineup from Diesel Driving Fire Protection Pump (D/D-FP) was implemented.	□	Same as above
17		9:30 pm	IC 3A valve was opened	□	Same as above
18		9:35 pm	Regarding IC, water was supplied from D/D-FP	□	Same as above
19	May 12th	1:48 am	Regarding IC, D/D-FP stopped supplying water by pump trouble, not by fuel run-out	□	Same as above
20		5:46 am	Injection of fresh water by the fire pump started	○	Report on May16th, 7. Operation records ※3
21		2:30 pm	Regarding the containment	△	Report on May16th, 7. Operation records

			vessel vent, operation of AO valve of suppression chamber side was implemented at 10:17am, and a pressure decrease was confirmed at 2:30pm.		We presumed that the success of vent is at 2:30pm, time when a pressure decrease was confirmed.
22		2:49 pm	Vent valve of PCV was closed	△	We presumed the event based on the pressure increase of PCV
23		2:53 pm	Injection of fresh water terminated	○	Report on May16th, 7. Operation records
24		3:36 pm	Explosion of reactor building of Unit 1 occurred	○	Report on May16th, 7. Operation records
25		8:20 pm	Injection of sea water started	○	Report on May16th, 7. Operation records ※3

※1 There are unclear points on the behavior of IC before SBO, however, as reactor pressure fluctuated between about 6.2 to 7.2MPa[abs] based on the 2.Records of charts in the report on May 16th, we presumed that the one of the system of IC had operated intermittently, as set pressure of SRV no.1 relief valve is 7.4 MPa[abs], and reseating pressure is 6.9MPa[abs].

※2 There are also unclear points on the operation of IC after SBO, however, we presumed that the function of IC was lost as we only have the insufficient amount of record which show IC is functioning.

※3 We set up the injection amount of water and the time we changed the amount based on the daily injection amount described in 7.Operation records of the report on March 16th, in order not to exceed the daily average injection amount and total injection amount.

3.1.2 Analysis Result

Table 3.1.3 shows the result of analysis based on the condition shown in 3.1.1. Fig. 3.1.1 to Fig 3.1.12 show the result of analysis on the trend of reactor water level, etc.

Table 3.1.3 Summary of Analysis Result on Unit 1

Item	Analysis Result
Start of reactor core exposure	Approx. 3 hours after earthquake
Start of reactor core damages	Approx. 4 hours after earthquake
Start of reactor pressure vessel damages	Approx. 15 hours after earthquake

The detail of analysis result is as follows.

The reactor water level reaches the Top of Active Fuel (TAF) approximately 2 hours after assumed timing of IC stop, followed by a reactor core damage (see Fig. 3.1.1).

After the earthquake occurred, the actual data of reactor water level was changing within the fuel range. It differs dramatically from the analysis result; the analysis results in the breach of the reactor pressure vessel, and the reactor water level cannot be maintained in the reactor pressure vessel. Regarding this matter, there is a possibility that the correct level is not shown because the water in the level gauge boiled away as the temperature of the PCV rose. As for Unit 1, after calibration of level gauge, it was confirmed that the water level is below the fuel range.

After assumed timing of IC stop, the reactor pressure increases, but it remains around 8MPa because of the SRV. After the timing of reactor core damage, the melted pellets move to the lower plenum, and then after 15 hours from the earthquake, the reactor pressure vessel breaches and the reactor pressure decreases rapidly (see Fig. 3.1.2).

The pressure of PCV temporarily increases because of the steam released from the reactor pressure vessel and hydrogen gas formed by the reaction of water and metal in the reactor, but after that the pressure shows a decreasing trend because of the leakage from the PCV assumed in the analysis, and then it decreases rapidly by the vent operation on Mar. 12 (see Fig. 3.1.3).

At the beginning of the incident the measured pressure of PCV is higher than the analysis result; this might be due to, for example, a release of steam from the reactor pressure vessel caused by a damage in the instrumentation pipe in the reactor at the initial stage of core damage, or a loss of sealing capability of a gasket used in the main steam system because of high temperature. However, currently the cause is unknown including whether it is a problem of instrumentation or not.

Regarding the assumption about the leakage of the PCV, at the time after 18 hours of the earthquake when the leakage is assumed, the PCV temperature is over 300 degree

C, which well exceeds the designed temperature of the vessel (138 degree C). Based on a Joint Utilities Studies conducted in the past, it is know that there is a possibility for gaskets to be damaged in such an over-temperature condition; therefore, if the leakage from the PCV is real, the damage of gasket by over-temperature can be one of the reasons. Also regarding the assumption of leakage from the PCV 50 hours after the earthquake, as the analysis shows a transition of PCV temperature in a high-temperature range (see Fig. 3.1.5), the gradual increase in leakage points may be attributed as one of the reasons for the increase in leakage.

Although water injection to the reactor starts at 14 hours after the assumed timing of IC stop, by then fuels melt by the decay heat and relocate to the lower plenum, leading to a breach in the reactor pressure vessel at about 15 hours after the earthquake (see Fig 3.1.4 and Fig 3.1.9).

Regarding the Fission Products (FP) released due to the reactor core damage, almost all noble gases are released to the atmosphere by the vent operation. According to the analysis, approximately 1% of cesium iodide and less than 1% of other nuclides are released (see Fig 3.1.7 and Fig 3.1.8). Plutonium belongs to UO_2 group as PuO_2, and the analysis shows that the release rate is under 10^{-7}.

Hydrogen is generated at the same time when the reactor core damage began, and it is possible that the cause of the explosion on Mar. 12 was the hydrogen generated during this period (see Fig. 3.1.6).

Operation of IC after the Tsunami arrival is unclear, however, we ran a case under the assumption that IC was temporary operable (assumed operation of one train of IC from approx. 6:00 pm, Mar. 11 to approx. 2 am, Mar. 12). The behavior of the reactor water level is similar although the absolute value is different (see Fig. 3.1.10). However, based on this assumption, the PCV pressure shows a totally different behavior from measured value (see Fig.3.1.11), such that it is impossible to clarify by this analysis about the operation of IC after SBO. Because the water level also cannot be kept in the fuel range in this sensitivity analysis of IC, the reactor core becomes damaged (see Fig.3.1.12).

This evaluation is implemented based on the analysis using MAAP code; it has some uncertainty on the determination of analysis condition and on the analysis model, so that it is necessary to take notice that the progresses of phenomenon as the result also have some uncertainty. Especially, the amount of released FP is greatly dependent on these uncertainties, so that the data should be used only as a reference.

3.1.3 Evaluation Result

As previously mentioned, we have had an analysis result that, after failure of all AC power (arrival of the tsunami), reactor core damages began at a relatively early period, leading to the breach of the reactor pressure vessel. However, we consider the analysis result to be stricter than in reality, when we refer to plant status estimated from temperatures in each part etc. in the following pages.

When we regained temperature measurement in various locations, those of reactor pressure vessels were above 400 degrees Celsius in multiple measuring points. At that time, though the condition of insufficient cool-down to the reactor core had continued, they have then sufficiently cooled down since we injected water through the feed-water line and, due to the secured water injection to the reactor, temperatures in each part rapidly decreased.

In addition, as a result of calibration of the water-level gauge, we have found that the water level in reactor pressure vessel is not in the fuel range.

On the other hand, most of the fuel is believed to be cooled in the reactor pressure vessel, because we can still measure temperatures in CRD housing, etc. at the lower reactor pressure vessel (if the reactor pressure vessel is breached, we may not be able to measure temperatures) and temperatures of the steel of the reactor pressure vessel currently change around between 100 degrees Celsius and 120 degrees Celsius and correlate changes in amount of water injection in multiple measuring points and temperatures in multiple points of the upper reactor pressure vessel are higher and the heat source is estimated to come from the inside of the reactor pressure vessel.

Hence, according to the analysis and plant parameters (temperatures at the periphery of the reactor pressure vessel), the reactor core has been significantly damaged, relocated below or slumped to the lower plenum from the fixed position of fuel loading, however, most of it is being stably cooled down around there.

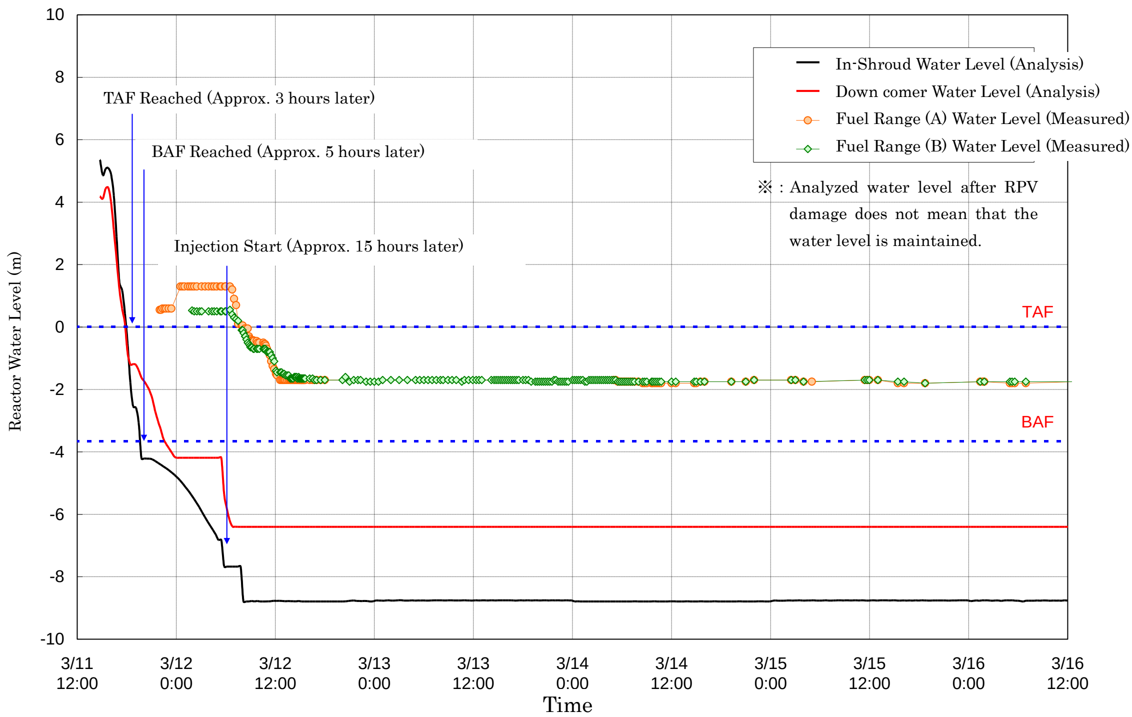


Figure3.1.1 Unit1 Reactor Water Level

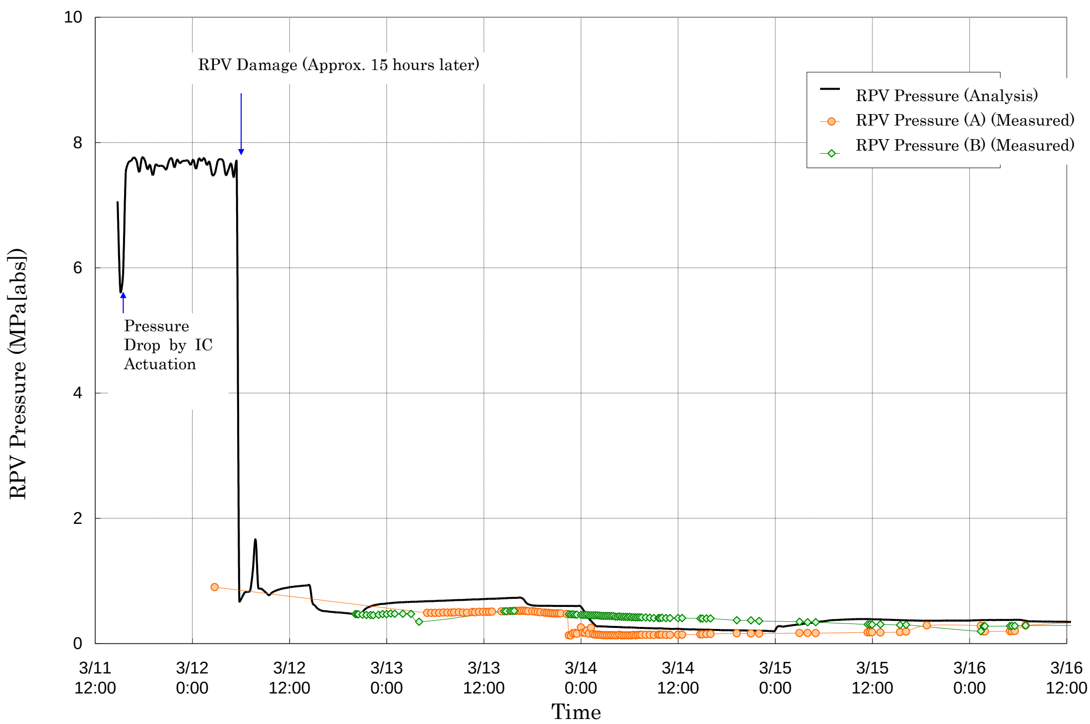


Figure3.1.2 Unit1 RPV Pressure

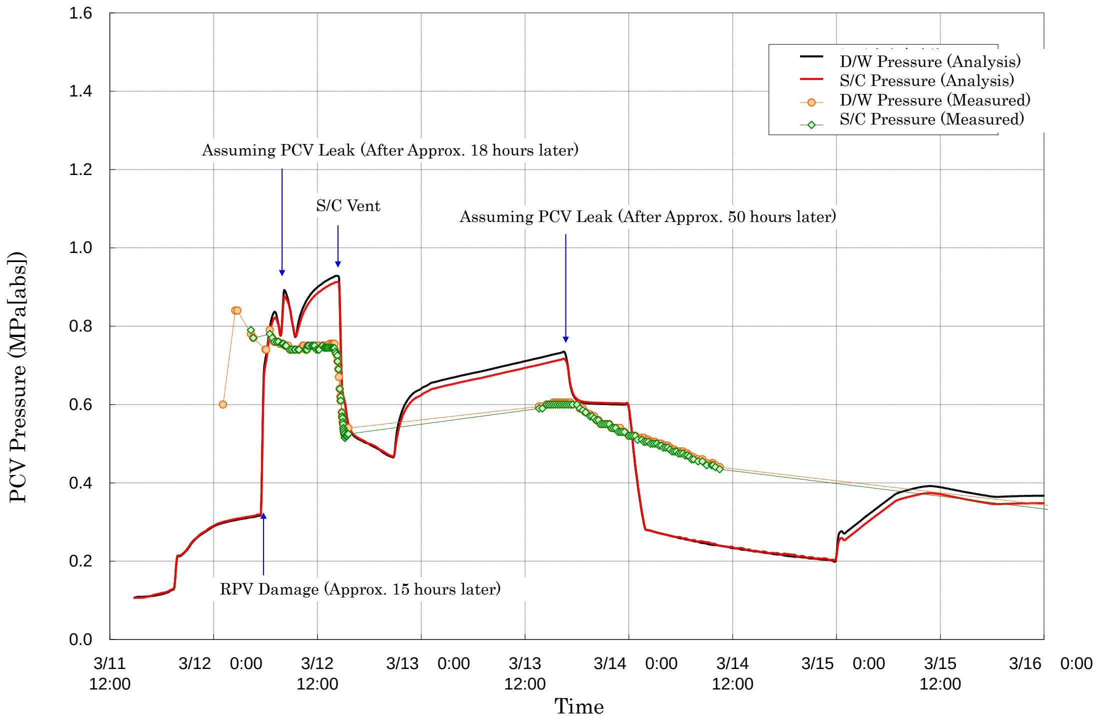


Figure3.1.3 Unit1 PCV Pressure

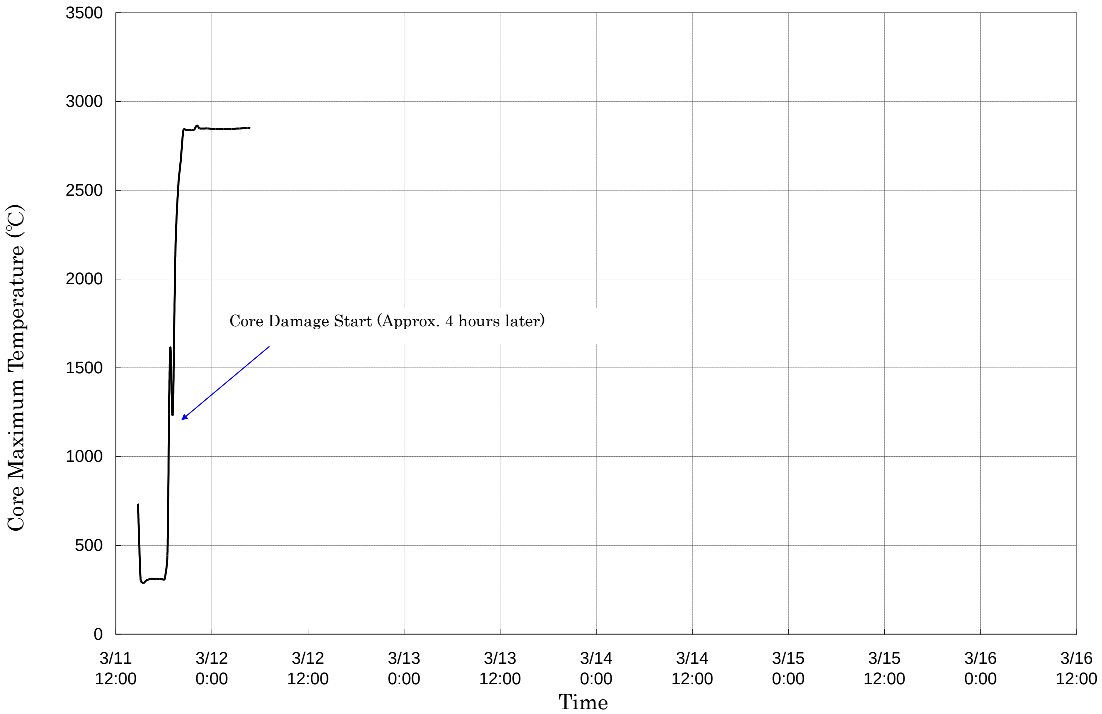


Figure3.1.4 Unit1 Core Temperature

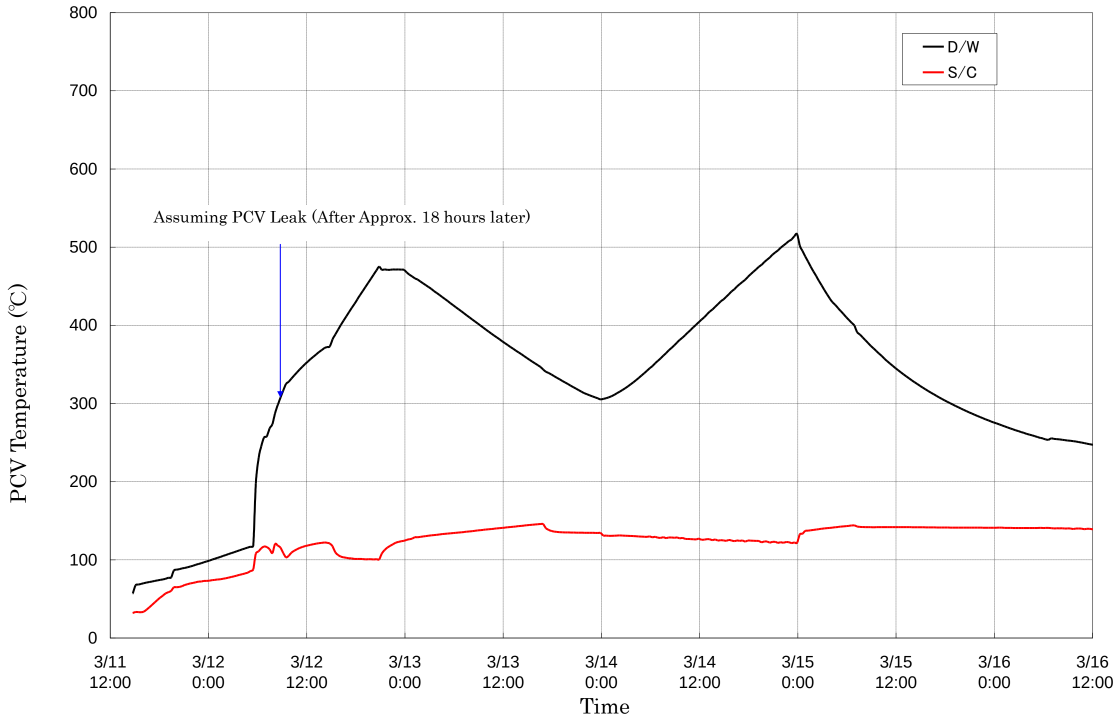


Figure3.1.5 Unit1 PCV Temperature

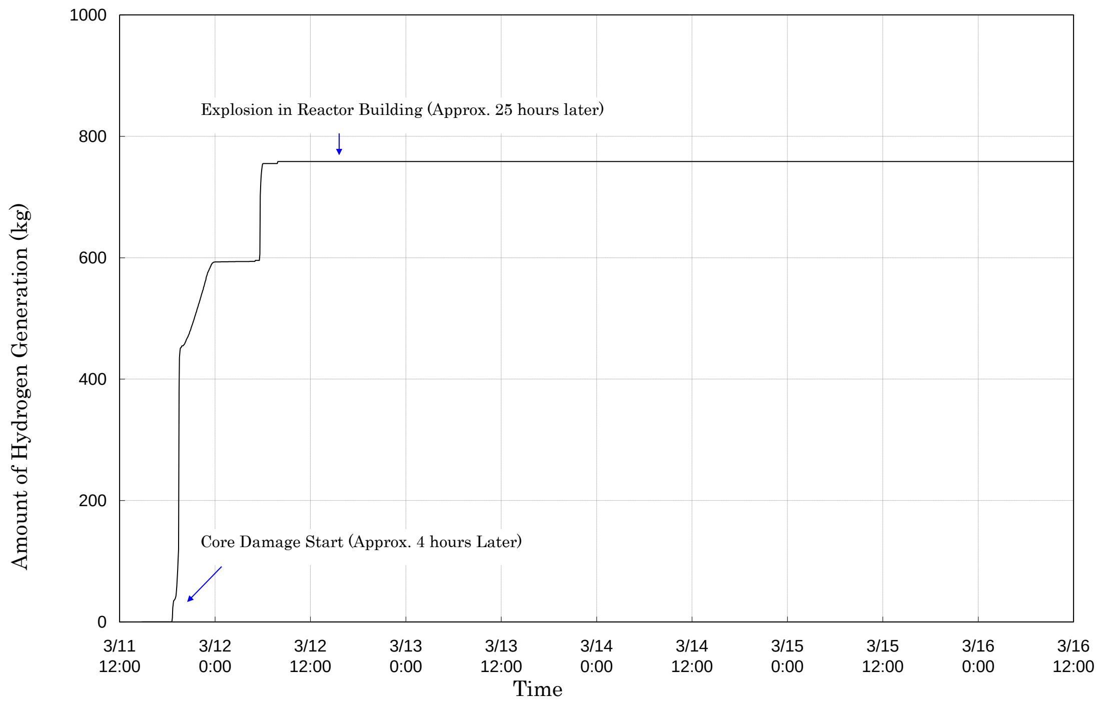


Figure3.1.6 Unit1 Amount of Hydrogen Generation

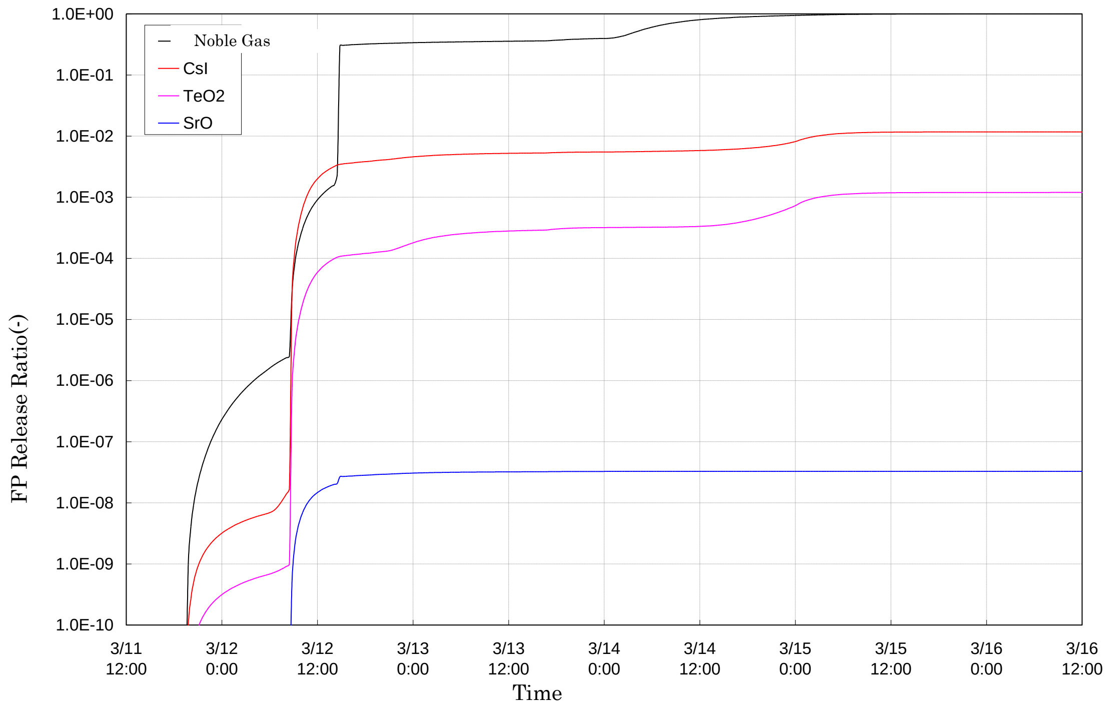


Figure3.1.7　Unit1 FP Release Ratio（１／３）

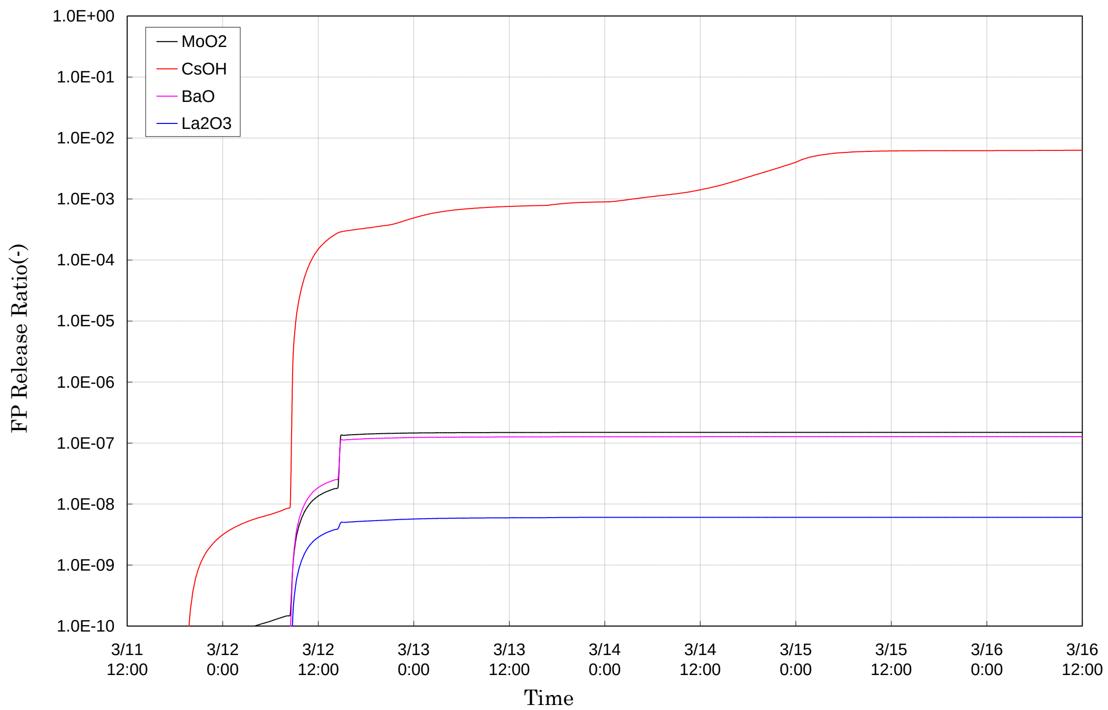


Figure3.1.7　Unit1　FP Release Ratio（２／３）

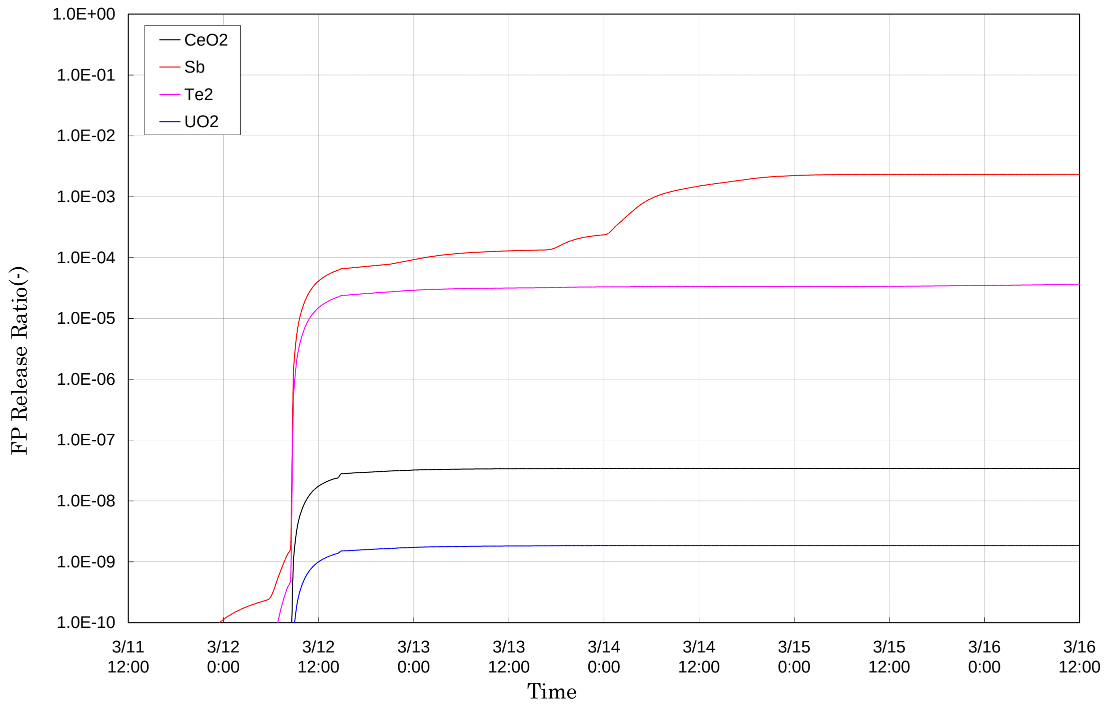


Figure3.1.7　Unit1　FP Release Ratio（３／３）

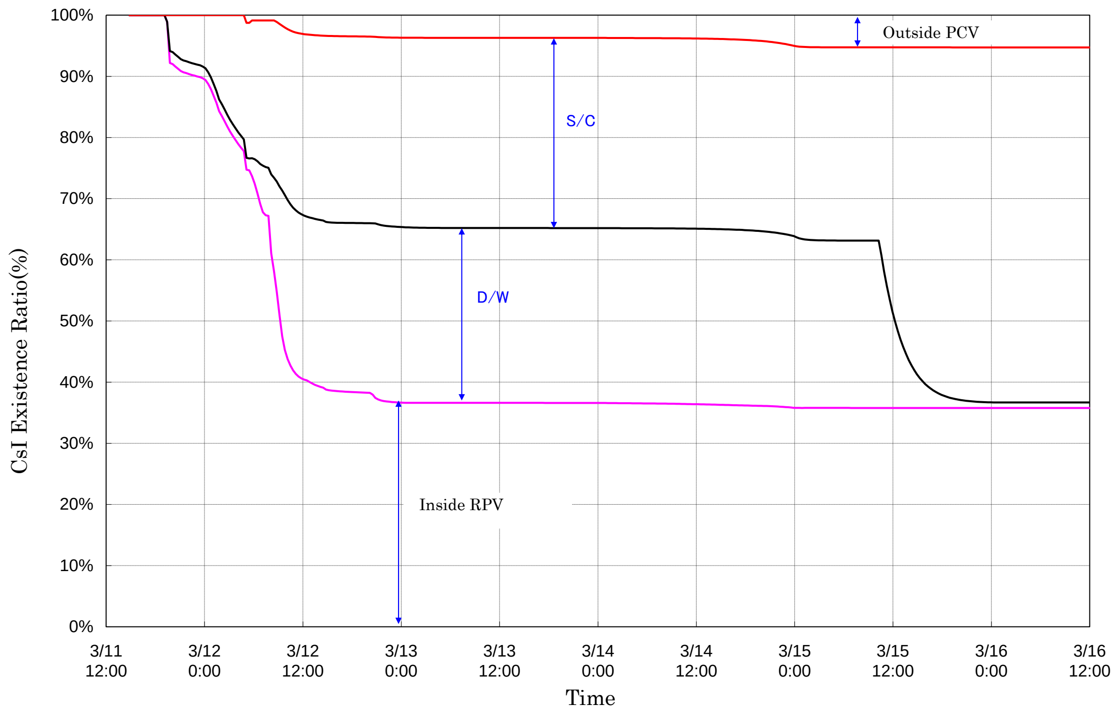


Figure3.1.8　Unit1　FP Existence Ratio（１／２）

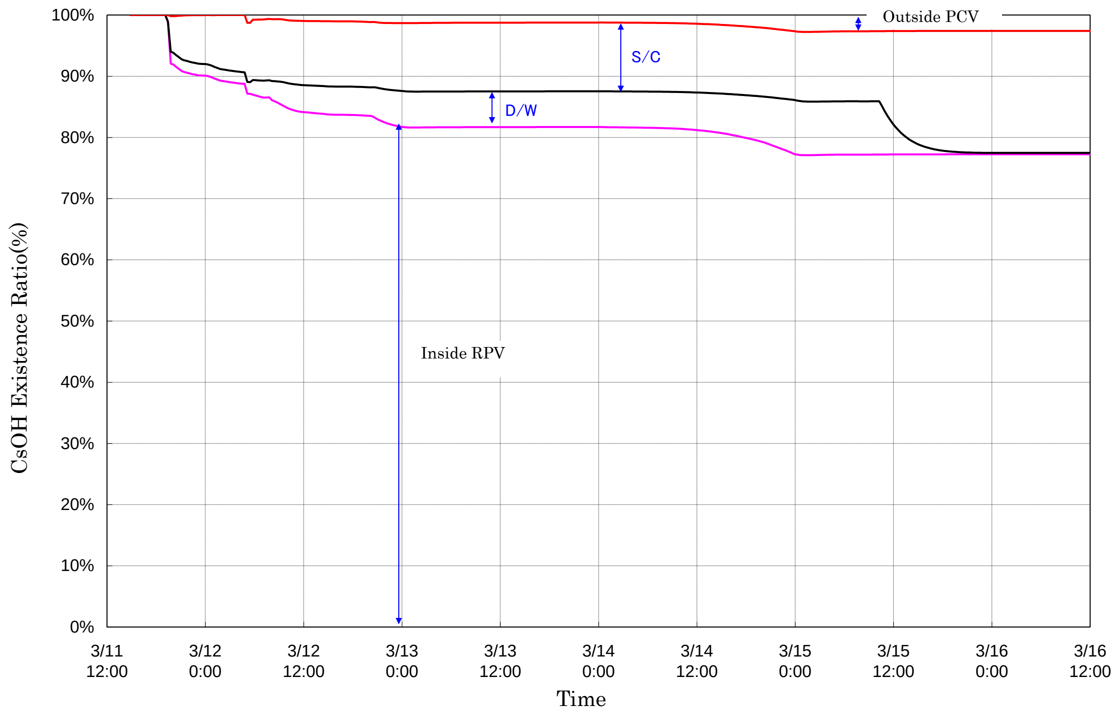


Figure3.1.8 Unit1 FP Existence Ratio（２／２）

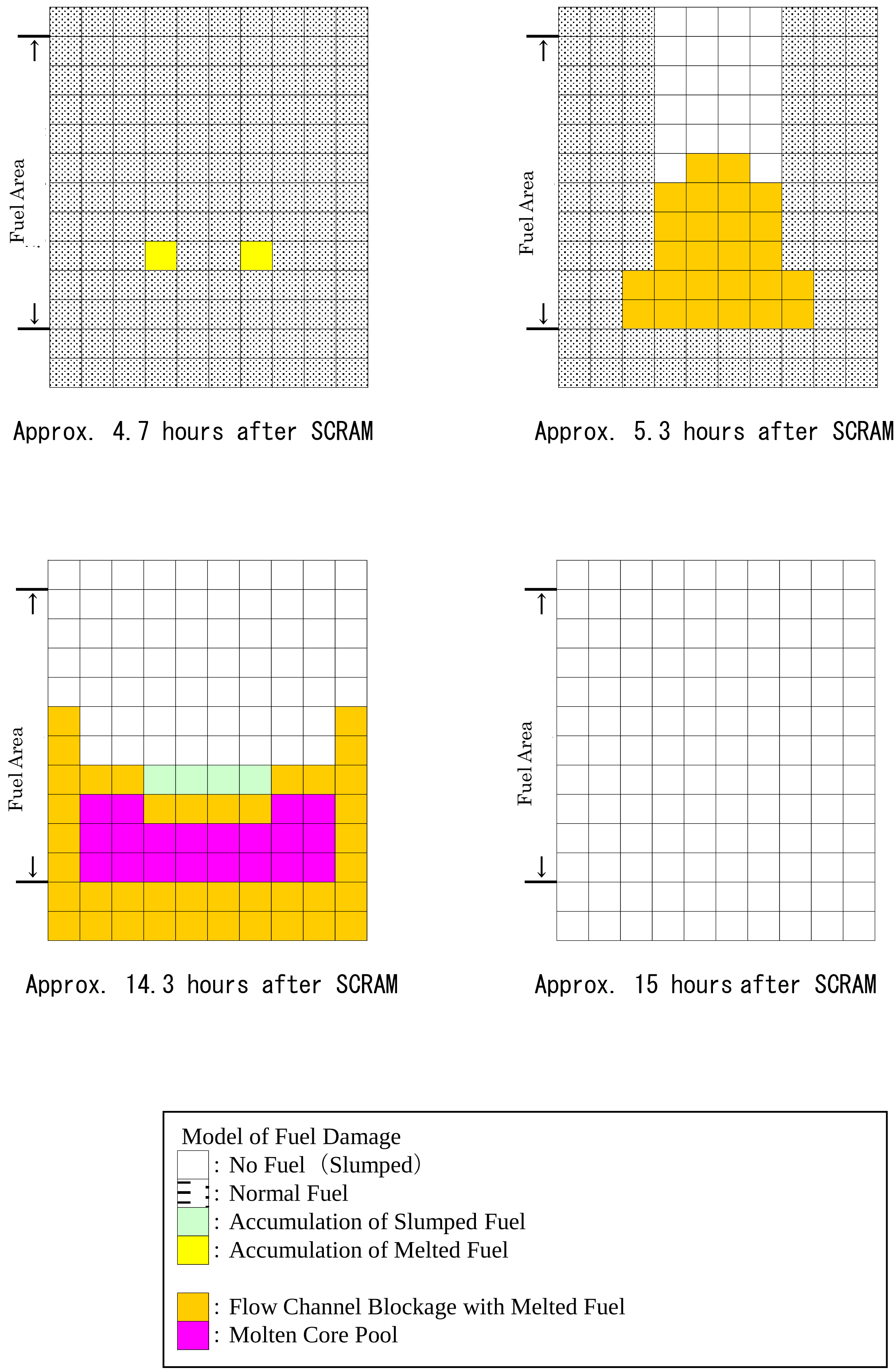


Figure3.1.9 Unit1 Core Status

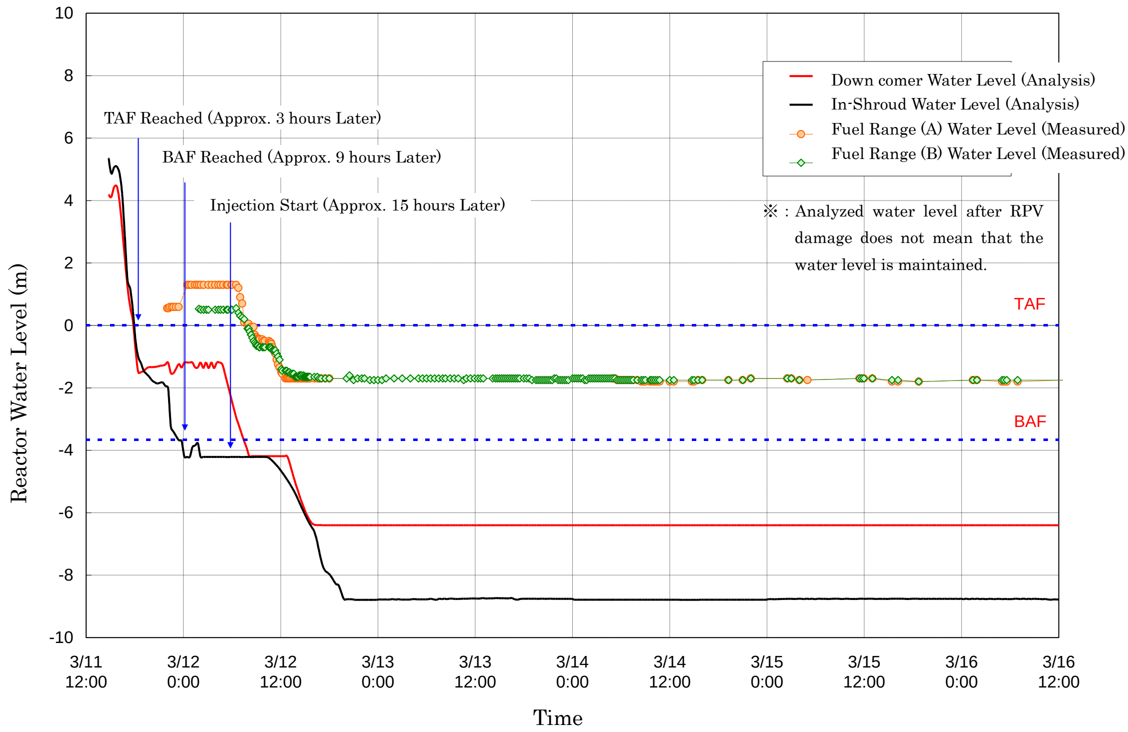


Figure3.1.10 Unit1 Reactor Water Level (IC Continued Operation Case)

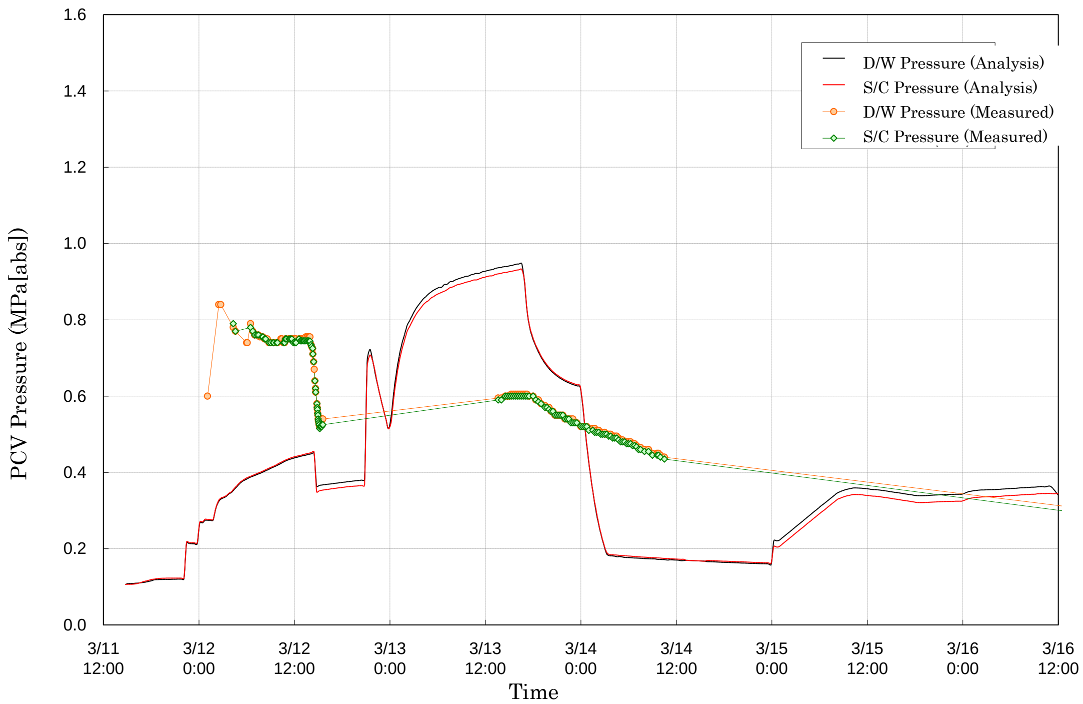


Figure3.1.11 Unit1 PCV Pressure (IC Continued Operation Case)

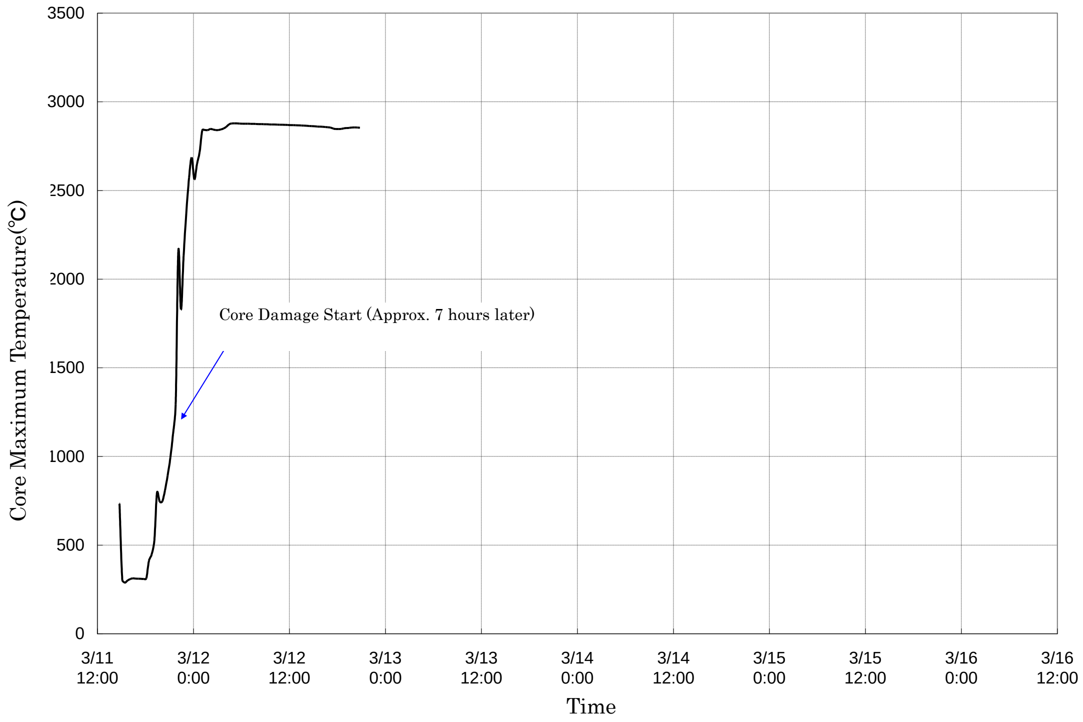


Figure3.1.12 Unit1 Core Temperature (IC Continued Operation Case)

3.2 Unit 2 of Fukushima Daiichi Nuclear Power Station

3.2.1 Analysis condition

Principal conditions of analysis regarding Unit 2 of Fukushima Daiichi Nuclear Power Station are shown in the Table 3.2.1 and 3.2.2.

We implemented the analysis in two cases below, and regarding a leak from PCV, we implemented the analysis based on the assumptions below.

① Cases of analysis

【Case 1】 In order to match the measured value of reactor water level, we presumed a smaller amount of flow rate compared to the discharge flow of the fire pump that could maintain the reactor water level.

【Case 2】 Based on the premise that it is impossible to maintain the reactor water level in the fuel range, we presumed an injection rate that can maintain slightly below the level of the fuel range, and not the flow rate of the discharge side of the fire pump.

② Assumption of the gas-phase leakage from PCV

In the analysis, we presumed that a leak (about ϕ 10 cm) from gas phase of D/W has occurred 21 hours after the earthquake occurred, in order to match the figure to the actually measured pressure of PCV to a certain extent. We also presumed a leak (about ϕ 10 cm) from gas phase of PCV since an abnormal sound occurred near the Suppression Chamber (S/C) on May 15th.

However, these assumptions were made for the sole purpose of analysis, and it is currently unclear whether the leak from D/W occurred actually, or it is a mismatch of measured figure and analyzed figure caused by the problem of the instrument.

Table 3.2.1 Plant Conditions

Items	Conditions
Initial reactor output	2381 MWt (rated power output)
Initial reactor pressure	7.03MPa[abs] (normal operation pressure)
Initial reactor water level	Normal level
Open space volume of PCV	D/W open space : 4240m^3 S/C open space : 3160m^3
Suppression pool water volume	2980m^3

Table 3.2.2 Events

Explanatory notes ○ : Records available △ : Estimates based on records □ : Assumption used on analysis

Analysis Condition				Classification	Notes	In case of ○ : Referred part of the records In case of △ or □ : Estimated, presumed reasons etc.
No	Time and Date		Analyzed Events			
1	March 11th	2:46 pm	Earthquake occurred	○	—	
2		2:47 pm	Reactor scram occurred	○	Report on May 16th, 4. Operation daily, Handover diary of shift supervisor	
3		3:02 pm	RCIC activated manually	○	Report on May16th, 7. Operation records	
4		3:28 pm	RCIC tripped（L-8）	○	Same as above	
5		3:41 pm	SBO occurred	○	Report on May 16th, 4. Operation daily, Handover diary of shift supervisor	
6	March 12th	4:20 am - 5:00 am	Changed the water source of RCIC from condensate storage tank to suppression chamber	○	Report on May16th, 7. Operation records	
7	March 14th	1:25 pm	RCIC stopped	○	Same as above	
8		4:34 pm	Started the operation of pressure reduction of Reactor Pressure Vessel（1 SRV open）	○	Same as above	
		4:34 pm	Started the injection of sea water through the fire protection system	○	Report on May16th, 7. Operation records ※1	

9		Around 6:00 pm	Confirmed the decrease of the reactor pressure	○	Report on May16th, 7. Operation records
10		7:20 pm	The fire pump stopped resulted from fuel run-out	○	Report on May16th, 7. Operation records ※1
11		7:54 pm	The fire pump activated	○	Report on May16th, 7. Operation records ※1 ※2
		7:57 pm	The second fire pump activated	○	Report on May16th, 7. Operation records ※1
12		9:20 pm	By opening 2 SRVs, reactor pressure decreased and water level recovered	○	Same as above
13		Around 11:00 pm	It is presumed that the 1 SRV was closed	□	As reactor pressure increased at around 11:00pm, it is presumed that 1 SRV was closed at this time.
14	March 15th	Around 6:14 am	An abnormal sound has occurred near the suppression chamber, and the pressure inside decreased	○	From the press release of Tokyo Electric Power Company（http://www.tepco.co.jp/index-j.html）

※1 There is a possibility that the certain amount of sea water was injected since 4:34pm, March 14th based on the record of 7:20pm, March 14th which describes "The fire pump has stopped", however, we presumed 7:54pm, March14th as the time which started the injection, as the water level has rose since then.

※2 We set up the injection amount of water and the time we changed the amount based on the daily injection amount described in 7.Operation records of the report on March 16th, in order not to exceed the daily average injection amount and total injection amount.

3.2.2.1 Analysis Result (Analysis Case 1)

Table 3.2.3 shows the result of analysis based on the condition shown in 3.2.1. And from Fig. 3.2.1.1 to Fig 3.2.1.10 show the result of analysis about the trend of reactor water level, etc.

Table 3.2.3 Summary of Analysis Result on Unit 2

Item	Analysis Result
Start of reactor core exposure	Approx. 75 hours after earthquake
Start of reactor core damages	Approx. 77 hours after earthquake
Start of reactor pressure vessel breach	(reactor pressure vessel breach did not occur in this analysis)

The details of analysis result are as follows.

The reactor water level gradually comes down after RCIC stops and the reactor core starts exposed, and the reactor core exposed completely by opening the SRV and the reactor core damage starts (see Fig.3.2.1.1). Although the water injection starts approximately at the same time, but in this analysis, because the water injection flow is assumed that it is commensurate with the reactor water level indicated by measurement equipment, so that the water injection flow is not enough and the water level is remained around a half level of the reactor core range. Therefore, the reactor core is damaged.

The reactor pressure is kept high around the pressure of SRV operation until RCIC stops. By opening the SRV after RCIC stopped the reactor pressure decreases rapidly, after that it goes down to around atmosphere pressure.

During the operation of RCIC, the measured value of the reactor pressure is lower than analyzed value, indicating the possibility that a leak path was formed through SRV to S/C, but currently it is not sure whether there was an actual path or it is only a problem of instrumentation. The behavior of analyzed value and measured value is in general agreement after SRV opening (see Fig.3.2.1.2).

The pressure of PCV increases with the increase of suppression pool water temperature, but because the leak from the PCV (D/W) is assumed, the increase from earthquake occurrence becomes slow which is same as measured value. After that, temporary increase of pressure occurs when the SRV opened on Mar. 14, and then at the measured value, the pressure changes decrease. Also regarding the analysis, the analysis was implemented on the condition that the timing of the abnormal sound noticed near S/C on Mar. 15 is set as a boundary; it means a leak occurred in the gas phase of S/C at this moment (see Fig. 3.2.1.3).

Regarding the assumption of leak from the PCV, considering that the vessel temperature already exceeded designed temperature at the timing of assumption, the increase of leakage from the vessel, which is caused by the influence of over-temperature could be assumed as one of the reasons (see Fig.3.2.1.5). In case there no assumption of leak for the PCV is made, the PCV pressure would reach 2Pd (twice the designed pressure) in relatively early stage (see Fig. 3.2.1.10). And after the moment of abnormal sound noticed near the S/C the pressure decreased rapidly, also the leak is assumed in the analysis, however currently it is not sure whether there is an actual leak in the PCV or it is only a problem of instrumentation.

Regarding reactor core temperature trend, after RCIC stop, the temperature increases with the decrease of reactor water level, and the fuel pellets start melting (see Fig.3.2.1.4).

A large amount of hydrogen is generated when the reactor core is exposed and the temperature of fuel cladding starts increasing. After 1 week of earthquake occurrence, the amount equal to the reaction of about 79% of fuel cladding in the active fuel range is generated (see Fig.3.2.1.6).

Regarding the release of FP, after reactor core damage, noble gases are released from the reactor pressure vessel to S/C, and according to the assumption of leak for this analysis, the result is that almost all noble gases are released. For cesium iodide, the release rate is about 1% and most exist in S/C. However, the release of FP out of the PCV is by the assumption of leak from the PCV, so it is possible that the result is different from actual situation (see Fig.3.2.1.7 and Fig.3.2.1.8).

The result says that, about the reactor core of Unit 2, there partially exists a molten core pool, but it remains in fuel range and does not lead to the reactor pressure vessel breach. The reason is that, the water injection by RCIC in the early stage was implemented continuously, and the period between when RCIC stopped and water injection begun was shorter than in the case of Unit 1 (see Fig.3.2.1.9).

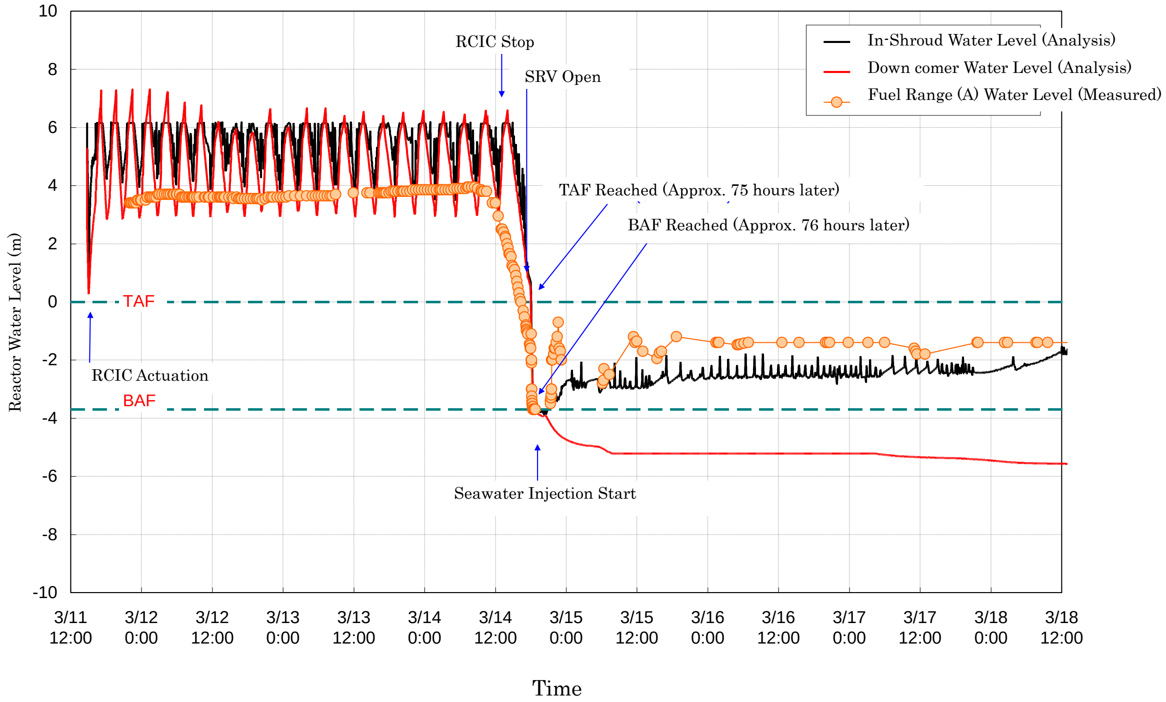


Figure3.2.1.1 Unit2 Reactor Water Level[Case1]

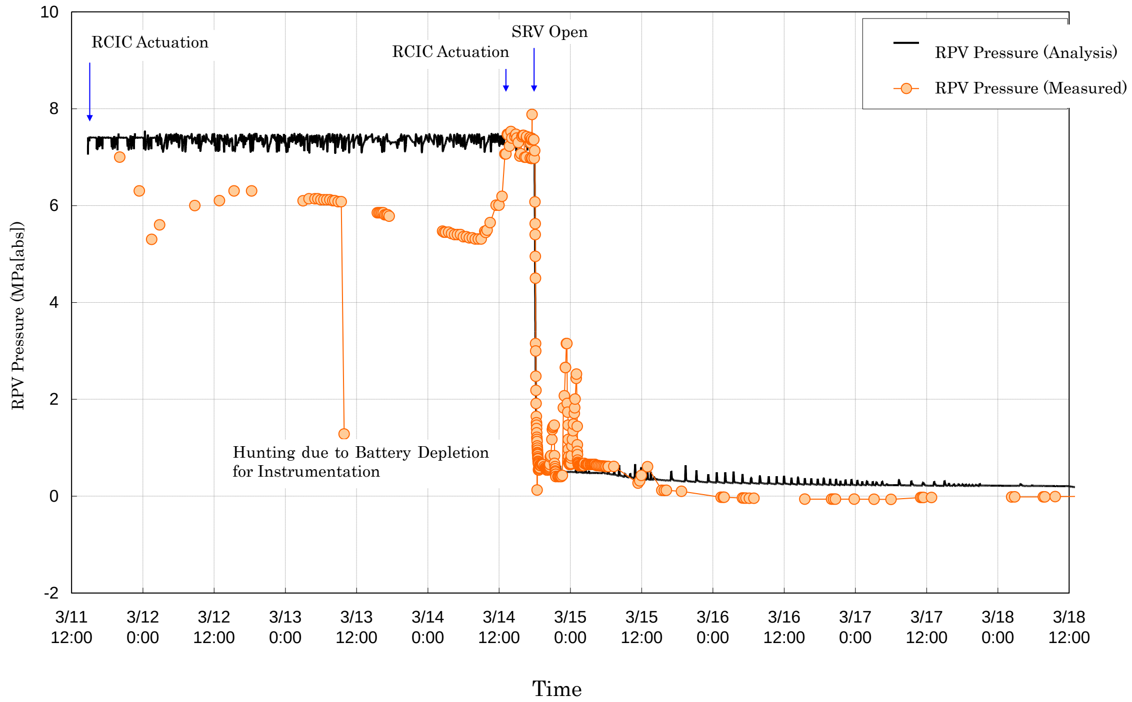


Figure3.2.1.2 Unit2 RPV Pressure[Case1]

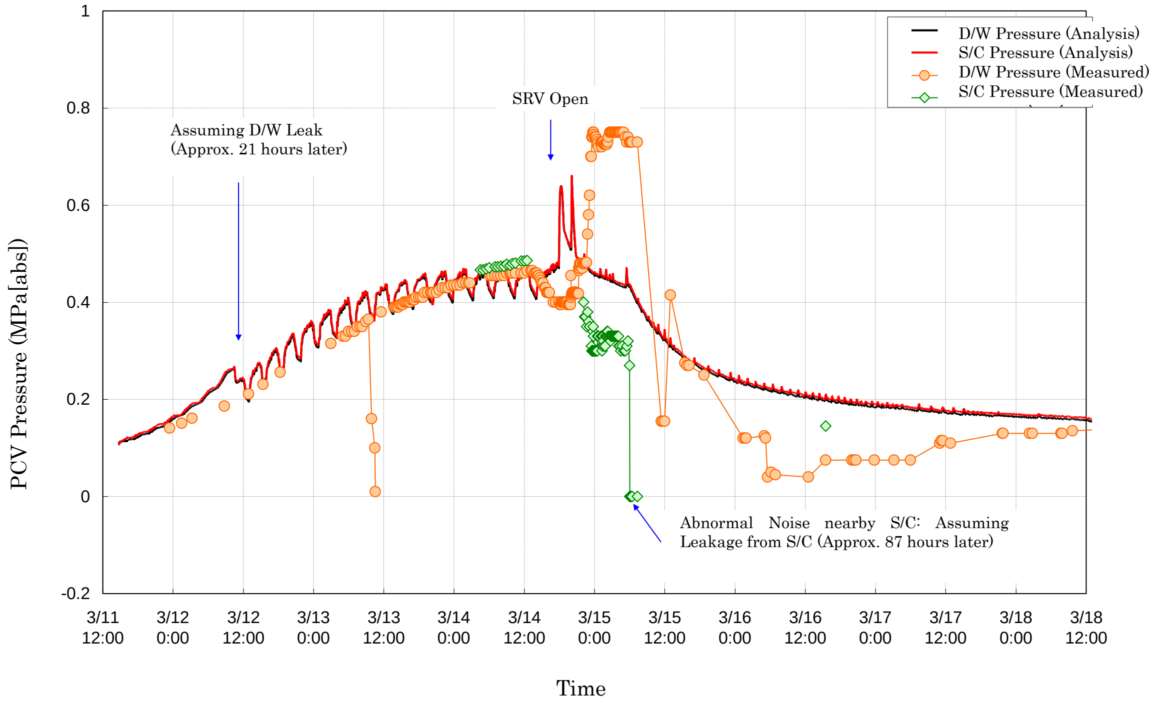


Figure3.2.1.3　Unit2 PCV Pressure[Case1]

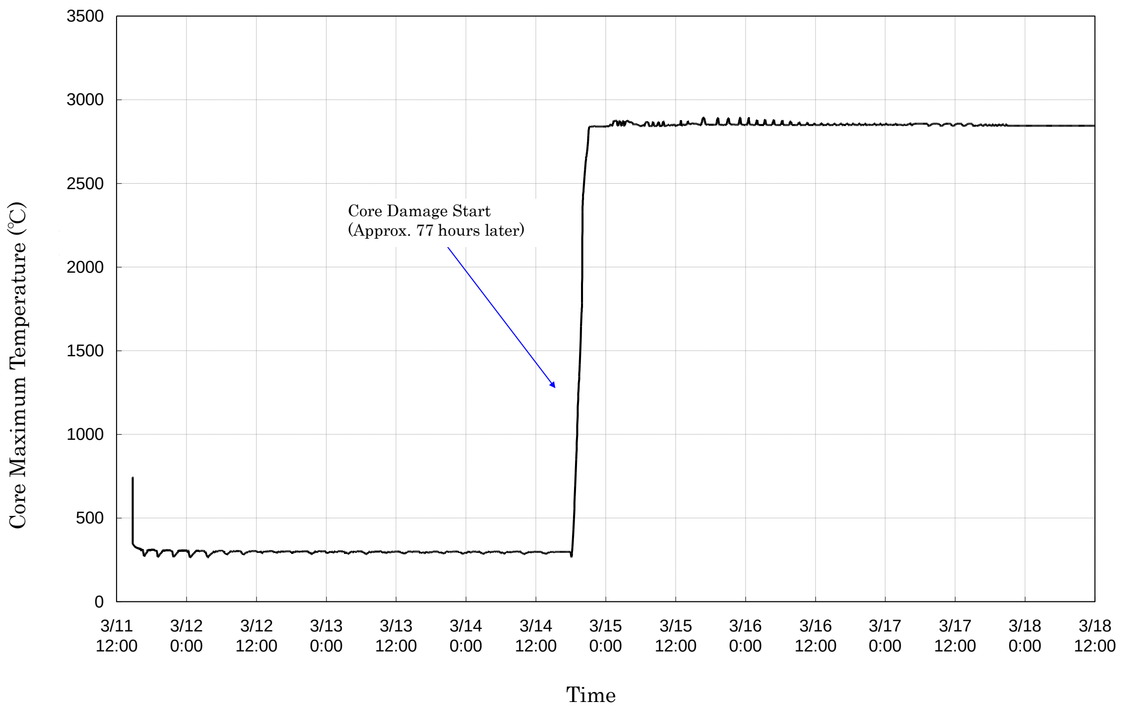


Figure3.2.1.4　Unit2 Core Temperature[Case1]

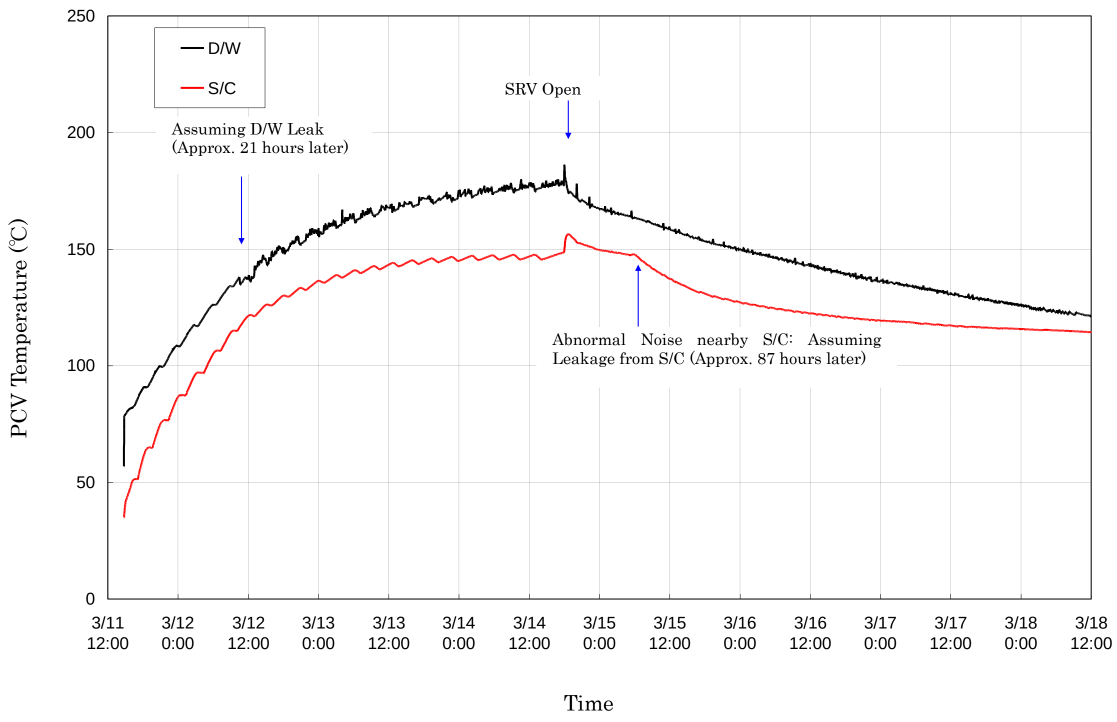


Figure3.2.1.5　Unit2 PCV Temperature[Case1]

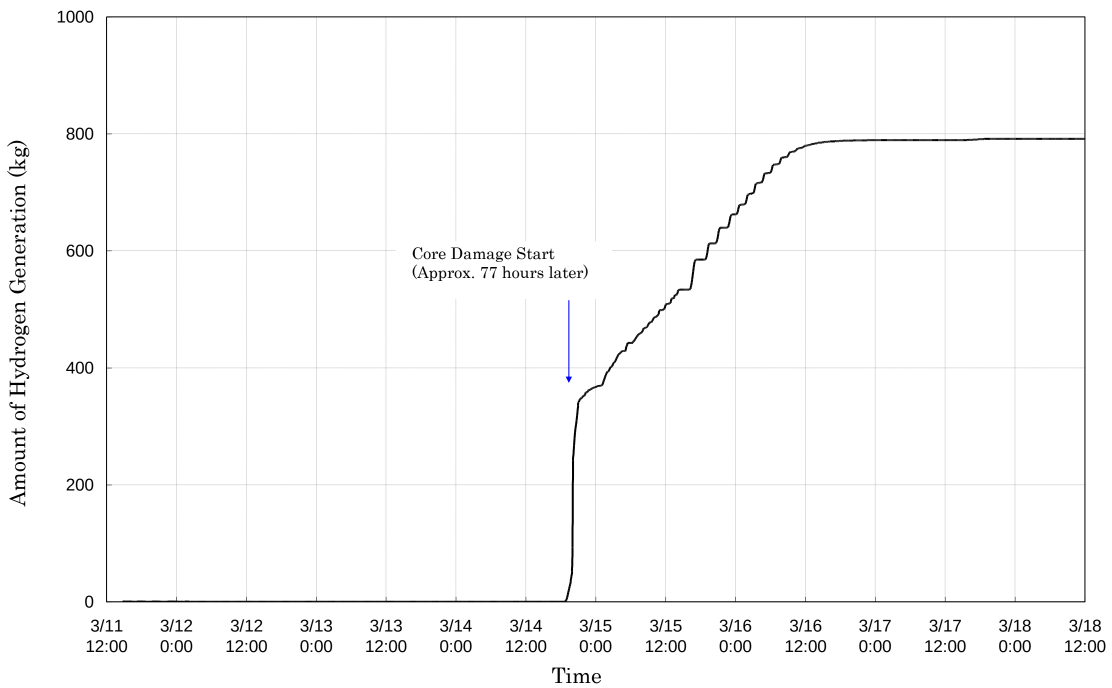


Figure3.2.1.6　Unit2 Amount of Hydrogen Generation[Case1]

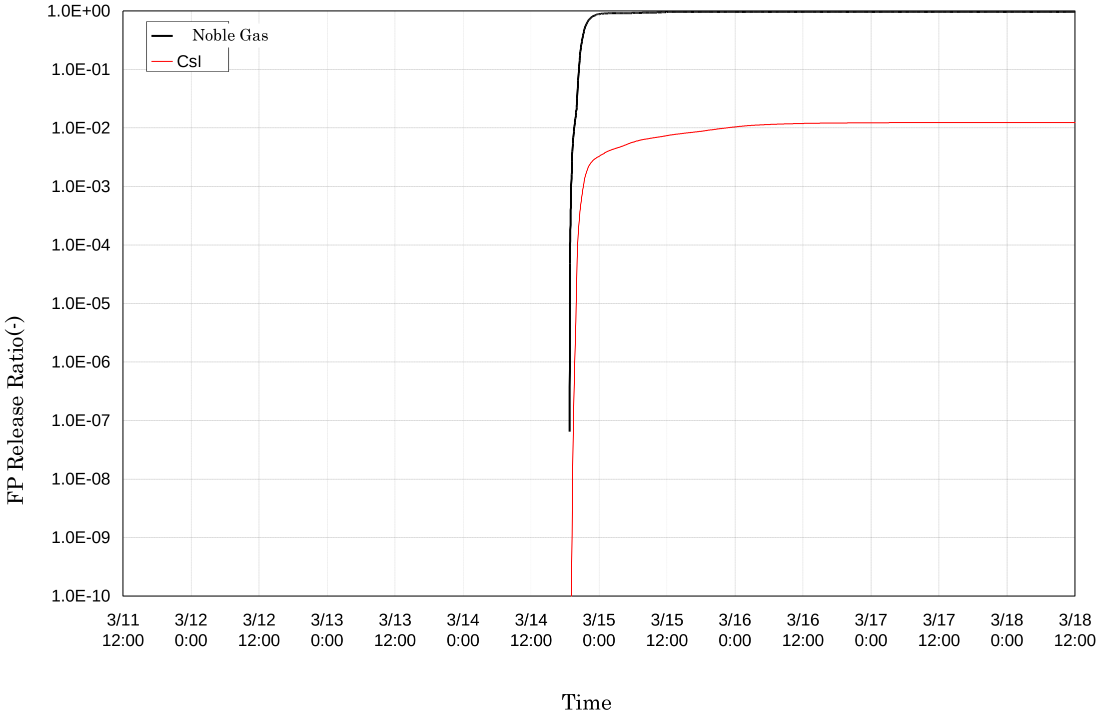


Figure3.2.1.7　Unit2 FP Release Ratio[Case1]

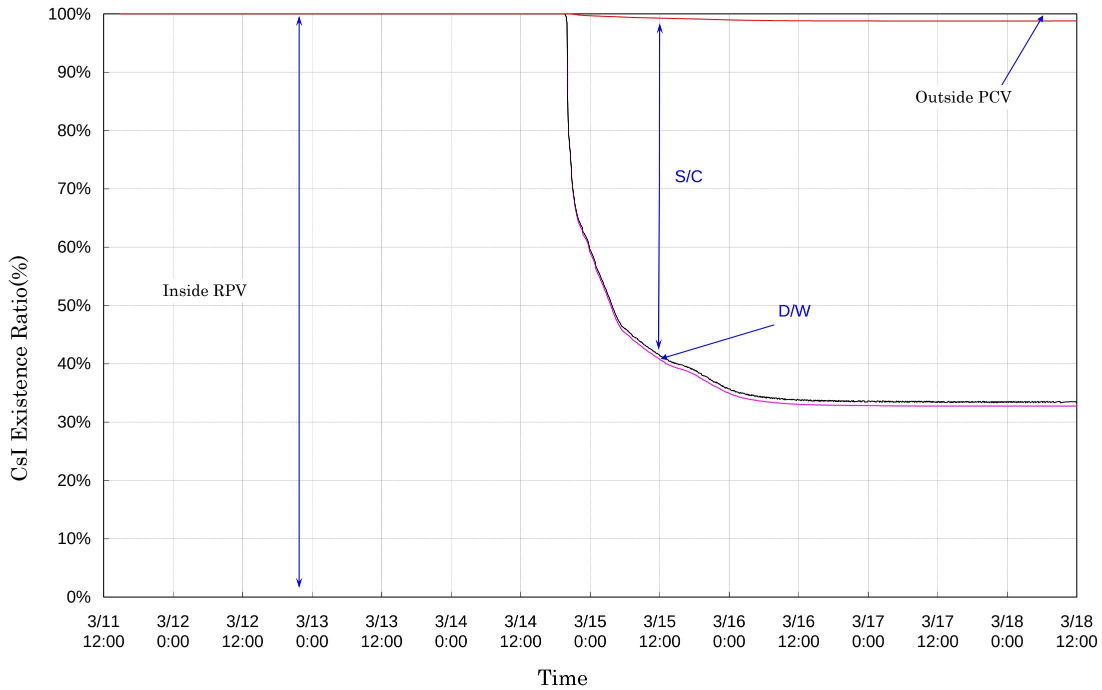


Figure3.2.1.8　Unit2 FP Existence Ratio(1/2)[Case1]

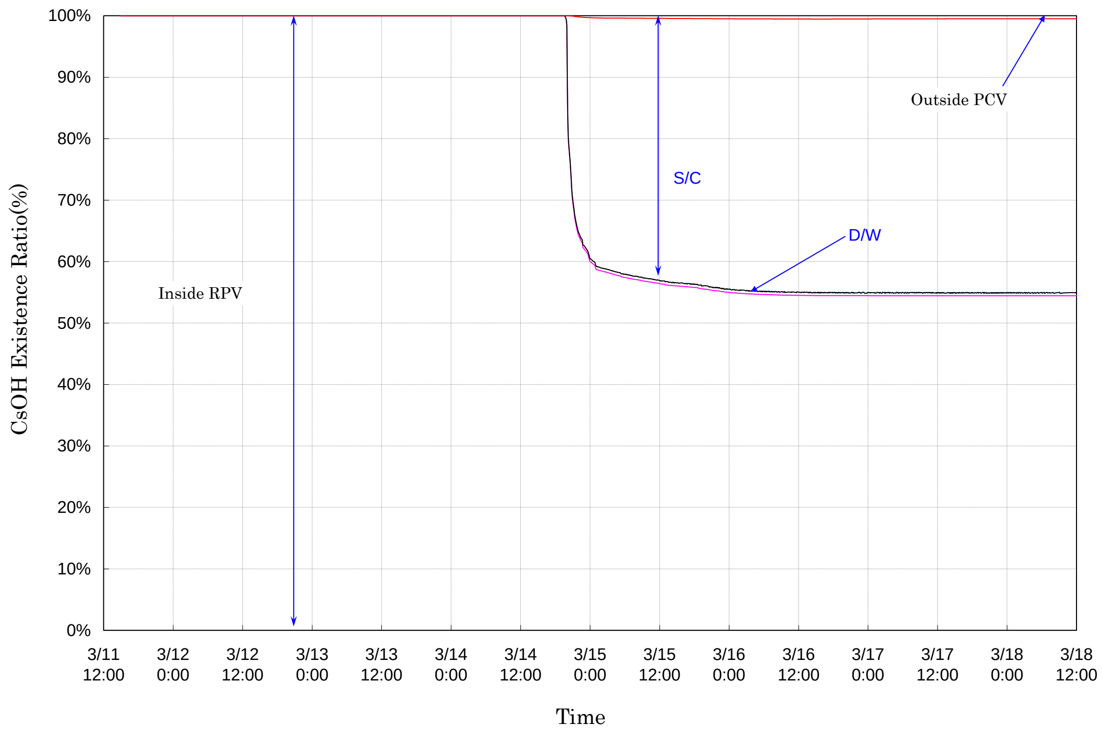
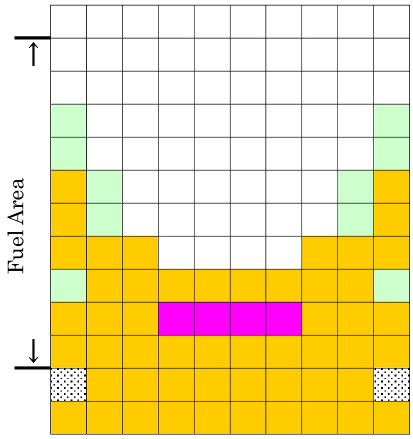
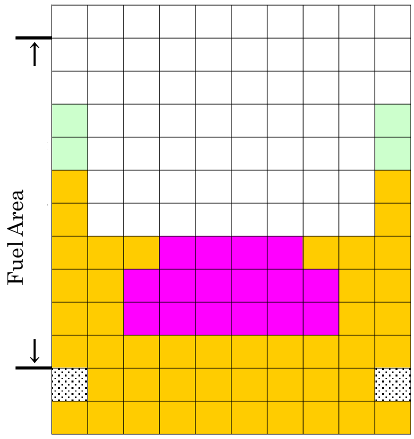


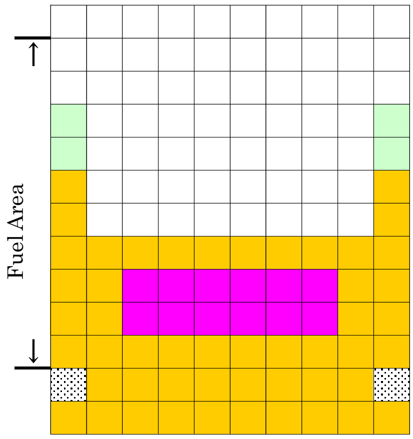
Figure3.2.1.8 Unit2 FP Existence Ratio(2/2)[Case1]



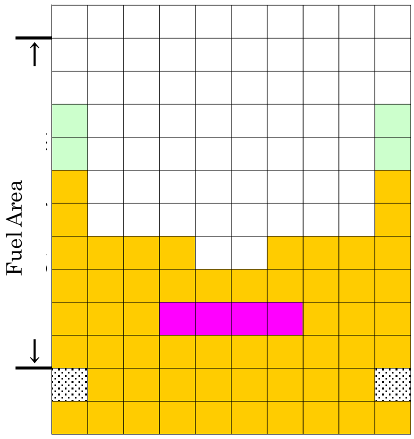
Approx. 87 hours after SCRAM



Approx. 96 hours after SCRAM



Approx. 120 hours after SCRAM



Approx. 1 week after SCRAM

Model of Fuel Damage
: No Fuel (Slumped)
: Normal Fuel
: Accumulation of Slumped Fuel
: Accumulation of Melted Fuel

: Flow Channel Blockage with Melted Fuel
: Molten Core Pool

Figure3.2.1.9 Unit2 Core Status[Case1]

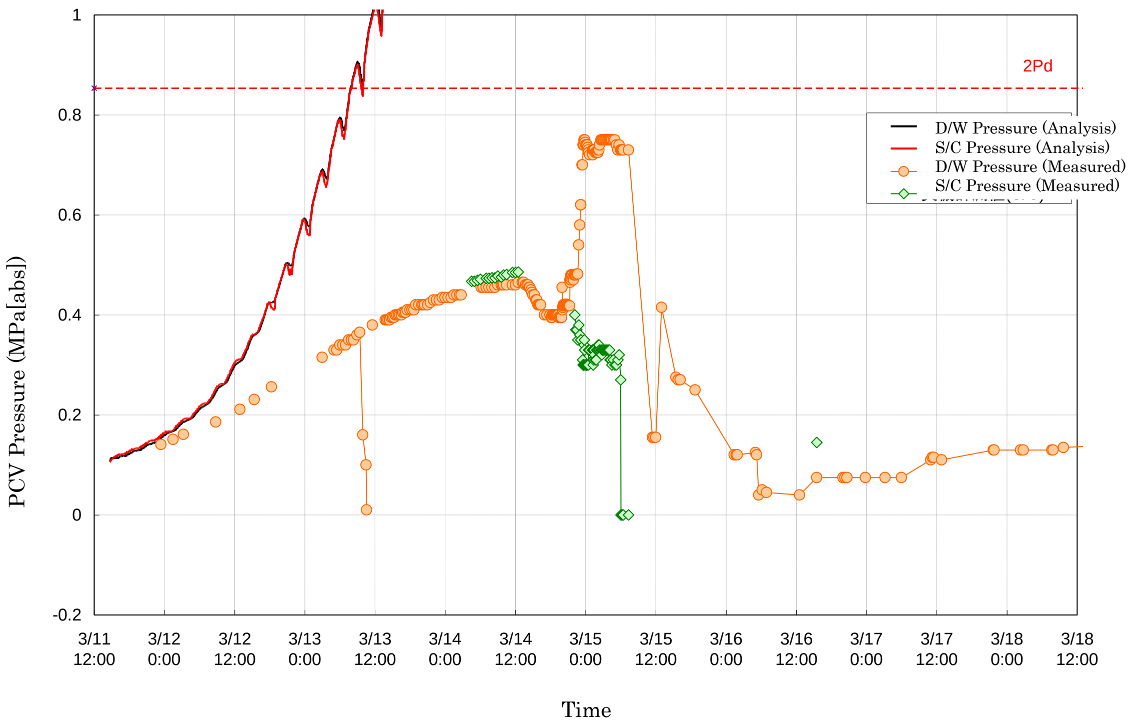


Figure3.2.1.10 Unit2 PCV Pressure[Case1] (Without Assuming Leak due to Superheat)

3.2.2.2 Analysis Result (Analysis Case 2)

Table 3.2.4 shows the result of analysis based on the condition shown in 3.2.1. And from Fig. 3.2.2.1 to Fig 3.2.2.9 show the result of analysis about the trend of reactor water level etc.

Table 3.2.4 Summary of Analysis Result on Unit 2

Item	Analysis Result
Start of reactor core exposure	Approx. 75 hours after earthquake
Start of reactor core damages	Approx. 77 hours after earthquake
Start of reactor pressure vessel breach	Approx. 109 hours after earthquake

The detail of analysis result is as follows.

The reactor water level gradually comes down after RCIC stop and the reactor core starts exposed, and the reactor core exposed completely by opening SRV and the reactor core damage starts. Although the water injection starts approximately at the same time, the assumed water injection flow is not enough so that the water level does not increase above the bottom of active fuel (see Fig.3.2.2.1).

Regarding the reactor pressure, there is a temporary increase by the steam generated by the relocation of reactor core to the lower plenum, but other behavior is almost same as the result of Case 1 (see Fig.3.2.2.2).

Regarding the pressure of PCV, it is similar to the reactor pressure, there is a temporary increase by the steam generated by the movement of reactor core to the lower plenum, but other behavior is almost same as the result of Case 1 (see Fig.3.2.2.3).

Regarding reactor core temperature trend, the temperature increases with the decrease of reactor water level, the fuel pellets start melting (see Fig.3.2.2.4).

A large amount of hydrogen is generated when the reactor core is exposed and the temperature of fuel cladding start increasing, the amount equal to the reaction of 36% of fuel cladding in the active fuel range is generated (see Fig.3.2.2.6).

Regarding the release of FP, for noble gases, the result is that almost all is released by the leak from S/C, which is similar to Case 1. For other materials such as cesium iodide, the release rate is under 1% (see Fig.3.2.2.7 and Fig.3.2.2.8).

The result says that, parts of the fuel remain in the reactor pressure vessel, but the reactor pressure vessel is breached. As the water injection flow in the early stage is assumed smaller than in Case 1, the result shows the damage of reactor core being more serious (see Fig.3.2.2.9).

3.2.3 Evaluation Result

In Analysis Case 1, we have had an analysis result that the reactor core of Unit 2 stays within the fuel range, though a partial fuel-melting pool exists, and the reactor pressure vessel will not be breached. In Analysis Case 2, we have had an analysis result that the reactor pressure vessel has been breached, though part of fuel stays within the reactor pressure vessel.

In addition, as a result of calibration of water-level gauge of Unit 1, we have found that the water level in reactor pressure vessel is not within fuel ranges. We cannot deny the possibility that a similar event has occurred in Unit 2.

Most of fuel is cooled down in the reactor pressure vessel, because, according to plant parameters, the temperatures at the bottom of the reactor pressure vessel currently change around between approximately 100 degrees Celsius and approximately 120 degrees Celsius and correlate changes in amount of water injection in multiple measuring points and temperature of the upper reactor pressure vessel is higher and its heat source is estimated to come from the inside of reactor pressure vessel.

Hence, according to the analysis and plant parameters, reactor core has been significantly damaged, relocated below or slumped to the lower plenums from fixed positions of fuel loading, however most of it is being stably cooled down around there.

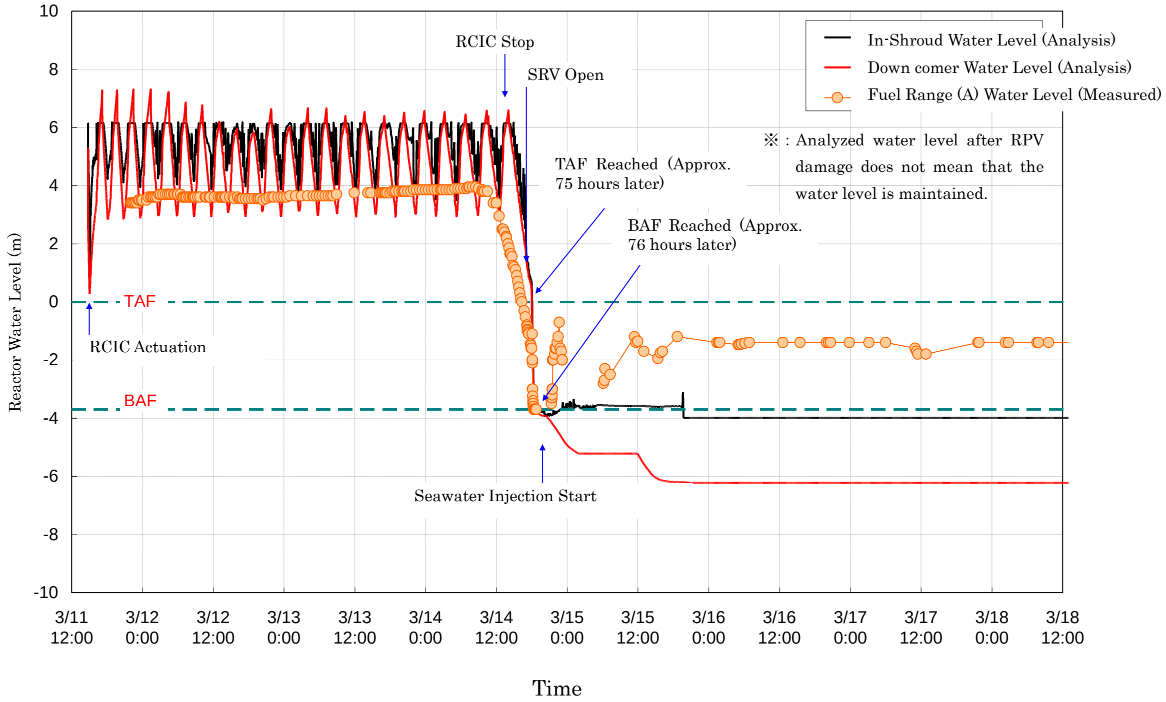


Figure3.2.2.1 Unit2 Reactor Water Level[Case2]

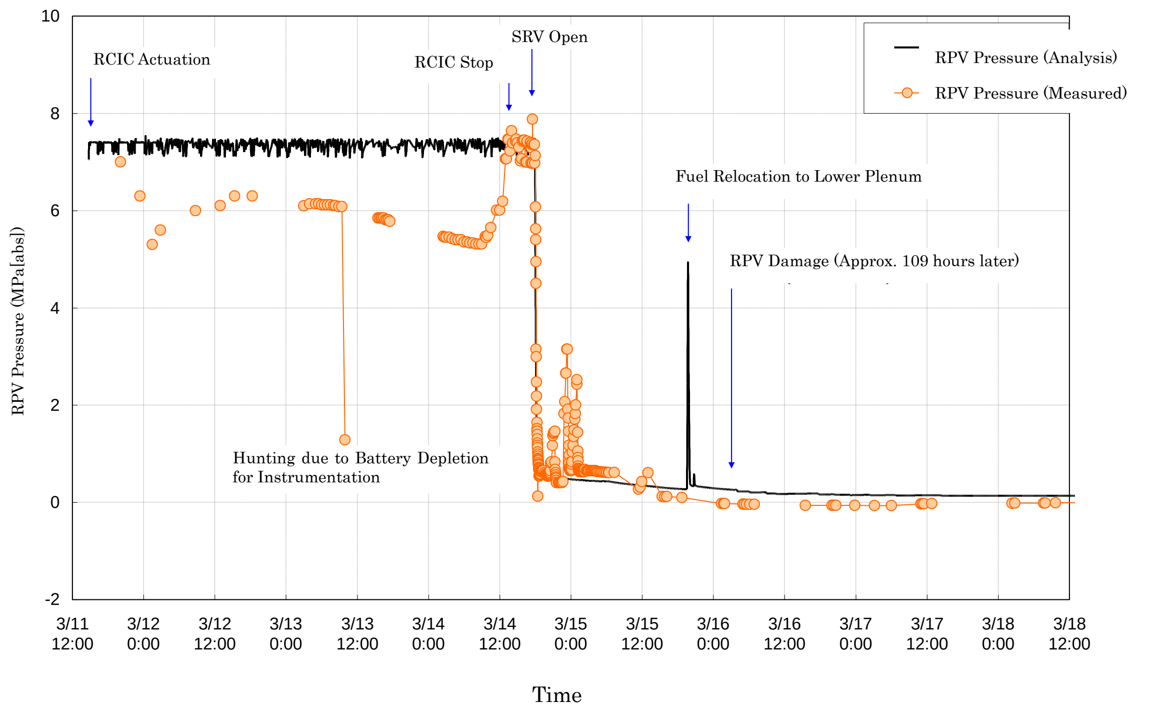


Figure3.2.2.2 Unit2 RPV Pressure[Case2]

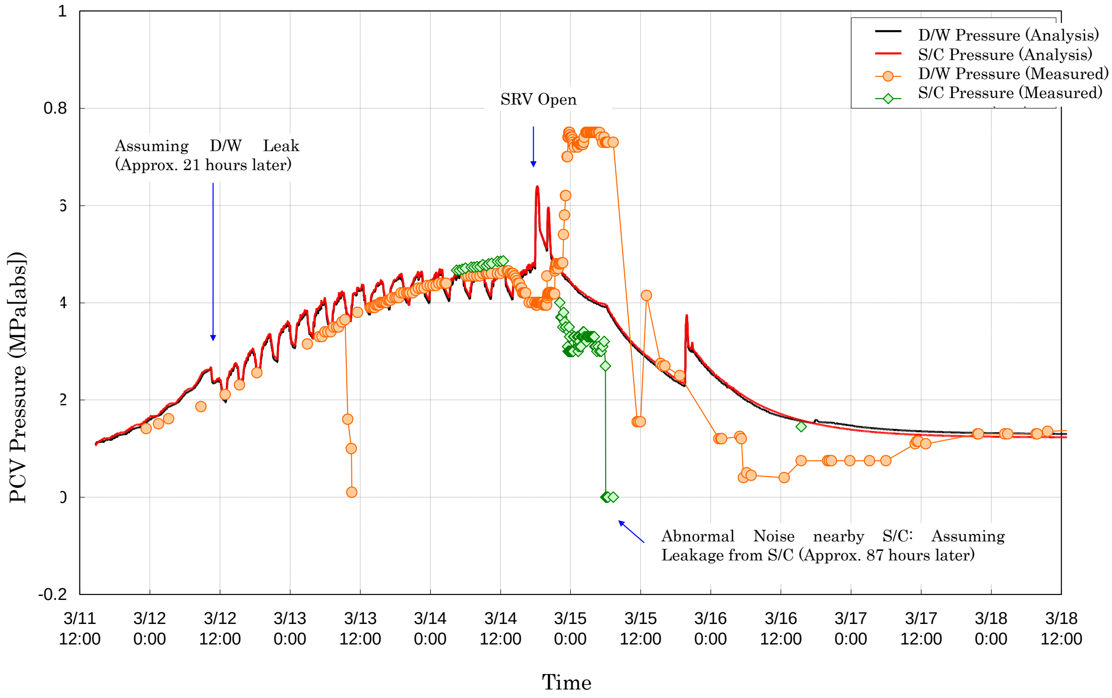


Figure3.2.2.3 Unit2 PCV Pressure[Case2]

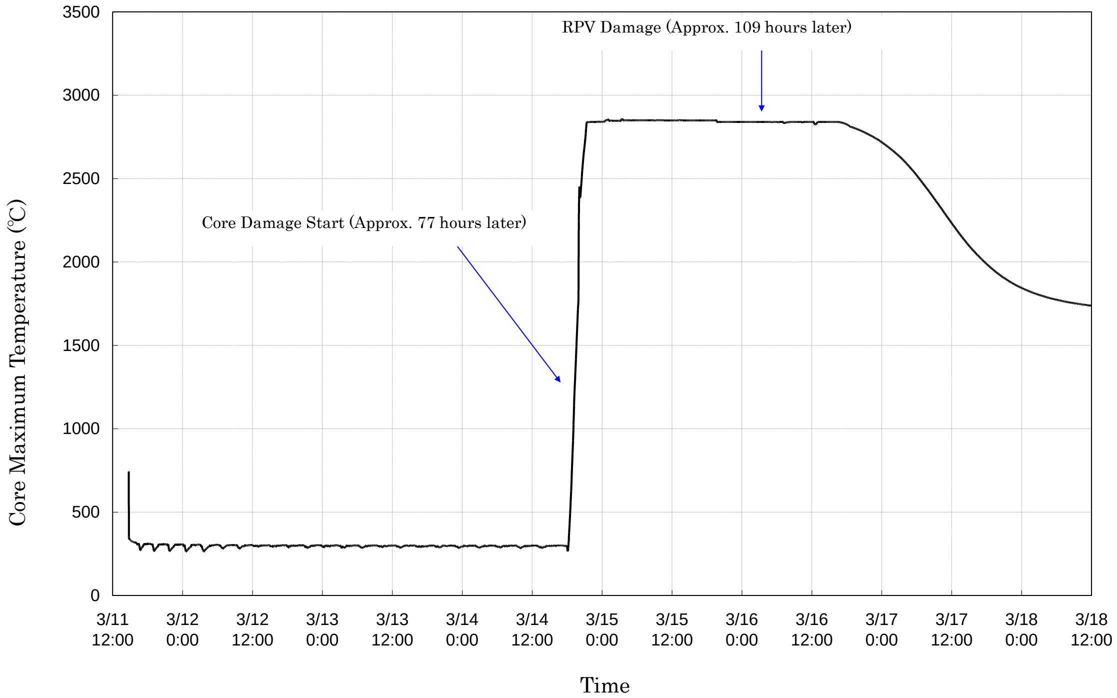


Figure3.2.2.4 Unit2 Core Temperature[Case2]

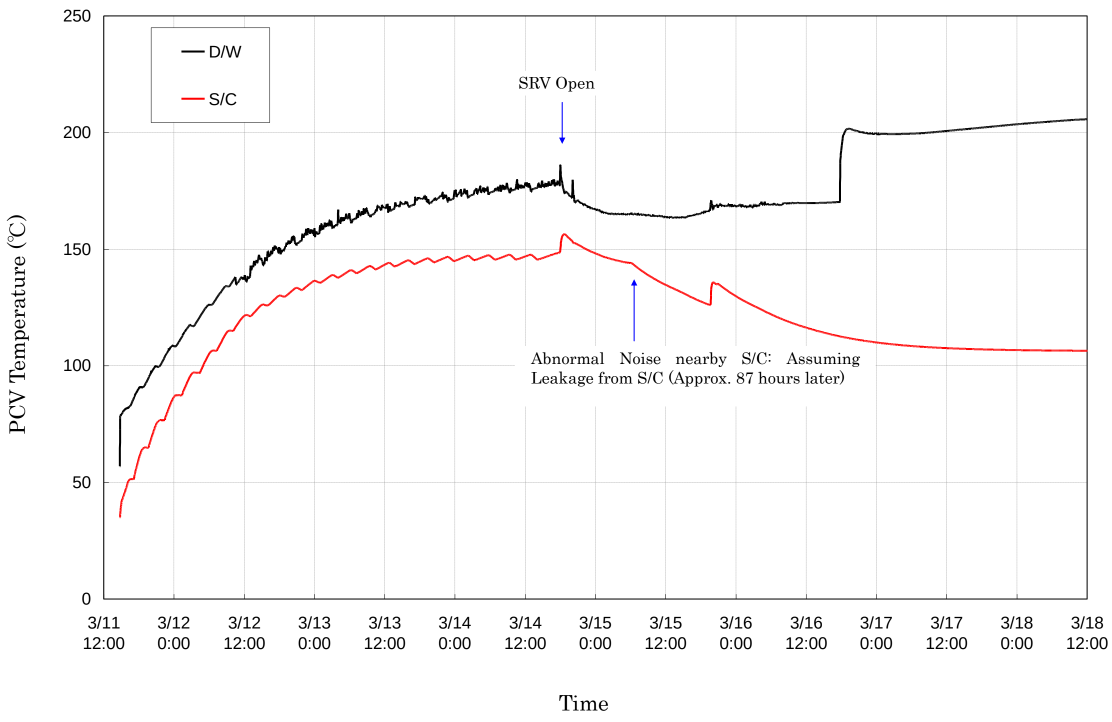


Figure3.2.2.5 Unit2 PCV Temperature[Case2]

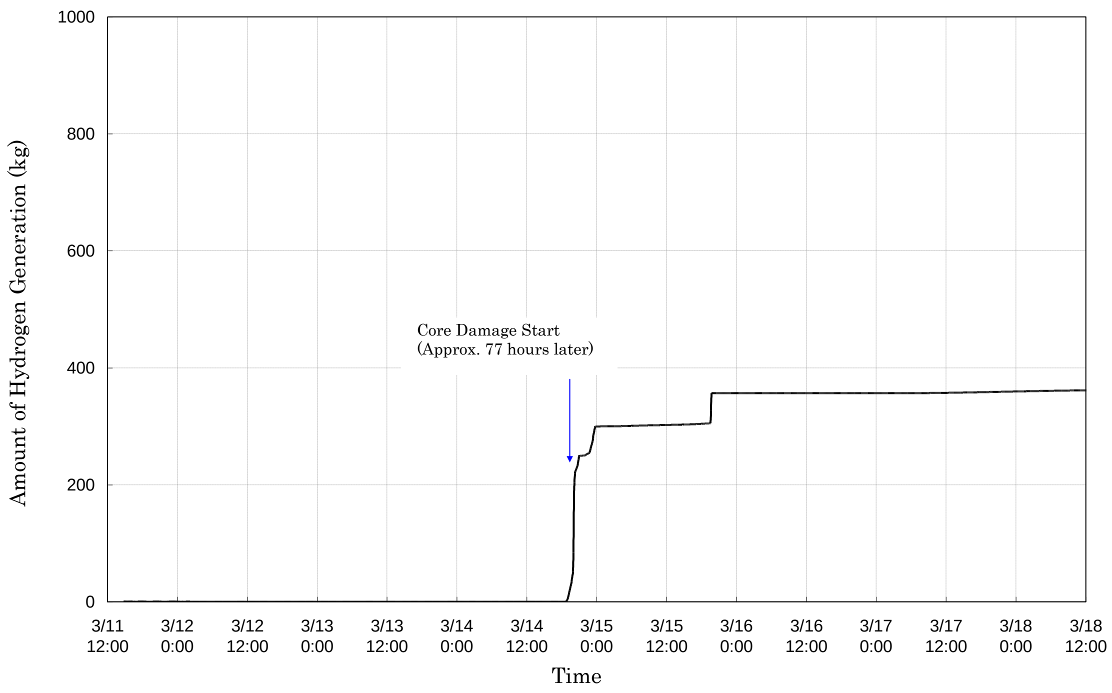


Figure3.2.2.6 Unit2 Amount of Hydrogen Generation[Case2]

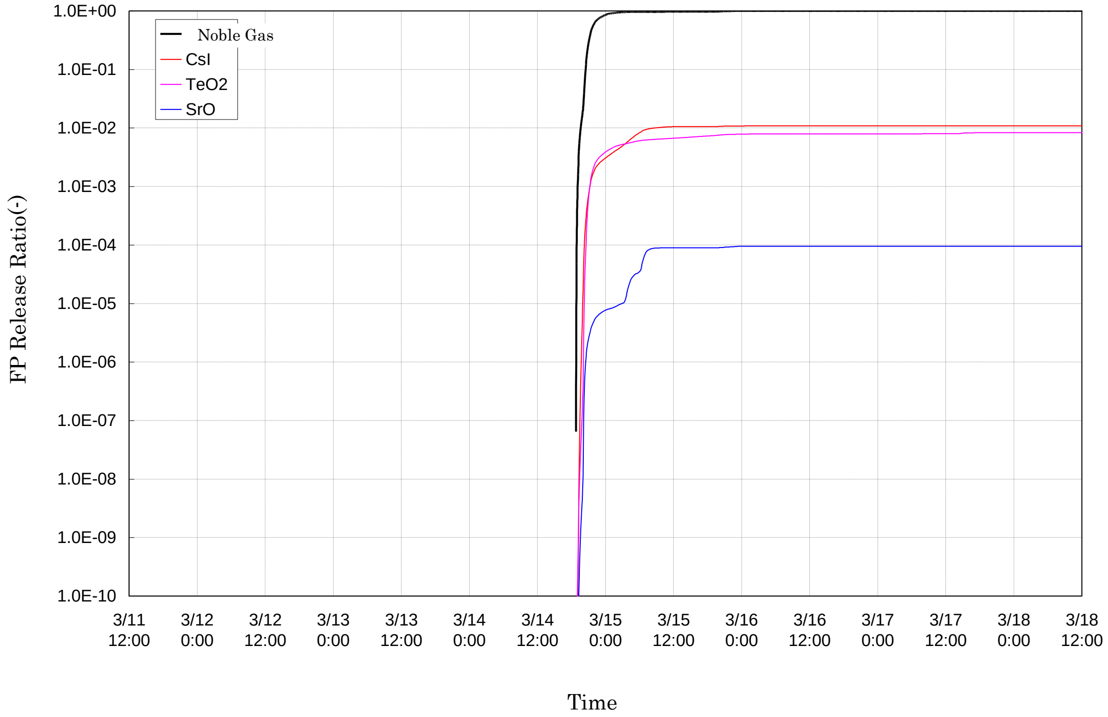


Figure3.2.2.7 Unit2 FP Release Ratio(1/3)[Case2]

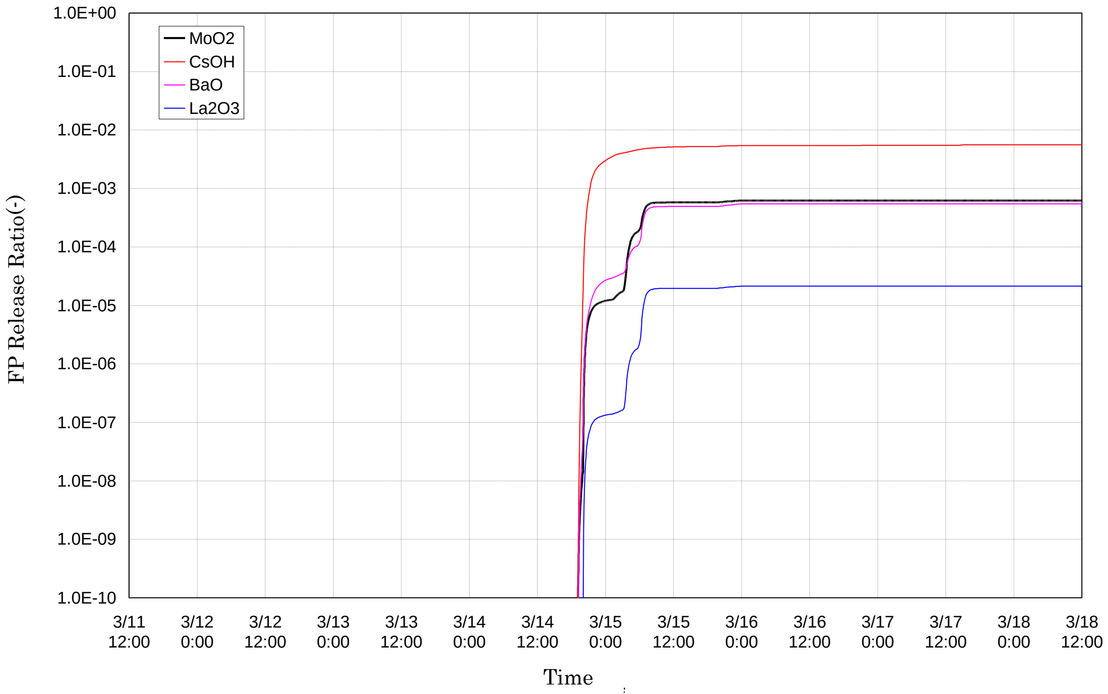


Figure3.2.2.7 Unit2 FP Release Ratio(2/3)[Case2]

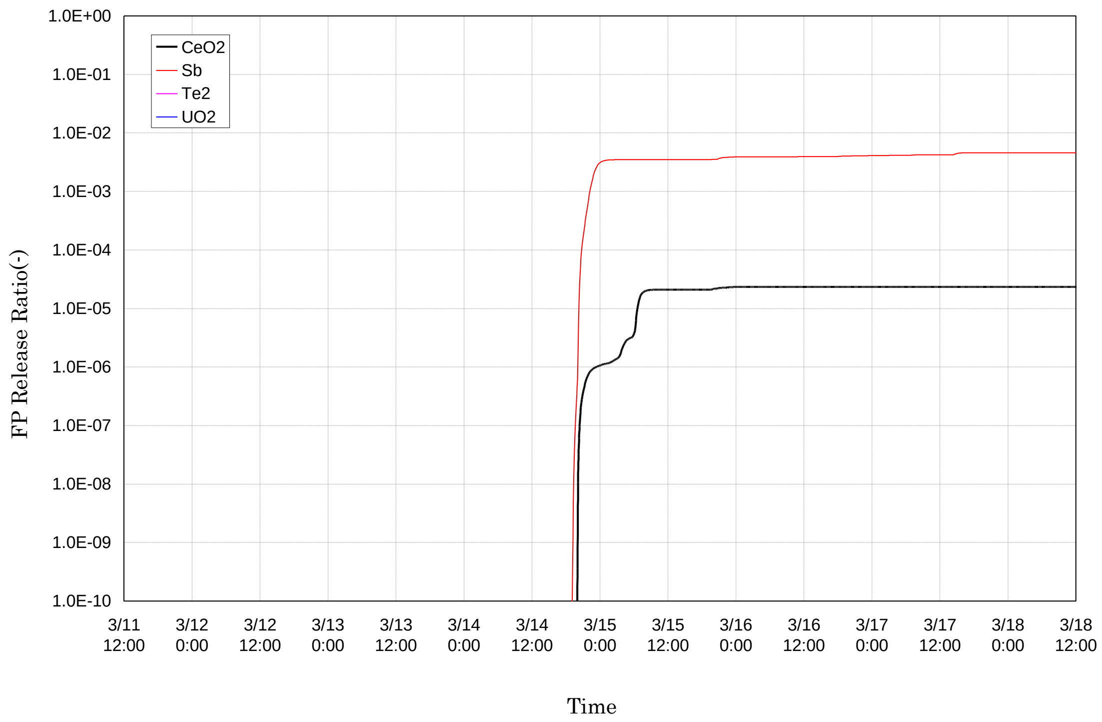


Figure3.2.2.7 Unit2 FP Release Ratio(3/3)[Case2]

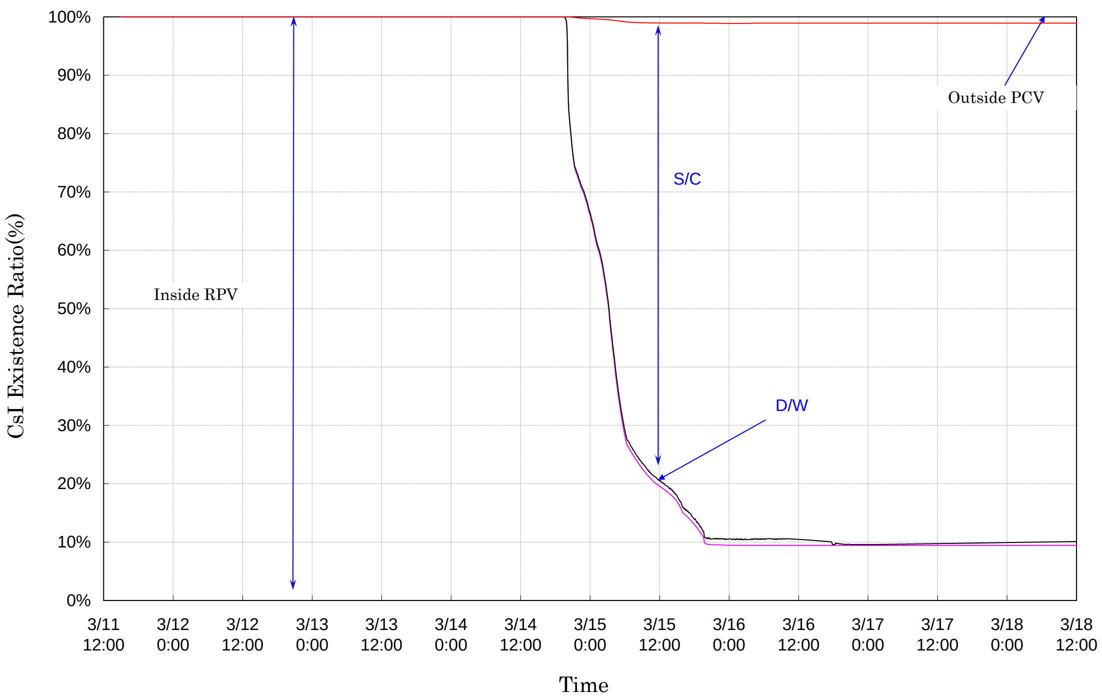


Figure3.2.2.8 Unit2 FP Existence Ratio(1/2)[Case2]

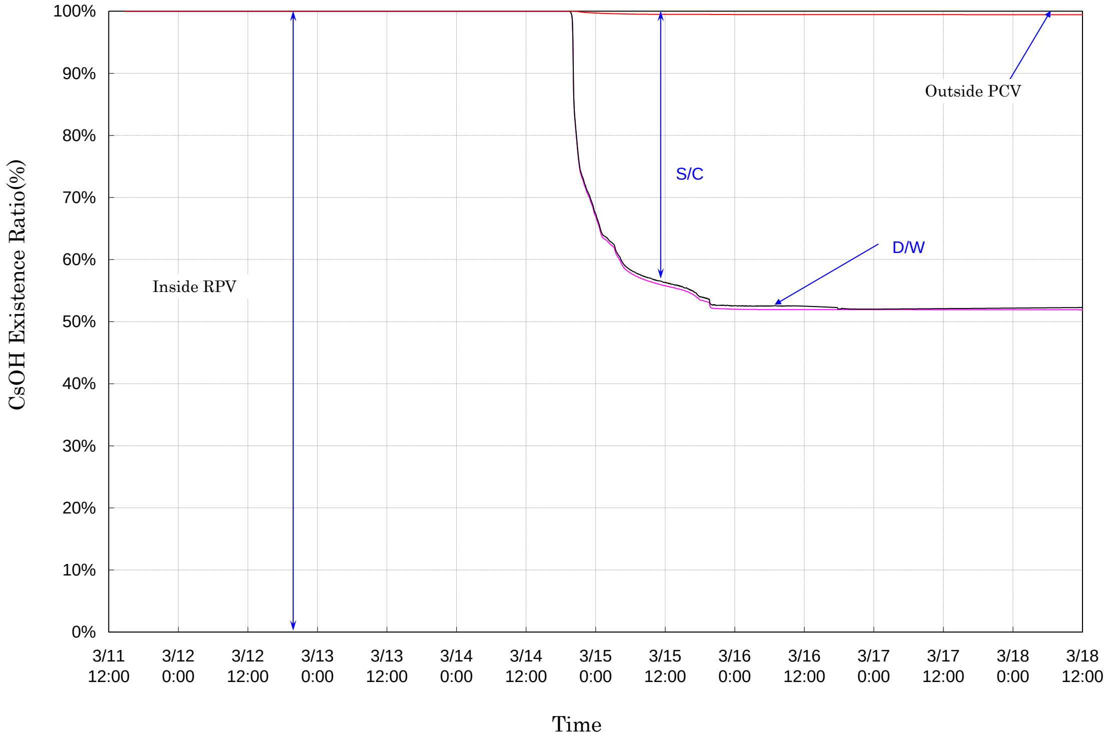


Figure3.2.2.8 Unit2 FP Existence Ratio(2/2)[Case2]

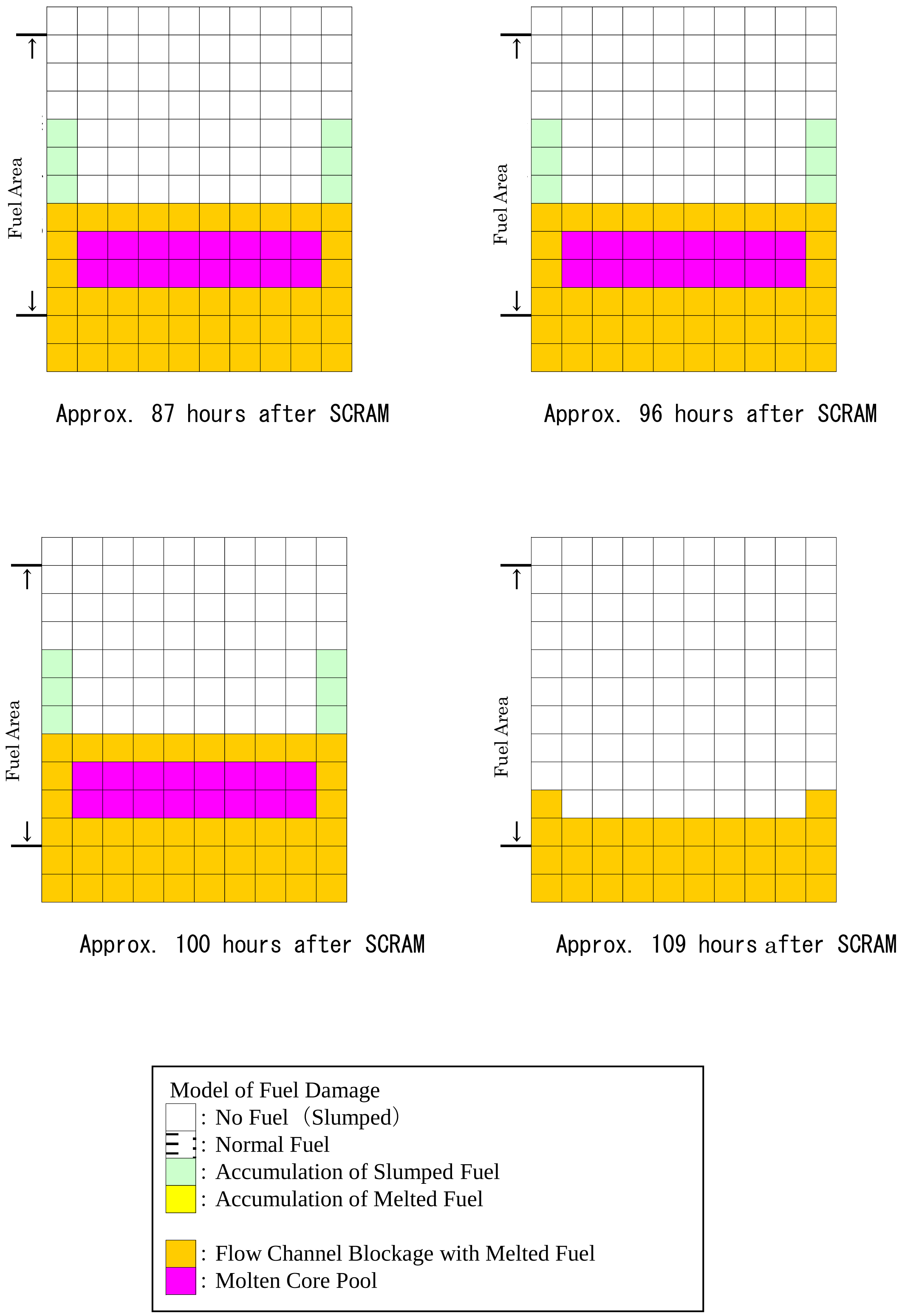


Figure3.2.2.9 Unit2 Core Status[Case2]

3.3 Unit 3 of Fukushima Daiichi Nuclear Power Station

3.3.1 Analysis condition

Principal conditions of analysis regarding Unit 3 of Fukushima Daiichi Nuclear Power Station are shown in the Table 3.3.1 and 3.3.2.

We implemented the analysis in two cases below.

① Cases of analysis

【Case 1】 In order to match the measured value of reactor water level, we presumed a smaller amount of flow rate compared to the discharge flow of the fire pump that could maintain the reactor water level.

【Case 2】Based on the premise that it is impossible to maintain the reactor water level in the fuel range, we presumed an injection rate that can maintain slightly below the level of the fuel range, and not the flow rate of the discharge side of the fire pump.

Table 3.3.1 Plant Conditions

Items	Conditions
Initial reactor output	2381 MWt (rated power output)
Initial reactor pressure	7.03MPa[abs] (normal operation pressure)
Initial reactor water level	Normal level
Open space volume of PCV	D/W open space：4240m^3 S/C open space：3160m^3
Suppression pool water volume	2980m^3

Chart 3.3.2 Events

Explanatory notes ○ : Records available △ : Estimates based on records □ : Assumption used on analysis

Analysis Condition				Classification	Notes	In case of ○ : Referred part of the records In case of △ or □ : Estimated, presumed reasons etc.
No	Time and Date		Analyzed Events			
1	March 11th	2:46 pm	Earthquake occurred	○	—	
2		2:47 pm	Reactor scram occurred	○	Report on May 16th, 4. Operation daily, Handover diary of shift supervisor	
3		3:06 pm	RCIC activated manually	○	Report on May 16th, 7. Operation records	
4		3:25 pm	RCIC tripped (L-8)	○	Same as above	
5		3:38 pm	SBO occurred	○	Report on May 16th, 4. Operation daily, Handover diary of shift supervisor	
6		4:03 pm	RCIC activated manually	○	Report on May 16th, 7. Operation records	
7	March 12th	11:36 am	RCIC tripped	○	Same as above	
8		0:35 pm	HPCI activated (L-2)	○	Same as above	
9	March 13th	2:42 am	HPCI stopped	○	Same as above	
10		Around 9:08 am	Started the pressure decrease of reactor pressure vessel by operating the SRV	○	Same as above	
11		9:20 am	Regarding the PCV vent, pressure decrease was	○	The vent line constitution is completed by the operation of AO valve in the 7.Operation records in	

			confirmed		the report on May 16th, however, we presumed the 9:20am as the start of the vent, since we confirmed the pressure decrease of PCV at this time.
12		9:25 am	Started the injection of fresh water	○	Report on May 16th, 7. Operation records ※1
13		11:17 am	Regarding the PCV vent, a closure of AO valve of vent line caused by the slip out of driving air pressure was confirmed	○	Report on May 16th, 7. Operation records
14		0:30 pm	Regarding the PCV vent, opening operation was implemented	○	Same as above
15		1:12 pm	Injection of water was changed from fresh water to sea water	○	Report on May 16th, 7. Operation records ※1
16		2:10 pm	Regarding the PCV vent, it is presumed that the vent valve is closed	△	We presume the termination of the vent which started 0:30pm, March 13th at this time based on the increase of D/W pressure. It is described in the 7.Operation records in the report on May 16th that the closure of the valve is confirmed at 4:00pm, May 15th.
17	March 14th	1:10 am	Injection of water was halted in order to supply water to water	○	Report on May16th, 7. Operation records

			source pit		
18		3:20 am	The supply to the water source pit was finished and the injection of water restarted	○	Report on May16th, 7. Operation records ※1
19		5:20 am	Regarding the PCV vent, AO valve of suppression chamber side was opened.	○	Report on May16th, 7. Operation records
20		0:00 pm	Regarding the PCV vent, it is presumed that the valve of suppression chamber side was closed.	△	We presume the termination of the vent which started 5:30am, March 14th at this time based on the increase of D/W pressure. It is described in the 7.Operation records in the report on May 16th that the closure of the valve is confirmed at 4:00pm, May 15th.
21		4:00 pm	Regarding the PCV vent, it is presumed that the valve of suppression chamber side was opened.	△	We presume the vent at this time based on the decrease of D/W pressure.
22		9:04 pm	Regarding the PCV vent, it is presumed that the valve of suppression chamber side was closed.	△	We presume the termination of the vent at this time based on the increase of D/W pressure.
23	March 15th	4:05 pm	Regarding the PCV vent, the valve of suppression chamber	○	Report on May16th, 7. Operation records

			side was opened.		
24	March 16th	1:55 am	Regarding the PCV vent, the valve of suppression chamber side was opened.	△	It is described in the 7.Operation records in the report on May 16th that the vent was implemented at this time, however, we presume that the vent was not implemented as the D/W pressure did not fluctuate.
25	March 17th	9:00 pm	Regarding the PCV vent, closure of the valve of suppression chamber side was confirmed.	△	It is described in the 7.Operation records in the report on May 16th that the closure of the valve was confirmed following the opening of the vent at 4:05pm March 15th, however, we presume that the valve was not closed based on the transition of the D/W pressure.
26		9:30 pm	Regarding the PCV vent, the valve of suppression chamber side was opened.	△	It is described in the 7.Operation records in the report on May 16th that the valve was opened, however, we presume that the valve was not opened based on the transition of the D/W pressure.
27	March 18th	5:30 am	Regarding the PCV vent, closure of the valve of suppression chamber side was confirmed.	—	Though it is described in the report on May 16th, it is out of the period for the analysis.
28		Around 5:30 am	Regarding the PCV vent, the valve of suppression chamber side was opened.	—	Same as above

29	March 19th	11:30 am	Regarding the PCV vent, closure of the valve of suppression chamber side was confirmed.	―	Same as above
30	March 20th	Around 11:25 am	Regarding the PCV vent, the valve of suppression chamber side was opened.	―	Same as above

※1 We set up the injection amount of water and the time we changed the amount based on the daily injection amount described in 7.Operation records of the report on March 16th, in order not to exceed the daily average injection amount and total injection amount.

3.3.2.1 Analysis Result (Analysis Case 1)

Table 3.3.3 shows the result of analysis based on the condition shown in 3.3.1. Fig. 3.3.1.1 to Fig 3.3.1.13 show the result of analysis about the trend of reactor water level etc.

Table 3.2.3 Summary of Analysis Result on Unit 3

Item	Analysis Result
Start of reactor core exposure	Approx. 40 hours after earthquake
Start of reactor core damages	Approx. 42 hours after earthquake
Start of reactor pressure vessel breach	(reactor pressure vessel breach did not occur in this analysis)

The detail of analysis result is as follows.

The reactor water level gradually comes down after HPCI stop and the reactor core starts exposed, and the reactor core exposed completely by opening SRV and the reactor core damage starts (see Fig.3.3.1.1). Although the water injection starts, but in this analysis, because the water injection flow is assumed that it is commensurate with the reactor water level indicated by measurement equipment, so that the water injection flow is not enough and the water level is remained around a half level of the reactor core range. Therefore, the reactor core is damaged.

The reactor pressure is kept high around the pressure of SRV action until RCIC and HCPI stop. By SRV opening after HCPI stops, the reactor pressure decreases rapidly, after that it goes down to around atmosphere pressure (see Fig.3.3.1.2). In the analysis, RCIC and HPCI are assumed to be in operation continuously, but there exist a pressure decrease in the part while HPCI is in operation. For example, if the leak of steam is assumed out of the PCV through the steam pipe of HPCI, the result is that the trend of pressure of reactor pressure vessel and PCV is almost similar (see Fig.3.3.1.10 and Fig.3.3.1.11). However, currently it is not sure whether there is an actual path at the HPCI system or it is only a problem of instrumentation.

Regarding the pressure of PCV, because the steam generated in the reactor is discharged to S/C, the pressure of D/W and S/C continue to increase. And the pressure increases temporary by SRV open, but the pressure decreases by S/C vent. After that the pressure repeats increasing and decreasing (see Fig.3.3.1.4).

A large amount of hydrogen is generated when the reactor core is exposed and the temperature of fuel cladding starts increasing. After 1 week of earthquake occurrence, the amount equal to the reaction of 70% of fuel cladding in the active fuel range is generated. In the analysis, most of the hydrogen is discharged out of PCV by S/C vent, but the amount of production assumed to be enough for causing explosion of the Reactor Building of Unit 3 (see Fig.3.3.1.6).

Regarding the release of FP, after reactor core damage, noble gases are released from the reactor pressure vessel to S/C, and the result is that approximately 86% of noble gas is released by vent. For cesium iodide, the release rate is about 0.5% and almost all exists in S/C (see Fig.3.3.1.7 and Fig.3.3.1.8).

Regarding the situation of reactor core, there partially exist a melted pool, but it remains in fuel range and does not lead to the reactor pressure vessel breach. The reason is that, the water injection by RCIC, HCPI in the early stage was implemented constantly, and the period between when the HPCI stopped and water injection begun was shorter than that in Unit 1 (see Fig.3.3.1.9).

Also, in this analysis, the water injection suspends 2 hours for the refill of water for the water source pit. We also implemented the analysis in case that the water injection went continuously. As a result, the reactor water level remains a little higher in the early stage, but is not enough to fill up the fuel range, so that the reactor core is damaged (see Fig.3.3.1.12 and Fig.3.3.1.13).

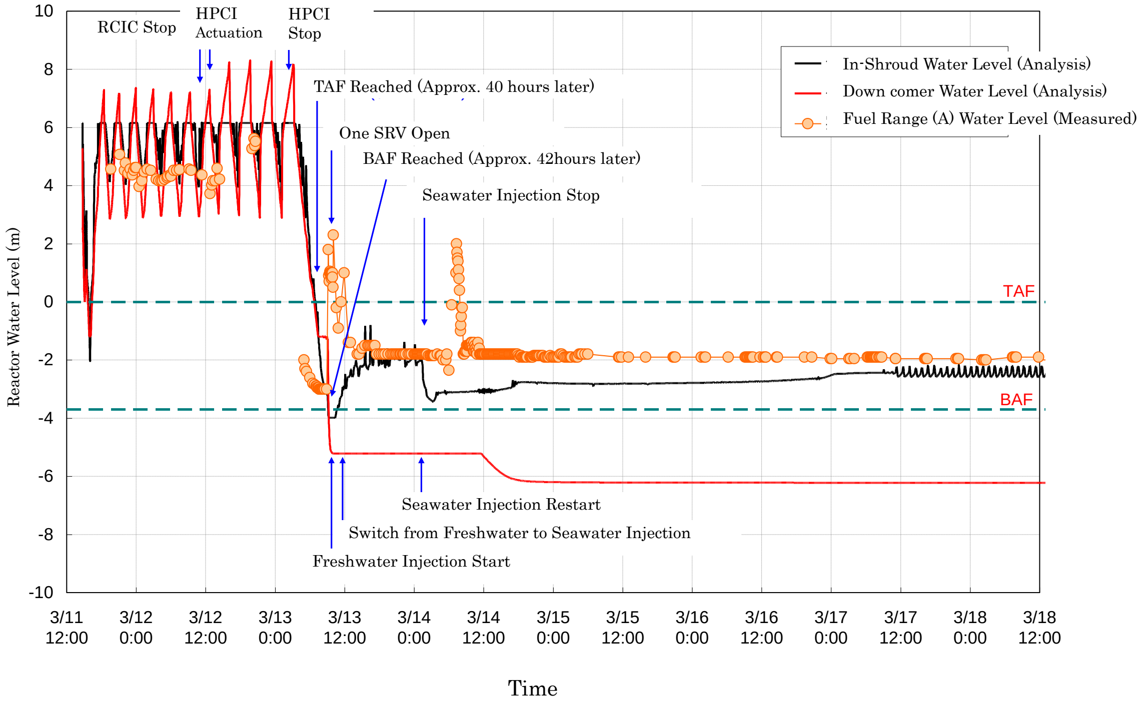


Figure3.3.1.1 Unit3 Reactor Water Level[Case1]

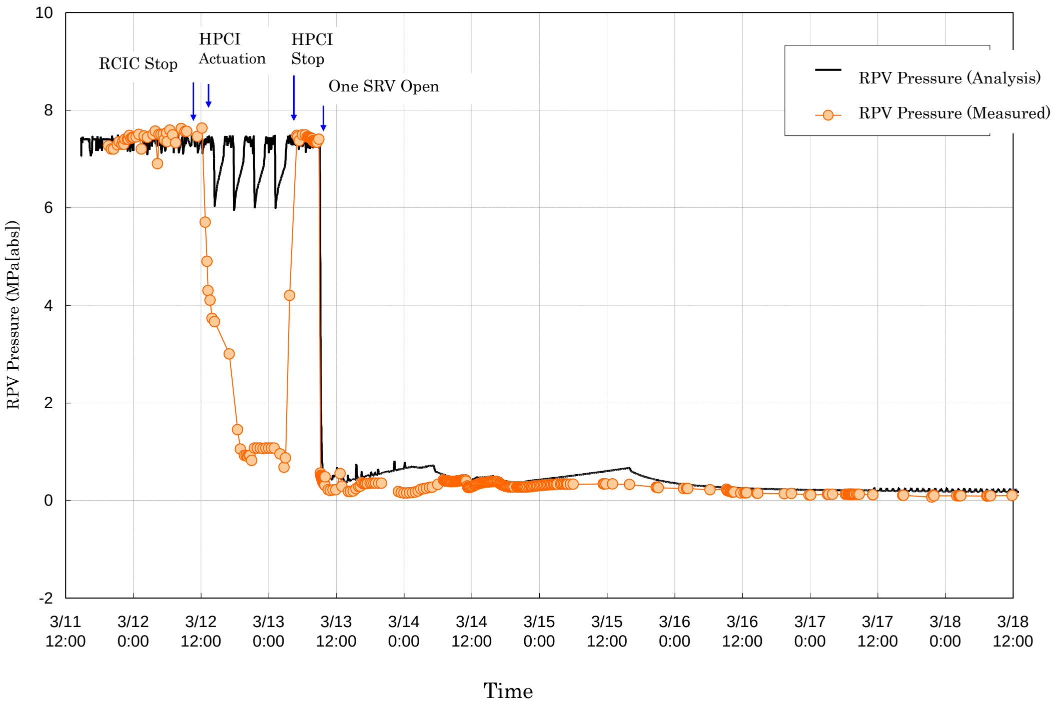


Figure3.3.1.2 Unit3 RPV Pressure[Case1]

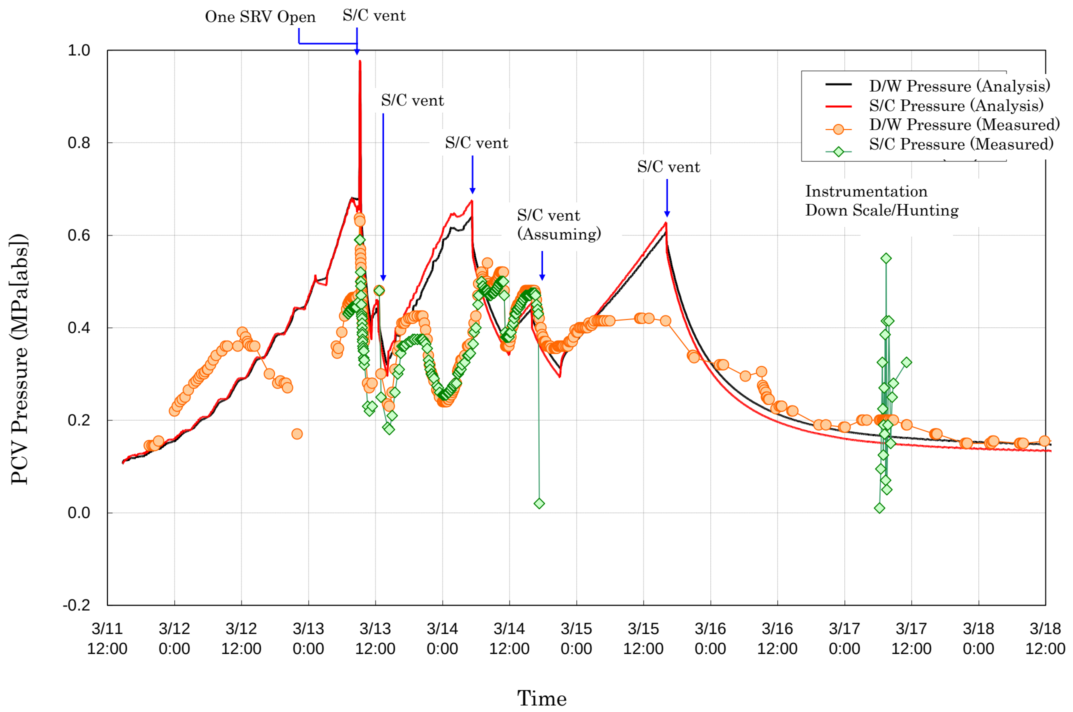


Figure3.3.1.3　Unit3 PCV Pressure[Case1]

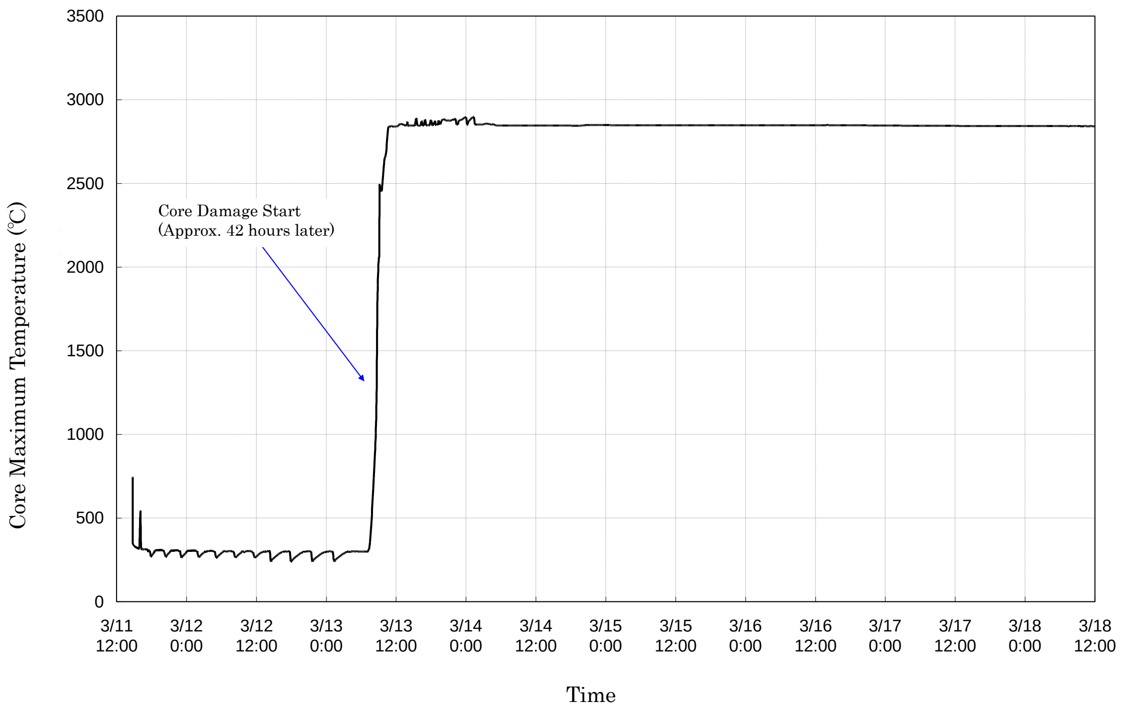


Figure3.3.1.4　Unit3 Core Temperature[Case1]

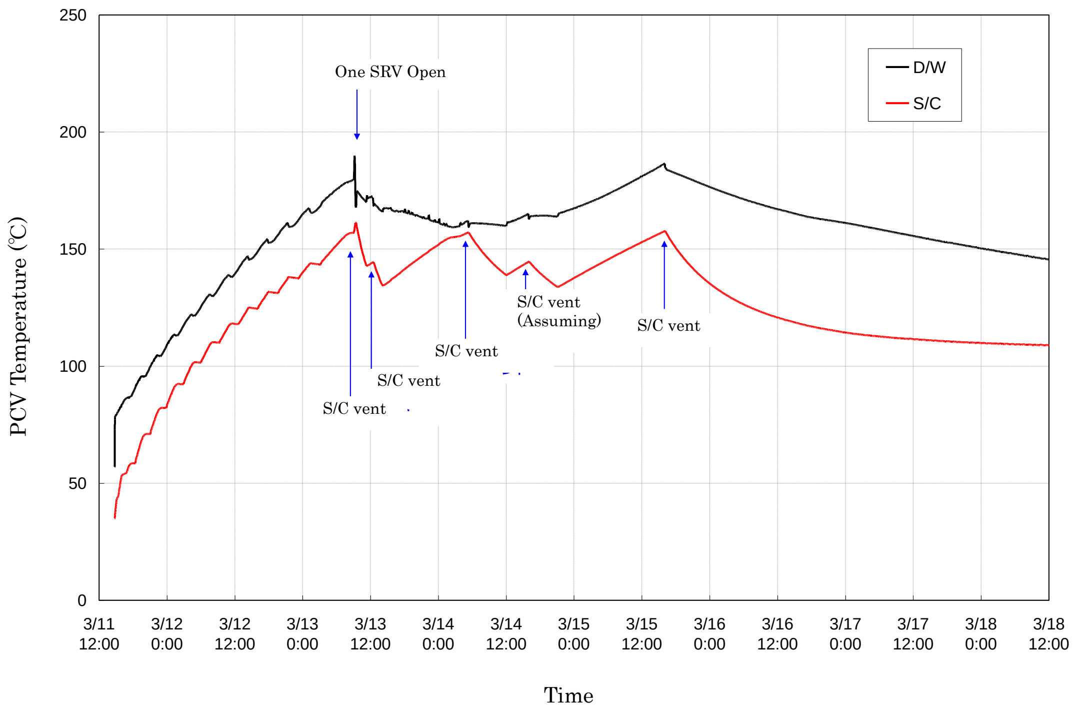


Figure3.2.1.5　Unit3 PCV Temperature[Case1]

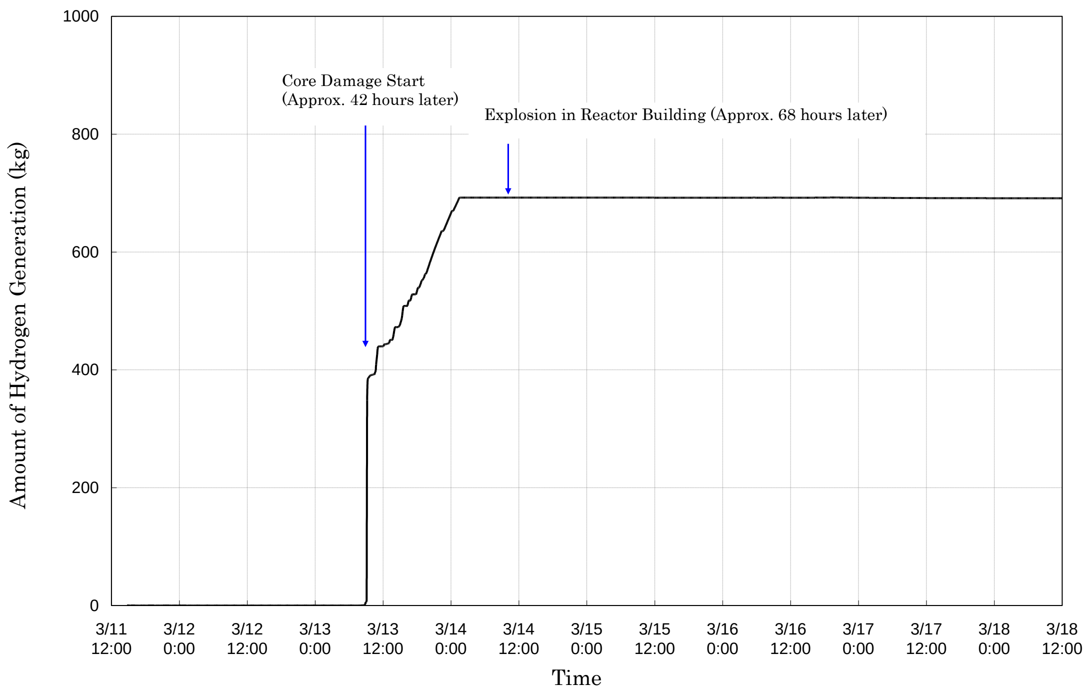


Figure3.3.1.6　Unit3 Amount of Hydrogen Generation[Case1]

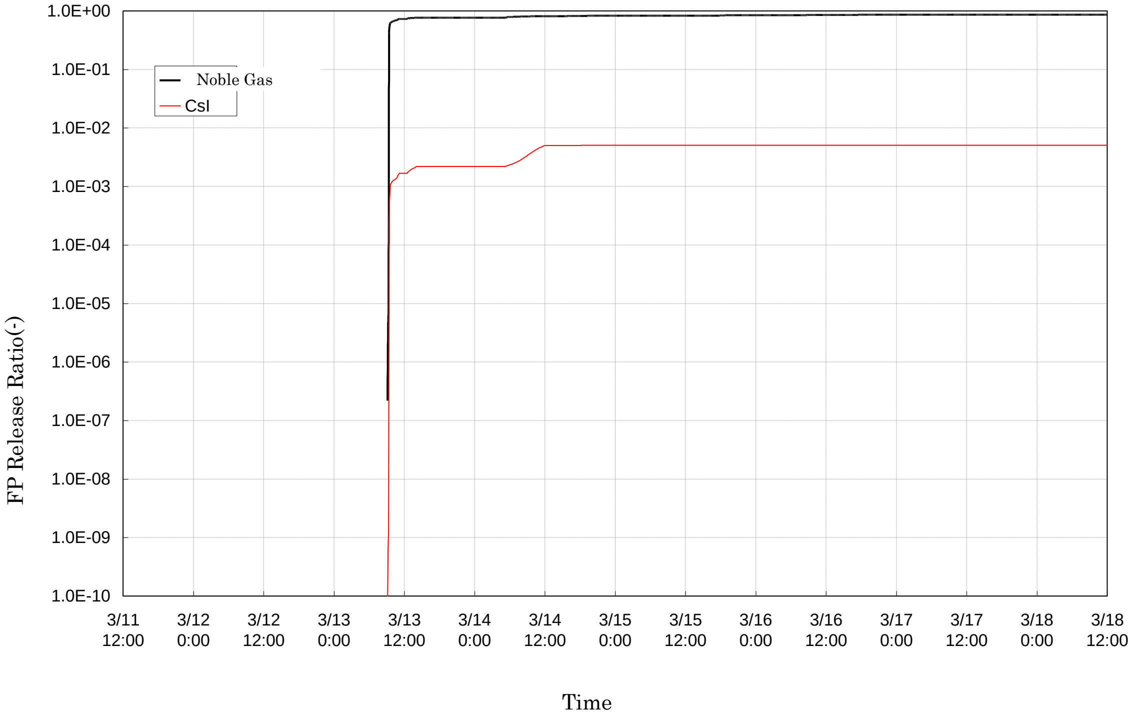


Figure3.3.1.7　Unit3　FP Release Ratio[Case1]

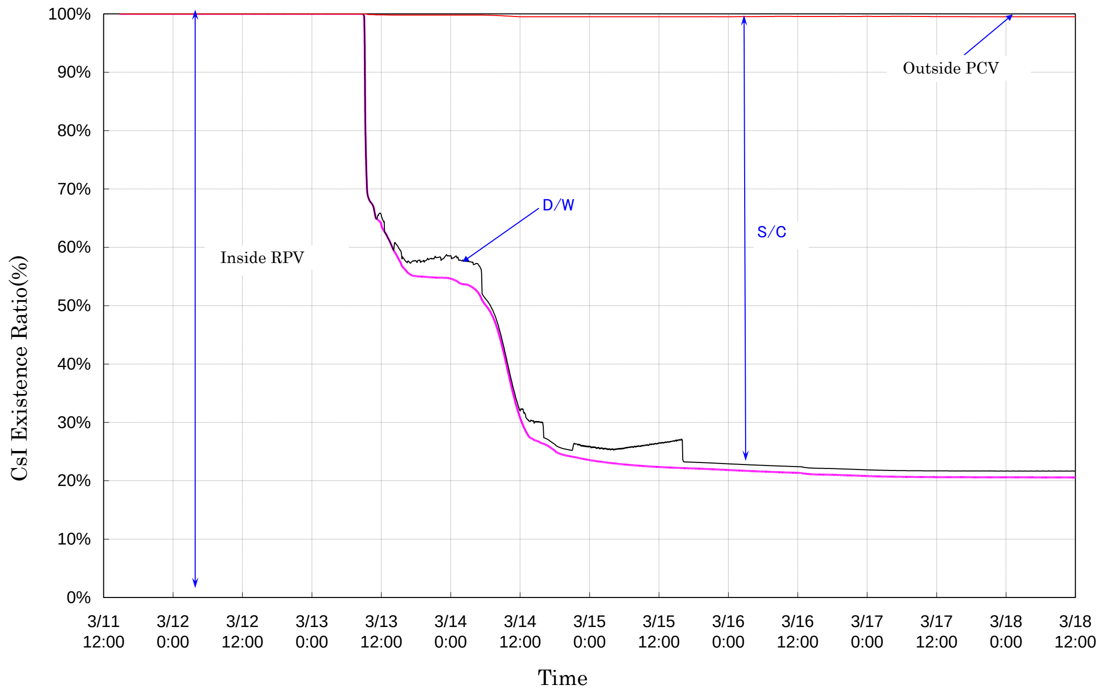


Figure3.3.1.8　Unit3 FP Existence Ratio(1/2)[Case1]

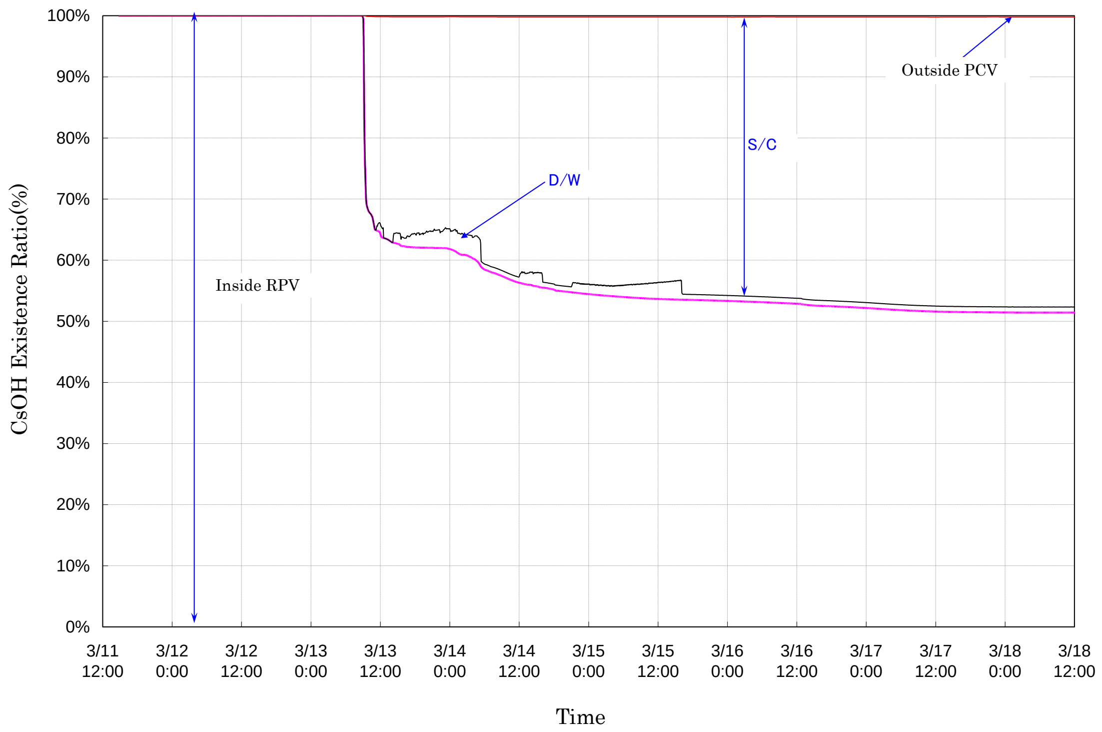
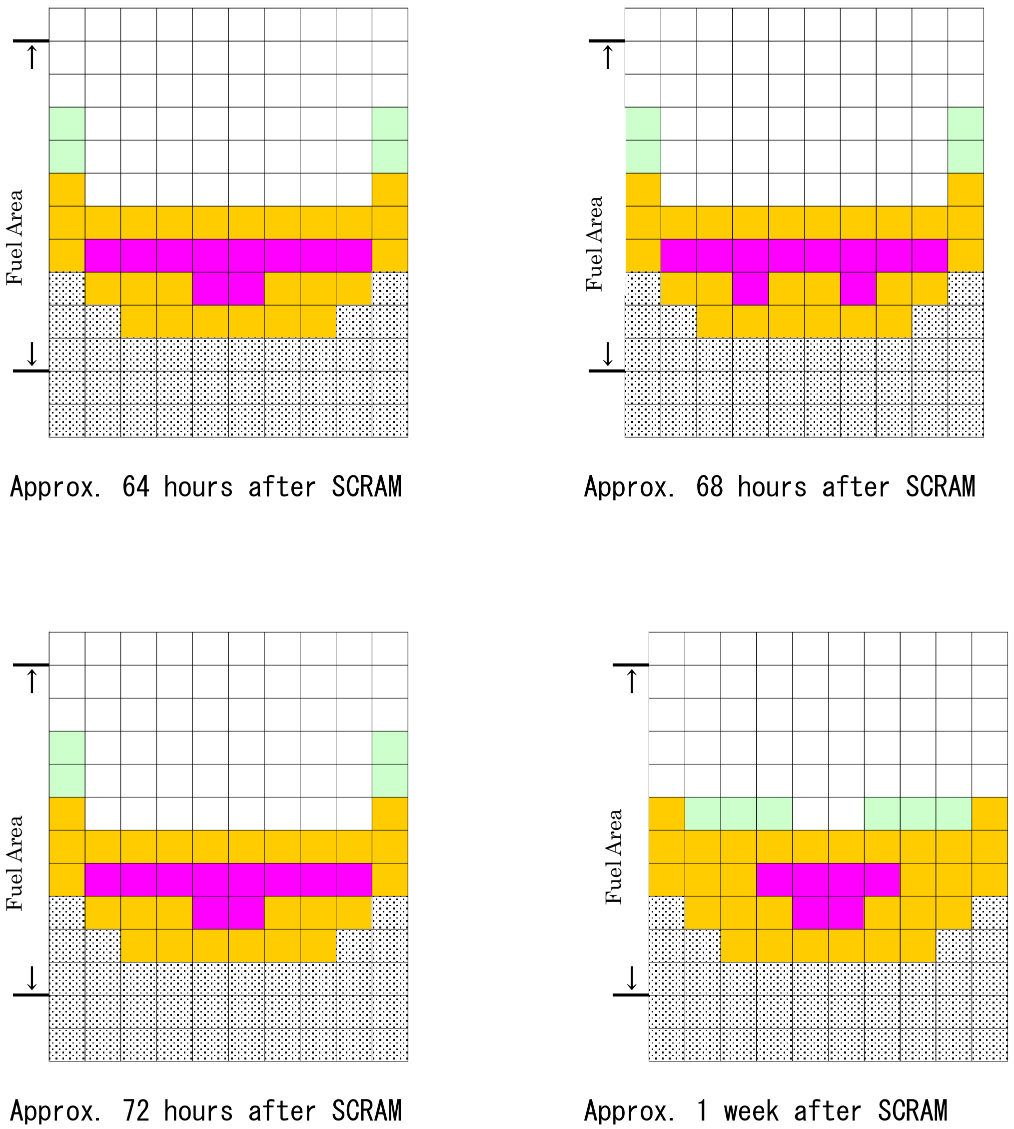


Figure3.3.1.8 Unit3 FP Existence Ratio(2/2) [Case1]



Model of Fuel Damage
: No Fuel (Slumped)
: Normal Fuel
: Accumulation of Slumped Fuel
: Accumulation of Melted Fuel

: Flow Channel Blockage with Melted Fuel
: Molten Core Pool

Figure3.3.1.9 Unit3 Core Status[Case1]

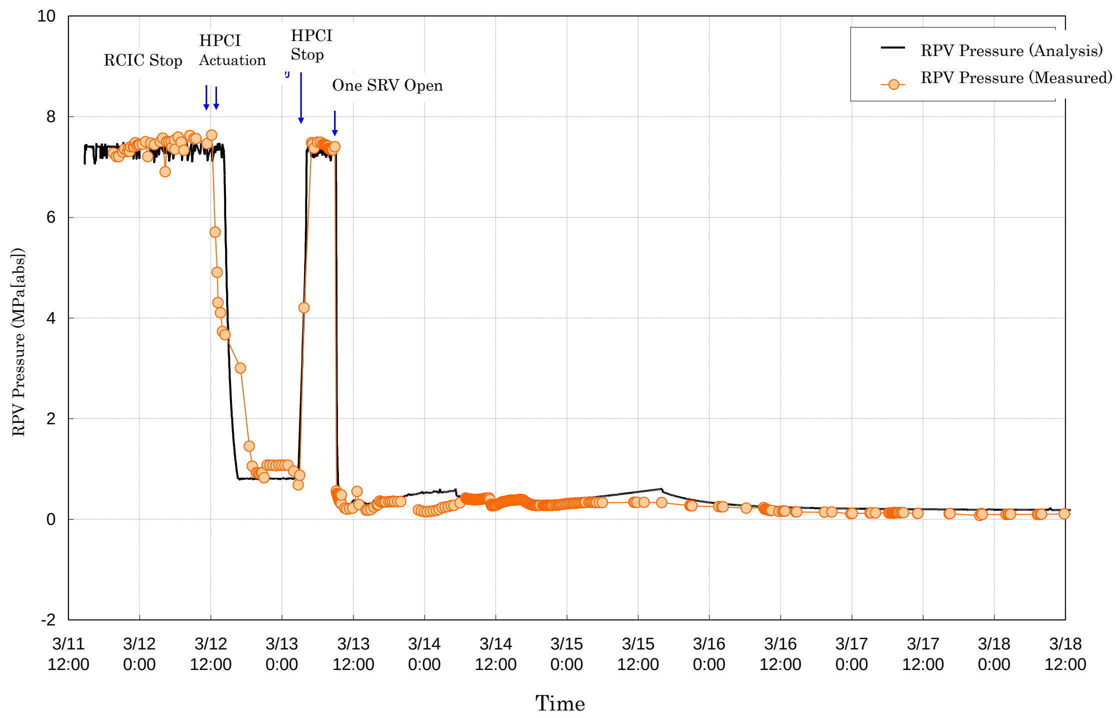


Figure3.3.1.10　Unit3 RPV Pressure[Case1] (Steam Leak)

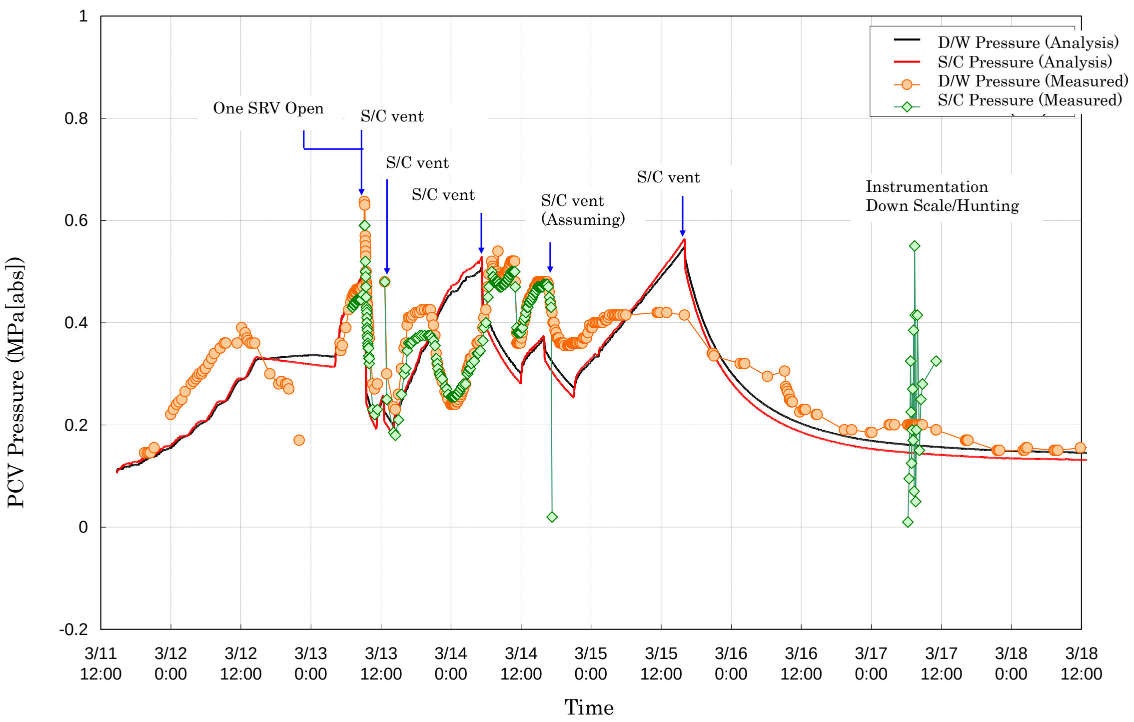


Figure3.3.1.11　Unit3 PCV Pressure[Case1] (Steam Leak)

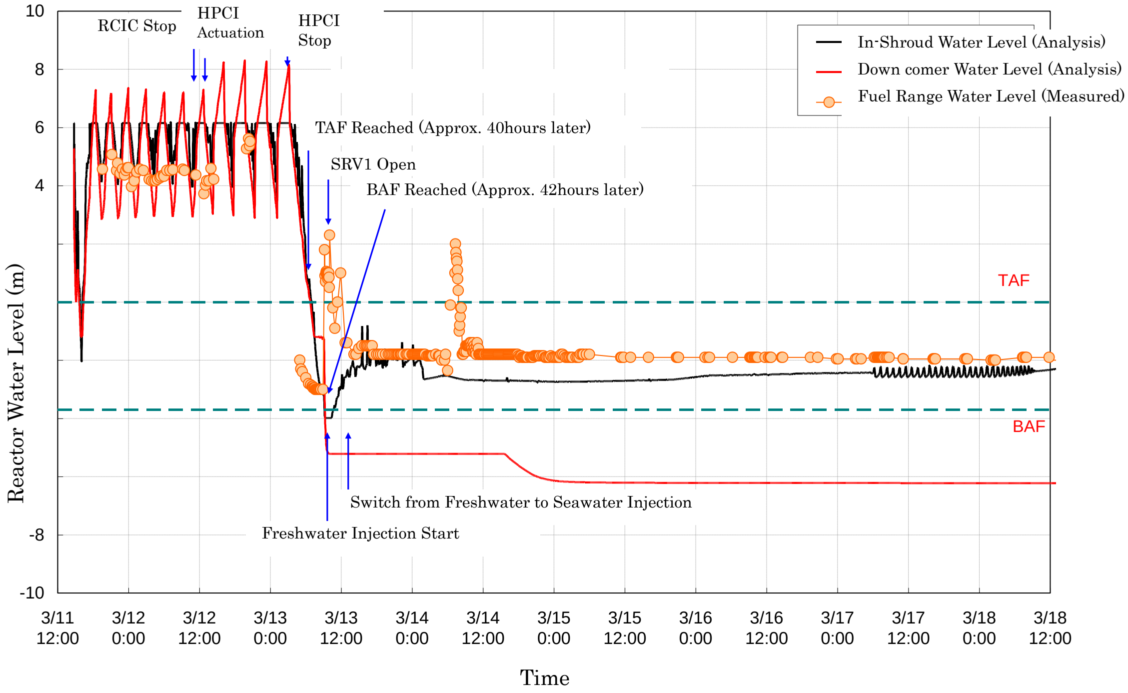


Figure3.3.1.12　Unit3 Reactor Water Level[Case1] (Continued Injection)

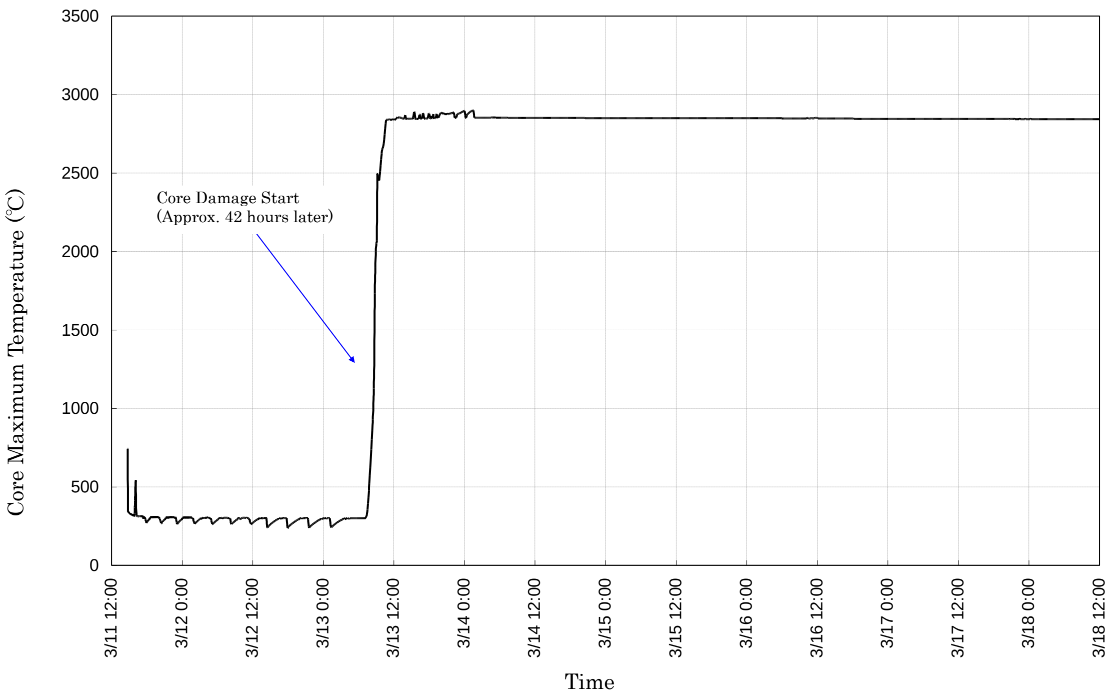


Figure3.3.1.13　Unit3 Core Temperature[Case1] (Continued Injection)

3.3.2.2 Analysis Result (Analysis Case 2)

Table 3.3.4 shows the result of analysis based on the condition shown in 3.3.1. And from Fig. 3.3.2.1 to Fig 3.3.2.9 show the result of analysis about the trend of reactor water level etc.

Table 3.3.4 Summary of Analysis Result on Unit 3

Item	Analysis Result
Start of reactor core exposure	Approx. 40 hours after earthquake
Start of reactor core damages	Approx. 42 hours after earthquake
Start of reactor pressure vessel breach	Approx. 66 hours after earthquake

The detail of analysis result is as follows.

The reactor water level gradually comes down after HPCI stops and the reactor core starts exposed, and the reactor core exposed completely by opening SRV and the reactor core damage starts (see Fig.3.3.2.1). Although the water injection starts, the assumed water injection flow is not enough so that the water level does not increase over the bottom of active fuel and as a result the reactor core is damaged more seriously than in case 1 (see Fig.3.3.2.1).

Regarding the reactor pressure, there is a temporary increase by the steam generated by the relocation of reactor core to the lower plenum, but other behavior is almost same as the result of Case 1 (see Fig.3.3.2.2).

Regarding the pressure of PCV, it is similar to the reactor pressure, there is a temporary increase by the steam generated by the relocation of reactor core to the lower plenum, but other behavior is almost same as the result of Case 1 (see Fig.3.3.2.3).

Regarding reactor core temperature trend, after HPCI stops, the temperature increases with the decrease of reactor water level, and reach to the melting point of the fuel pellets (see Fig.3.3.2.4).

A large amount of hydrogen is generated when the reactor core is exposed and the temperature of fuel cladding start increasing, the amount equal to the reaction of 59% of fuel cladding in the active fuel range is generated. In the analysis, almost all hydrogen is discharged out of PCV by S/C vent. The amount of production assumed to be enough for causing explosion of the Reactor Building of Unit 3 (see Fig.3.3.2.6).

Regarding the release of radioactive materials, after reactor core damage, noble gases are released from the reactor pressure vessel to S/C, and the result is that almost all noble gas is released by vent. For cesium iodide, the release rate is about 0.5% and most exists in S/C (see Fig.3.3.2.7 and Fig.3.3.2.8).

The result says that, parts of the fuel remain in the reactor pressure vessel, but the reactor pressure vessel is breached. As the water injection flow in the early stage is assumed to be smaller than in Case 1, the result says the damage of reactor core is more serious (see Fig.3.3.2.9).

3.3.3 Evaluation Result

In Analysis Case 1, we have had an analysis result that the reactor core of Unit 3 stays within the fuel range, though a partial fuel-melting pool exists, and the reactor pressure vessel will not be breached. In Analysis Case 2, we have had an analysis result that the reactor vessel has been breached, though part of fuel stays within it.

In addition, as a result of calibration of water-level gauge of Unit 1, we have found that the water level in reactor pressure vessel is not within fuel ranges. We cannot deny the possibility that a similar event has occurred in Unit 3.

Most of fuel is cooled down in the reactor pressure vessel, because, according to plant parameters, temperatures of the steel of the reactor pressure vessel currently change around between approximately 100 degrees Celsius and approximately 200 degrees Celsius and correlate changes in amount of water injected in multiple measuring points and temperatures in some points are increasing in May (though we keep following up conditions while the rate of inflow to the reactor increased) and due to the increase in temperatures their heat source is estimated to come from inside of reactor pressure vessel and the temperatures at the bottom of the reactor pressure vessel change around between approximately 100 degrees Celsius and approximately 170 degrees Celsius and correlate changes in temperatures in other parts of the reactor pressure vessel.

Hence, according to the analysis and plant parameters, it is evaluated that reactor core has been significantly damaged, relocated below or slumped to the lower plenum from fixed position of fuel loading, however most of it is being stably cooled down around there.

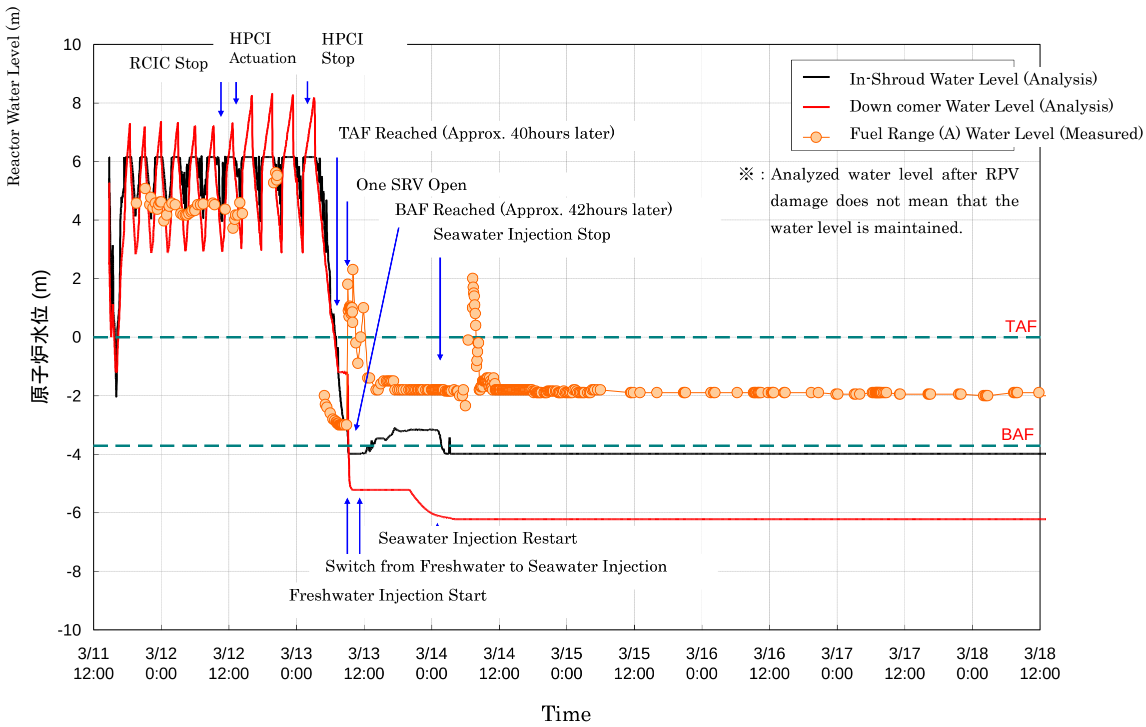


Figure3.3.2.1 Unit3 Reactor Water Level[Case2]

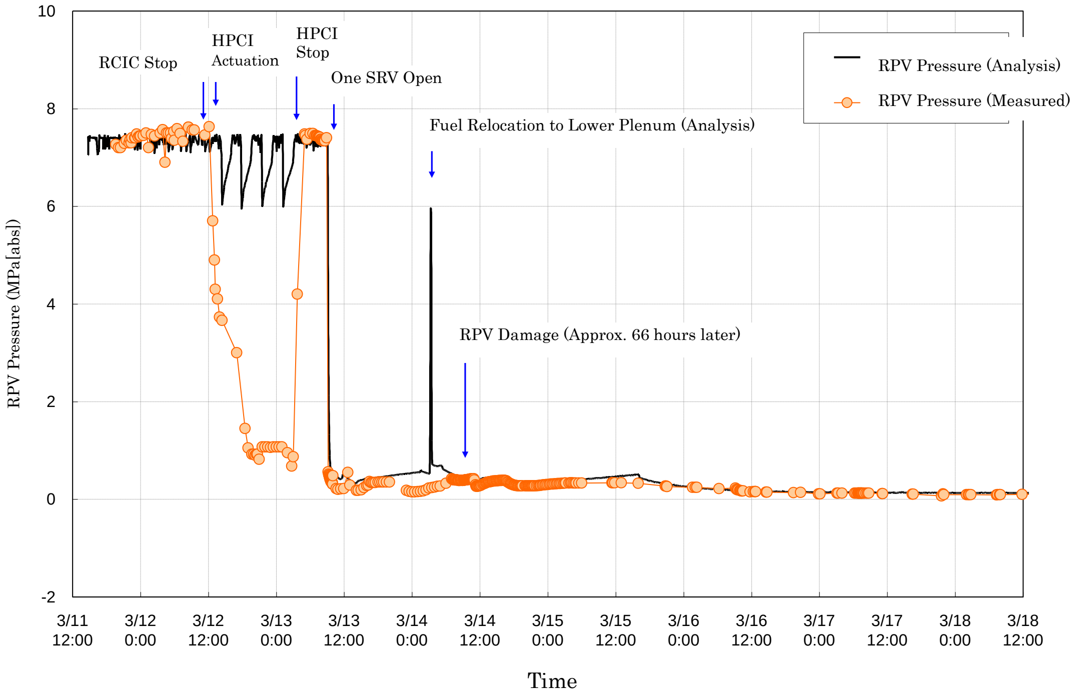


Figure3.3.2.2 Unit3 RPV Pressure[Case2]

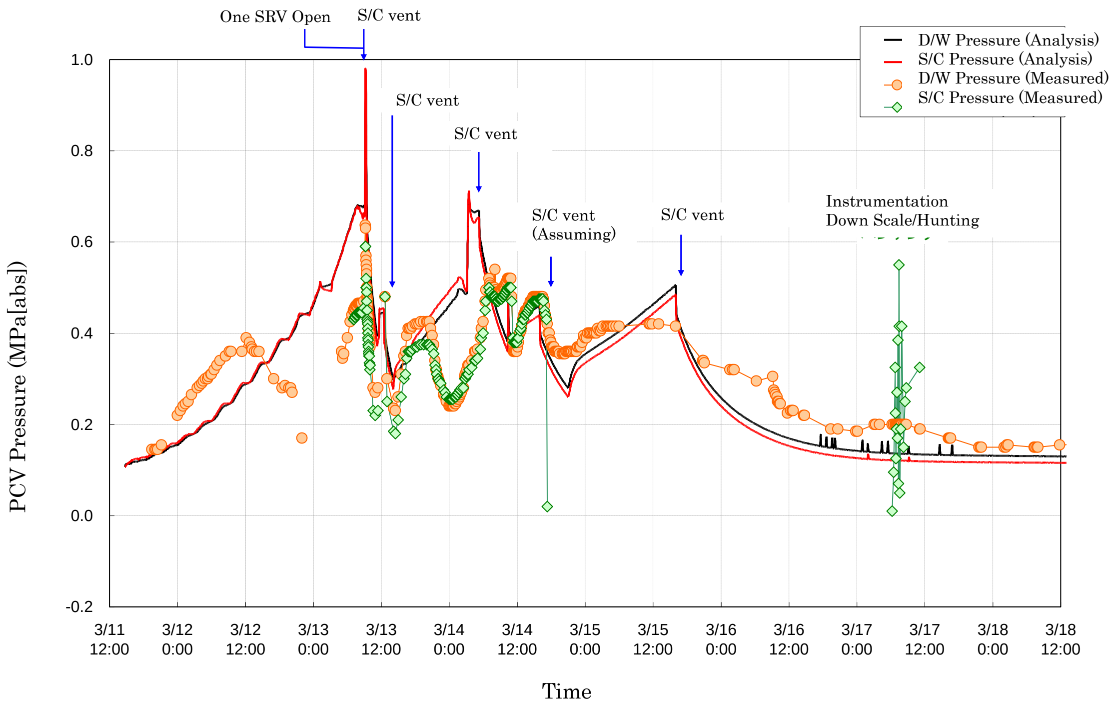


Figure3.3.2.3　Unit2 PCV Pressure[Case2]

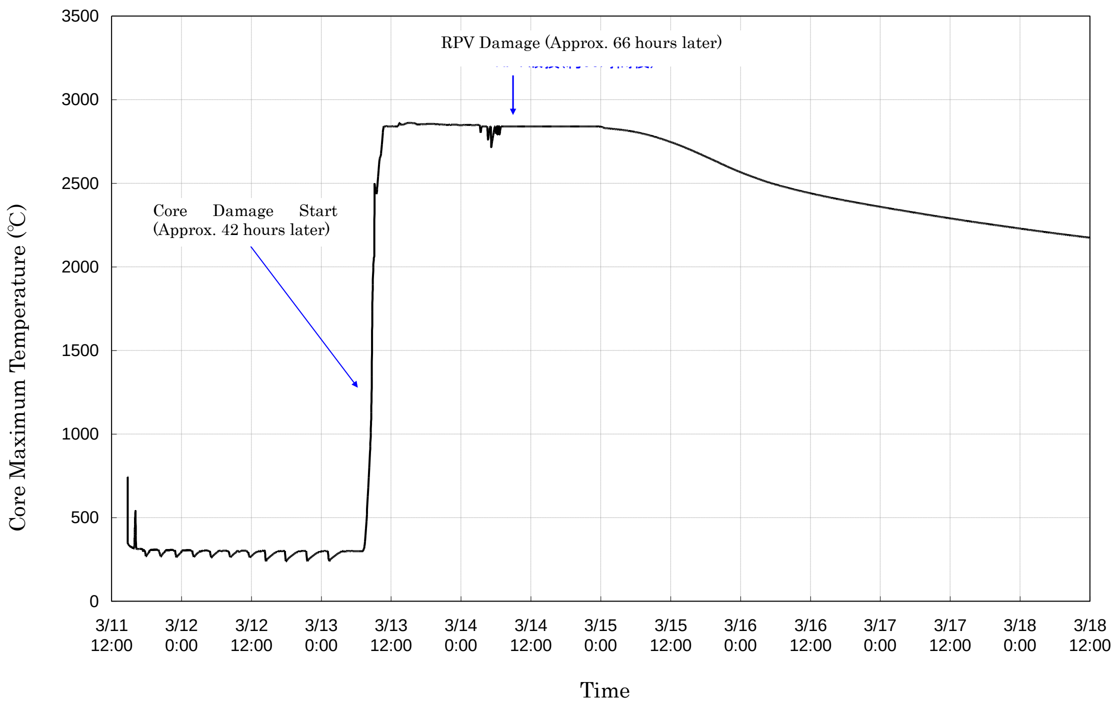


Figure3.3.2.4　Unit3 Core Temperature[Case2]

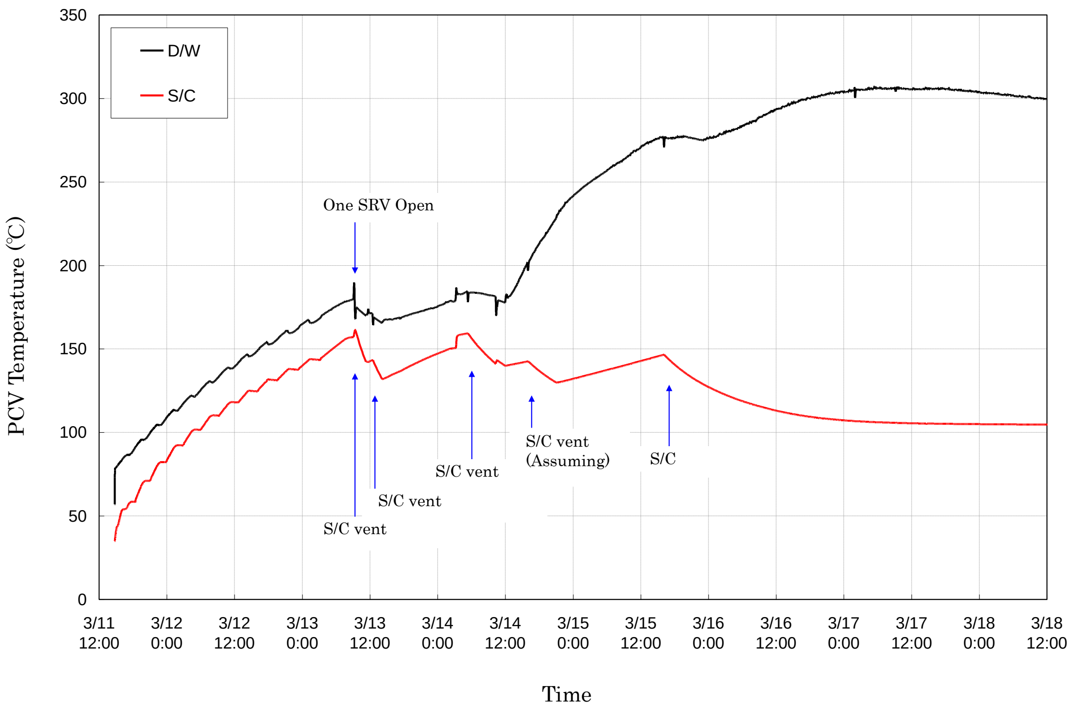


Figure3.3.2.5　Unit3 PCV Temperature[Case2]

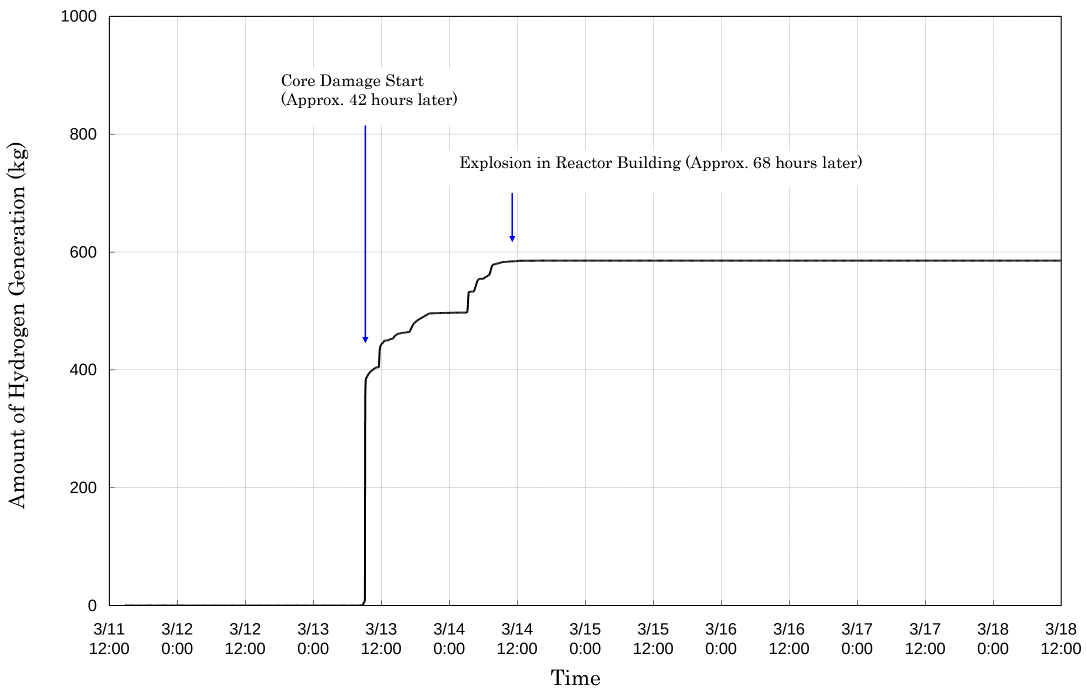


Figure3.3.2.6　Unit3 Amount of Hydrogen Generation[Case2]

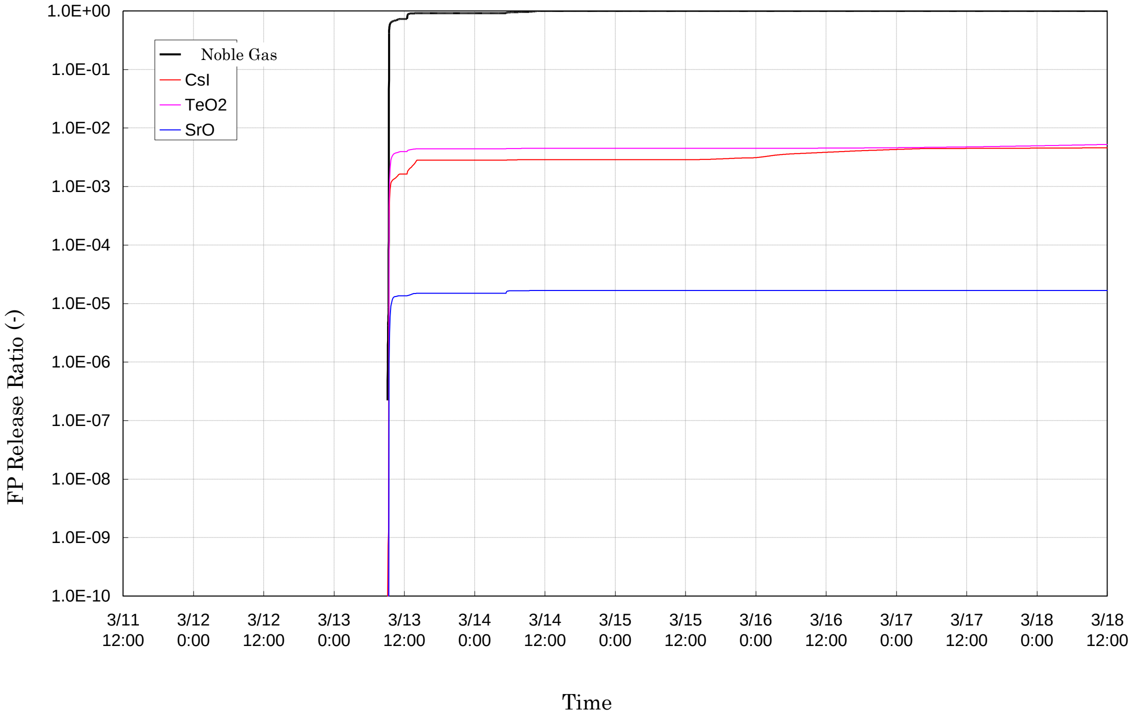


Figure3.3.2.7　Unit3 FP Release Ratio(1/3)[Case2]

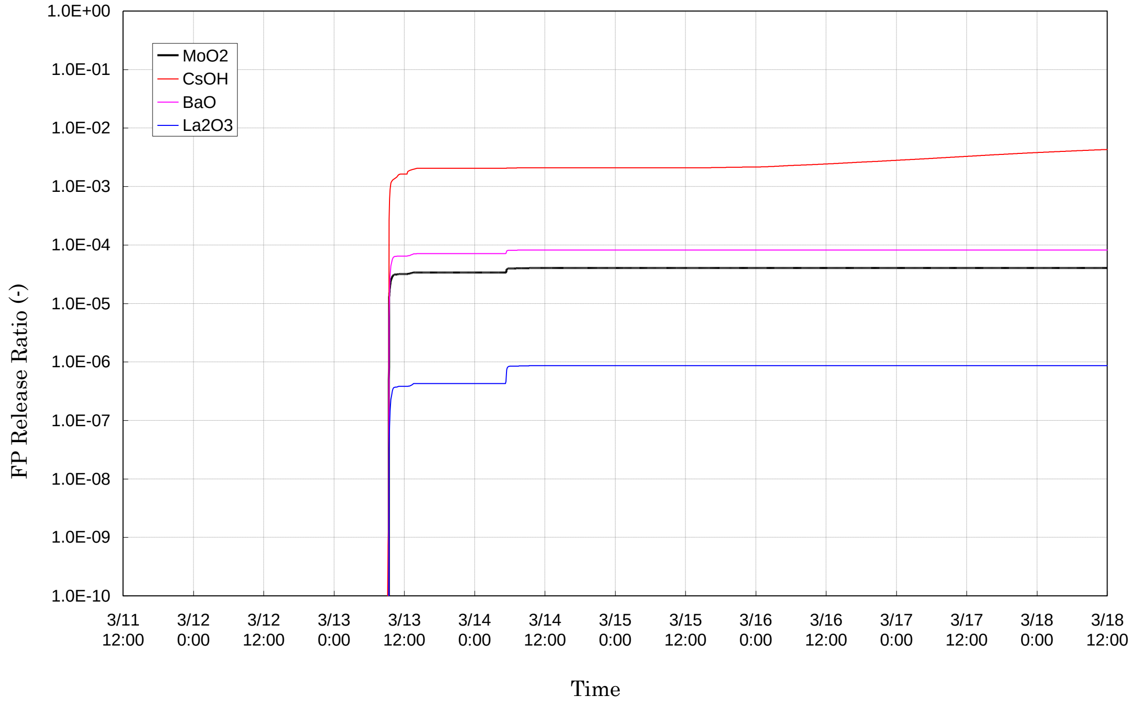


Figure3.3.2.7　Unit3 FP Release Ratio(2/3)[Case2]

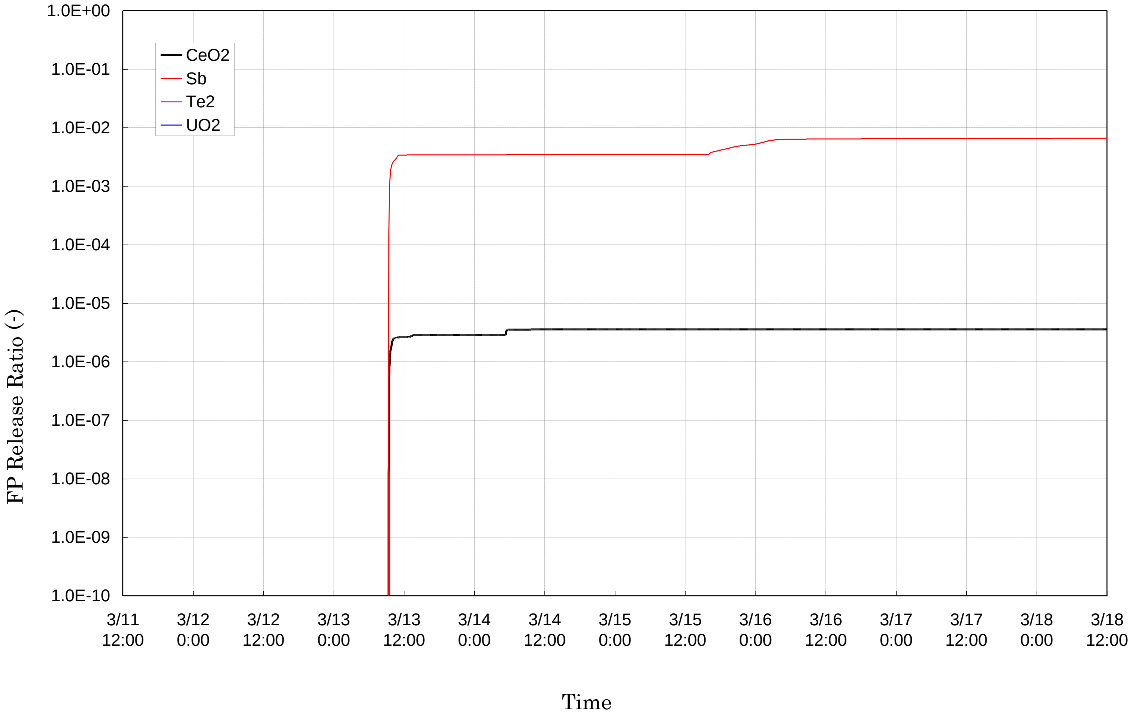


Figure3.3.2.7 Unit3 FP Release Ratio(3/3)[Case2]

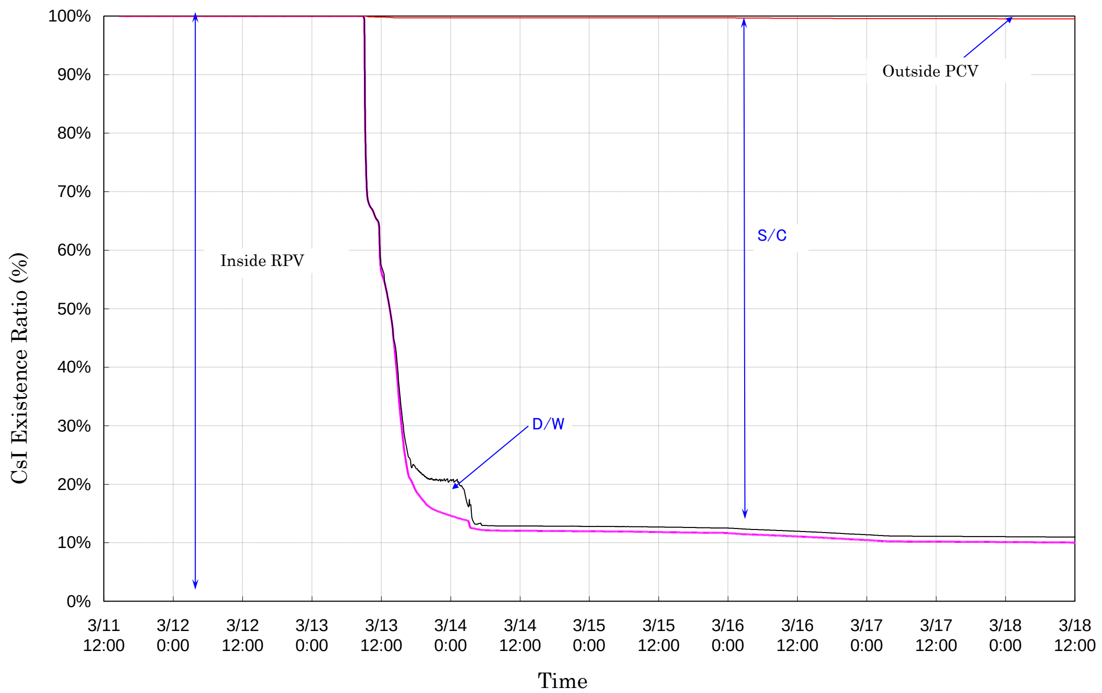


Figure3.3.2.8 Unit3 FP Existence Ratio(1/2)[Case2]

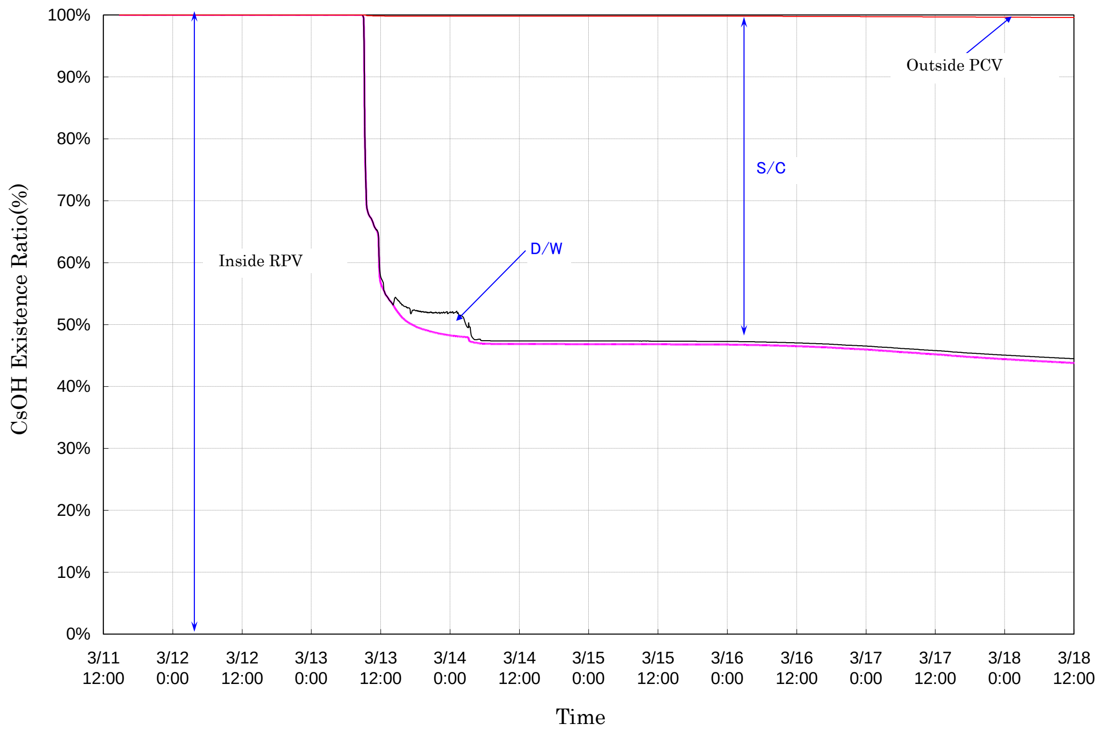
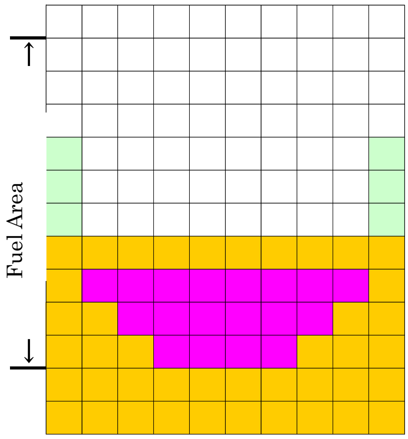
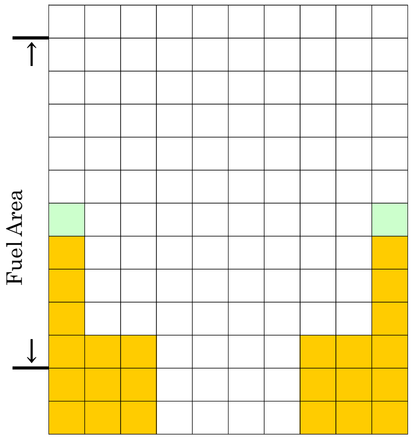


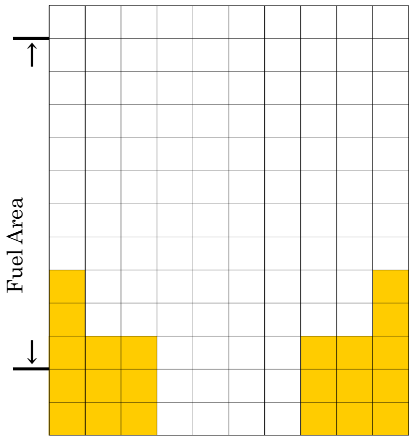
Figure3.3.2.8　Unit2 FP Existence Ratio(2/2)[Case2]



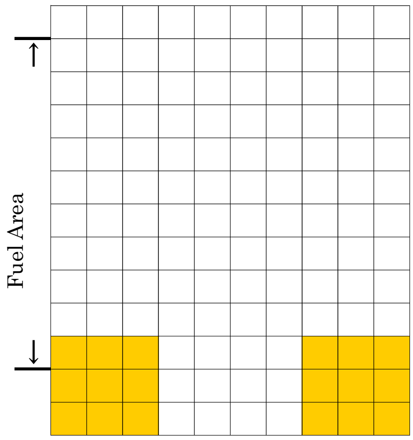
Approx. 58 hours after SCRAM



Approx. 62 hours after SCRAM



Approx. 66 hours after SCRAM



Approx. 96 hours after SCRAM

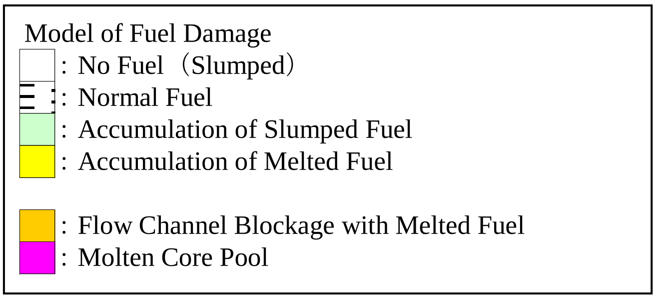


Figure3.3.2.9 Unit3 Core Status[Case2]

Abstracts of the cross check analysis on the evaluation of the cores of Unit 1, 2 and 3 of Fukkushima Dai-ichi NPP reported by TEPCO

１． Abstracts

On the accident of Fukushima Dai-ichi NPP, a lot of works to converge it and collecting essential information to determine the cause are in progress. Nuclear and Industry Safety Agency (NISA) issued to TEPCO to submit reports of accident records and others related to the Fukushima Dai-ichi NPP on April 25 pursuant to the Provisions of Article 67, Paragraph 1 of the Act on Regulation of Nuclear Source Materials, Nuclear Fuel Materials and Reactors and Article 106, Paragraph 3 of the Electricity Business Act, with the purpose of implementing adequate measures going forward. According to the report, NISA directed TEPCO on May 16 to submit reports of evaluation of safety on nuclear reactor facilities regarding to the analysis of records before and after the earthquake.

On the core damage unit 1 through 3 of Fukushima Dai-ichi NPP, TEPCO submitted evaluation reports, which were calculated by severe accident analysis code MAAP based on the operation records and observed parameters, to NISA on May 23

NISA examined the reports to confirm the validity of analysis and evaluation. The examination was carried out by using other severe accident analysis code, Methods for Estimation of Leakages and Consequences of Releases (MELCOR), supported by Japan Nuclear Energy Safety Organization (JNES). Abstract of analysis results by MELCOR is described below.

２． Analysis methods and conditions

Based on the observed data, chronology, etc. of Unit 1 through 3 of Fukushima Dai-ichi NPP which were reported by utility, computational analysis was calculated. A severe accident analysis code MELCOR, which is developed by US NRC in charge and is used widely by regulators and TSOs as JNES, was used in this work.

On the MELCOR analysis, transient of plant during 4 days from the accident, major events occurred, was calculated. We cared a lot about parameters which have great effect on the consequences or whose chronology is uncertain. According to the sensitivity analysis on them, uncertain chronology was confirmed and accident scenario was studied.

For example, analysis conditions conducted by TEPCO were confirmed and sensitivity analyses, shown in Tables 1-a, 2-a, and 3-a, were carried out.

３．Results and conclusions

Abstracts of MELCOR analysis are described below. Comparisons to the results of utility are shown in Table 1-1～3, Table 2-1～2, and Table 3-1～2.

Release ratio of fission products to the environment in each analysis is shown in Table 4. Preliminary calculation of fission products, regarding inventory of each unit, released to the environment during the term of the analysis is shown in Table 5. This work was calculated by using conditions (IC operation, PCV ventilation, alternative water injection, etc.) based on the operation record, alarms, and plant behavior at the transition which were reported by TEPCO on May 16. Total amount of fission products released to the environment was scrutinized and total amount of I□131 and Cs-137 (conversion to I□131) from unit 1, 2, and 3 is 840000 TBq. Compared to the reported value 370000 TBq (630000 TBq by NSC) for INES on April 12, it is in the same range.

Information about operation and behavior of equipment is still insufficient, however, further investigation is conducted to reveal the cause of accident.

Table 1-a Analysis conditions on Unit 1

Identifier	Analysis conditions	Remarks（results）
TEPCO	Correspond to utility's analysis	Table 1-1, Fig. 1-1-1～11
Case 1	Increasing of heat removal (restart IC-B with IC-A)	Table 1-2, Fig. 1-2-1～2
Case 2	①Amount of water injected through the fire protection line varies with RPV pressure. ②PCV leakage area at 50 hours is ca. 35 cm^2.	Table 1-3, Fig. 1-3-1～12

Table 2-a Analysis conditions on Unit 2

Identifier	Analysis conditions	Remarks（results）
TEPCO-1	Correspond to utility's analysis No.1	Table 2-1、Fig.2-1-1～13
TEPCO-2	Correspond to utility's analysis No.2 ①Amount of water injected through the fire protection line varies with RPV pressure. ②PCV leakage area is ca. 50 cm^2. ③S/C leakage area is ca. 300 cm^2	Table 2-2, Fig.2-2-1～12
Case-1	Based on the utility's analysis No.1, but ①PCV is intact	Fig.2-3-1～2
Case-2	Based on the utility's analysis No.1, but ①PCV leakage area is ca. 50 cm^2.	Fig.2-4-1
Case-3	Based on the utility's analysis No.1, but ①S/C leakage area is ca. 300 cm^2	Fig.2-5-1

Table 3-a Analysis conditions on Unit 3

Identifier	Analysis conditions	Remarks（results）
TEPCO-1	Correspond to utility's analysis No.1	Table 3-1, Fig.3-1-1～11
TEPCO-2	Correspond to utility's analysis No.2	Table 3-2, Fig.3-2-1～14

Table 1-1 Result of analysis on Unit 1 [TEPCO] and comparison to the utility's result

Event	Results (this work)		Utility's result
Core exposure	16：40, Mar. 11	2 hours (relative time)	3 hours (relative time)
Core damage	18：00, Mar. 11	3 hours (relative time)	4 hours (relative time)
RPV failure	20：00, Mar. 11	5 hours (relative time)	15 hours (relative time)

Table 1-2 Result of analysis on Unit 1 [case 1] and comparison to the utility's result

Event	Results (this work)		Utility's result
Core exposure	16：50, Mar. 11	2 hours (relative time)	3 hours (relative time)
Core damage	18：20, Mar. 11	4 hours (relative time)	4 hours (relative time)
RPV failure	2：50, Mar. 12	12 hours (relative time)	15 hours (relative time)

Table 1-3 Result of analysis on Unit 1 [case 2] and comparison to the utility's result

Event	Results (this work)		Utility's result
Core exposure	16：40, Mar. 11	2 hours (relative time)	3 hours (relative time)
Core damage	18：00, Mar. 11	3 hours (relative time)	4 hours (relative time)
RPV failure	20：00, Mar. 11	5 hours (relative time)	15 hours (relative time)

Table 2-1 Result of analysis on Unit 2 [TEPCO-1] and comparison to the utility's result

Event	Results (this work)		Utility's result (No.1)
Core exposure	18：00, Mar 14	75 hours (relative time)	75 hours (relative time)
Core damage	22：30, Mar 14	80 hours (relative time)	77 hours (relative time)
RPV failure	— (RPV doesn't fail)		— (RPV doesn't fail)

Table 2-2 Result of analysis on Unit 2 [TEPCO-2] and comparison to the utility's result

Event	Results (this work)		Utility's result (No.2)
Core exposure	18：00, Mar 14	75 hours (relative time)	75 hours (relative time)
Core damage	19：50, Mar 14	77 hours (relative time)	77 hours (relative time)
RPV failure	22：50, Mar 14	80 hours (relative time)	109 hours (relative time)

Table 3-1 Result of analysis on Unit 3 [TEPCO-1] and comparison to the utility's result

Event	Results (this work)		Utility's result (No. 1)
Core exposure	7：40, Mar 13	41 hours (relative time)	40 hours (relative time)
Core damage	10：20, Mar 13	44 hours (relative time)	42 hours (relative time)
RPV failure	— (RPV doesn't fail)		— (RPV doesn't fail)

Table 3-2 Result of analysis on Unit 3 [TEPCO-2] and comparison to the utility's result

Event	Results (this work)		Utility's result (No. 2)
Core exposure	7：40, Mar 13	41 hours (relative time)	40 hours (relative time)
Core damage	10：20, Mar 13	44 hours (relative time)	42 hours (relative time)
RPV failure	22：10, Mar 14	79 hours (relative time)	66 hours (relative time)

Table 4 FP release ratio

Unit	Identifier of analysis	Noble gas	CsI	Cs	Te	Ba	Ru	Ce	La
1	TEPCO	9.9E-01	1.9E-03	9.1E-04	2.4E-02	1.2E-04	6.4E-09	1.1E-06	1.1E-06
	Case 1	9.5E-01	1.2E-03	8.2E-04	1.1E-02	6.2E-05	2.1E-11	8.9E-07	6.9E-07
	Case 2	9.5E-01	6.6E-03	2.9E-03	1.1E-02	4.0E-05	9.0E-10	1.4E-07	1.2E-07
2	TEPCO-1	8.1E-01	3.8E-03	3.4E-03	4.2E-03	4.9E-04	7.6E-10	7.4E-11	6.5E-08
	TEPCO-2	9.6E-01	6.7E-02	5.8E-02	3.0E-02	2.6E-04	5.4E-10	4.0E-06	8.4E-07
	Case 1	9.7E-01	1.3E-03	4.6E-04	2.5E-04	3.3E-04	2.0E-11	1.5E-12	1.5E-09
	Case 2	9.7E-01	3.9E-02	3.8E-02	5.1E-02	2.9E-04	4.1E-11	8.2E-06	1.1E-06
	Case 3	9.7E-01	4.1E-02	3.9E-02	3.5E-02	4.0E-04	4.6E-11	1.3E-05	1.2E-06
3	TEPCO-1	6.5E-01	8.2E-03	5.9E-03	2.7E-03	6.1E-04	2.9E-10	2.5E-11	2.7E-08
	TEPCO-2	9.9E-01	3.0E-03	2.7E-03	2.4E-03	4.3E-04	8.6E-10	5.0E-08	1.3E-07

Table 5 Preliminary calculation of FP released to the environment
in the early stage of Fukushima Ddai-ichi accident（Bq）

			Unit 1	Unit 2	Unit 3	Total
Xe-133	5.2	d	3.4×10^{18}	3.5×10^{18}	4.4×10^{18}	1.1×10^{19}
Cs-134	2.1	y	7.1×10^{14}	1.6×10^{16}	8.2×10^{14}	1.8×10^{16}
Cs-137	30.0	y	5.9×10^{14}	1.4×10^{16}	7.1×10^{14}	1.5×10^{16}
Sr-89	50.5	d	8.2×10^{13}	6.8×10^{14}	1.2×10^{15}	2.0×10^{15}
Sr-90	29.1	y	6.1×10^{12}	4.8×10^{13}	8.5×10^{13}	1.4×10^{14}
Ba-140	12.7	d	1.3×10^{14}	1.1×10^{15}	1.9×10^{15}	3.2×10^{15}
Te-127m	109.0	d	2.5×10^{14}	7.7×10^{14}	6.9×10^{13}	1.1×10^{15}
Te-129m	33.6	d	7.2×10^{14}	2.4×10^{15}	2.1×10^{14}	3.3×10^{15}
Te-131m	30.0	h	9.5×10^{13}	5.4×10^{10}	1.8×10^{12}	9.7×10^{13}
Te-132	78.2	h	7.4×10^{14}	4.2×10^{11}	1.4×10^{13}	7.6×10^{14}
Ru-103	39.3	d	2.5×10^{09}	1.8×10^{09}	3.2×10^{09}	7.5×10^{09}
Ru-106	368.2	d	7.4×10^{08}	5.1×10^{08}	8.9×10^{08}	2.1×10^{09}
Zr-95	64.0	d	4.6×10^{11}	1.6×10^{13}	2.2×10^{11}	1.7×10^{13}
Ce-141	32.5	d	4.6×10^{11}	1.7×10^{13}	2.2×10^{11}	1.8×10^{13}
Ce-144	284.3	d	3.1×10^{11}	1.1×10^{13}	1.4×10^{11}	1.1×10^{13}
Np-239	2.4	d	3.7×10^{12}	7.1×10^{13}	1.4×10^{12}	7.6×10^{13}
Pu-238	87.7	y	5.8×10^{08}	1.8×10^{10}	2.5×10^{08}	1.9×10^{10}
Pu-239	24065	y	8.6×10^{07}	3.1×10^{09}	4.0×10^{07}	3.2×10^{09}
Pu-240	6537	y	8.8×10^{07}	3.0×10^{09}	4.0×10^{07}	3.2×10^{09}
Pu-241	14.4	y	3.5×10^{10}	1.2×10^{12}	1.6×10^{10}	1.2×10^{12}
Y-91	58.5	d	3.1×10^{11}	2.7×10^{12}	4.4×10^{11}	3.4×10^{12}
Pr-143	13.6	d	3.6×10^{11}	3.2×10^{12}	5.2×10^{11}	4.1×10^{12}
Nd-147	11.0	d	1.5×10^{11}	1.3×10^{12}	2.2×10^{11}	1.6×10^{12}
Cm-242	162.8	d	1.1×10^{10}	7.7×10^{10}	1.4×10^{10}	1.0×10^{11}
I-131	8.0	d	1.2×10^{16}	1.4×10^{17}	7.0×10^{15}	1.6×10^{17}
I-132	2.3	h	4.5×10^{14}	9.6×10^{11}	1.8×10^{13}	4.7×10^{14}
I-133	20.8	h	6.5×10^{14}	1.4×10^{12}	2.6×10^{13}	6.8×10^{14}
I-135	6.6	h	6.1×10^{14}	1.3×10^{12}	2.4×10^{13}	6.3×10^{14}
Sb-127	3.9	d	1.7×10^{15}	4.2×10^{15}	4.5×10^{14}	6.4×10^{15}
Sb-129	4.3	h	1.6×10^{14}	8.9×10^{10}	3.0×10^{12}	1.6×10^{14}
Mo-99	66.0	h	8.1×10^{07}	1.0×10^{04}	6.7×10^{06}	8.8×10^{07}

※：Evaluated by using the results of case2(unit 1), TEPCO-2(unit 2), TEPCO-2(unit3) in table 4

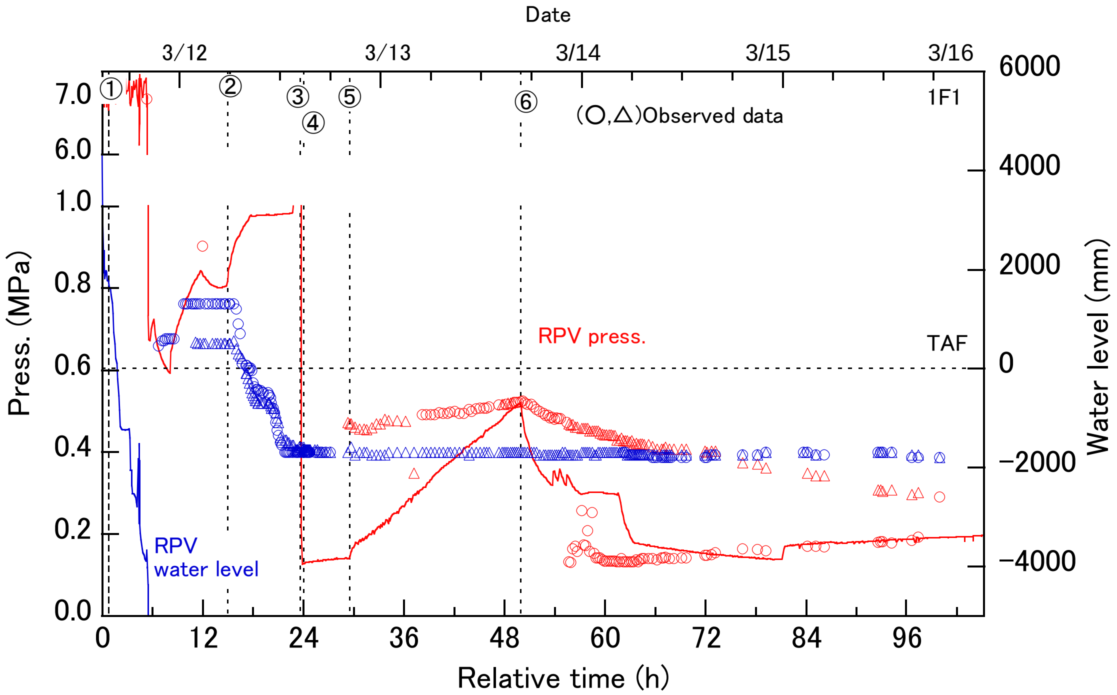


Fig. 1-1-1 RPV pressure and water level (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

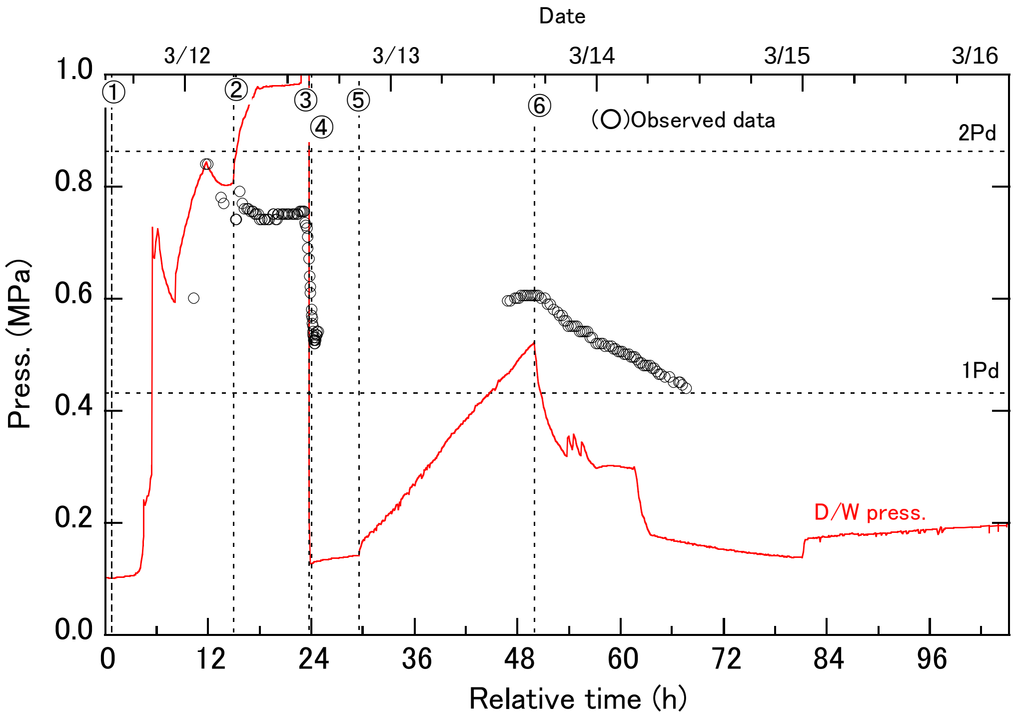


Fig. 1-1-2 D/W pressure (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

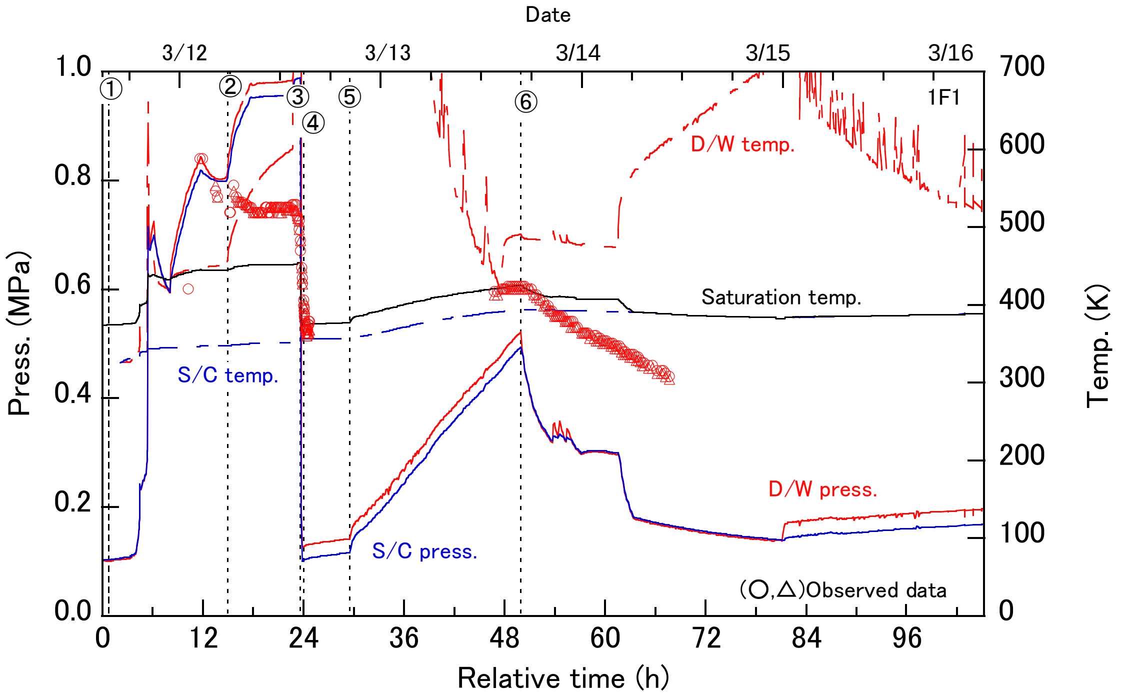


Fig. 1-1-3 PCV pressure and temperature (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

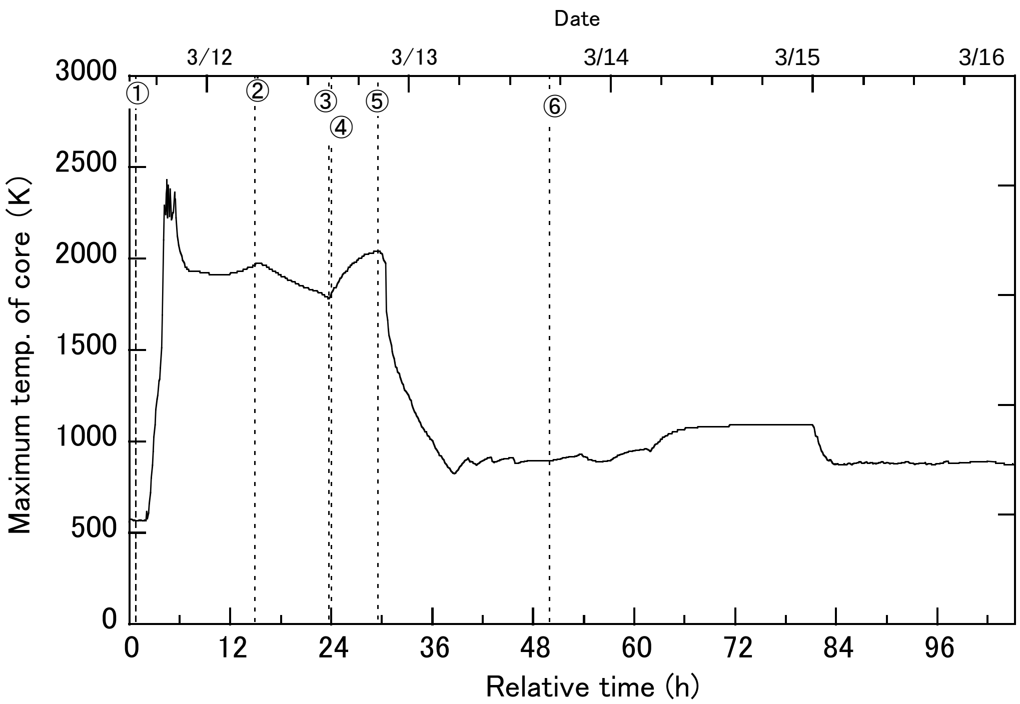


Fig. 1-1-4 Maximum temperature of the core (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

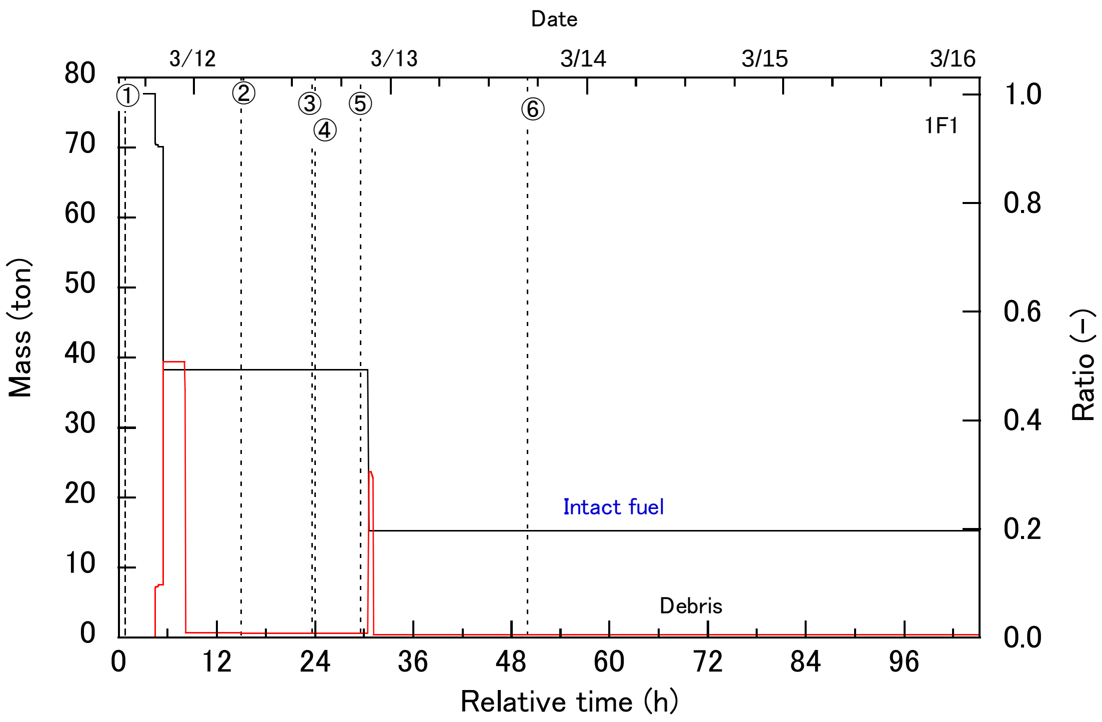


Fig. 1-1-5 Mass of the core (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

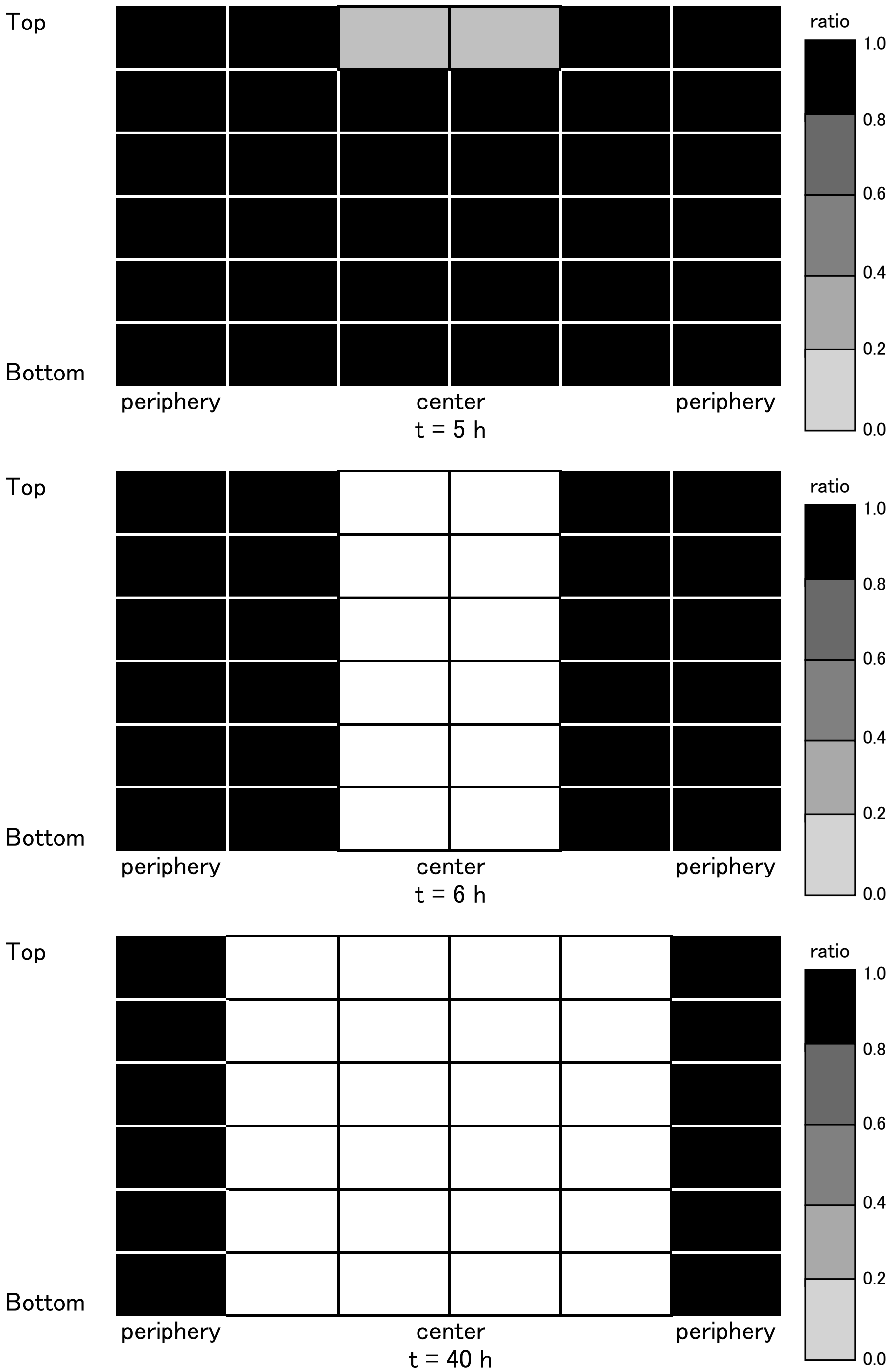


Fig. 1-1-6 Distribution of intact fuel (unit 1) [TEPCO]

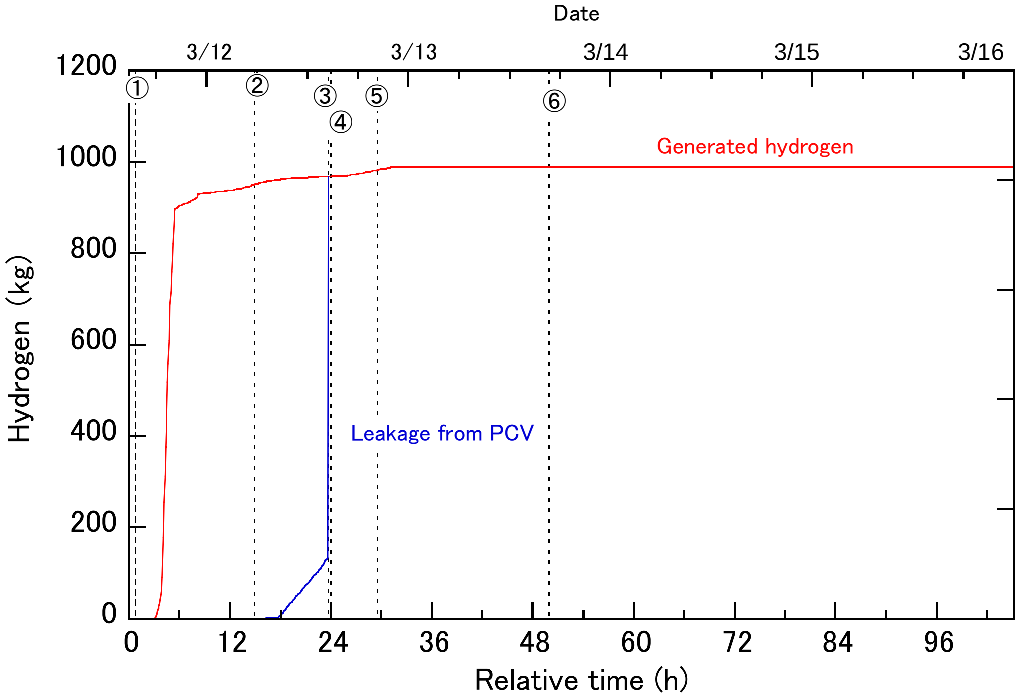
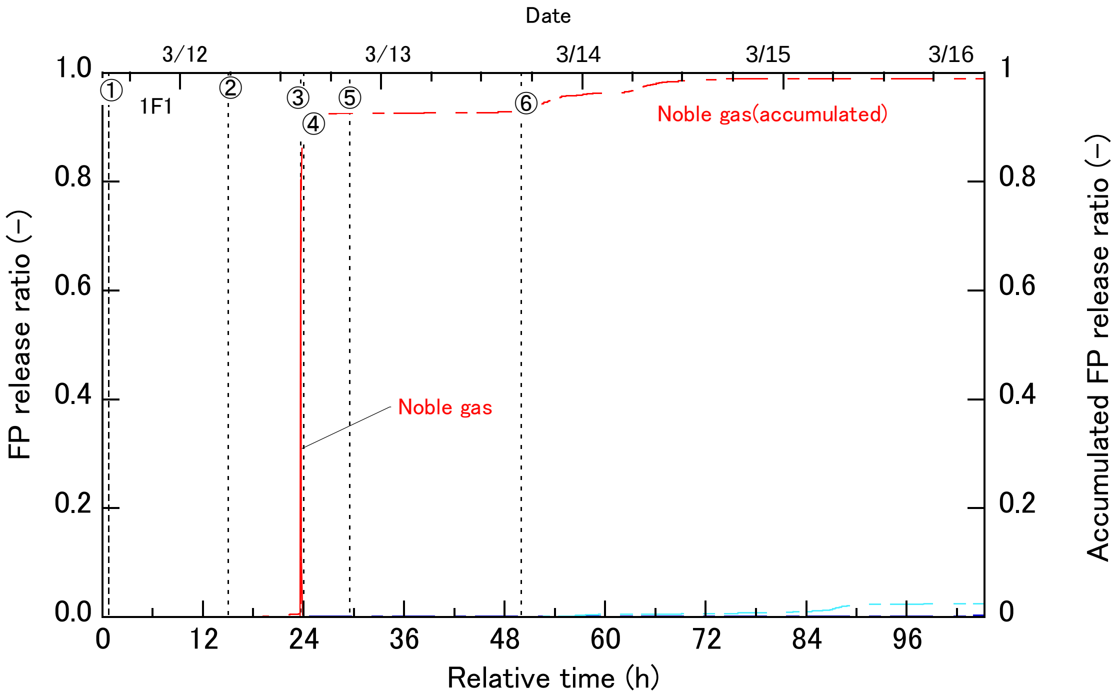


Fig. 1-1-7 Hydrogen generation (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)



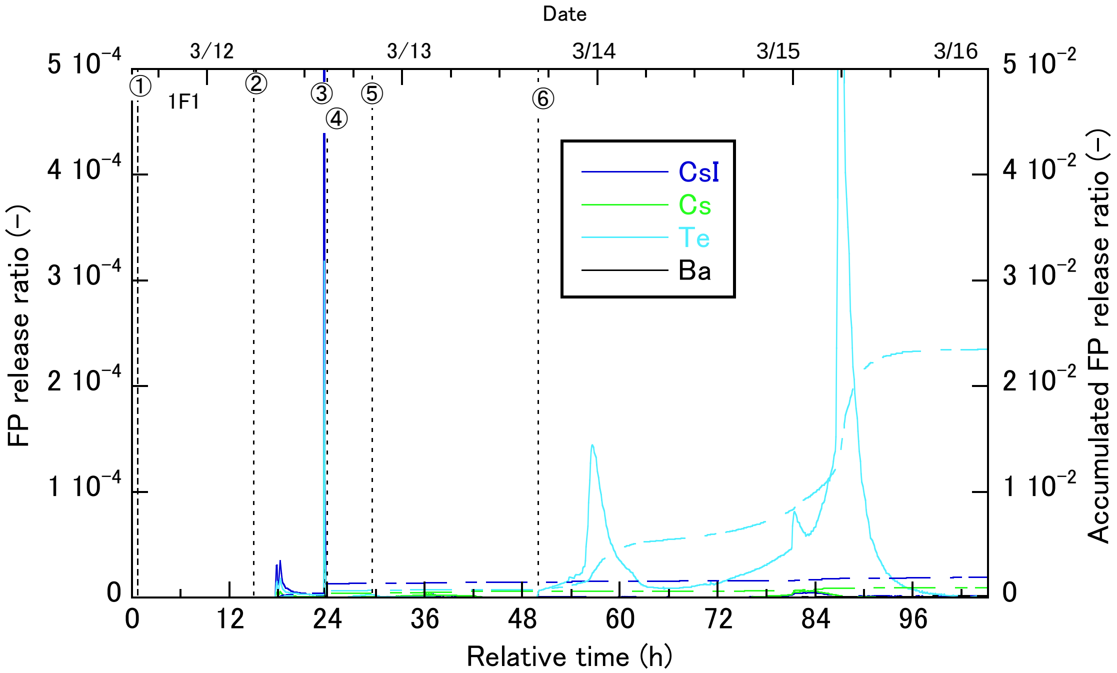


Fig. 1-1-8 FP release ratio to the environment (1/2) (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

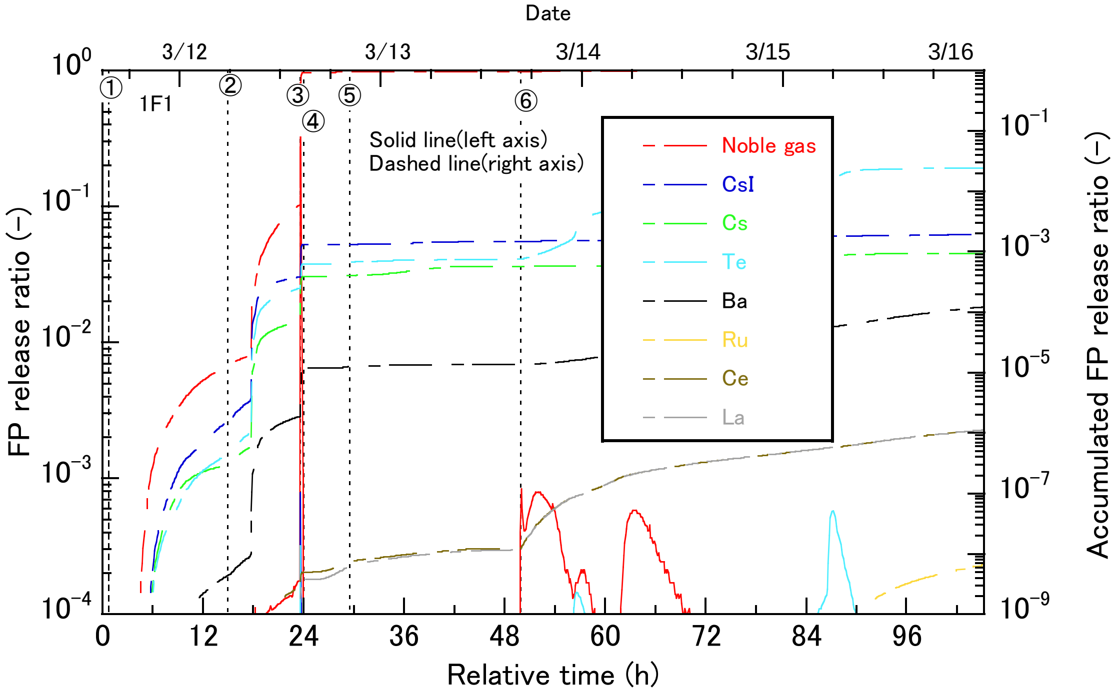


Fig. 1-1-9 FP release ratio to the environment (2/2) (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

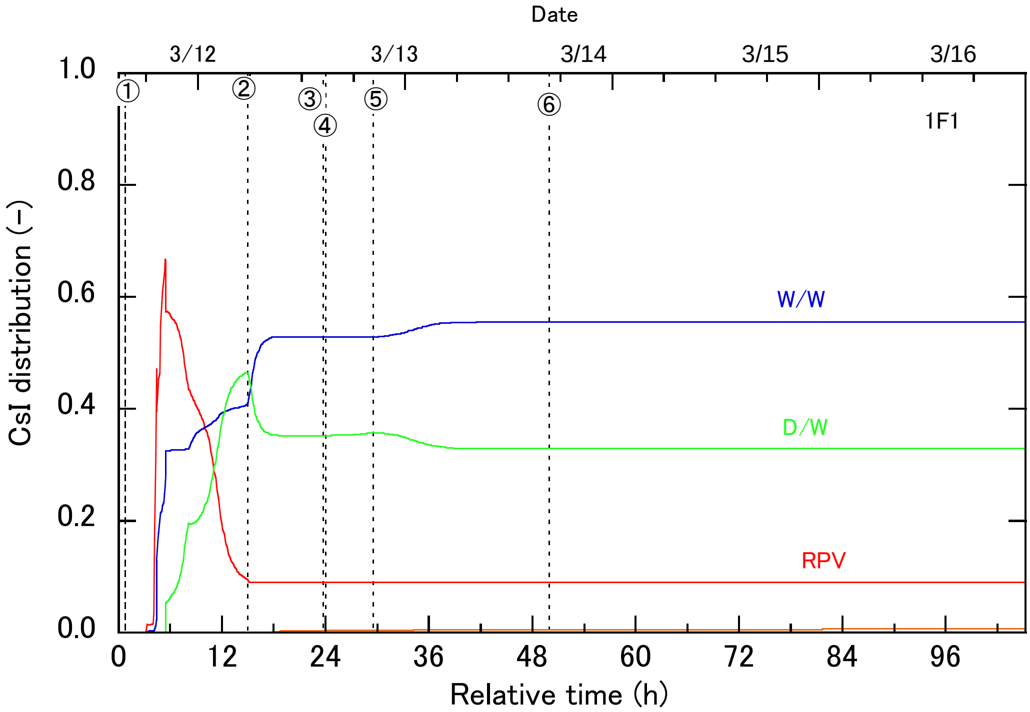


Fig. 1-1-10 Distribution of CsI (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

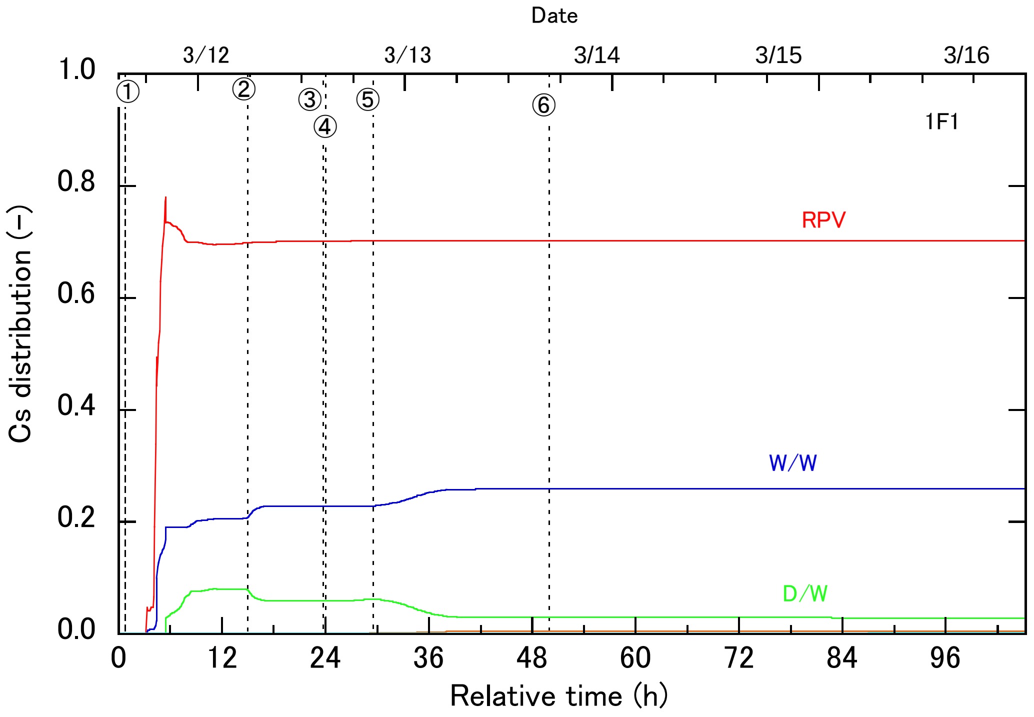


Fig. 1-1-11 Distribution of Cs (unit 1) [TEPCO]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

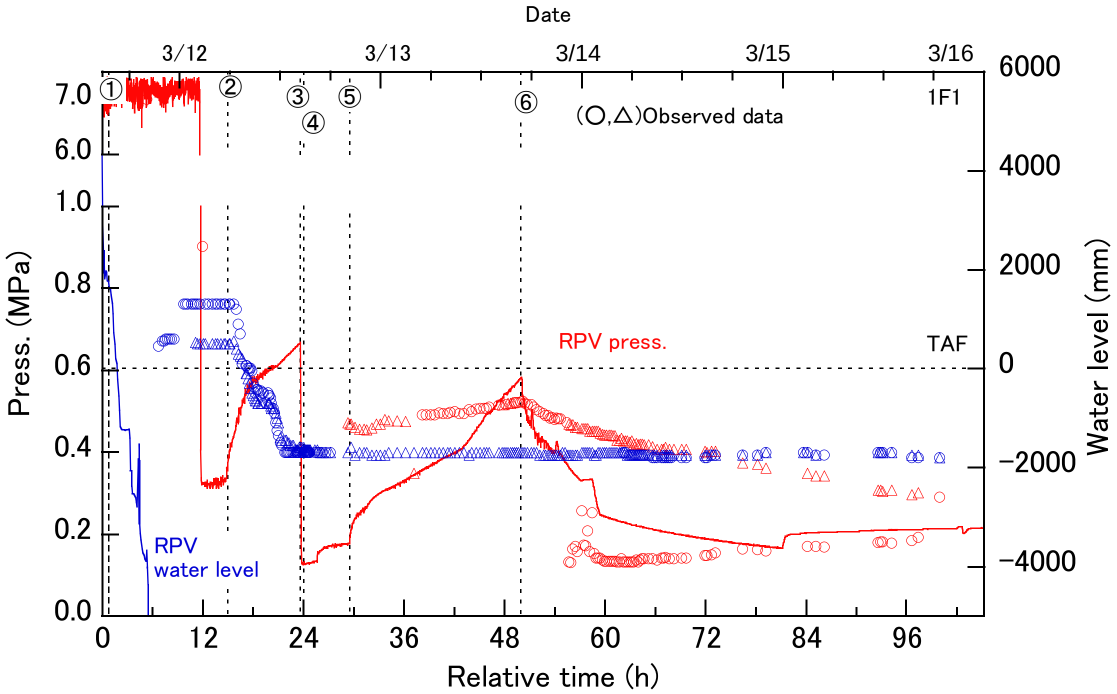


Fig. 1-2-1 RPV pressure and water level (unit 1) [case 1]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

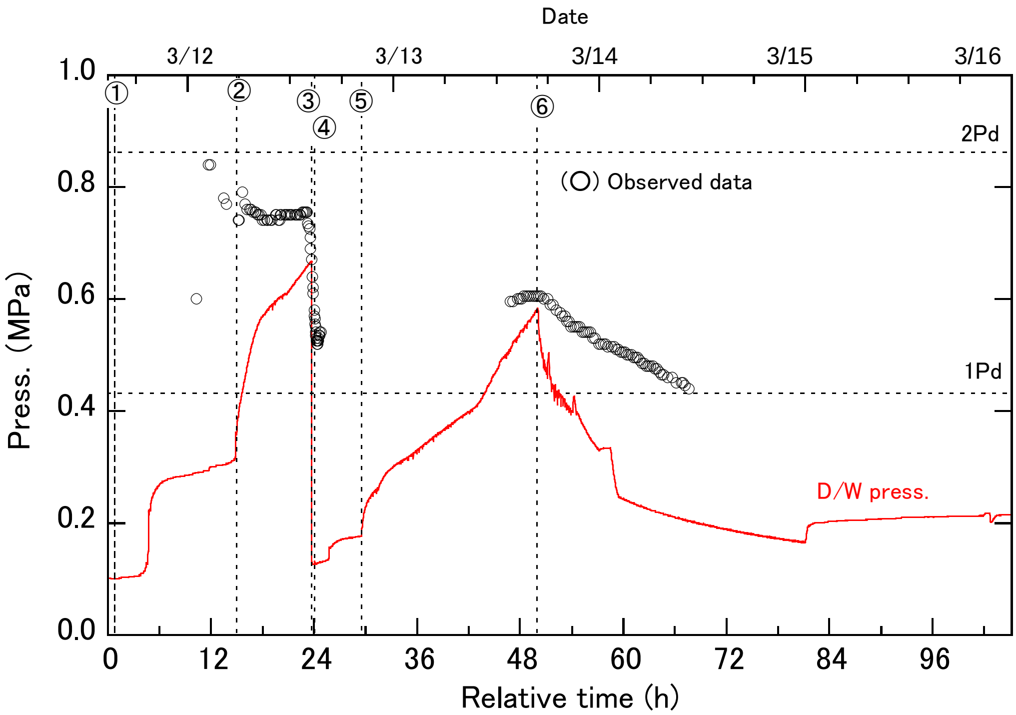


Fig. 1-2-2 D/W pressure (unit 1) [case 1]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

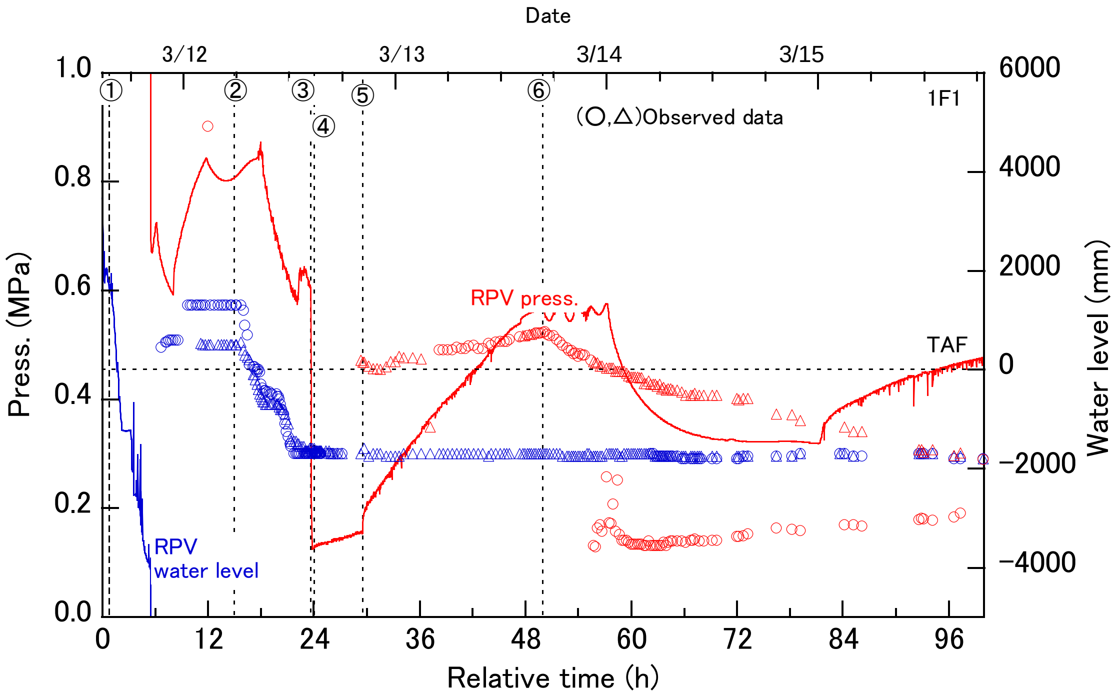


Fig. 1-3-1 RPV pressure and water level (unit 1) [case 2]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

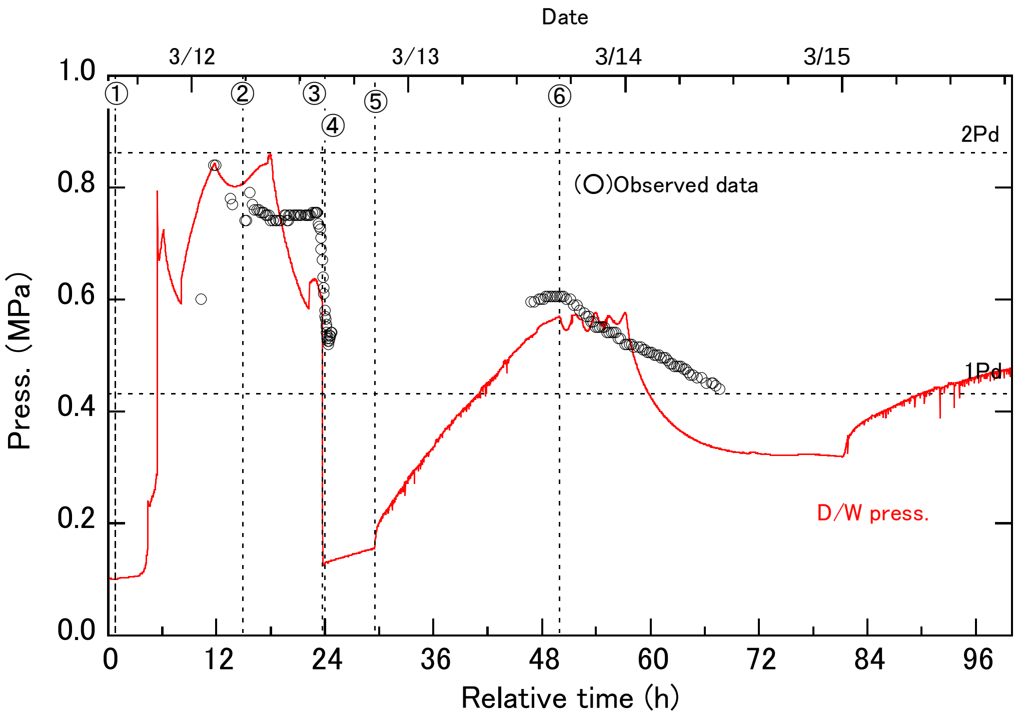


Fig. 1-3-2 D/W pressure (unit 1) [case 2]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

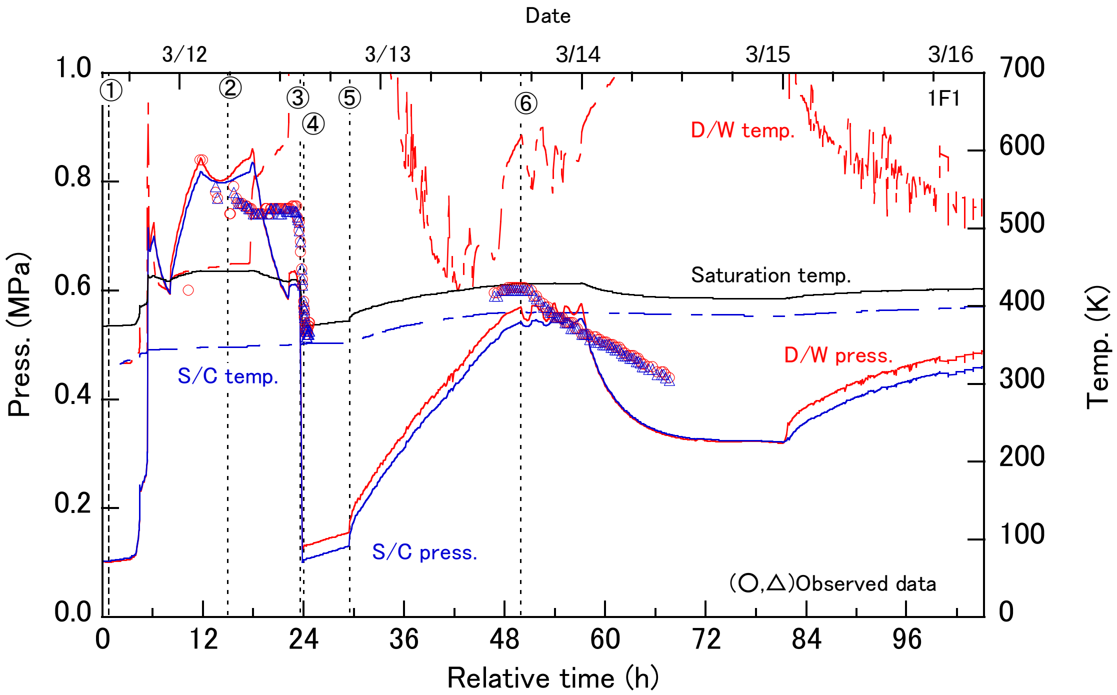


Fig. 1-3-3 PCV pressure and temperature (unit 1) [case 2]
①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

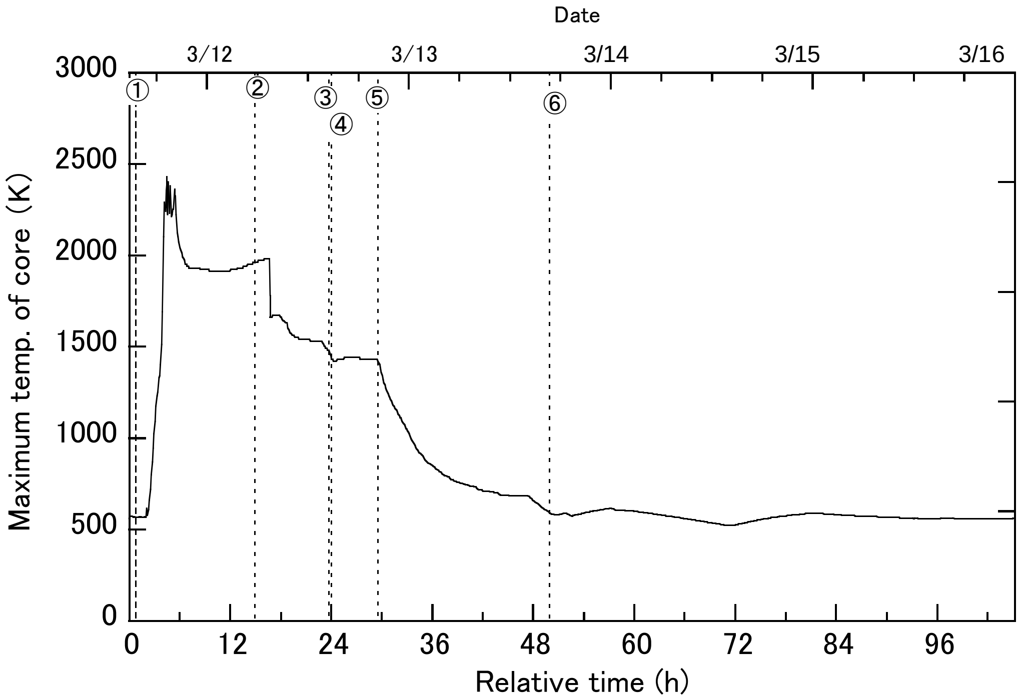


Fig. 1-3-4 Maximum temperature of the core (unit 1) [case 2]
①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

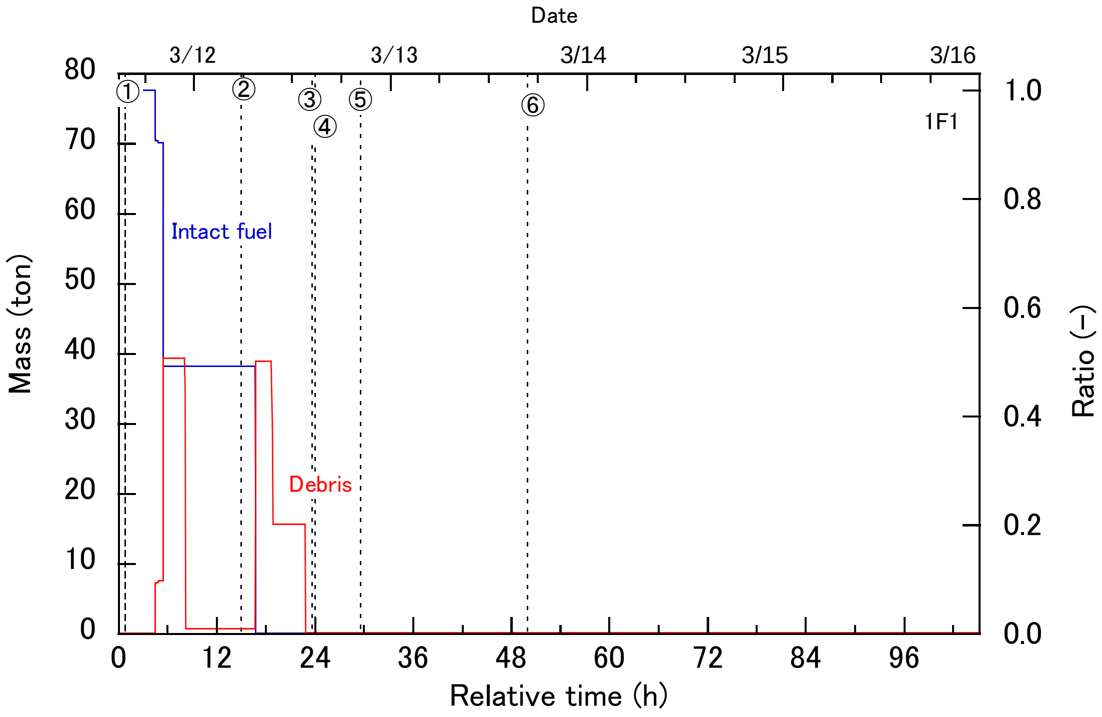


Fig. 1-3-5 Mass of the core (unit 1) [case 2]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

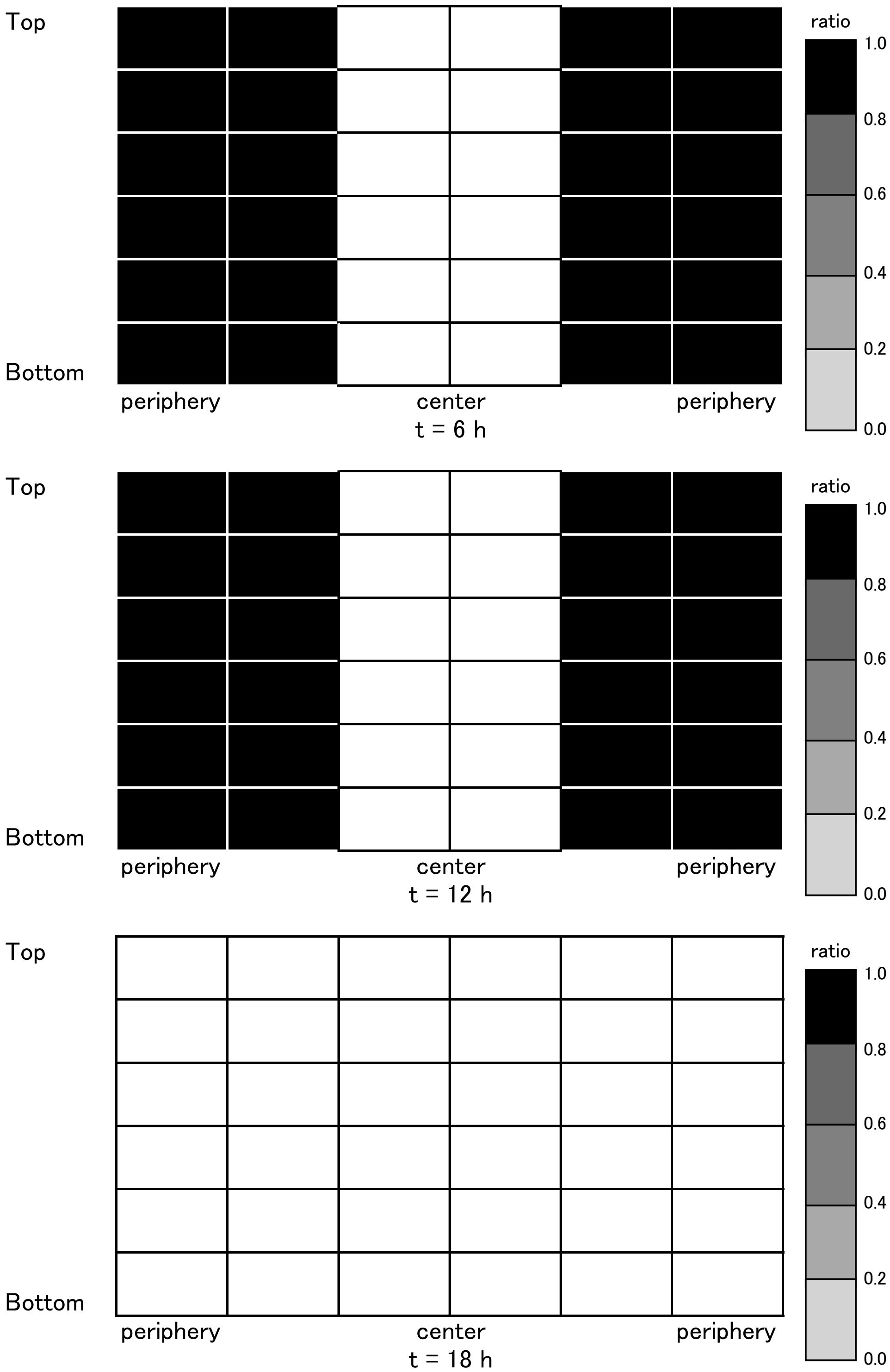


Fig. 1-3-6 Distribution of intact fuel (unit 1) [case 2]

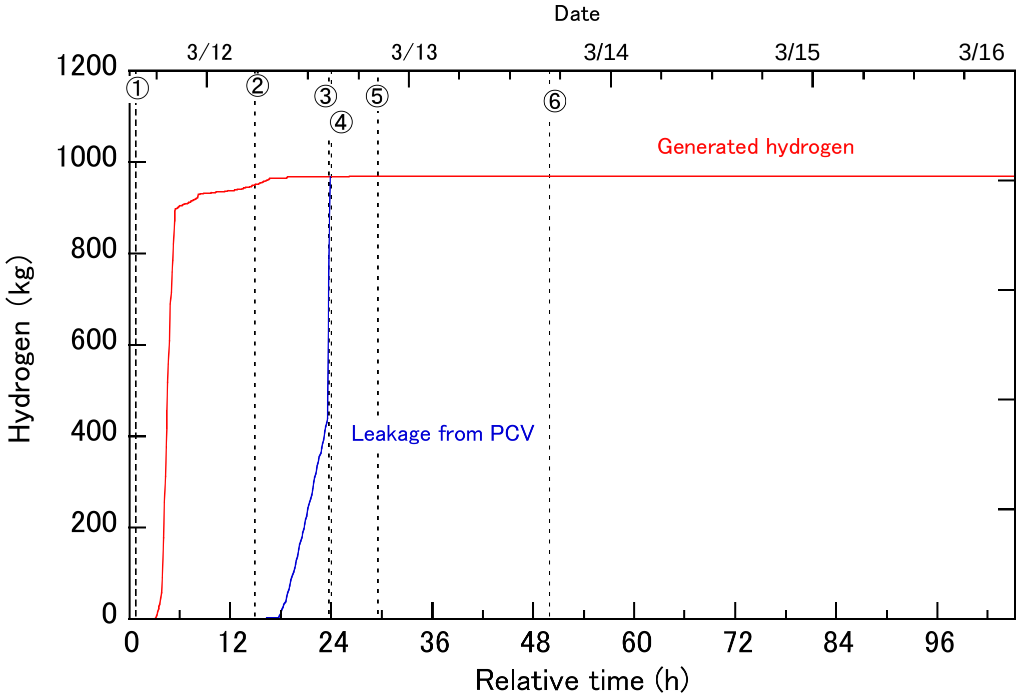


Fig. 1-3-7 Hydrogen generation (unit 1) [case 2]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

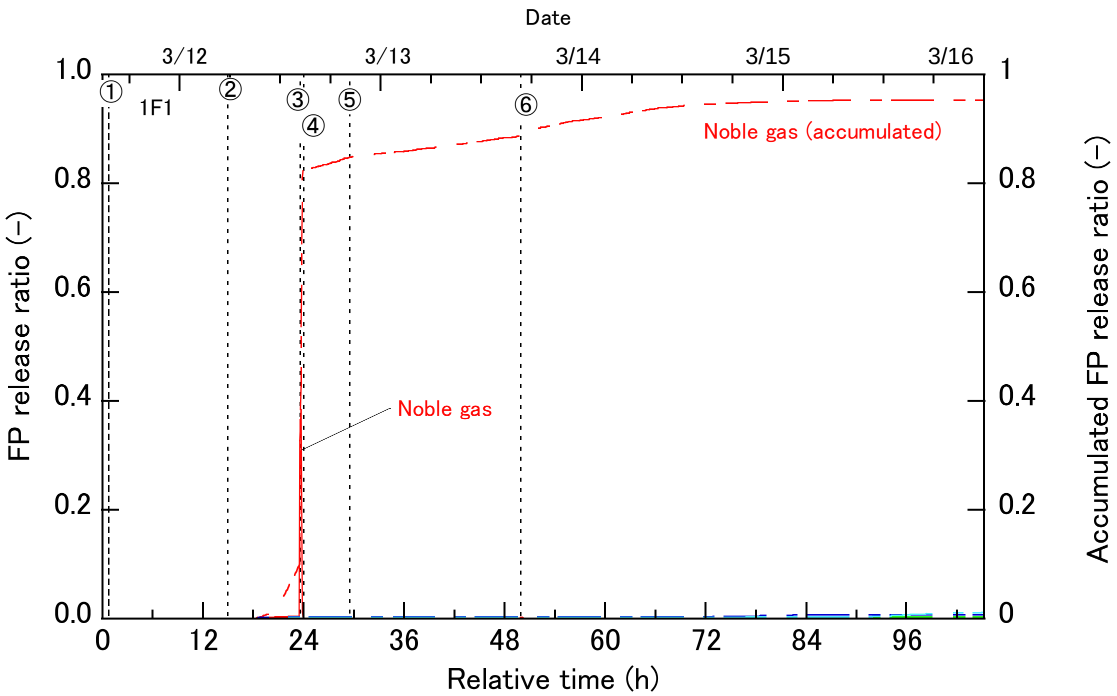


Fig. 1-3-8 FP release ratio to the environment (1/3) (unit 1) [case 2]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

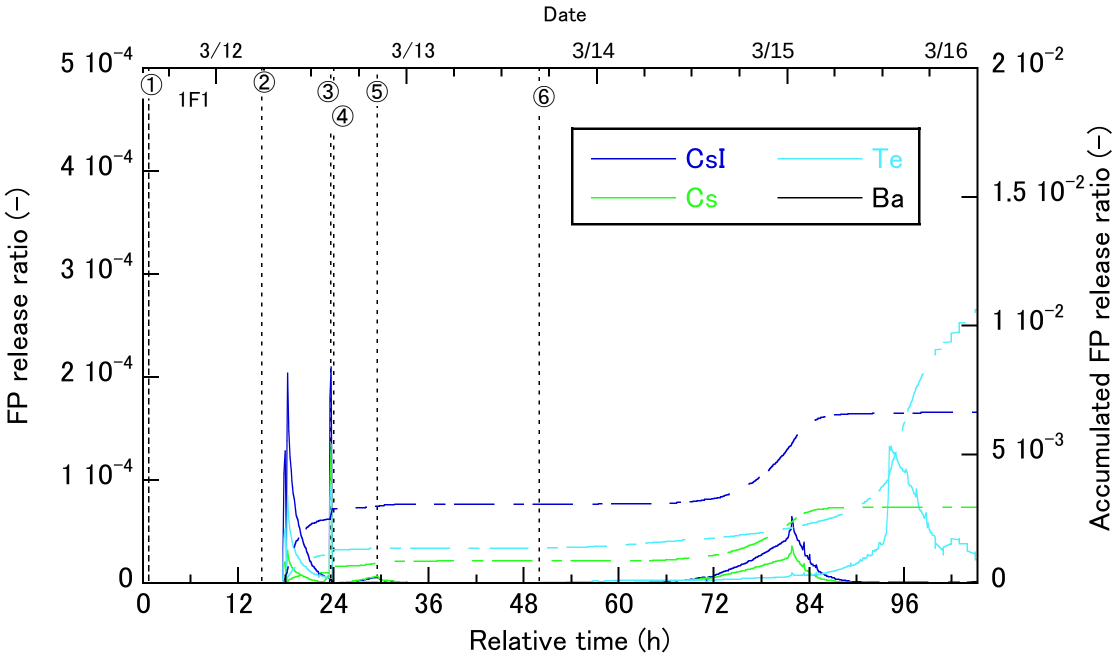


Fig. 1-3-9 FP release ratio to the environment (2/3) (unit 1) [case 2]
①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

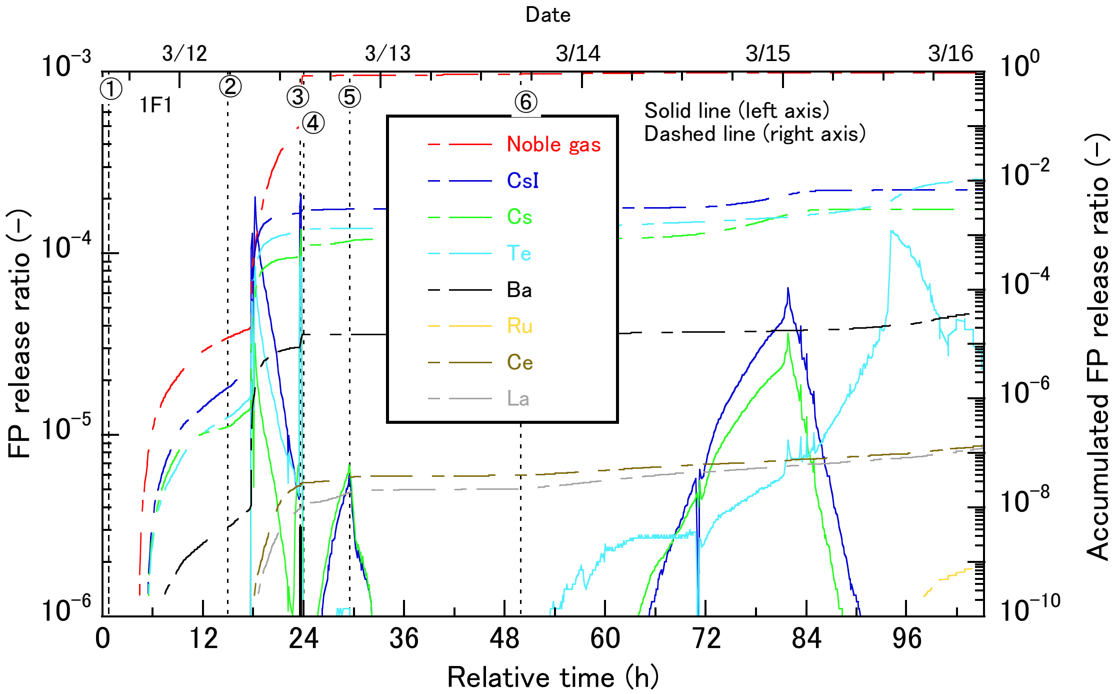


Fig. 1-3-10 FP release ratio to the environment (3/3) (unit 1) [case 2]
①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤sea water inject., ⑥expansion of PCV failure (assumption)

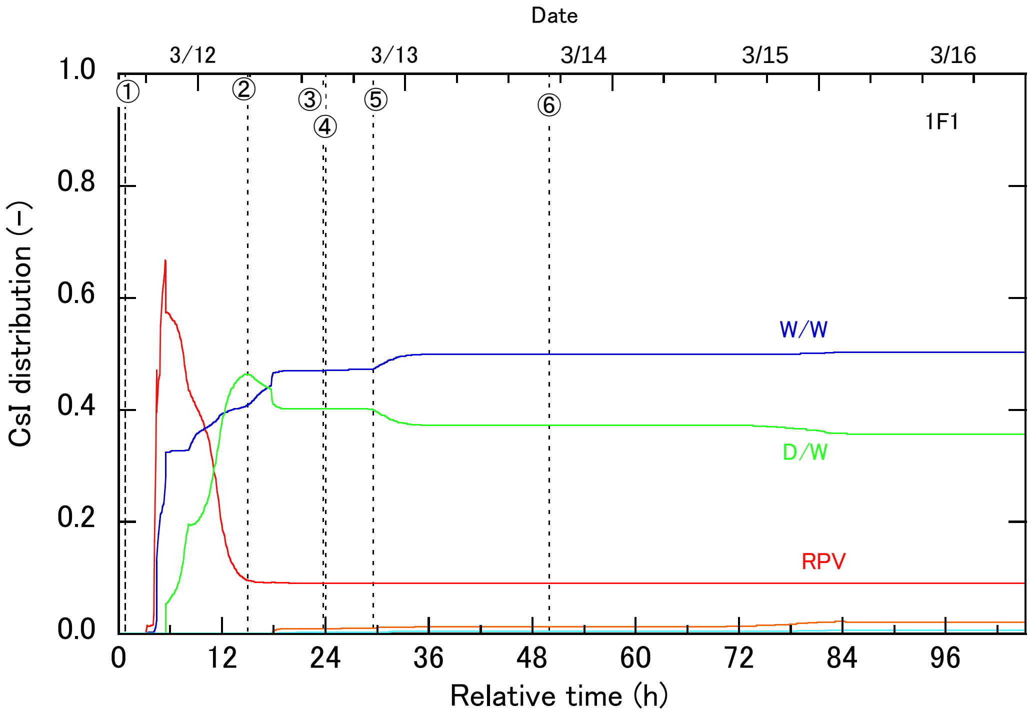


Fig. 1-3-11 Distribution of CsI (unit 1) [case 2]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

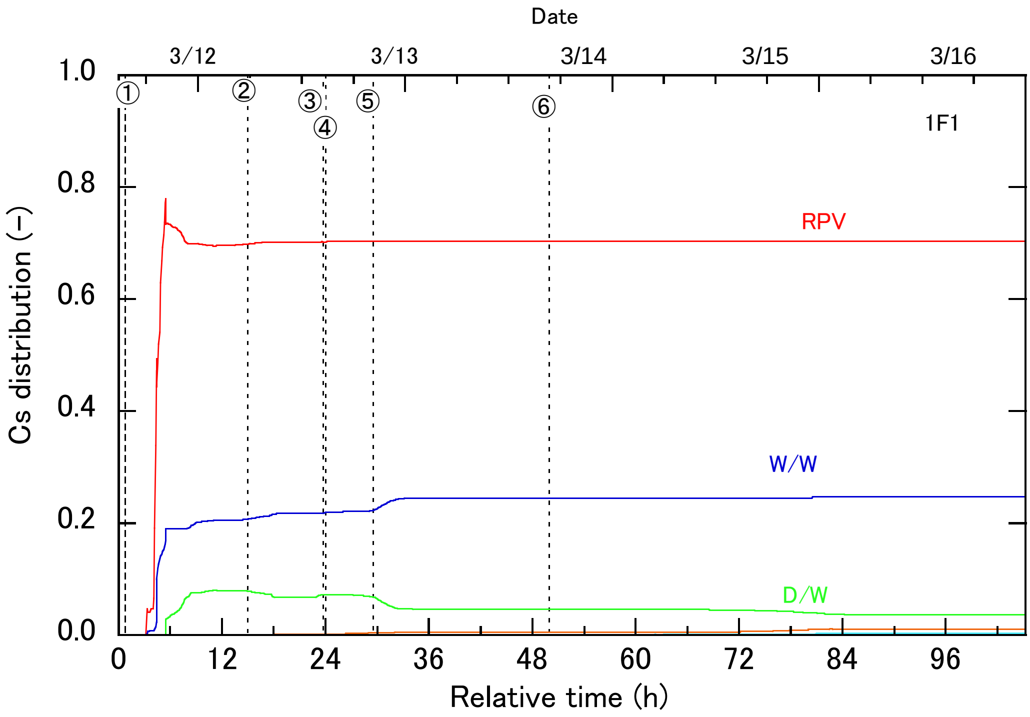


Fig. 1-3-12 Distribution of Cs (unit 1) [case 2]

①IC stop, ②PCV failure (assumption), ③W/W ventilation (open), ④W/W ventilation (close), ⑤ sea water inject., ⑥expansion of PCV failure (assumption)

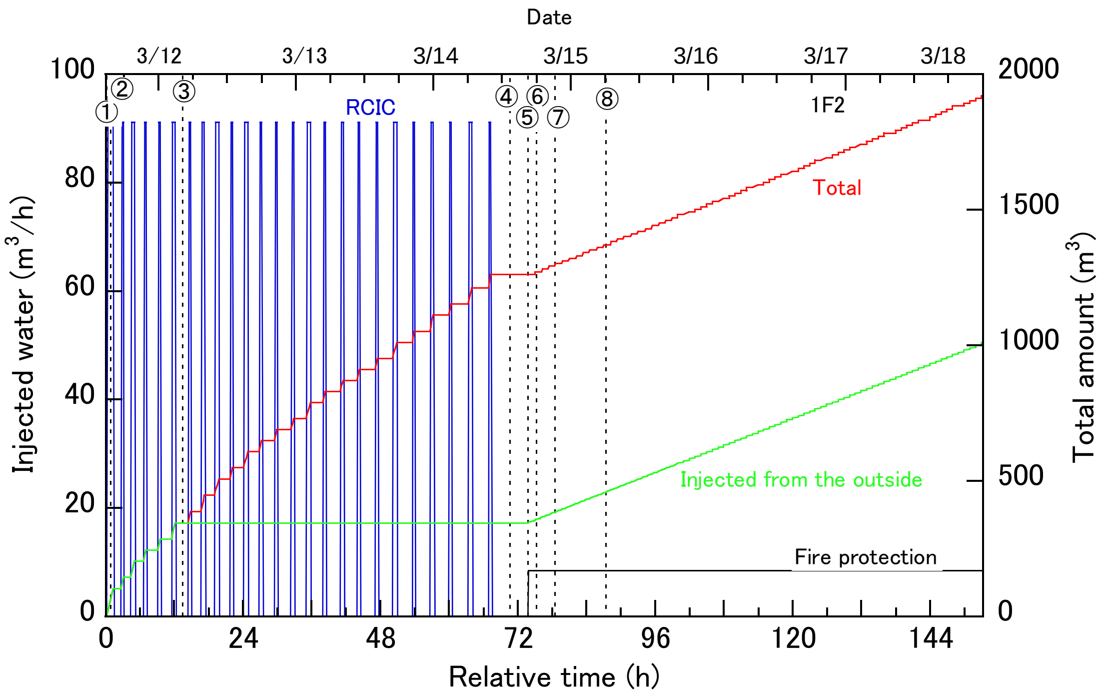


Fig. 2-1-1 Amount of water injection (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

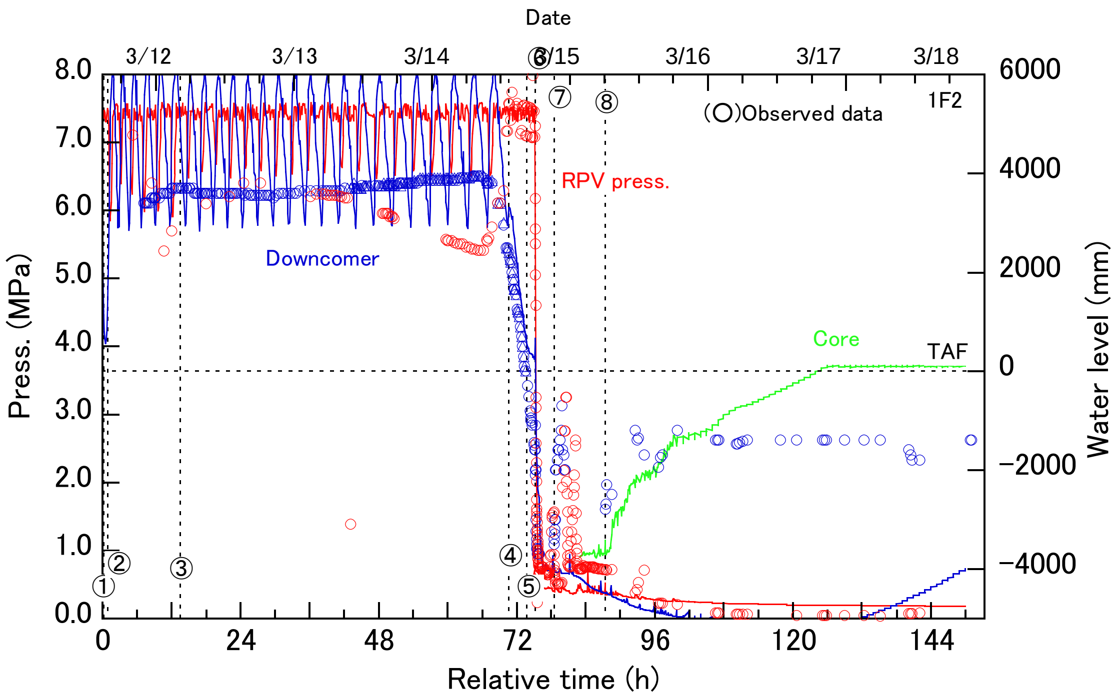


Fig. 2-1-2 RPV pressure and water level (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

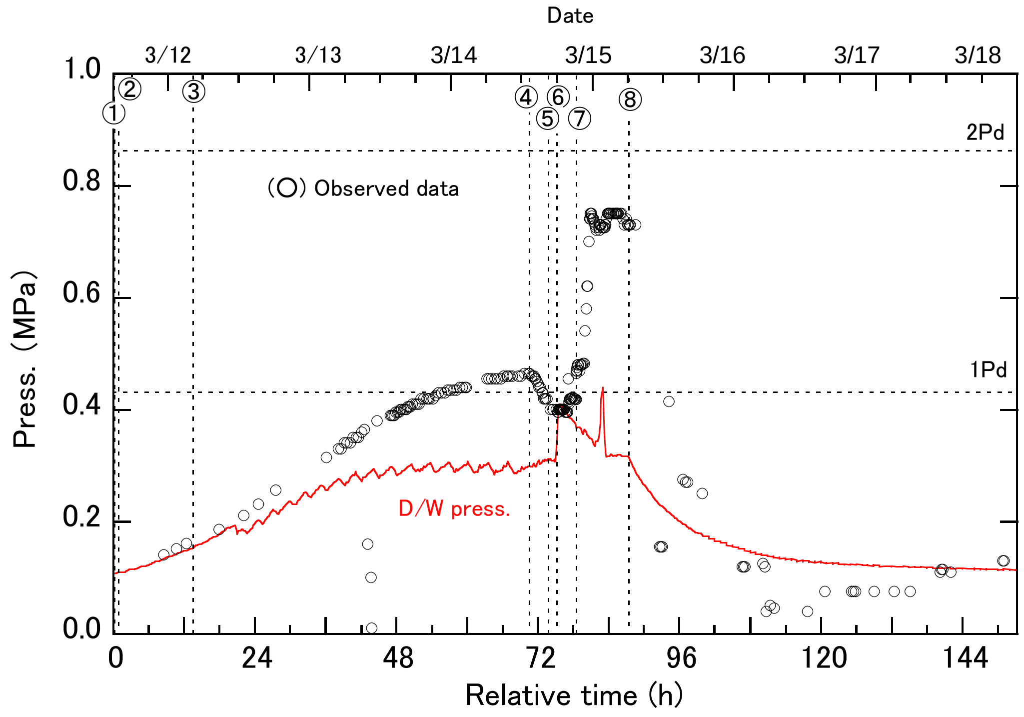


Fig. 2-1-3 D/W pressure (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

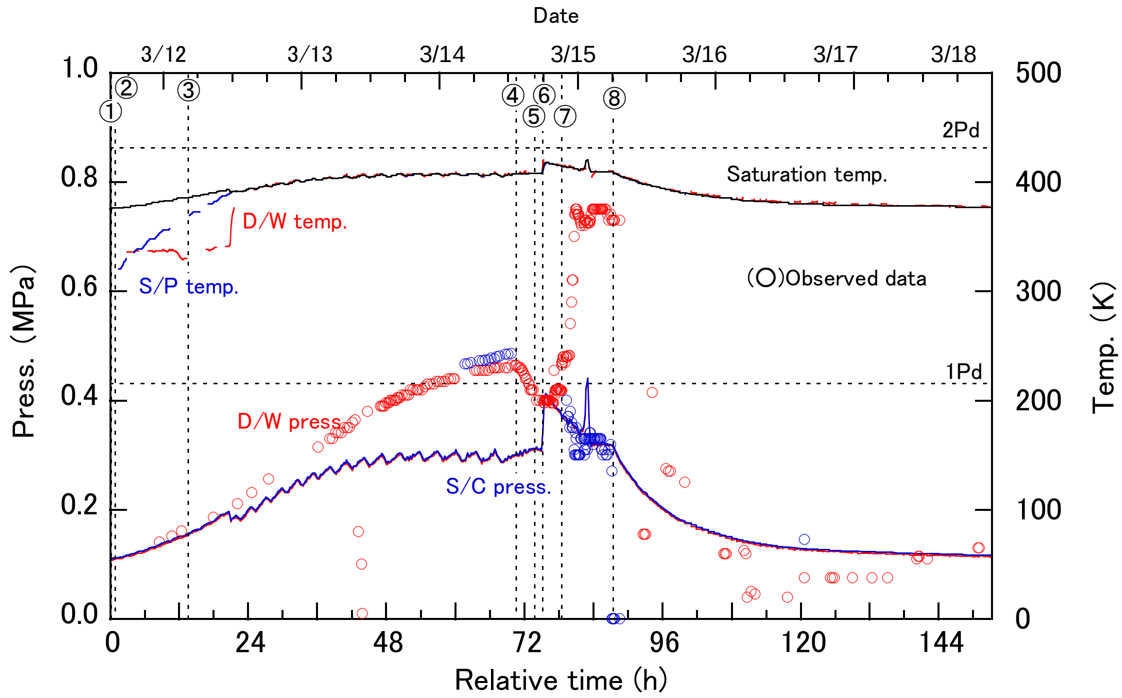


Fig. 2-1-4 PCV pressure and temperature (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

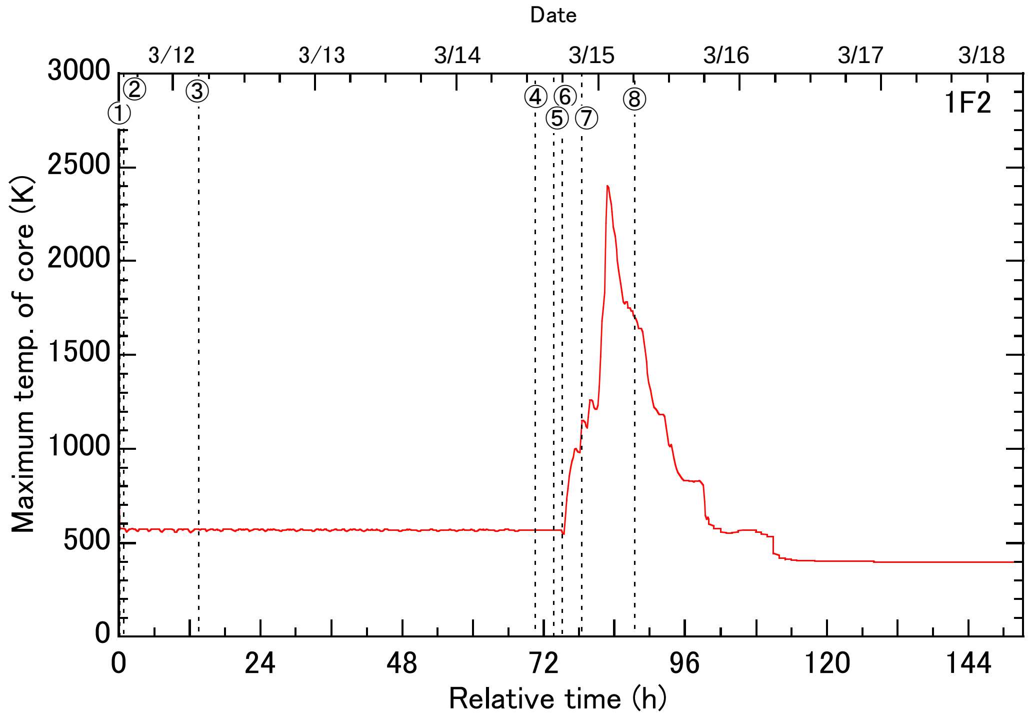


Fig. 2-1-5 Maximum temperature of the core (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

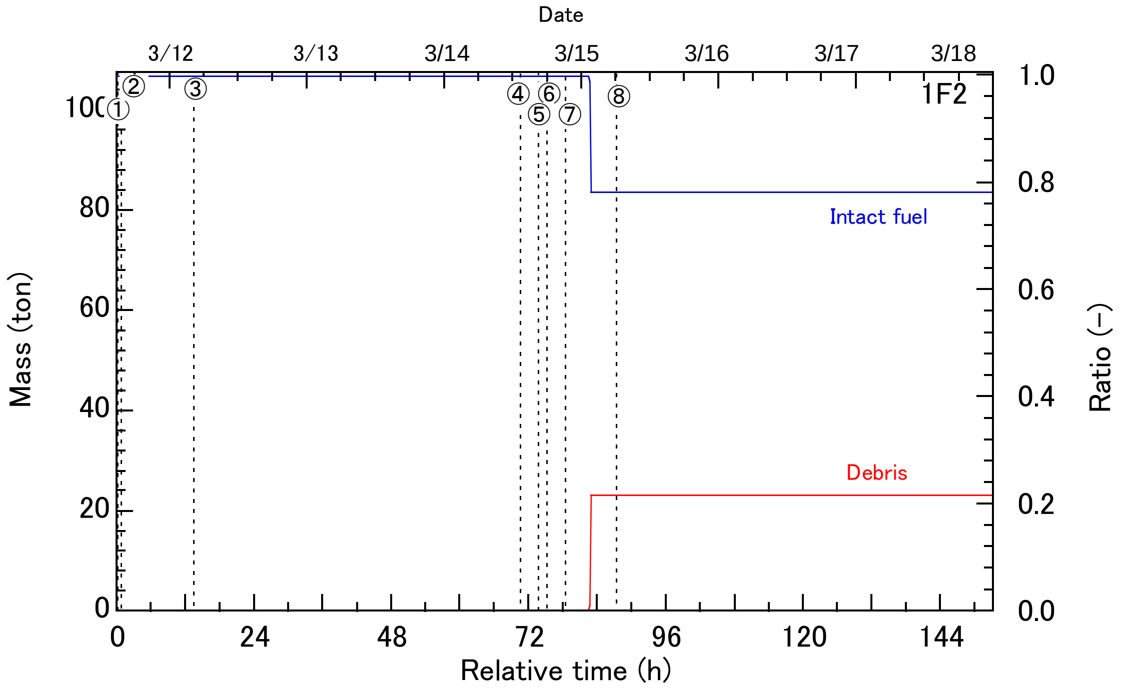


Fig. 2-1-6 Mass of the core (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

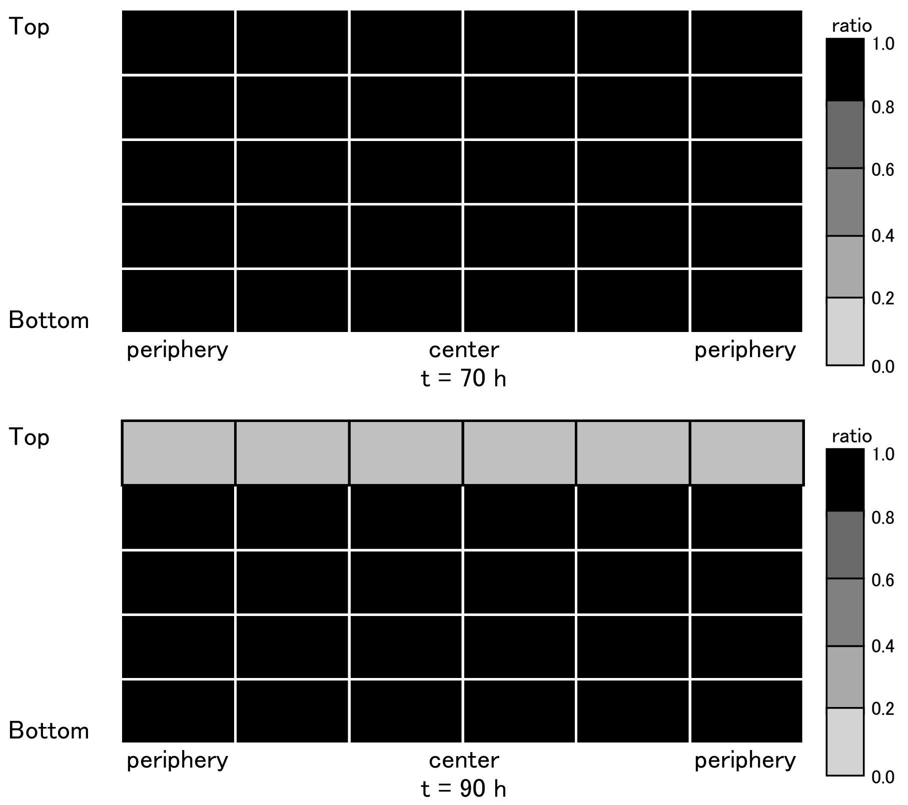


Fig. 2-1-7 Distribution of intact fuel (unit 2) [TEPCO-1]

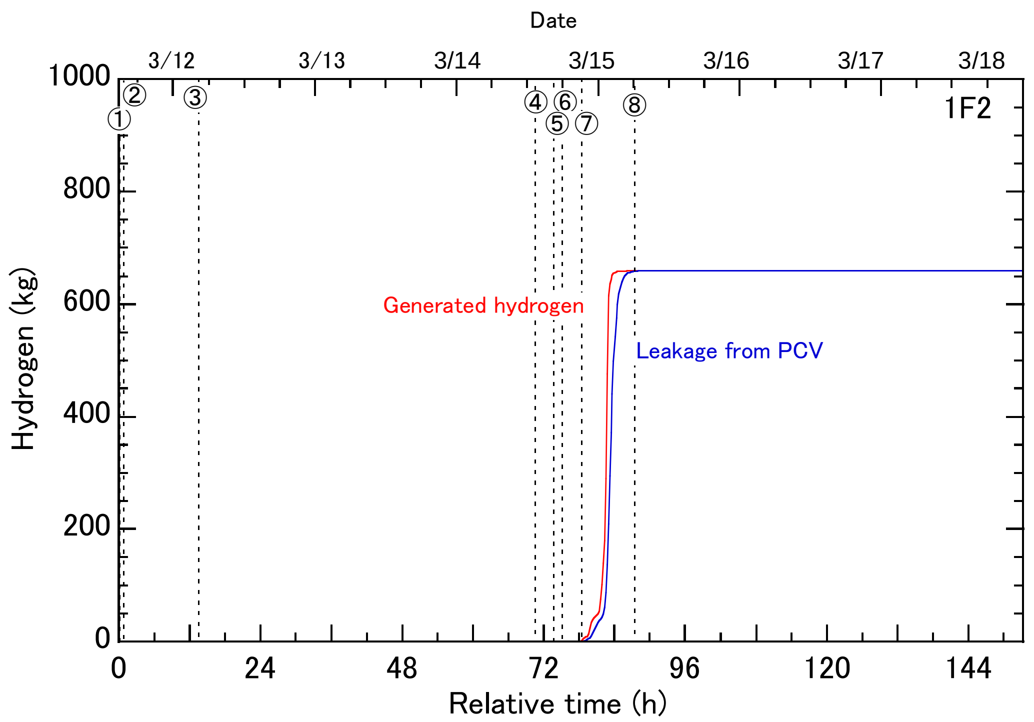


Fig. 2-1-8 Hydrogen generation (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

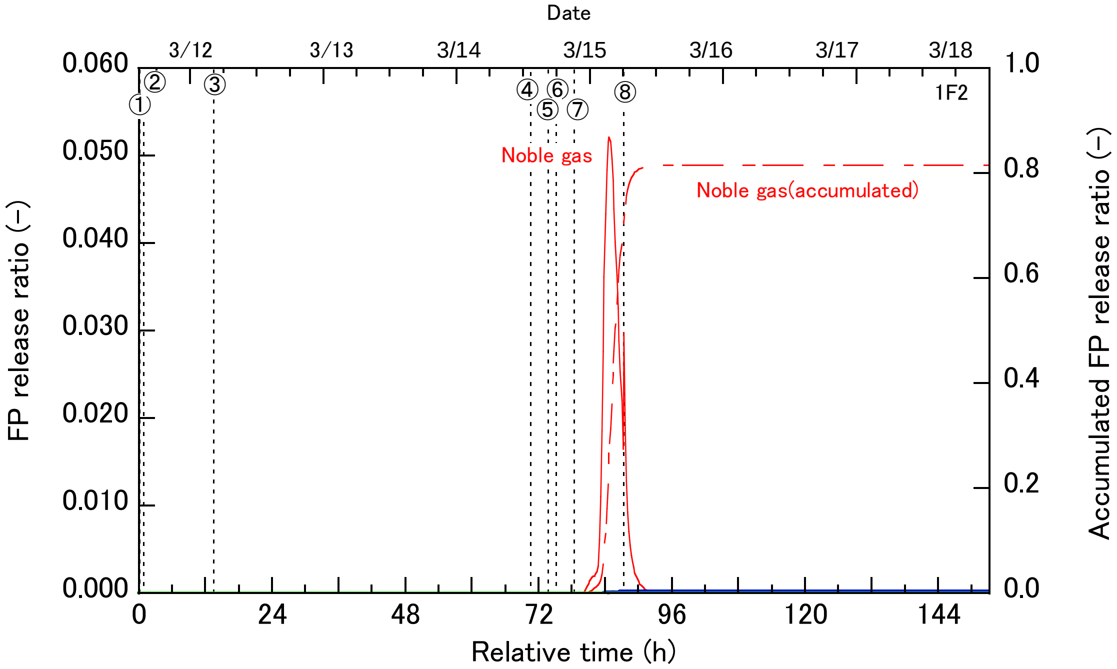


Fig. 2-1-9 FP release ratio to the environment (1/3) (unit 2) [TEPCO-1]
①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

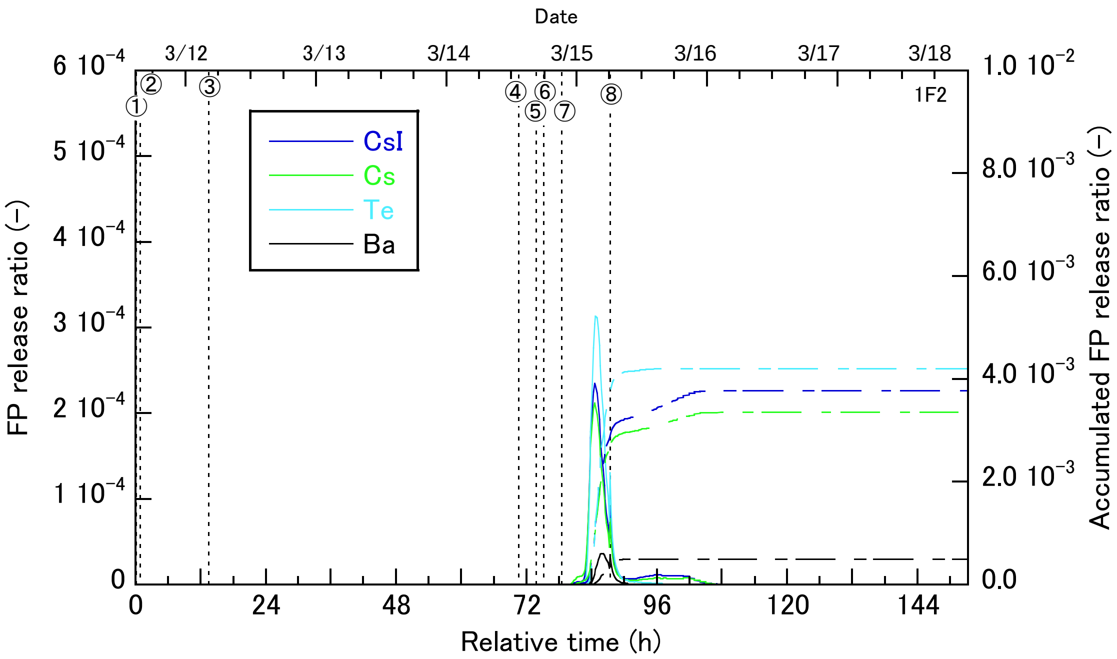


Fig. 2-1-10 FP release ratio to the environment (2/3) (unit 2) [TEPCO-1]
①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

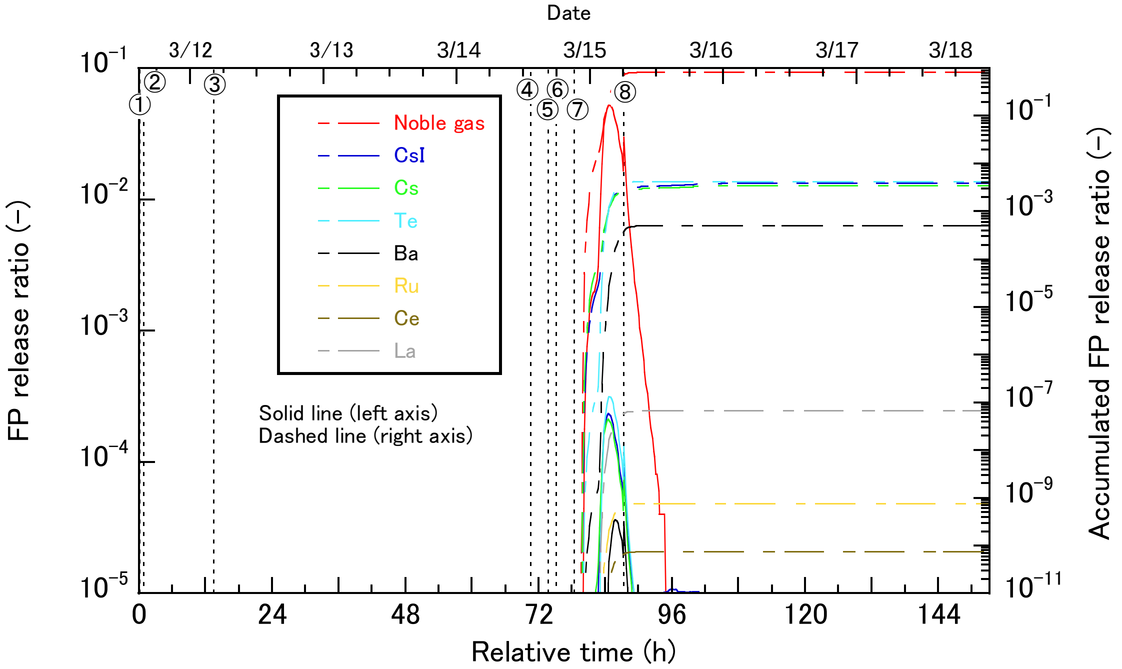


Fig. 2-1-11 FP release ratio to the environment (3/3) (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

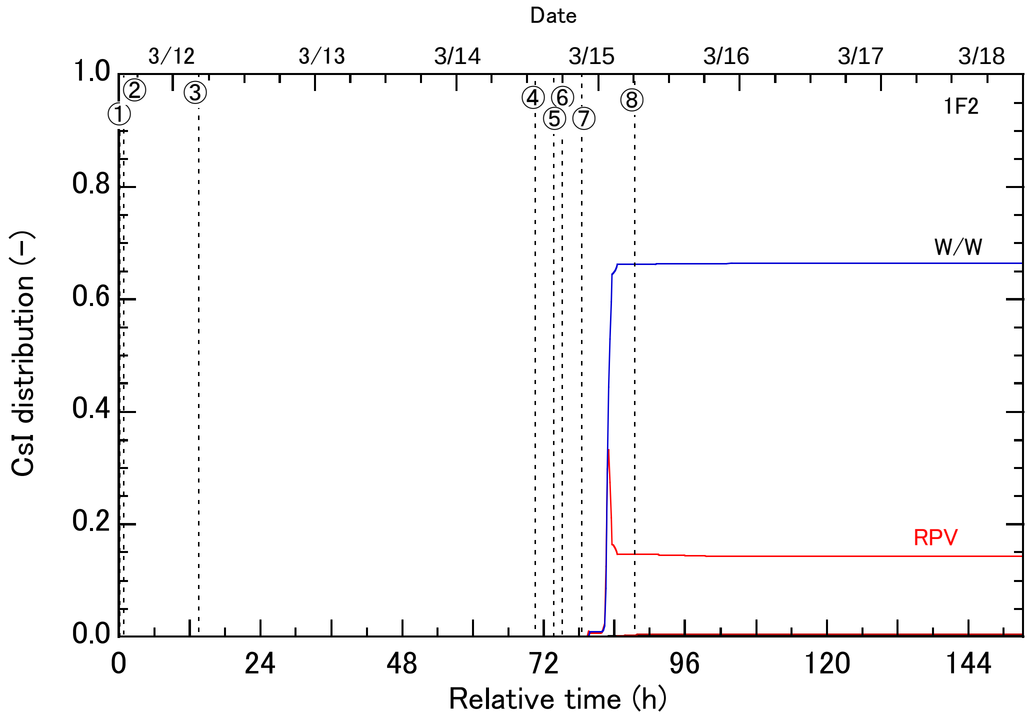


Fig. 2-1-12 Distribution of CsI (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

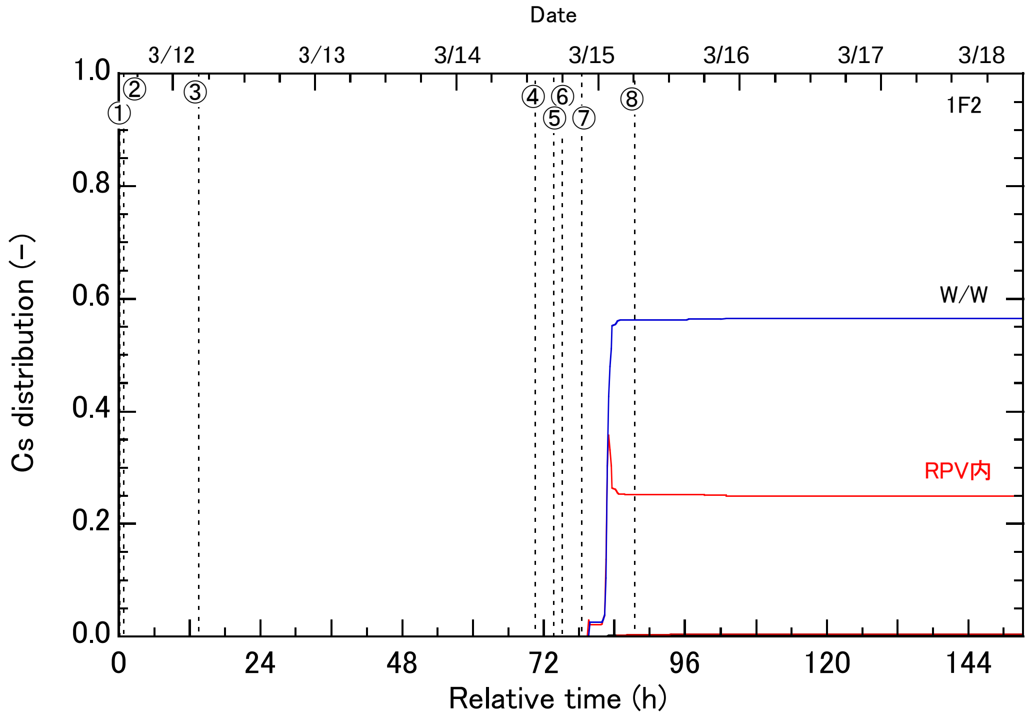


Fig. 2-1-13 Distribution of Cs (unit 2) [TEPCO-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

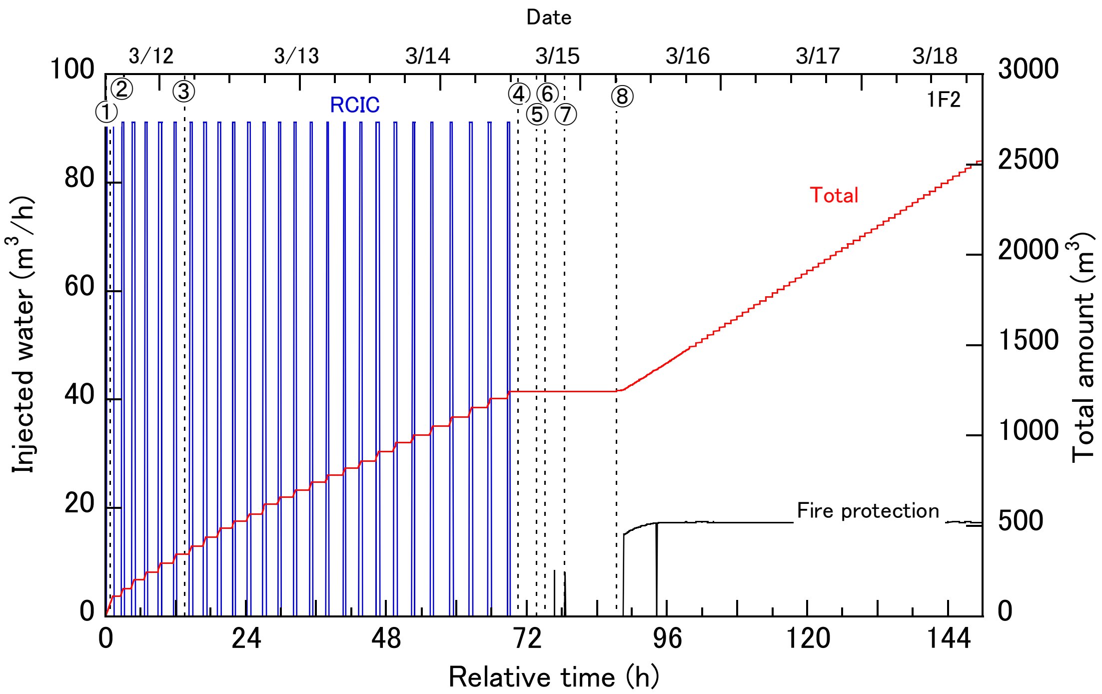


Fig. 2-2-1 Amount of water injection (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

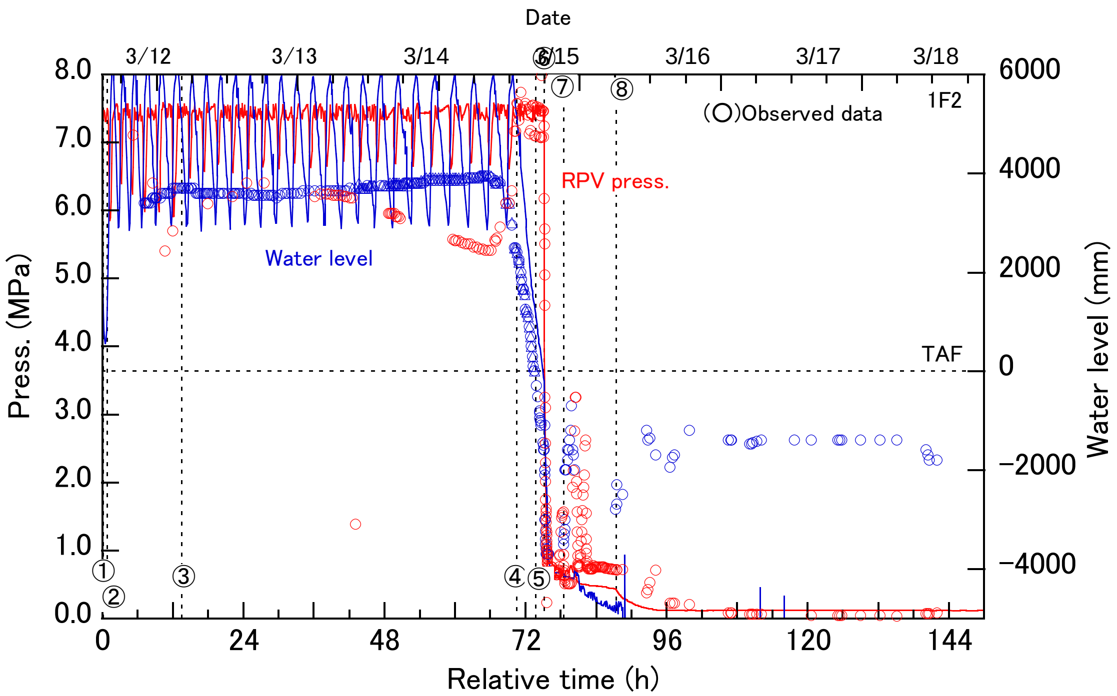


Fig. 2-2-2 RPV pressure and water level (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

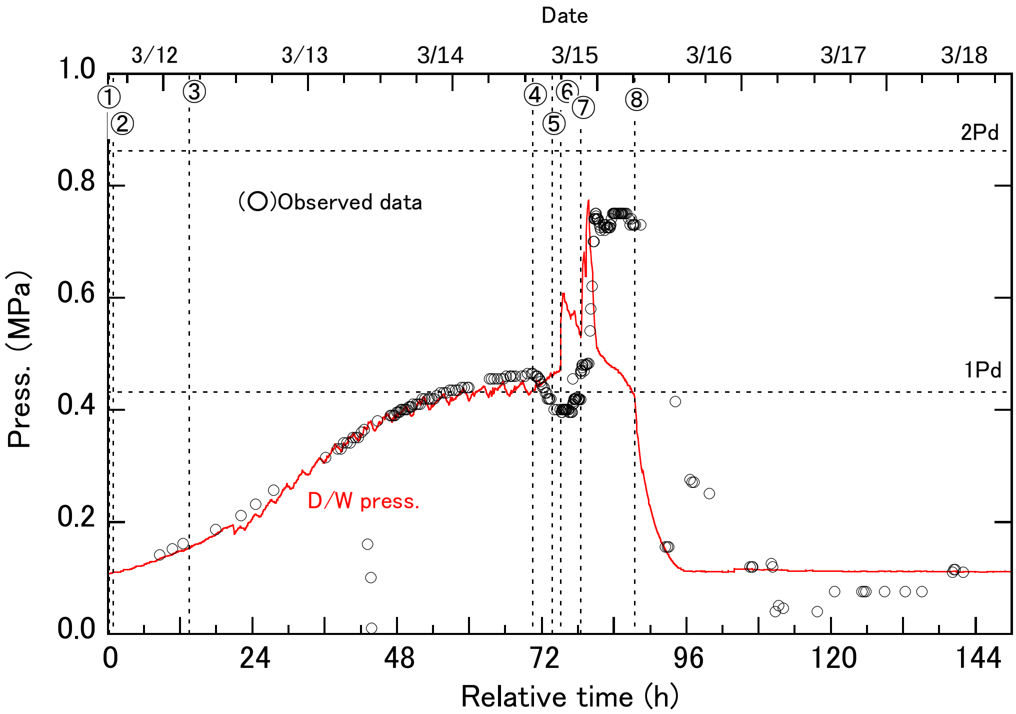


Fig. 2-2-3 D/W pressure (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

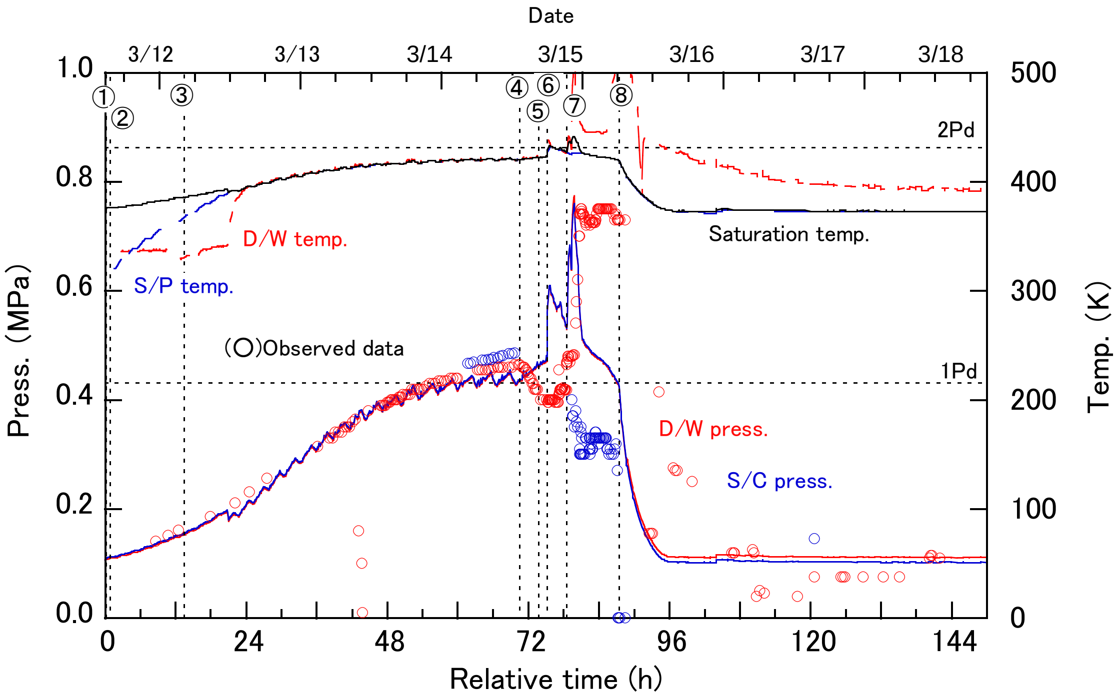


Fig. 2-2-4 PCV pressure and temperature (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

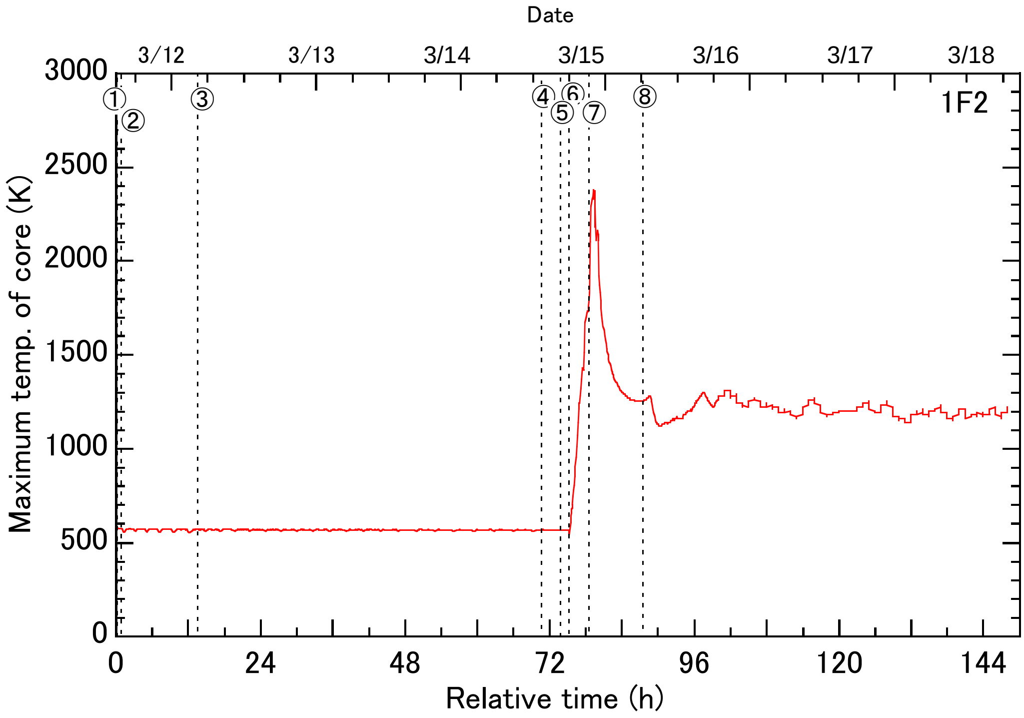


Fig. 2-2-5 Maximum temperature of the core (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

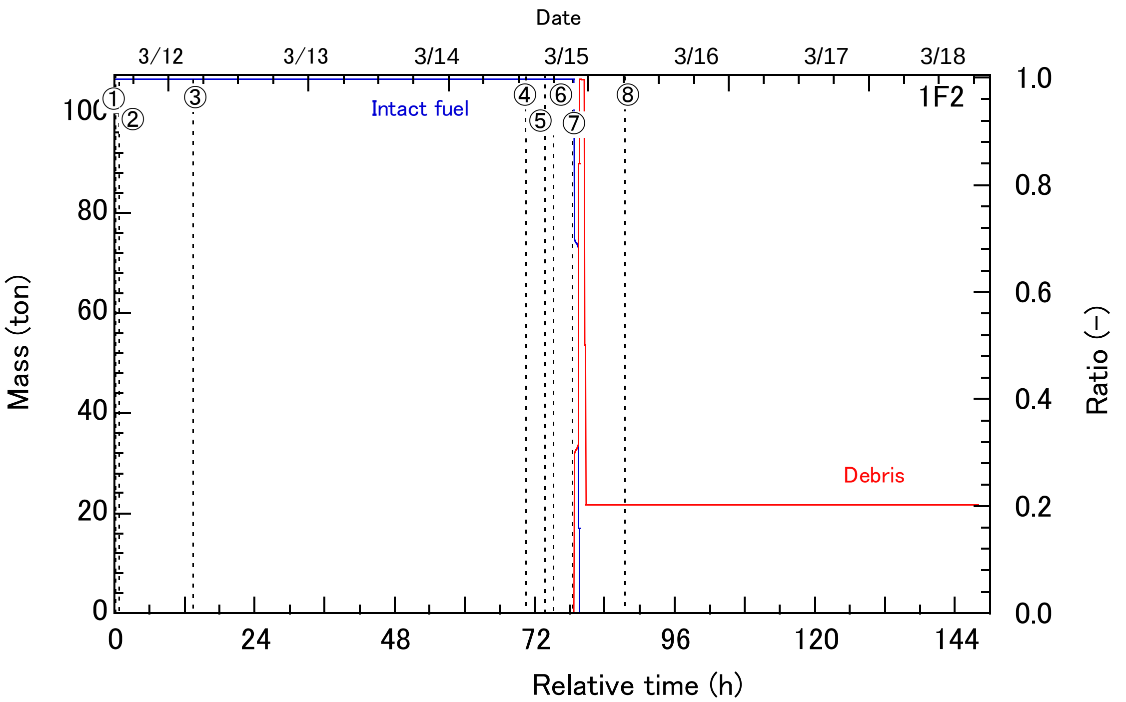


Fig. 2-2-6 Mass of the core (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

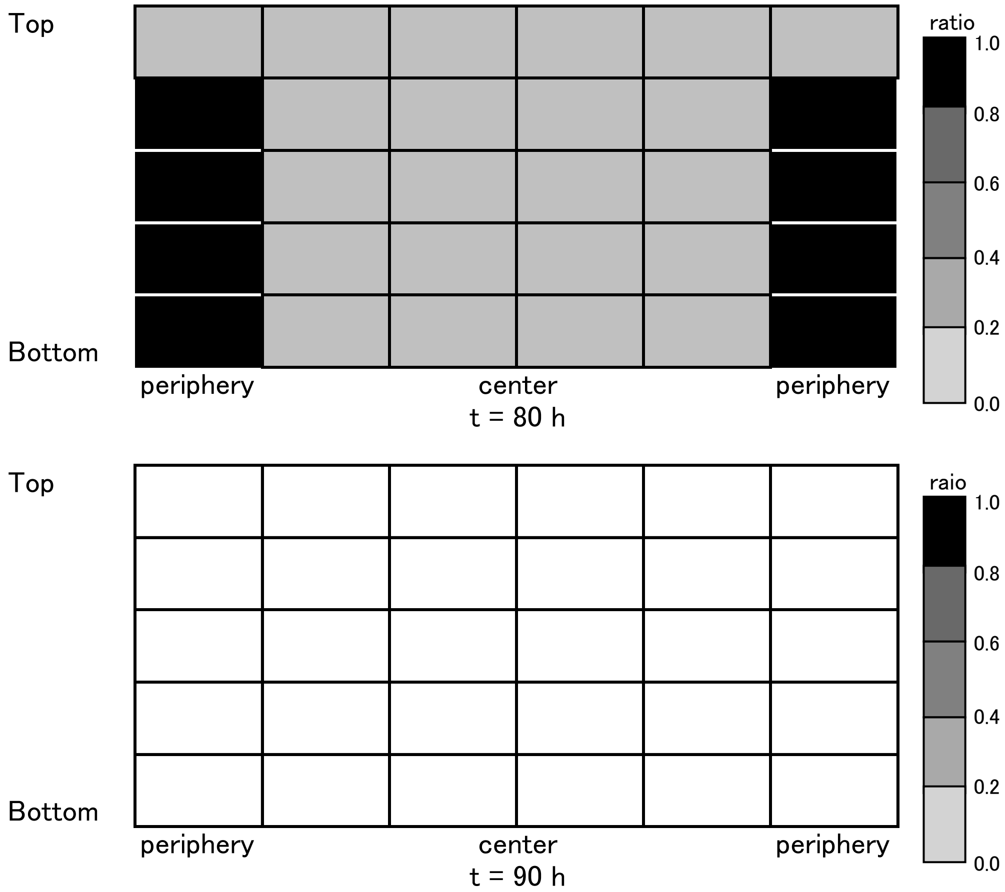


Fig. 2-2-7 Distribution of intact fuel (unit 2) [TEPCO-2]

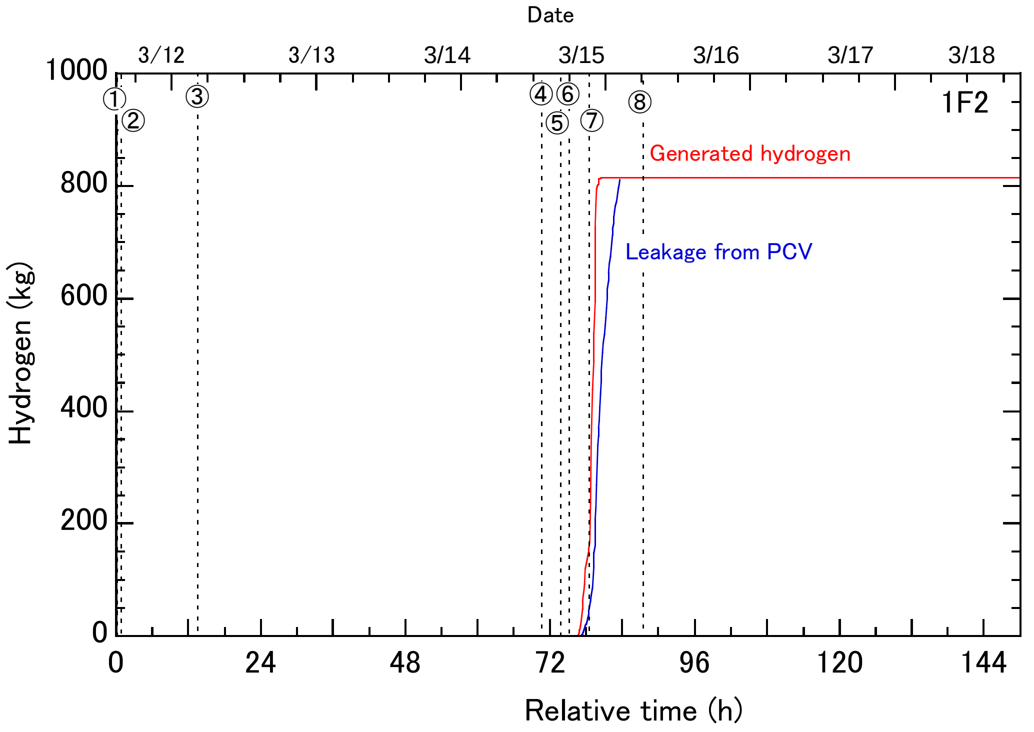


Fig. 2-2-8 Hydrogen generation (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

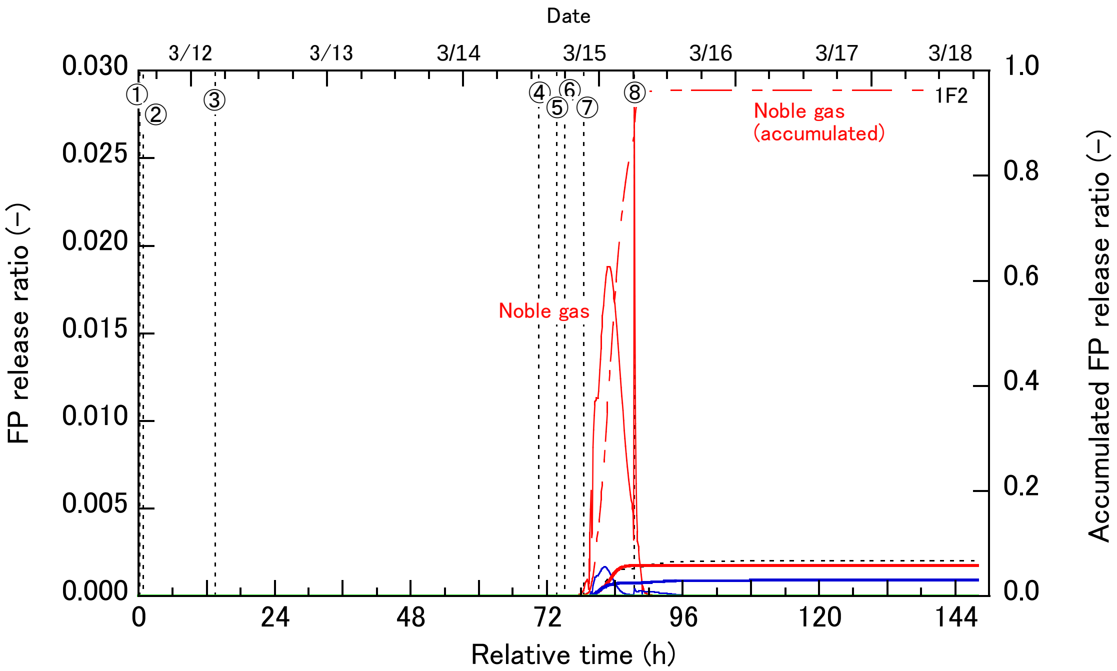


Fig. 2-2-9 FP release ratio to the environment (1/2) (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

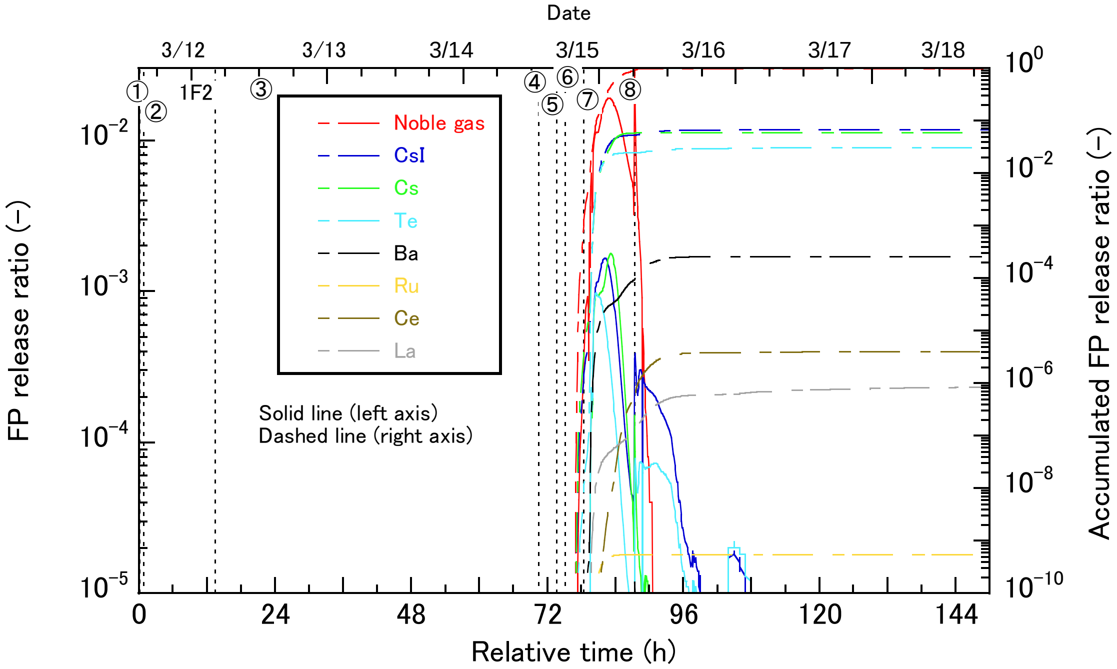


Fig. 2-2-10 FP release ratio to the environment (2/2) (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

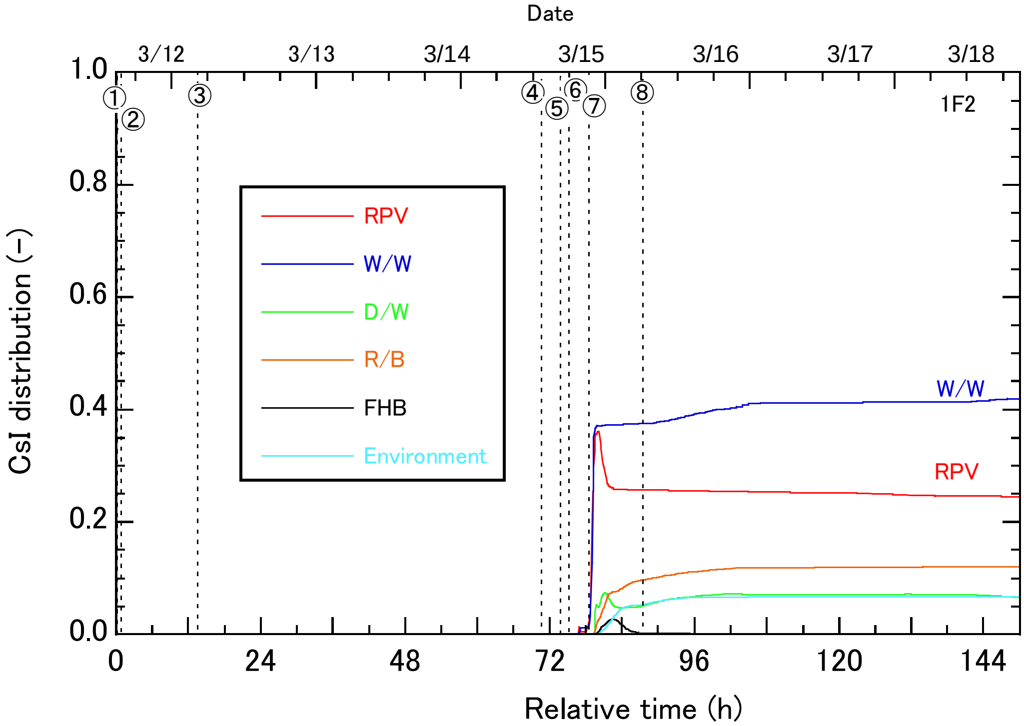


Fig. 2-2-11 Distribution of CsI (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

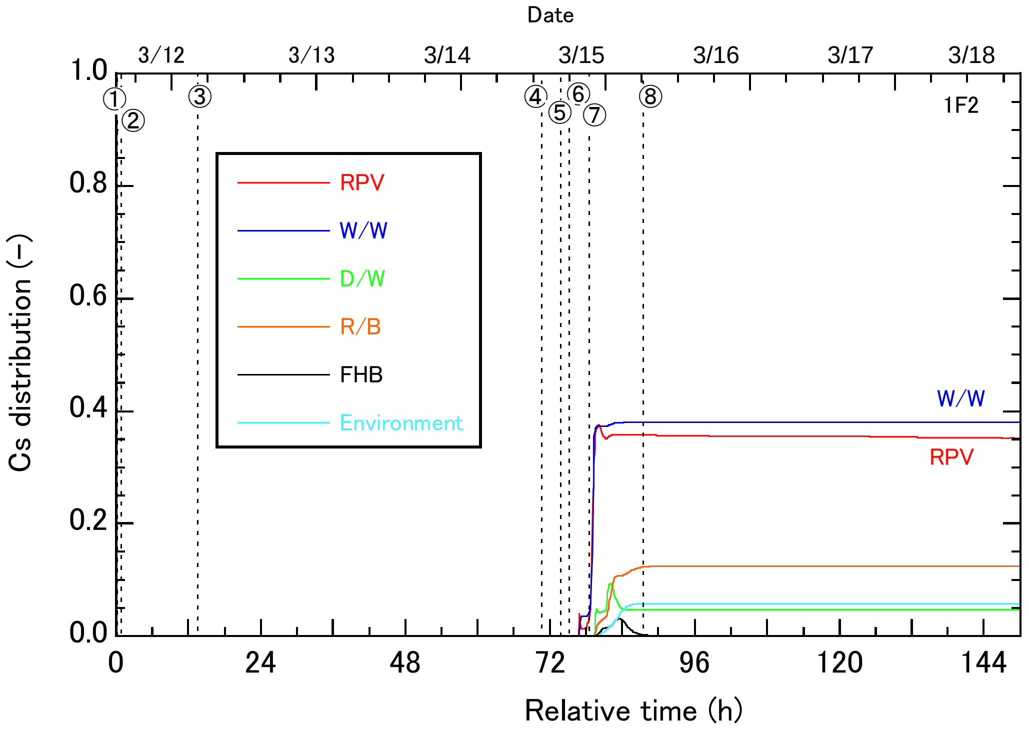


Fig. 2-2-12 Distribution of Cs (unit 2) [TEPCO-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

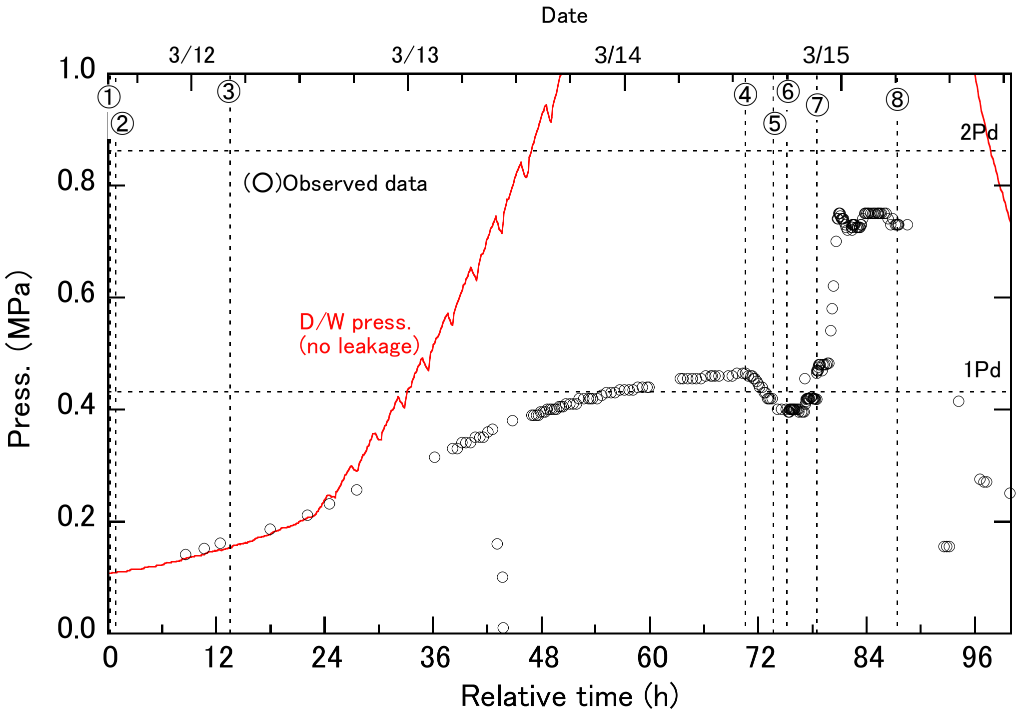


Fig. 2-3-1 D/W pressure (unit 2) [case-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

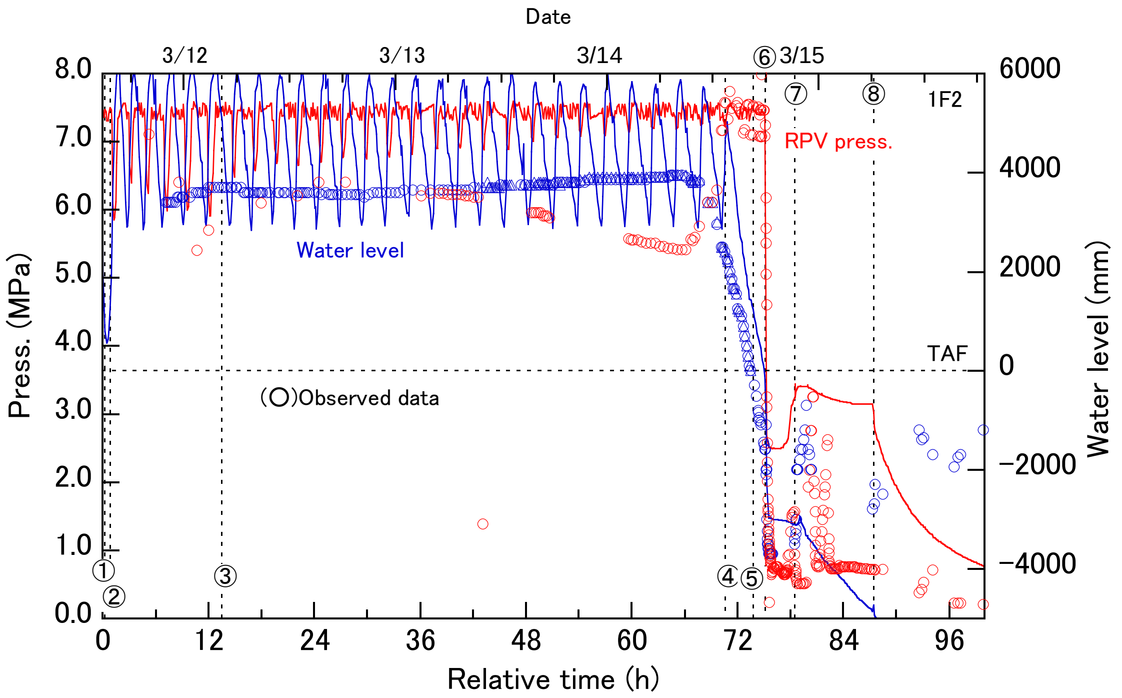


Fig. 2-3-2 RPV pressure and water level (unit 2) [case-1]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

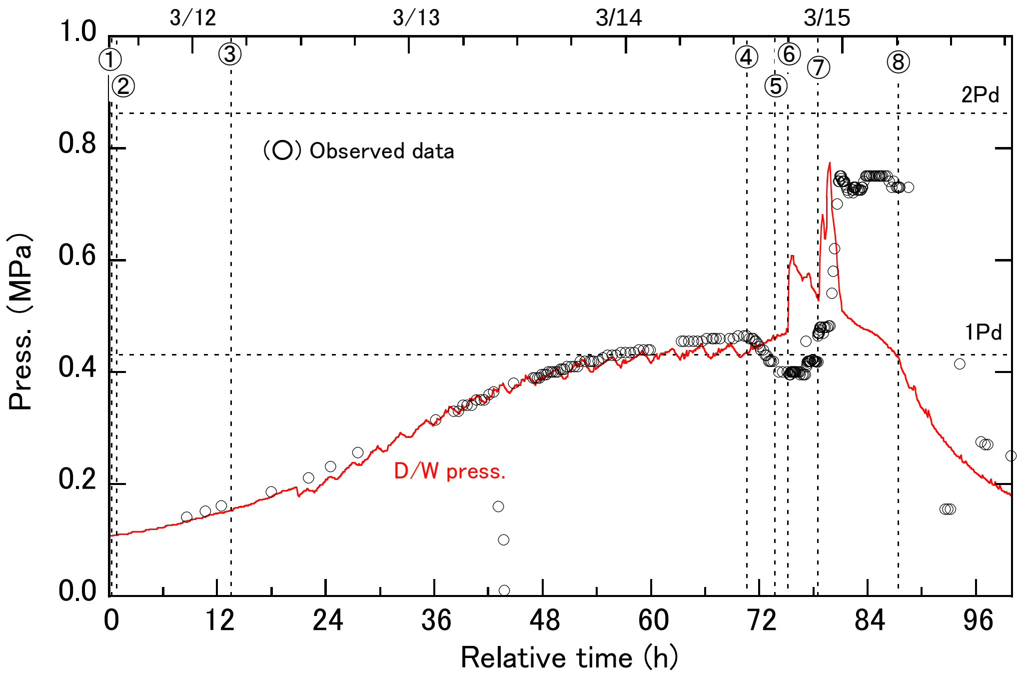


Fig. 2-4-1 D/W pressure (unit 2) [case-2]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

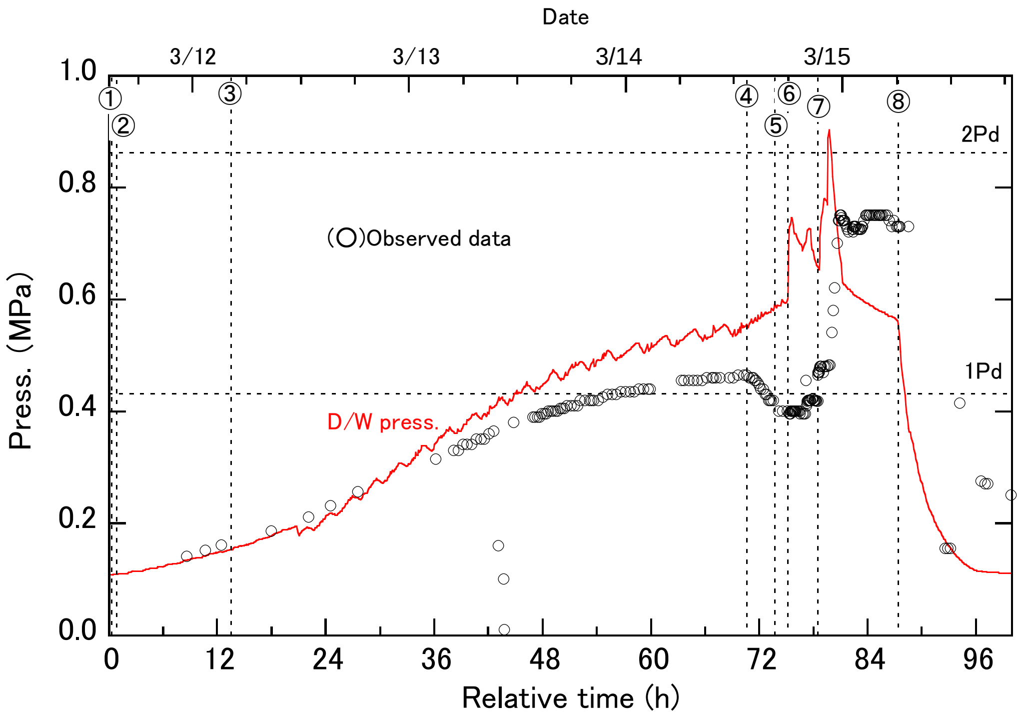


Fig. 2-5-1 D/W pressure (unit 2) [case-3]

①RCIC start manually, ②SBO, ③Water source change from CST to S/P, ④RCIC stop, ⑤Sea water inject., ⑥RPV depressurized, ⑦S/R valve-2 open, ⑧Impact sound

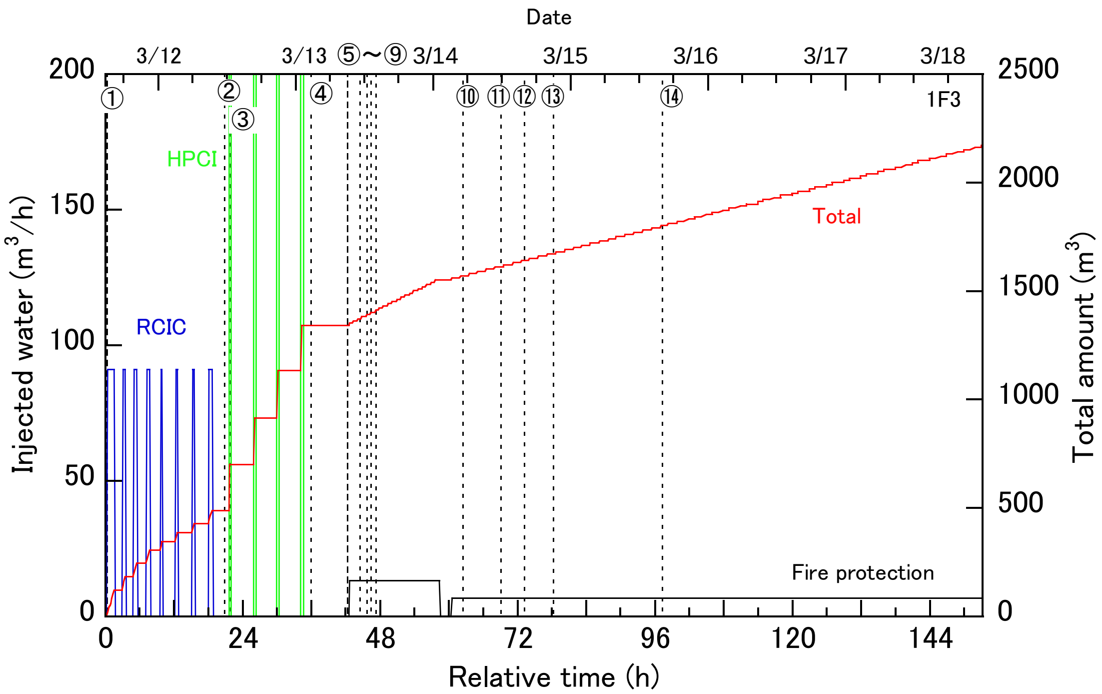


Fig.3-1-1 Amount of water injection (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩〜⑭PCV vent (open⇔close)

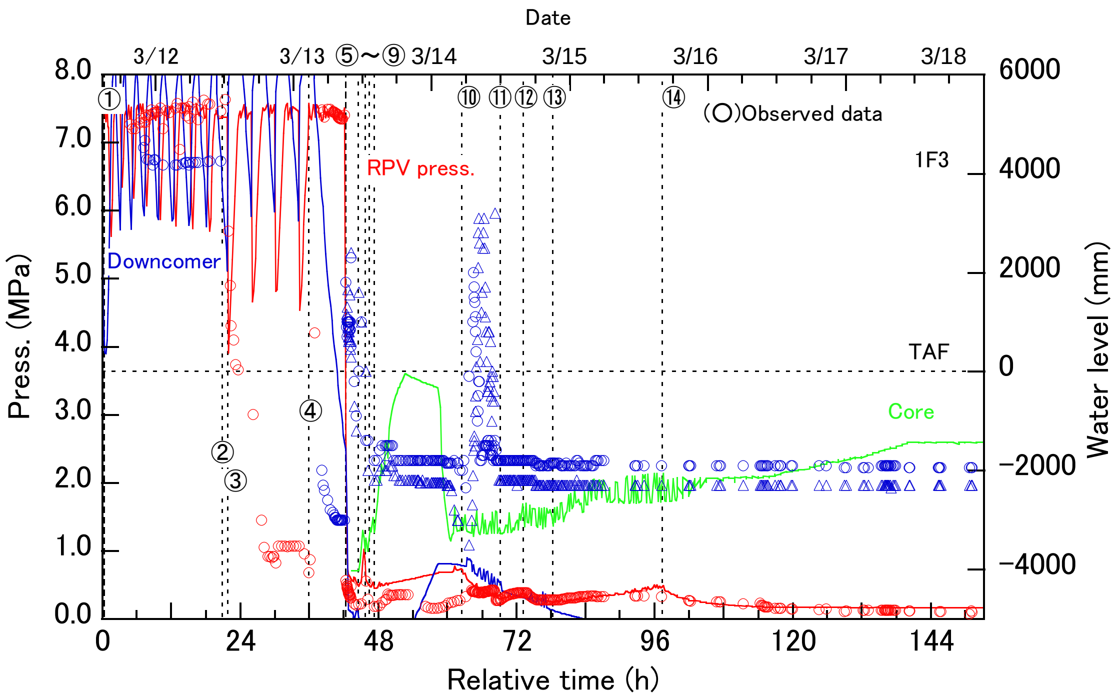


Fig.3-1-2 RPV pressure and water level (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩〜⑭PCV vent (open⇔close)

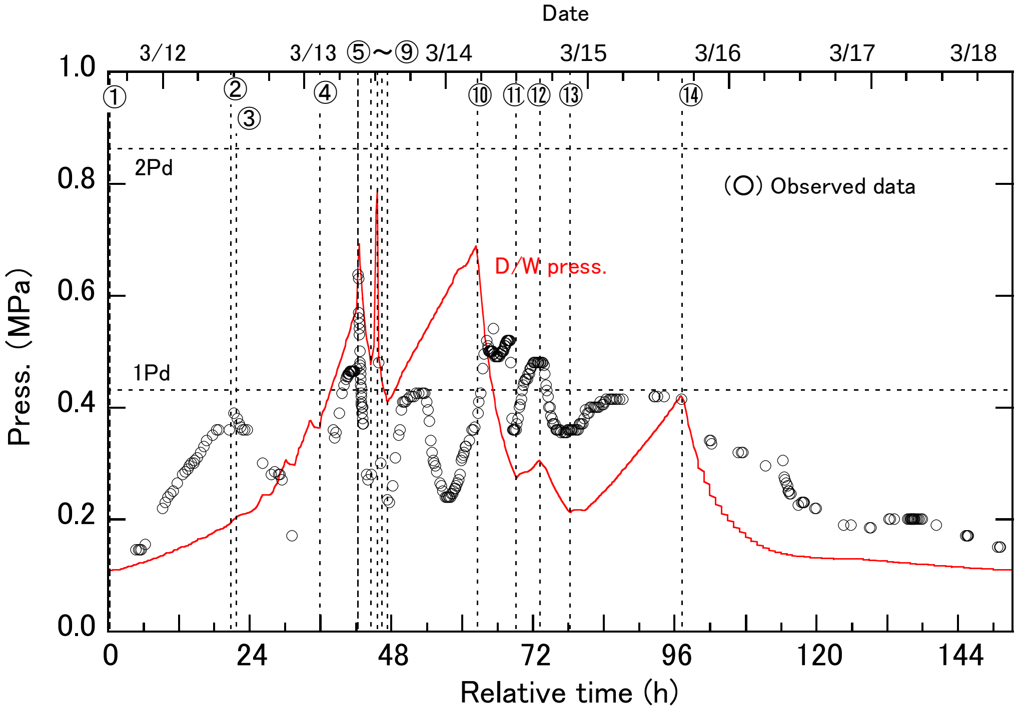


Fig.3-1-3 D/W pressure (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

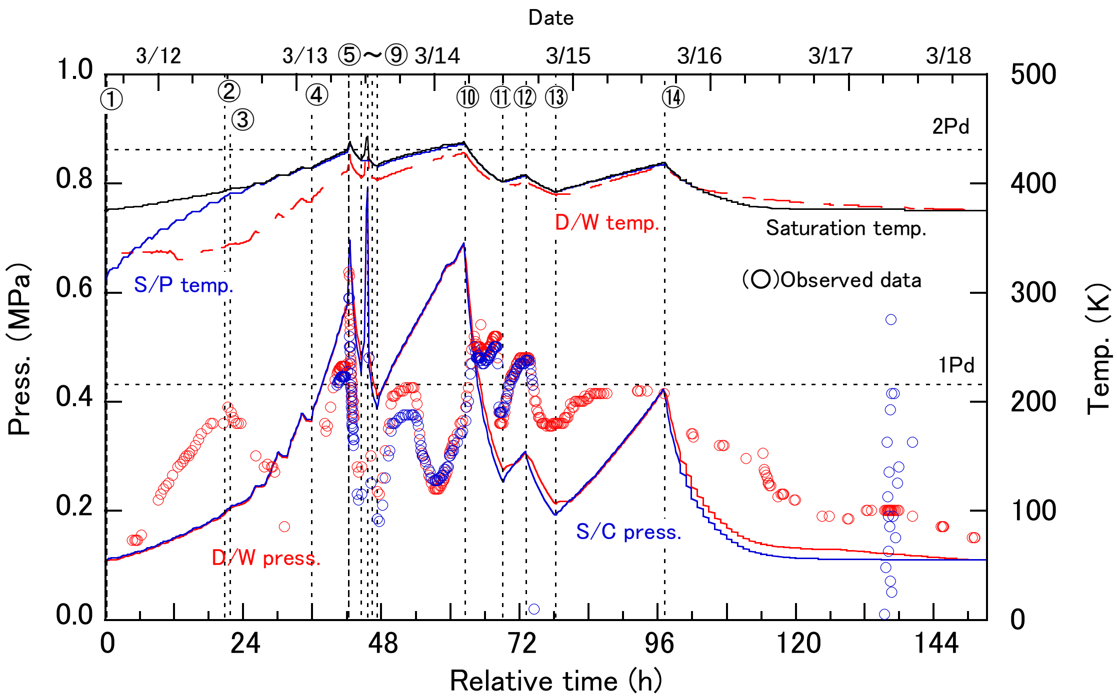


Fig.3-1-4 PCV pressure and temperature (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

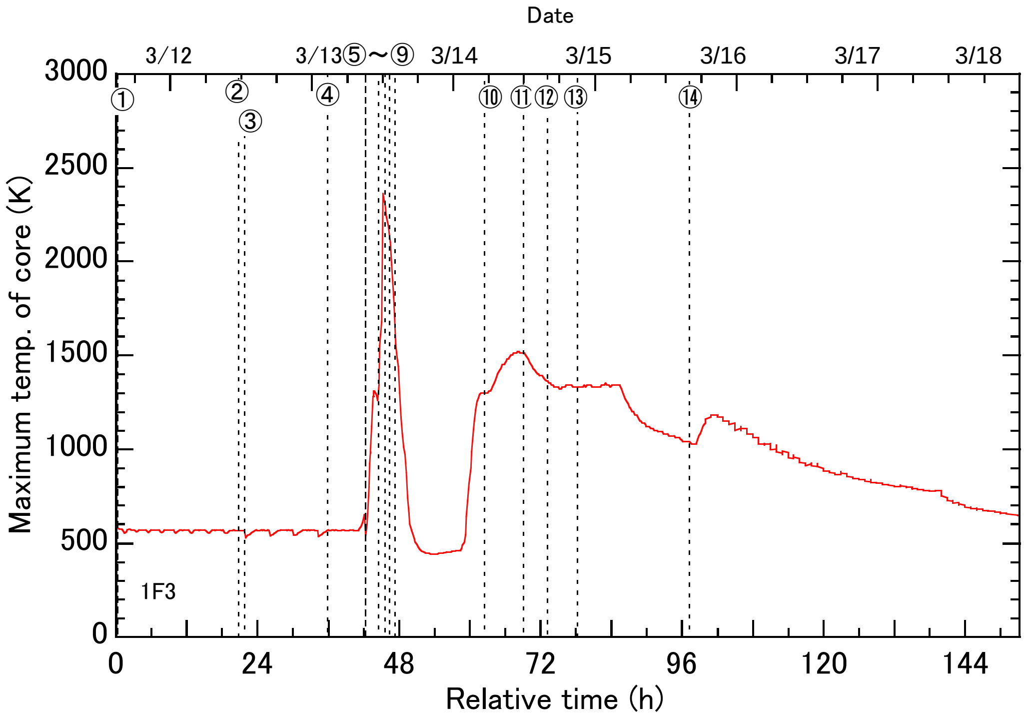


Fig.3-1-5 Maximum temperature of the core (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

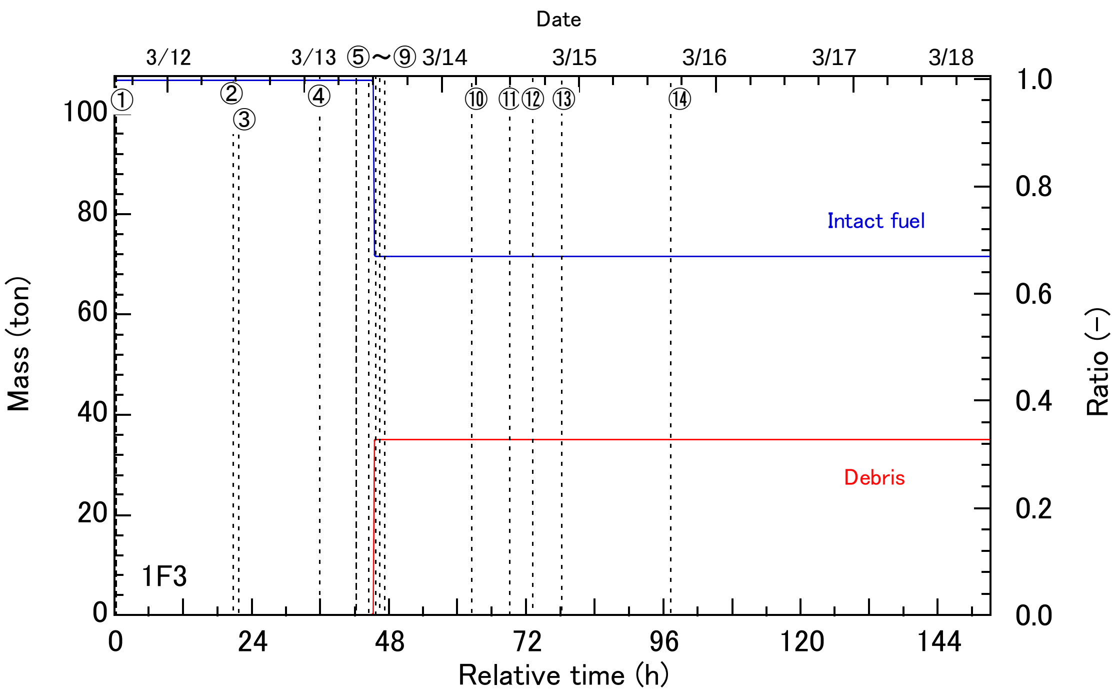


Fig.3-1-6 Mass of the core (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

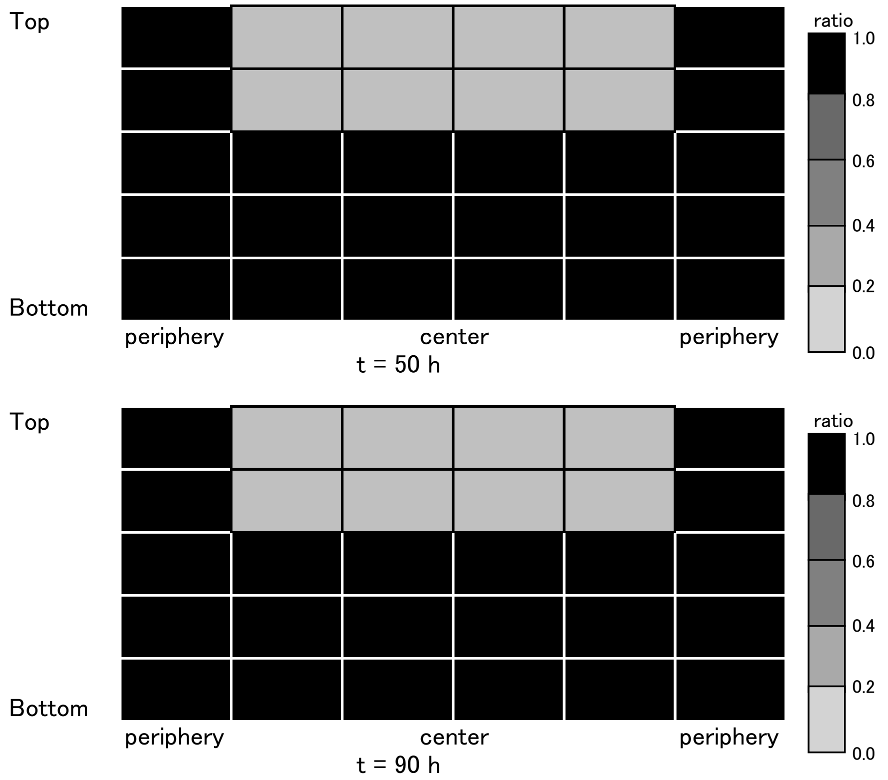


Fig.3-1-7 Distribution of intact fuel (unit 3) [TEPCO-1]

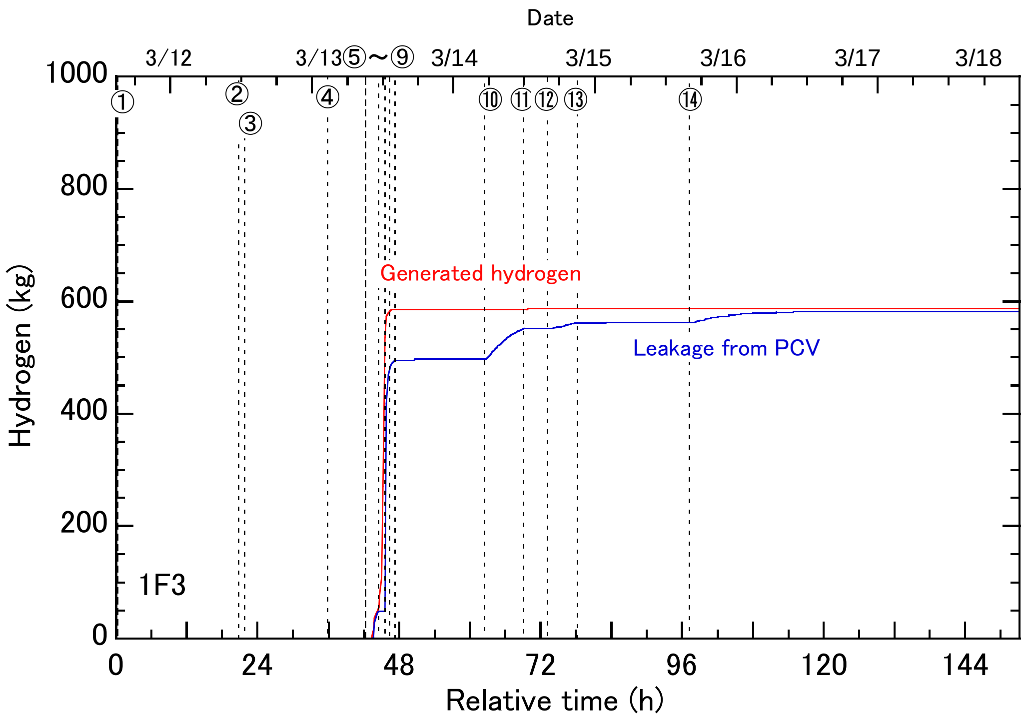


Fig.3-1-8 Hydrogen generation (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

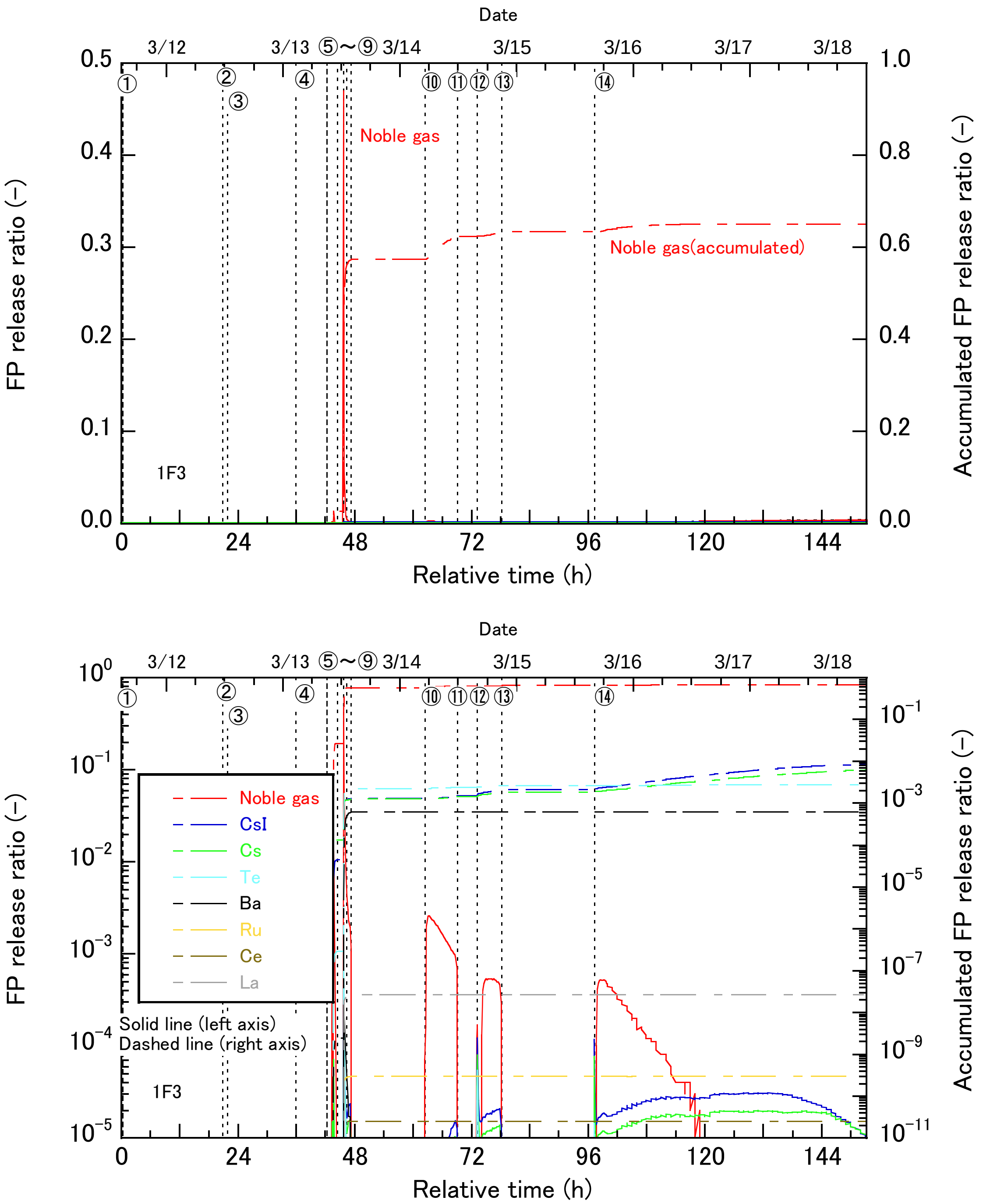


Fig.3-1-9 FP release ratio to the environment (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

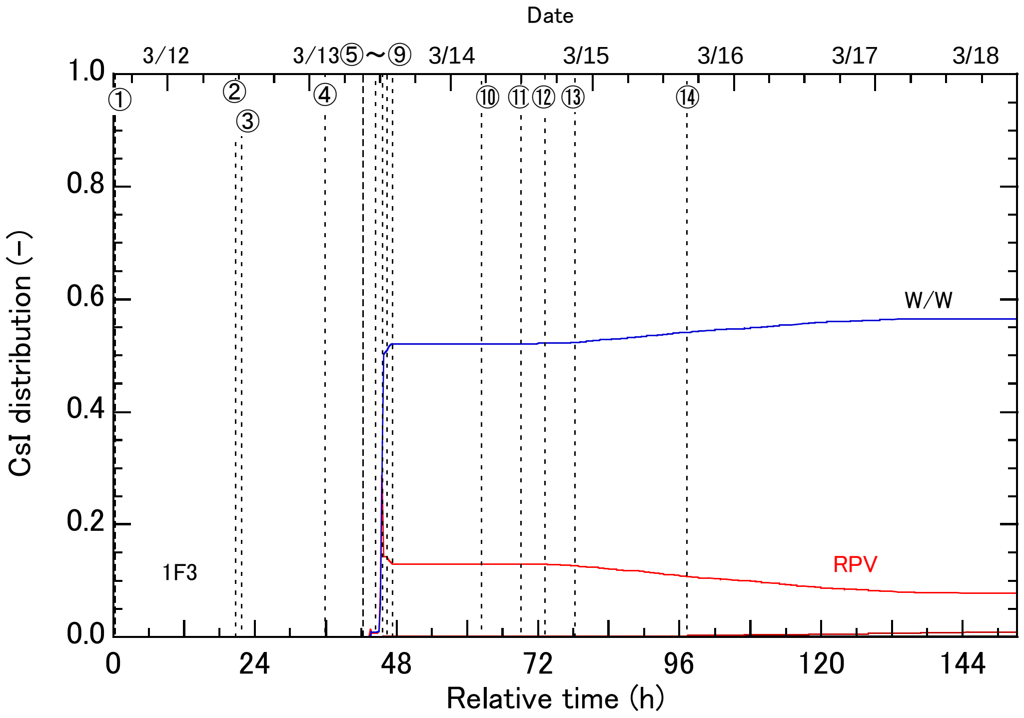


Fig.3-1-10 Distribution of CsI (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

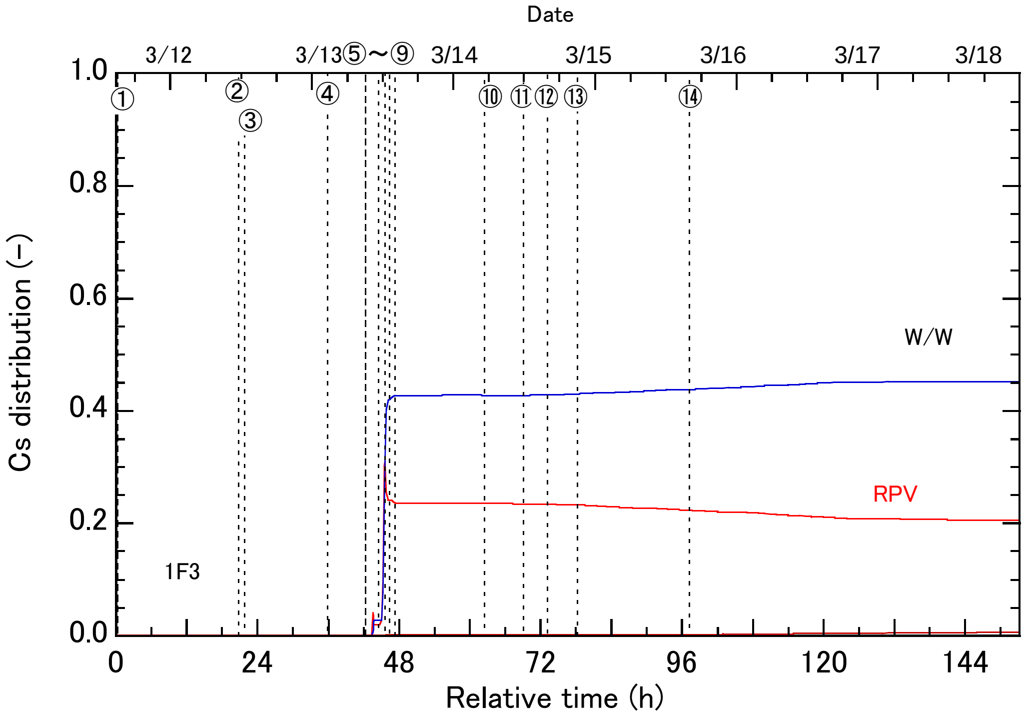


Fig.3-1-11 Distribution of Cs (unit 3) [TEPCO-1]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

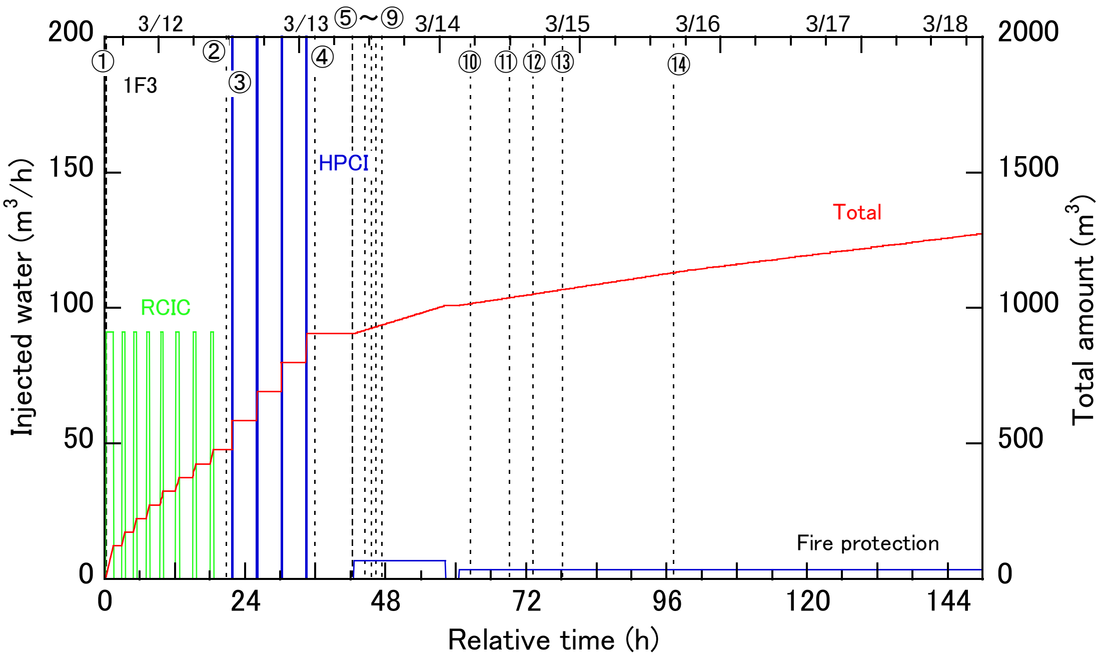


Fig.3-2-1 Amount of water injection (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

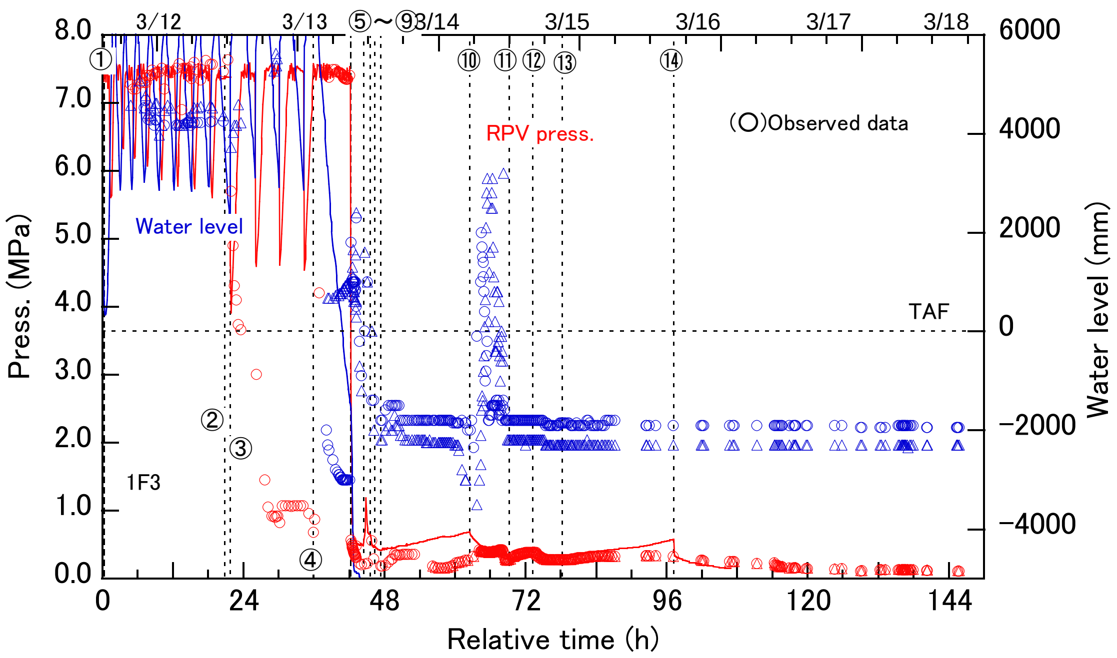


Fig.3-2-2 RPV pressure and water level (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

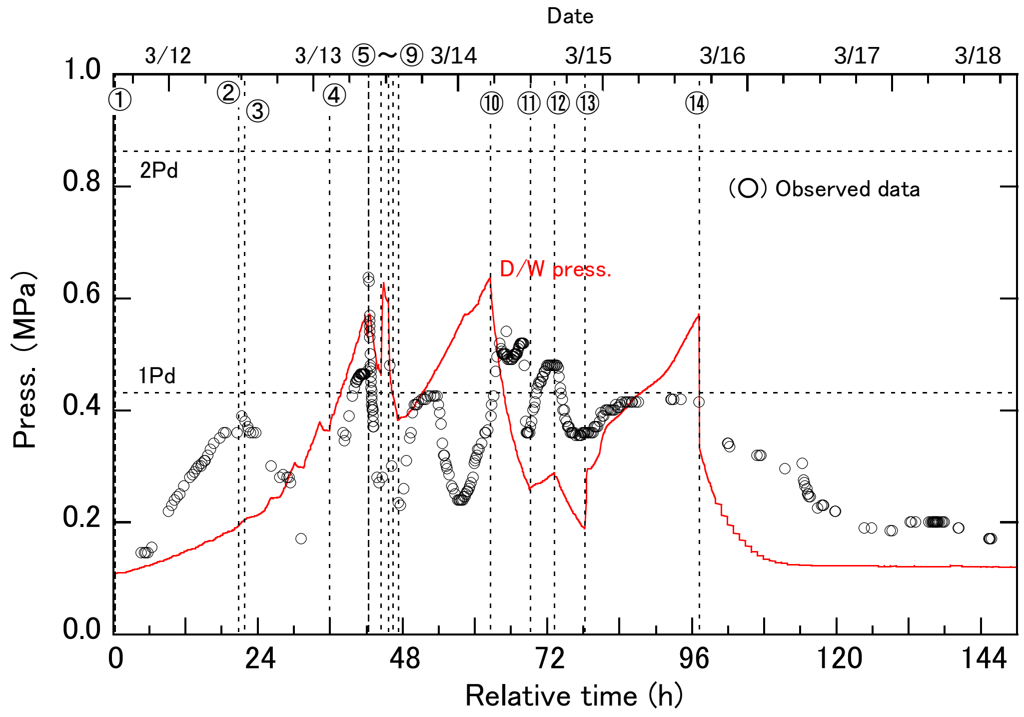


Fig.3-2-3 D/W pressure (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

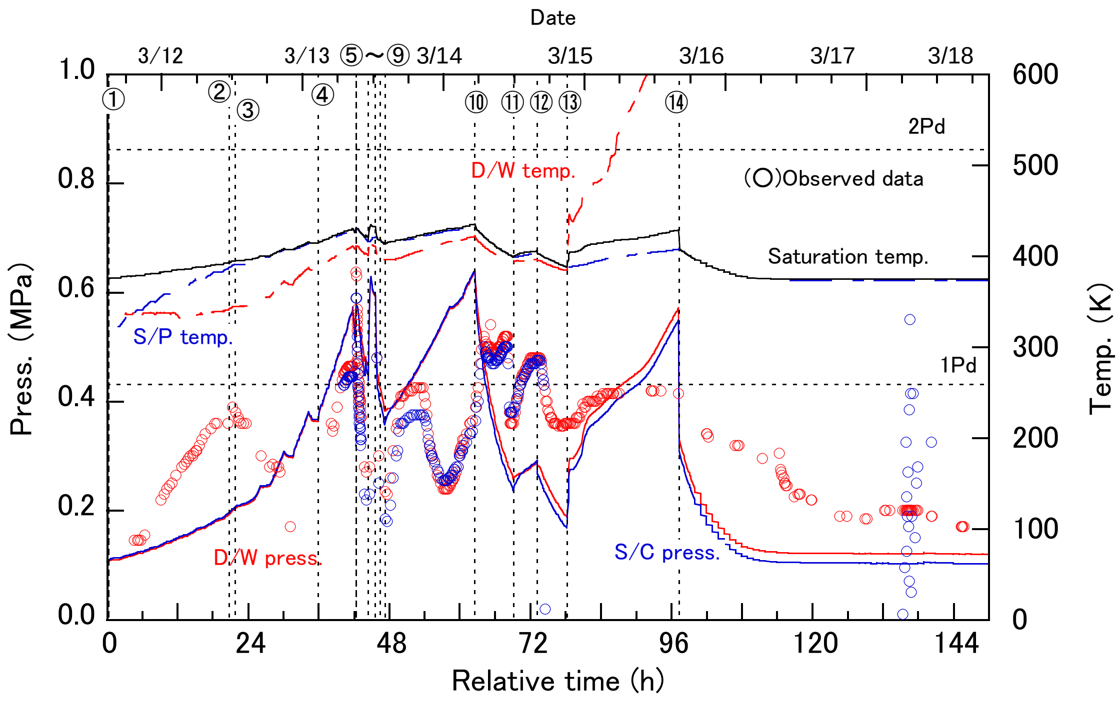


Fig.3-2-4 PCV pressure and temperature (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

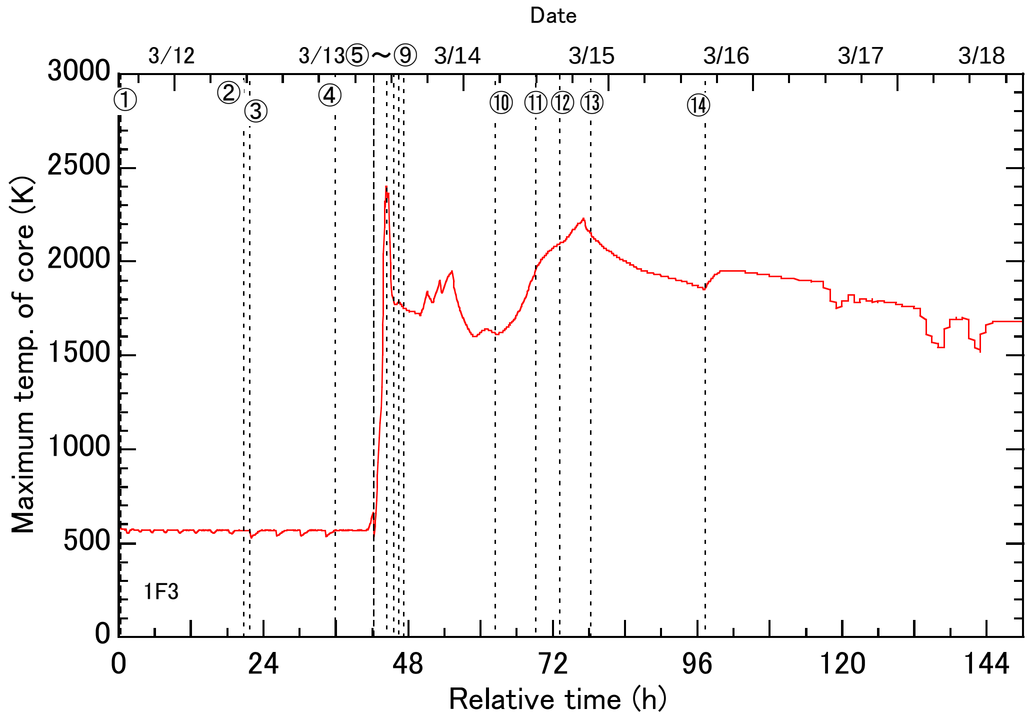


Fig.3-2-5 Maximum temperature of the core (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

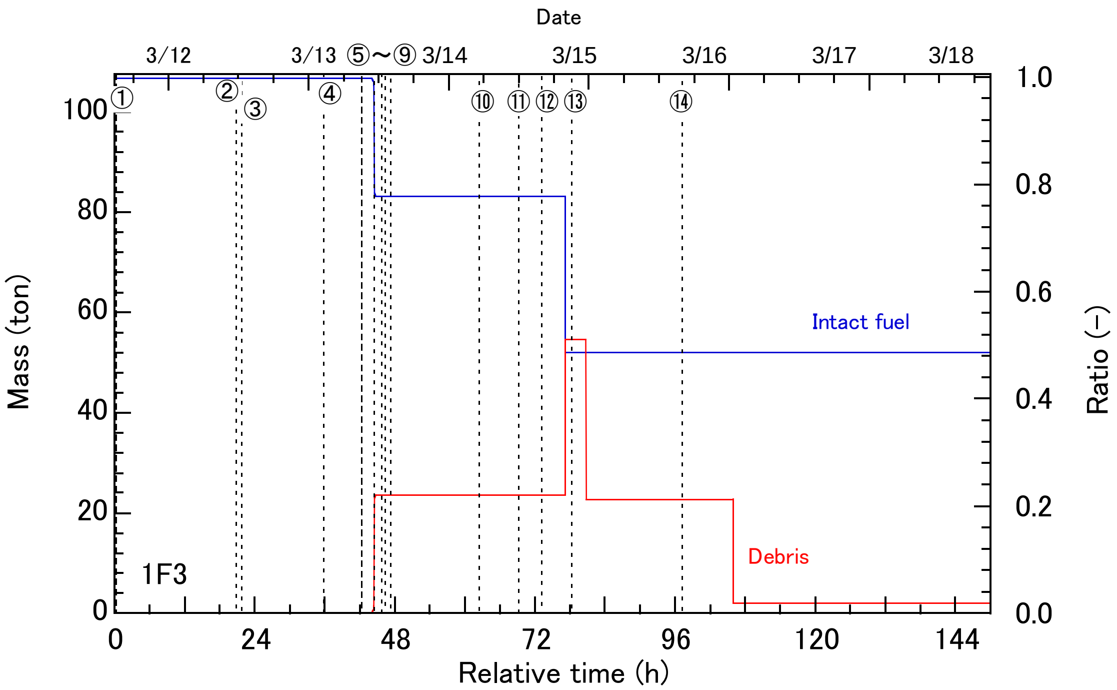


Fig.3-2-6 Mass of the core (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

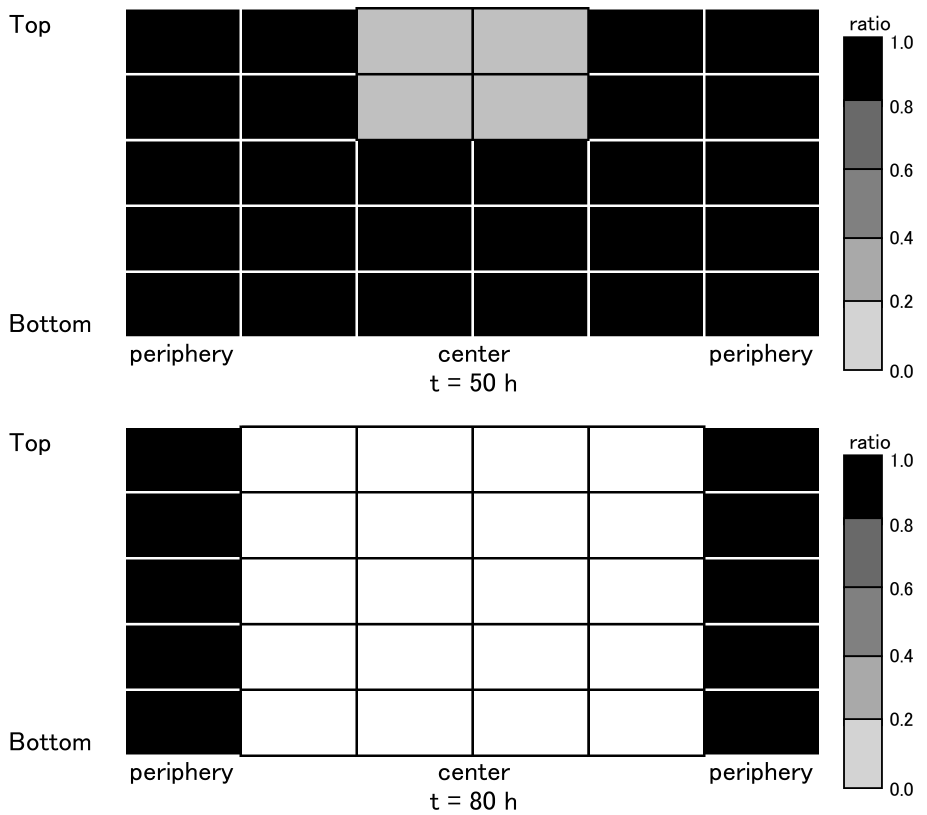


Fig.3-2-7 Distribution of intact fuel (unit 3) [TEPCO-2]

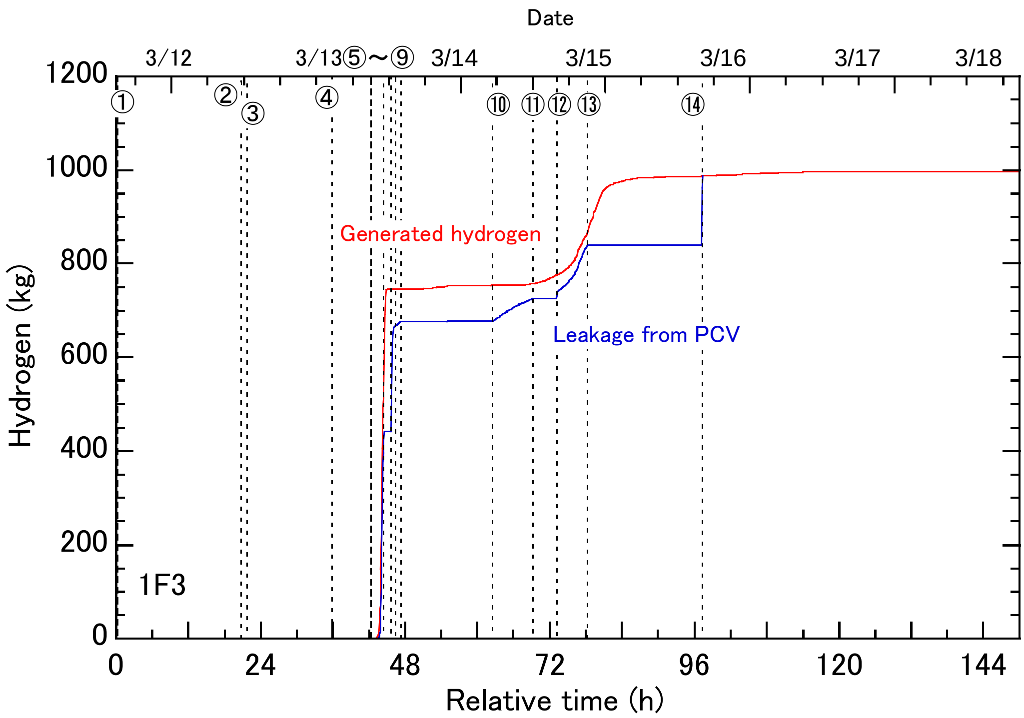
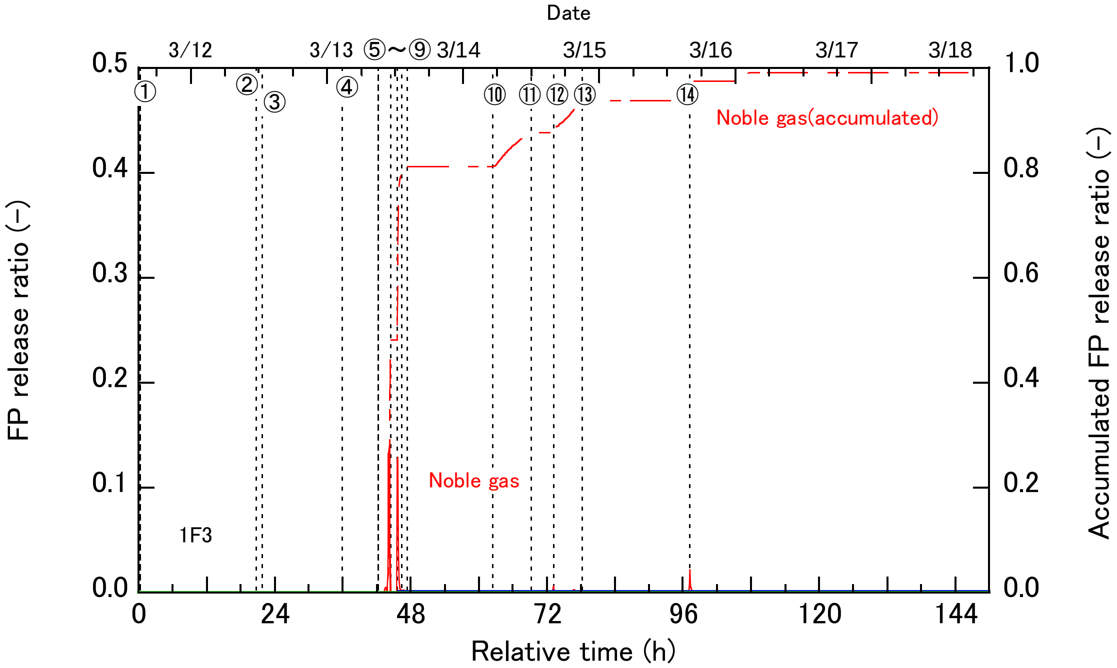


Fig.3-2-8 Hydrogen generation (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)



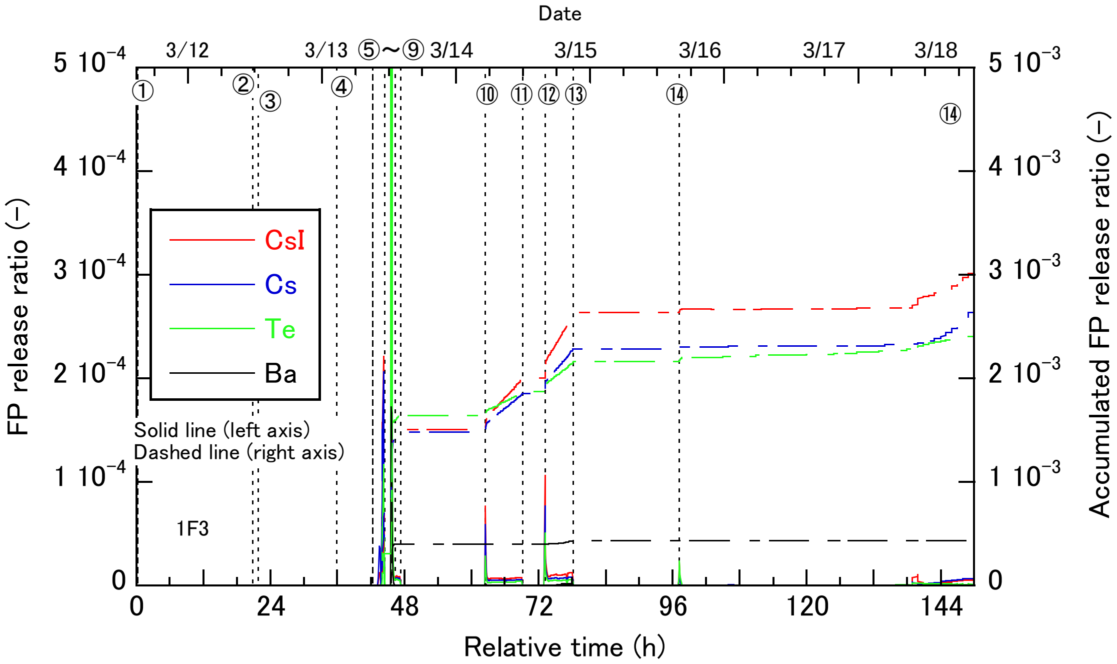


Fig.3-2-9 FP release ratio to the environment (1/2) (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

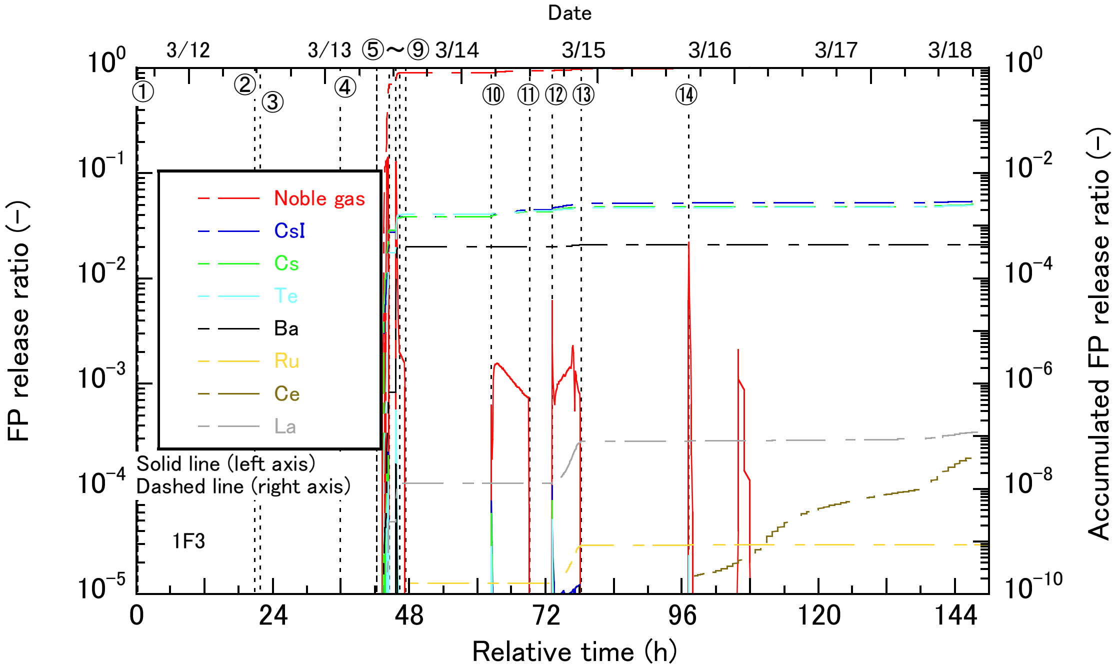


Fig.3-2-10 FP release ratio to the environment (2/2) (unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩〜⑭PCV vent (open⇔close)

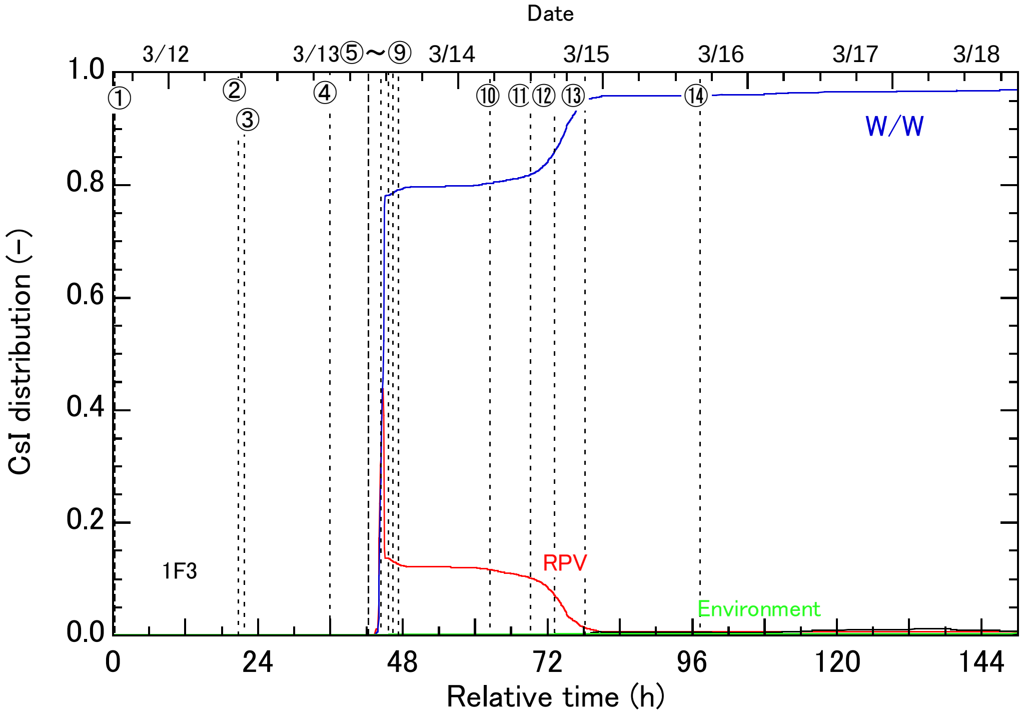


Fig.3-2-11 Distribution of CsI (1/2)(unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩〜⑭PCV vent (open⇔close)

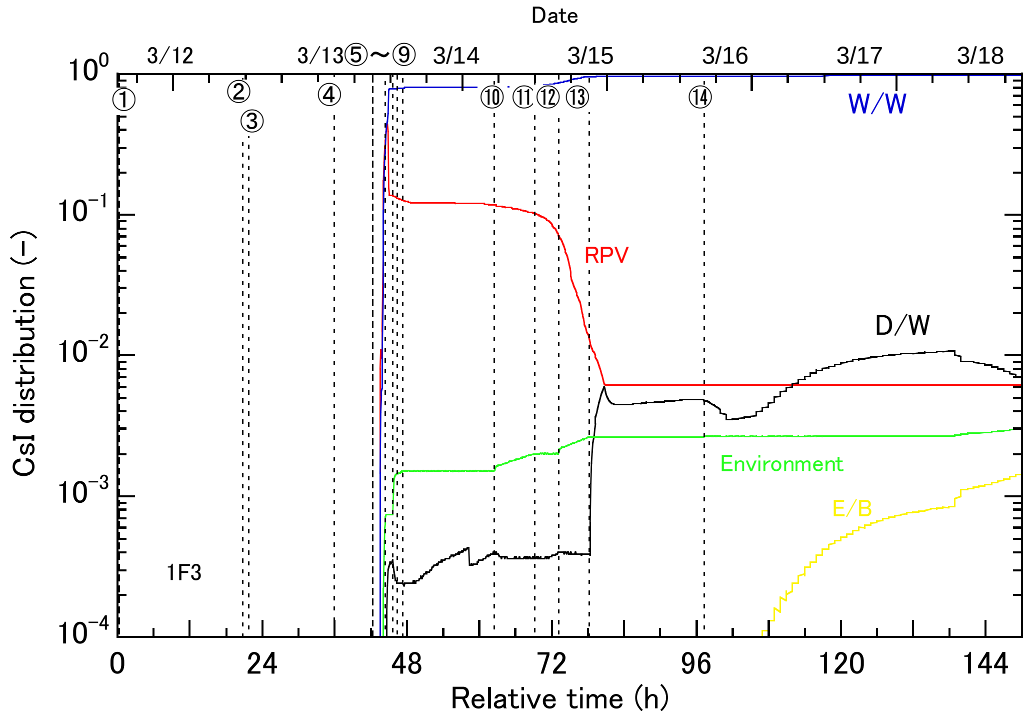


Fig.3-2-12 Distribution of CsI (2/2)(unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

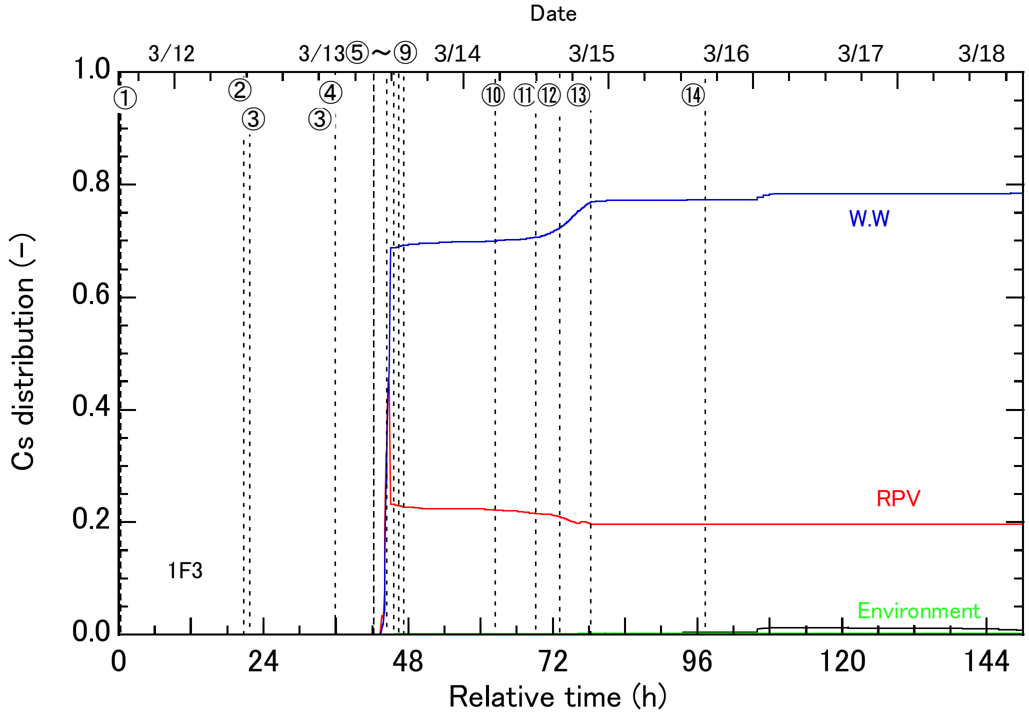


Fig.3-2-13 Distribution of Cs (1/2)(unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

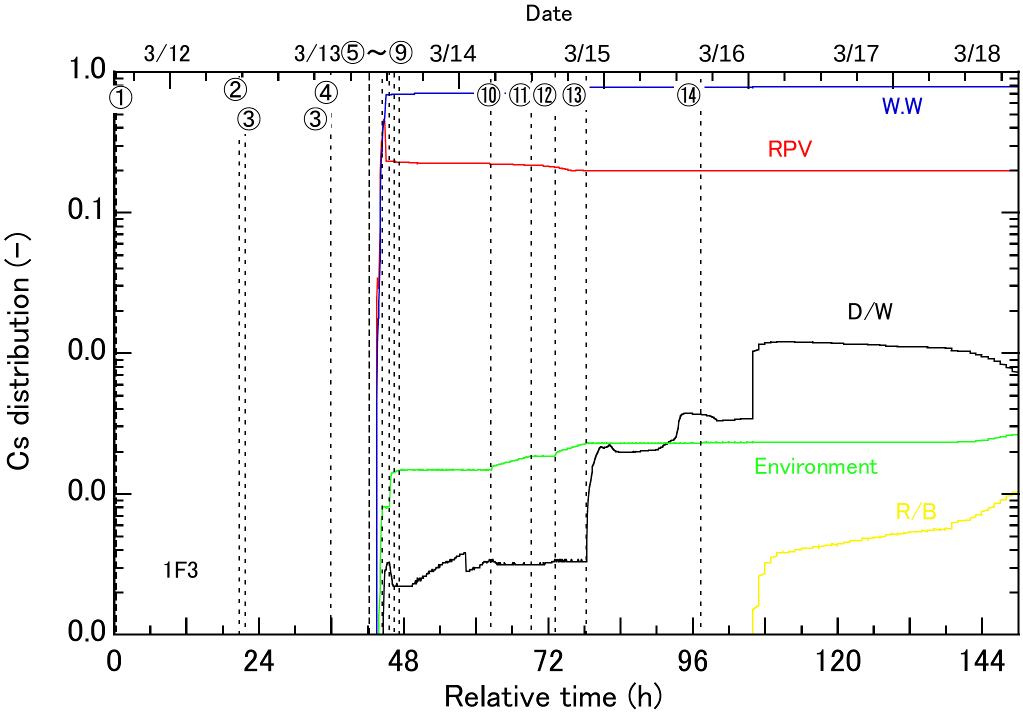


Fig.3-2-14 Distribution of Cs (2/2)(unit 3) [TEPCO-2]

①RCIC start manually, ②RCIC stop, ③HPCI start, ④HPCI stop, ⑤S/RV(open), ⑥PCV vent (open), ⑦Water inject., ⑧PCV vent (close), ⑨Sea water inject., ⑩～⑭PCV vent (open⇔close)

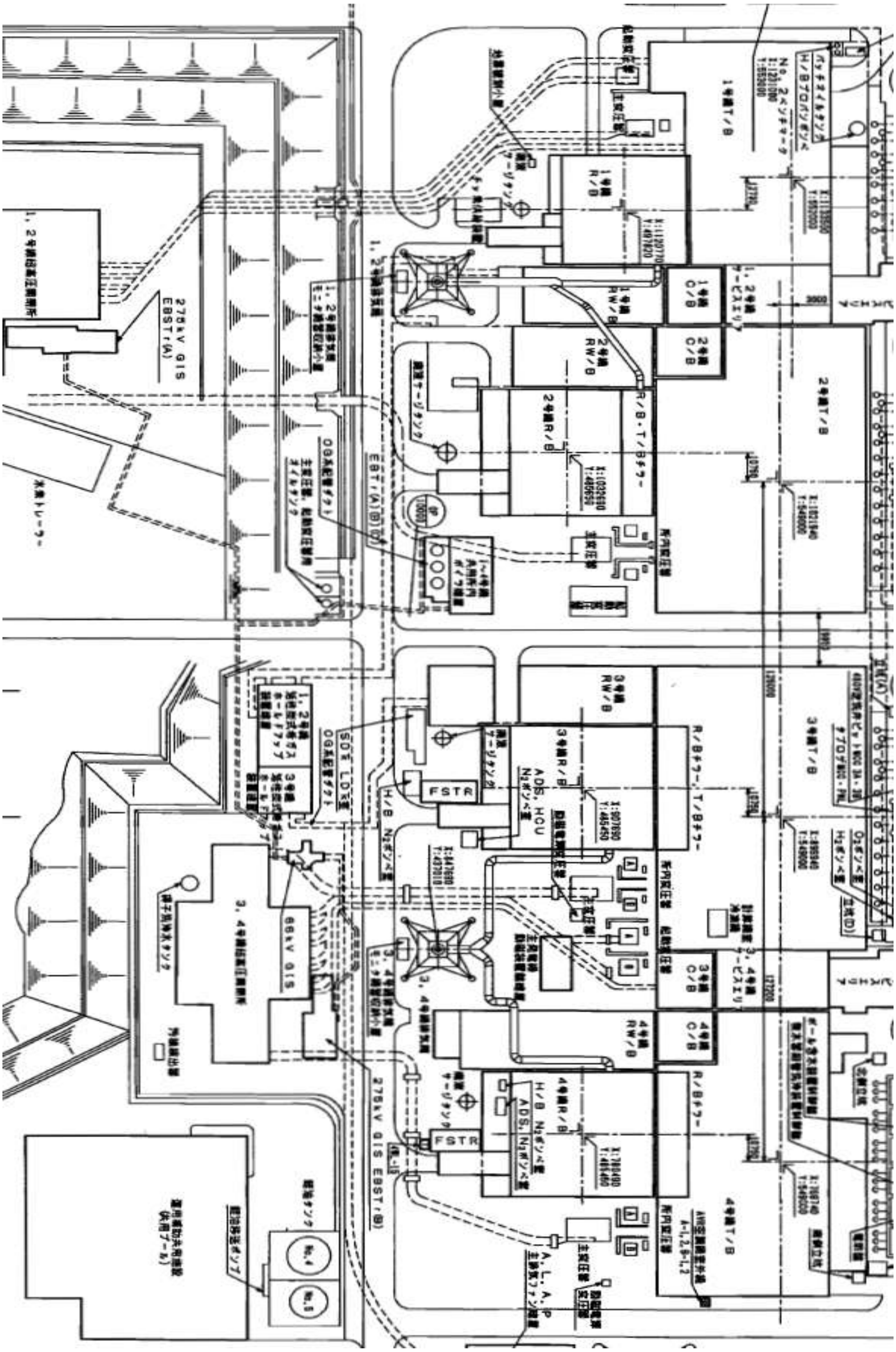


Fig. 1-1 Building Layout for Units 1 to 4, Fukushima Dai-ichi NPS

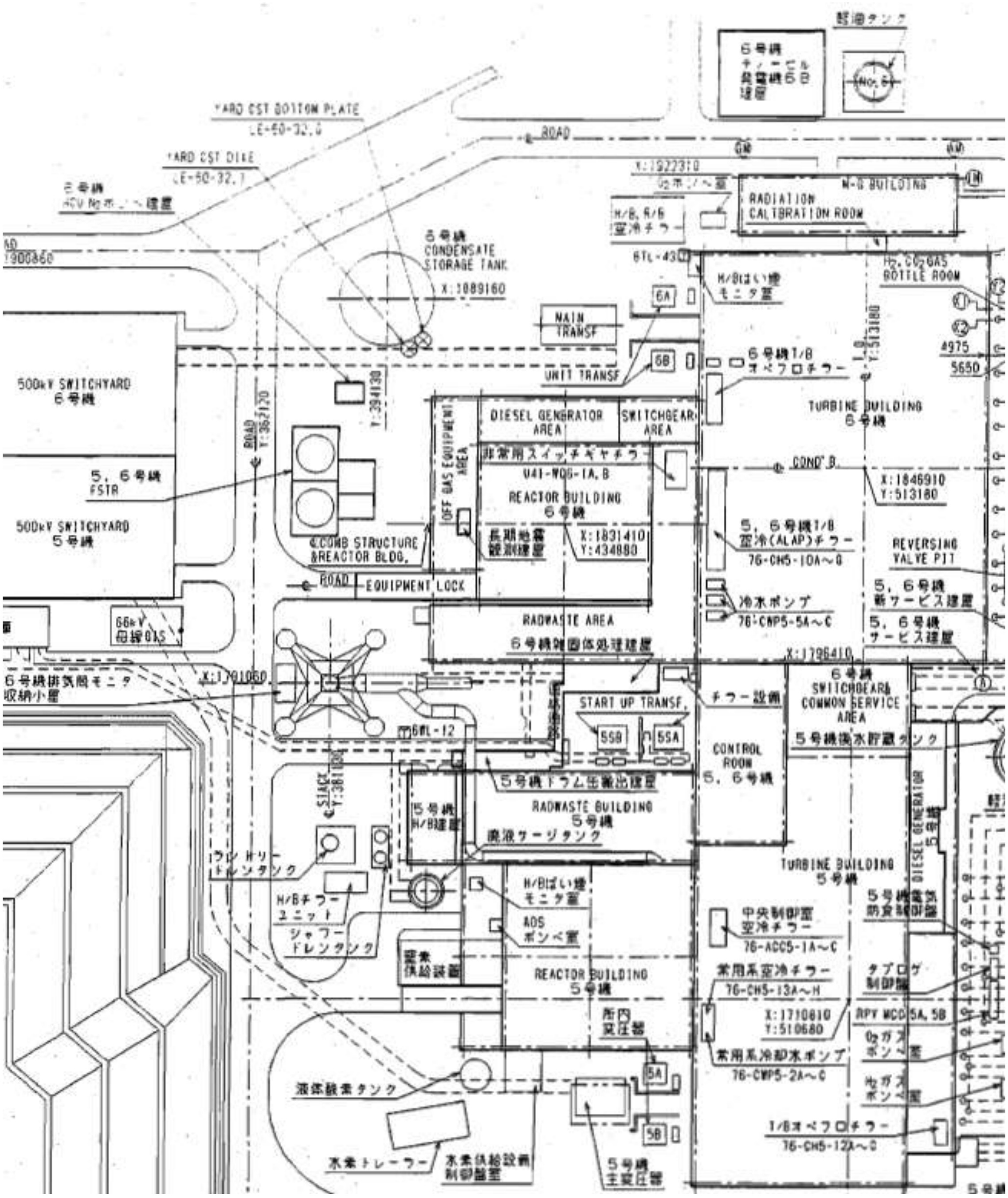


Fig. 1-2　Building Layout for Units 5 and 6, Fukushima Dai-ichi NPS

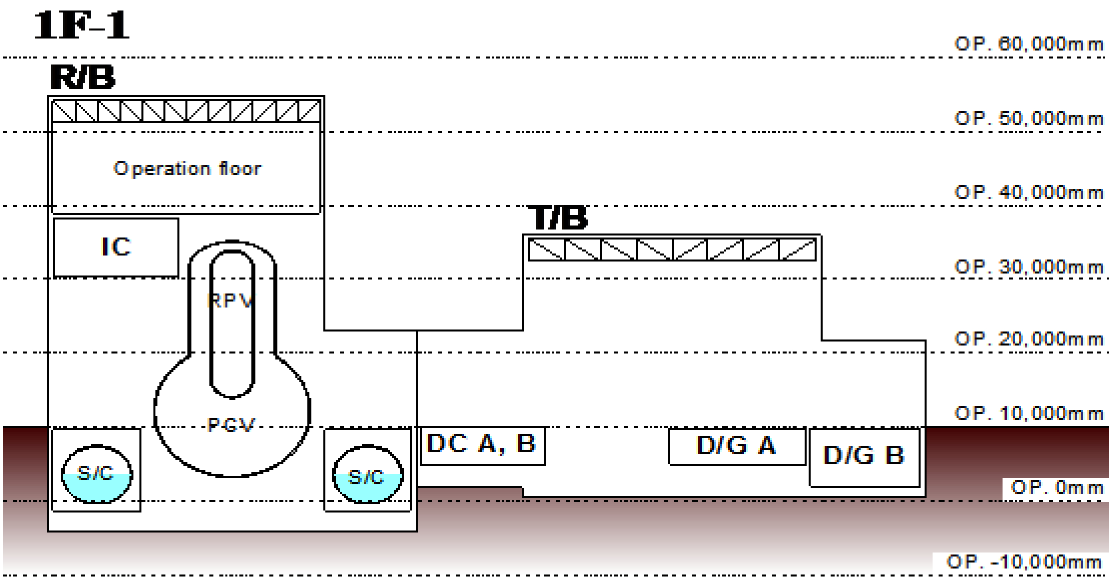


Fig. 2-1 Building Cross-section for Unit 1, Fukushima Dai-ichi NPS

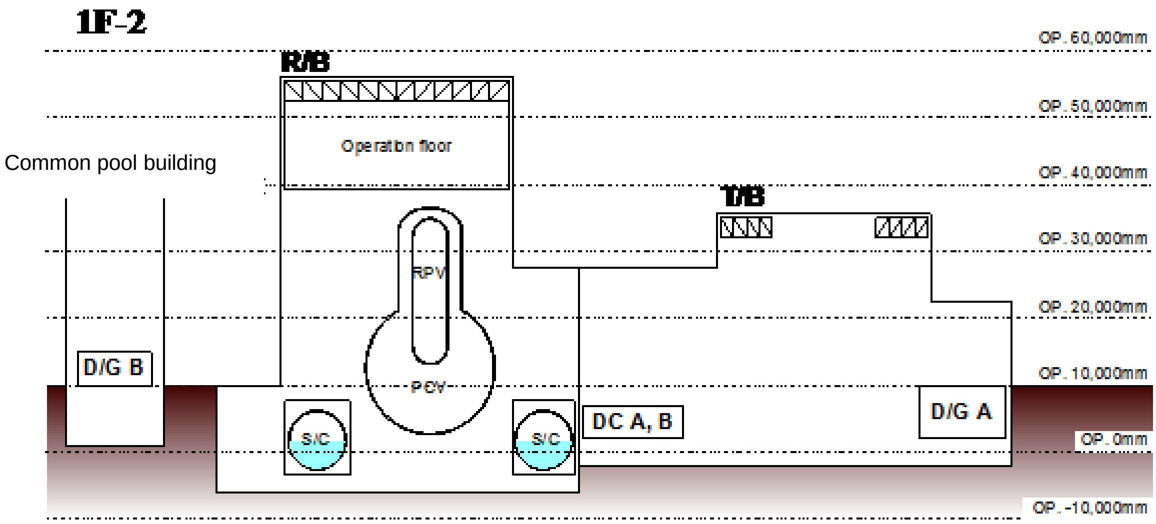


Fig. 2-2 Building Cross-section for Unit 2, Fukushima Dai-ichi NPS

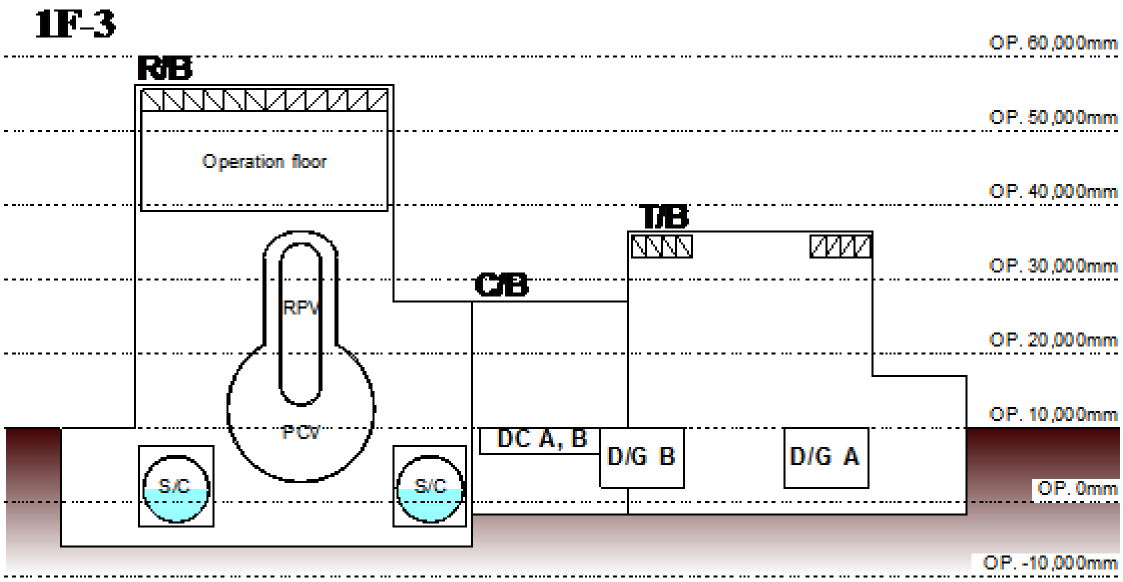


Fig. 2-3 Building Cross-section for Unit 3, Fukushima Dai-ichi NPS

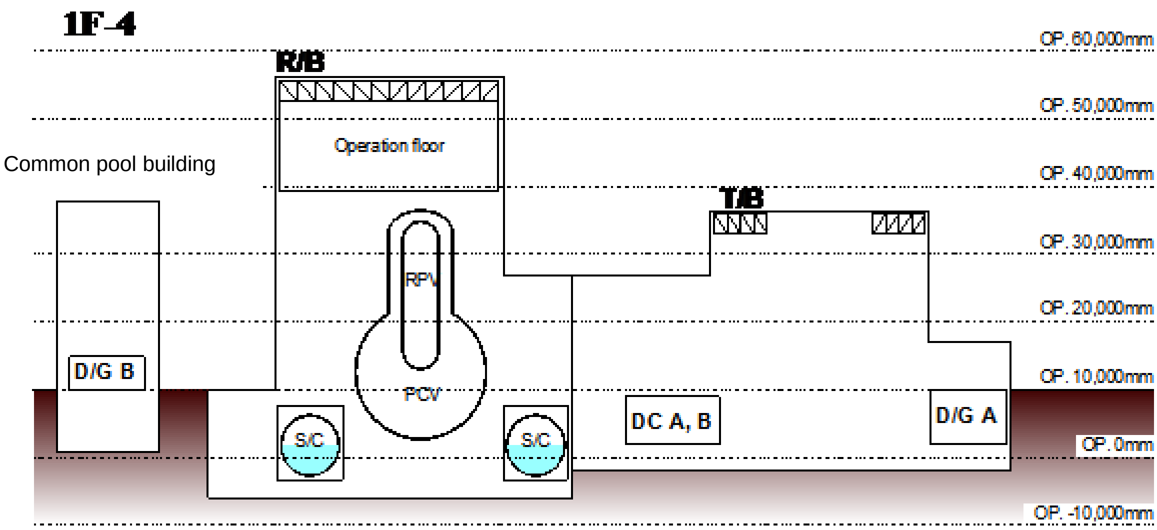


Fig. 2-4 Building Cross-section for Unit 4, Fukushima Dai-ichi NPS

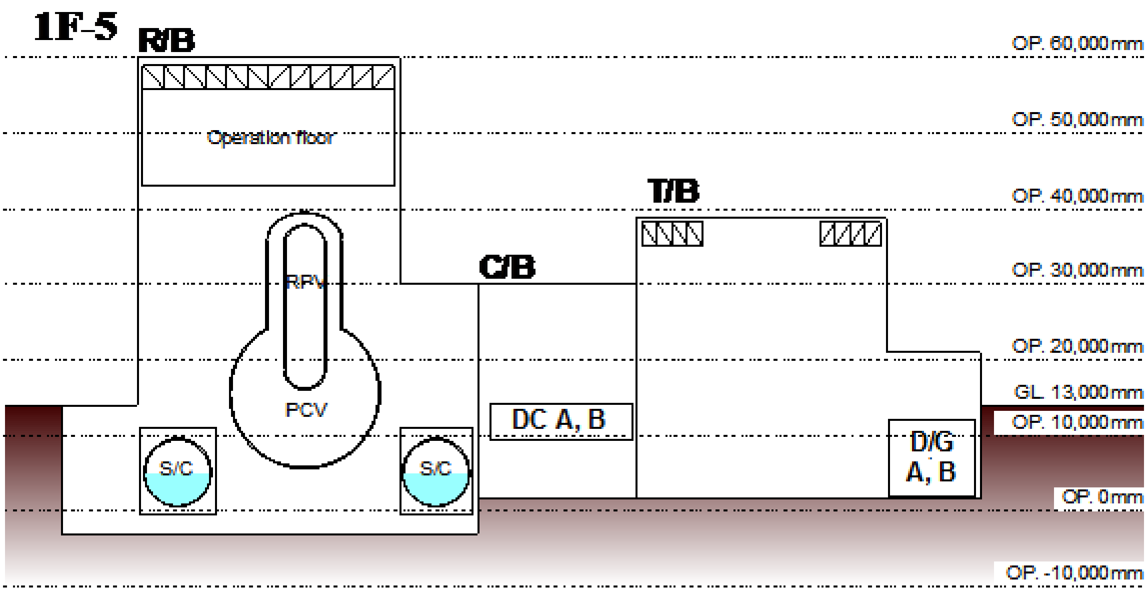


Fig. 2-5 Building Cross-section for Unit 5, Fukushima Dai-ichi NPS

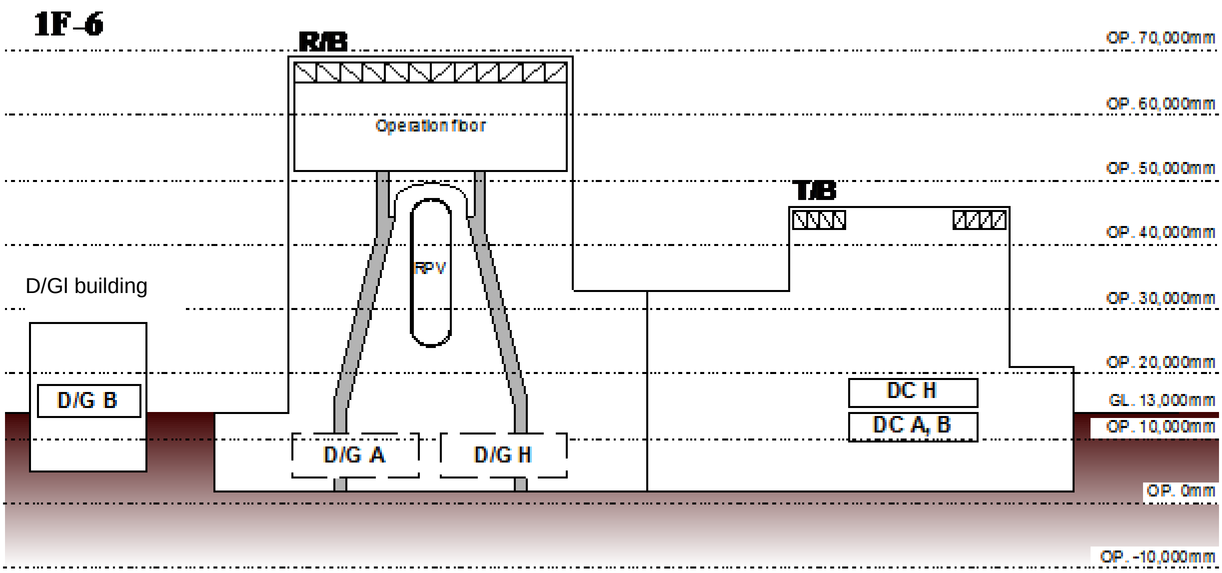


Fig. 2-6 Building Cross-section for Unit 6, Fukushima Dai-ichi NPS

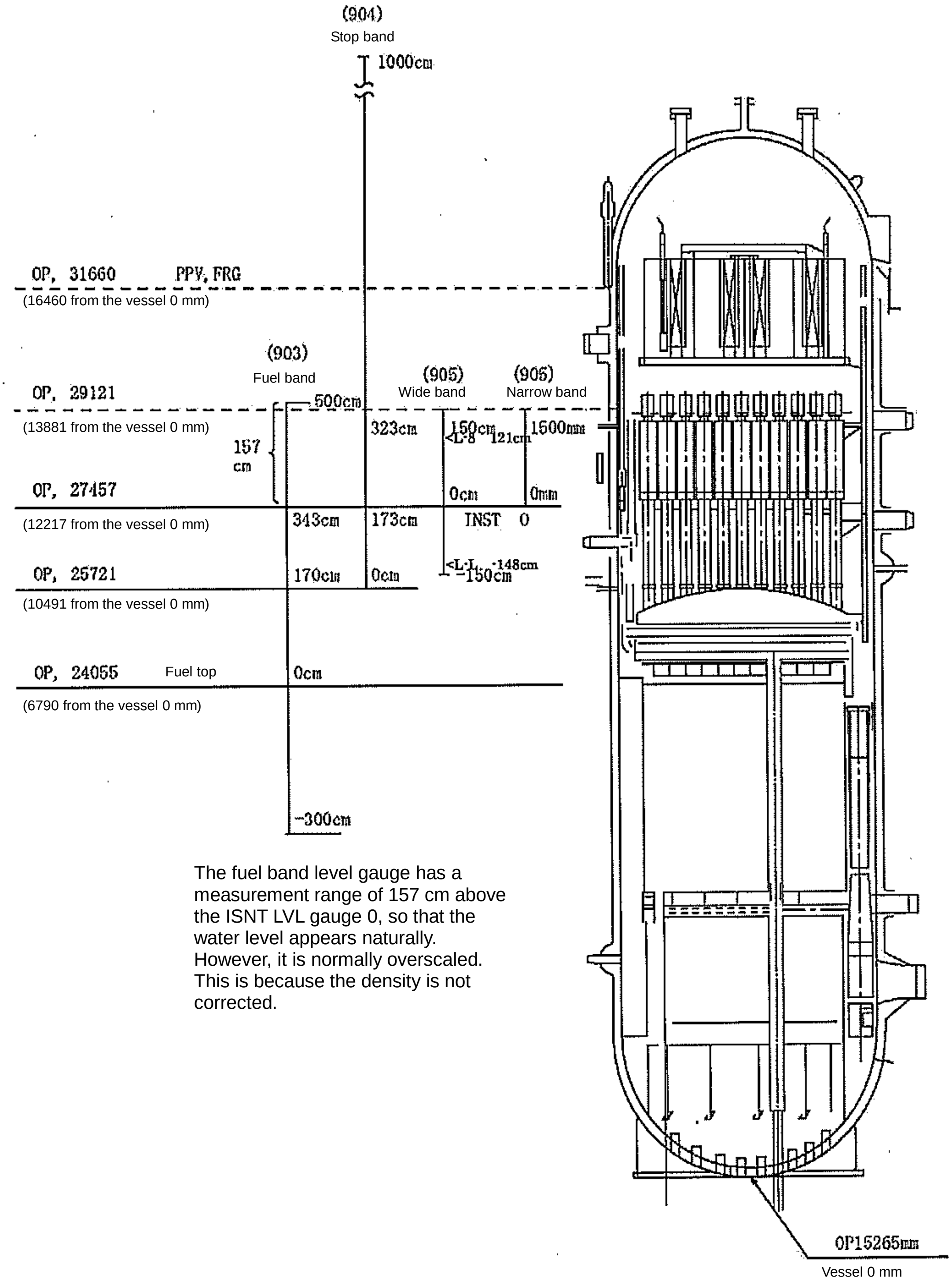


Fig. 3-1 Range of reactor water instrumentations (Unit 1, Fukushima Dai-ichi)

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

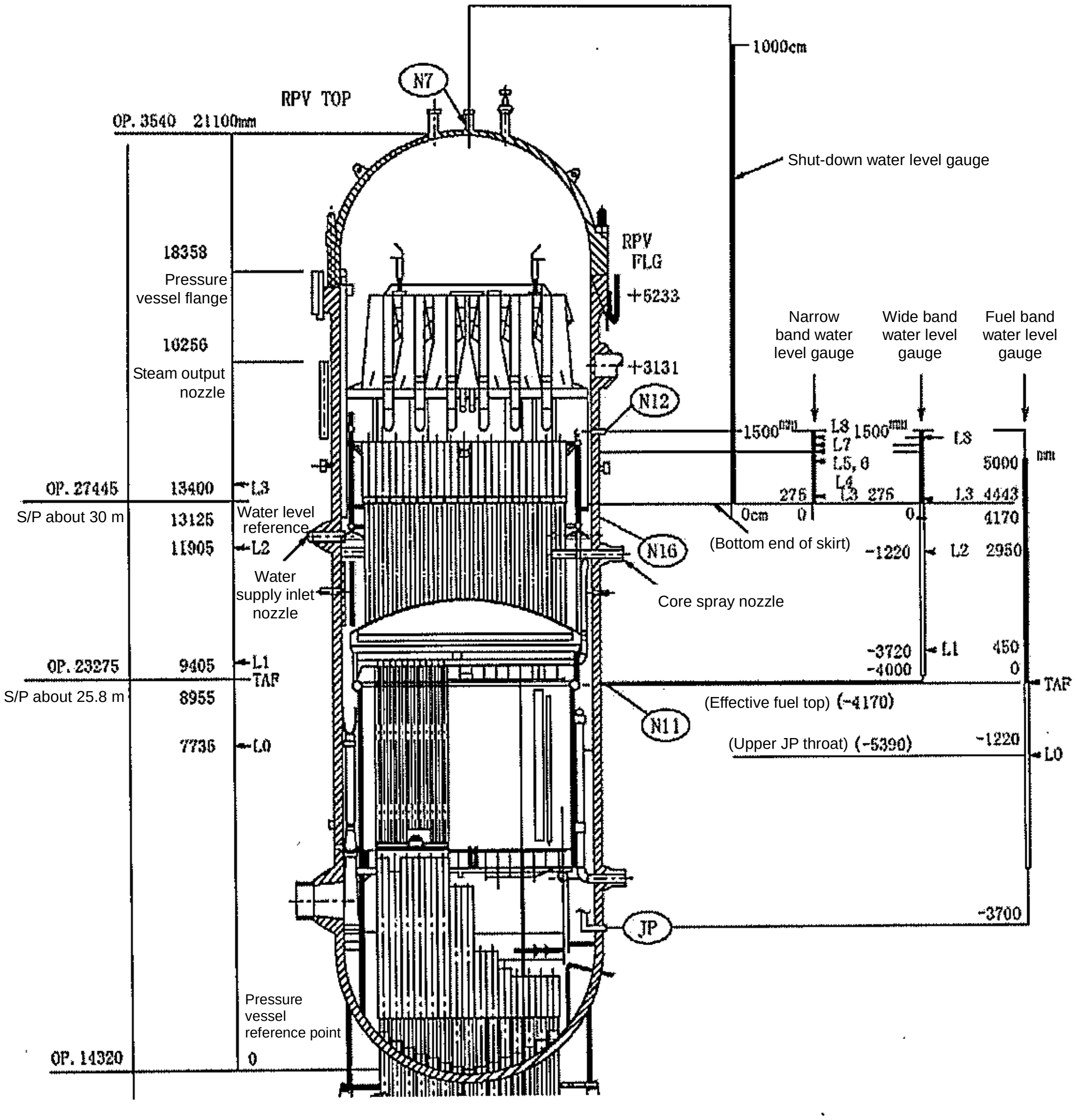


Fig. 3-2 Range of reactor water instrumentations (Unit 2, Fukushima Dai-ichi)

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

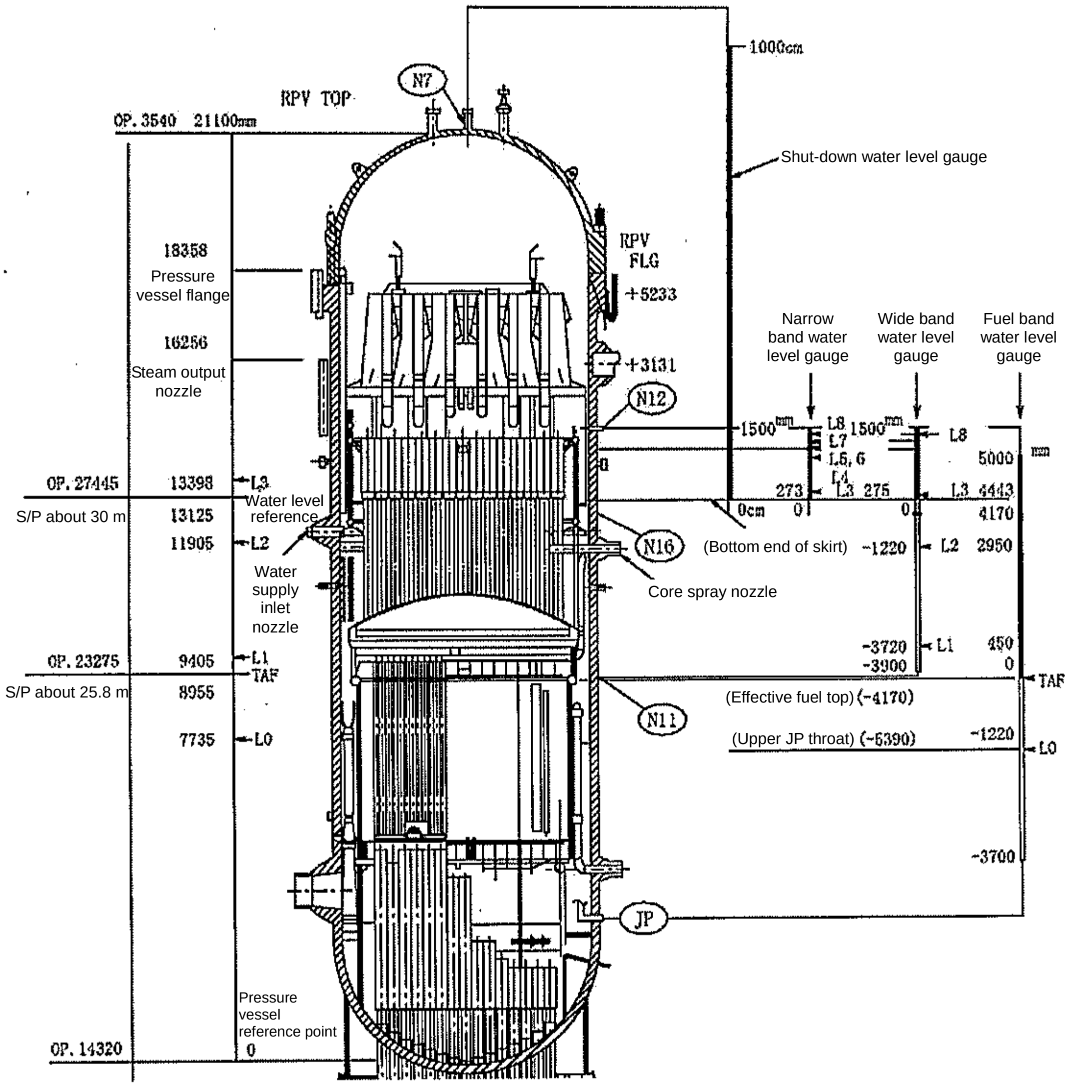


Fig. 3-3 Range of reactor water instrumentations (Unit 3, Fukushima Dai-ichi)

Source: “Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects” (May 23, 2011, TEPCO)

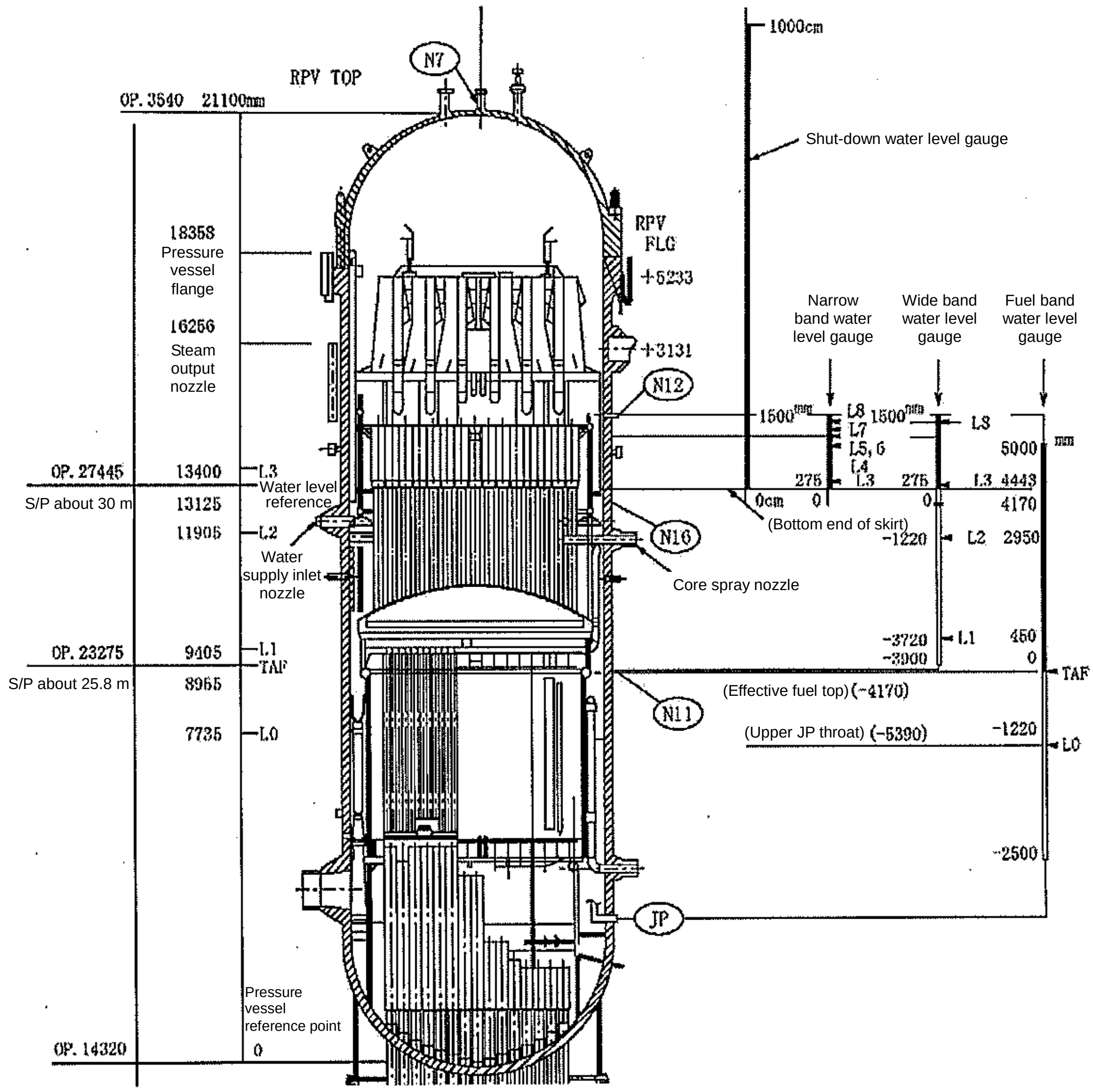


Fig. 3-4 Range of reactor water instrumentations (Unit 4, Fukushima Dai-ichi)

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

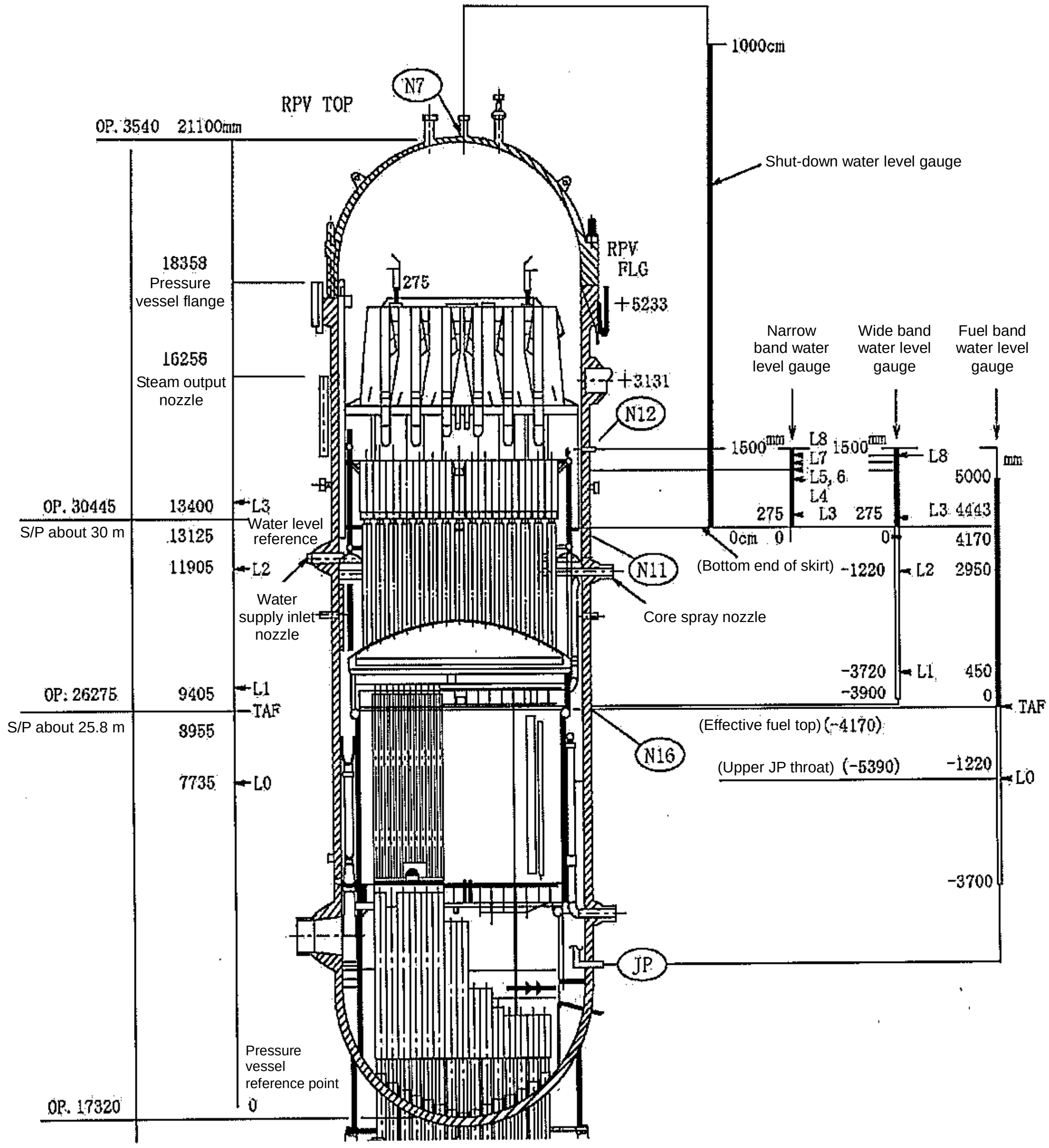


Fig. 3-5 Range of reactor water instrumentations (Unit 5, Fukushima Dai-ichi)

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

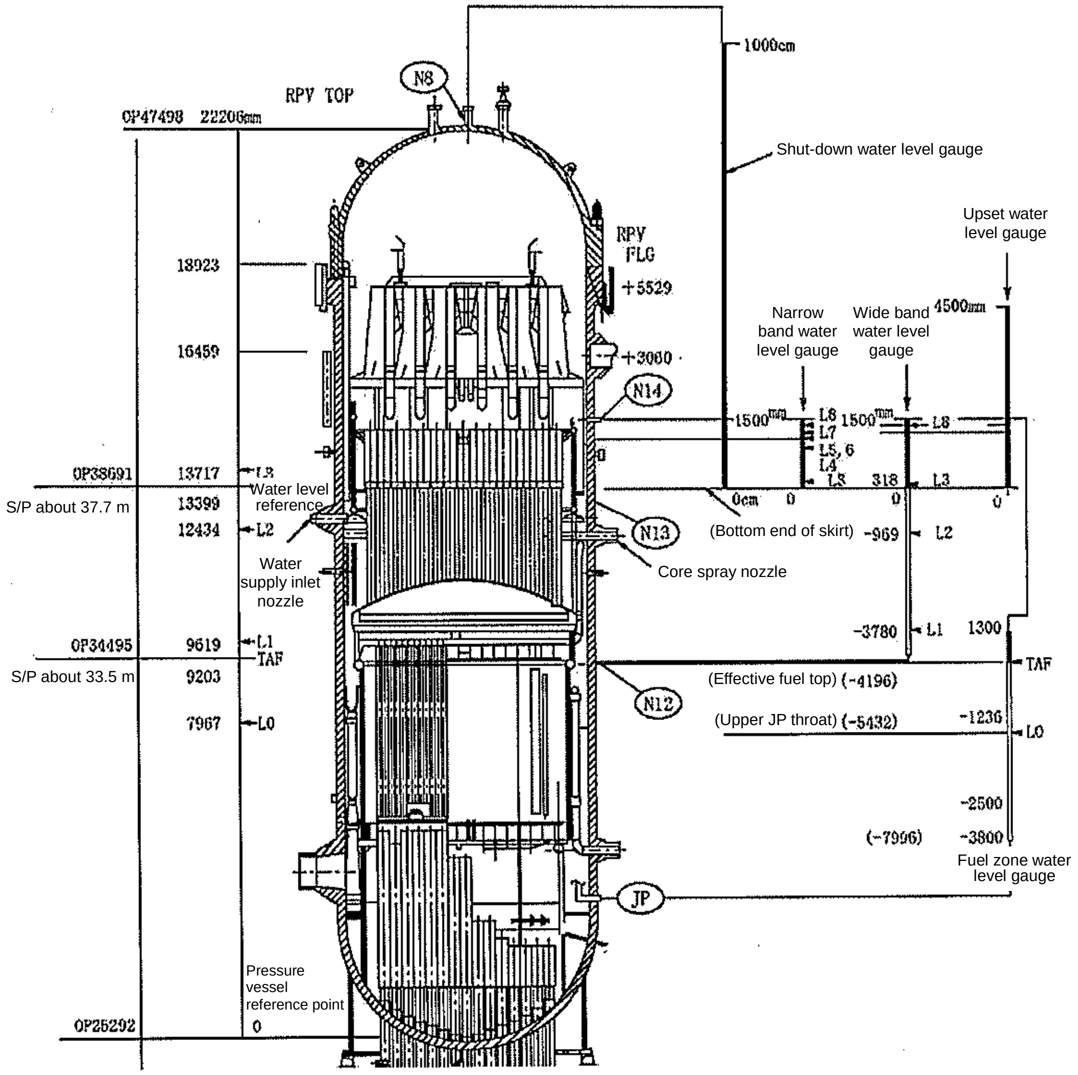


Fig. 3-6 Range of reactor water instrumentations (Unit 6, Fukushima Dai-ichi)

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

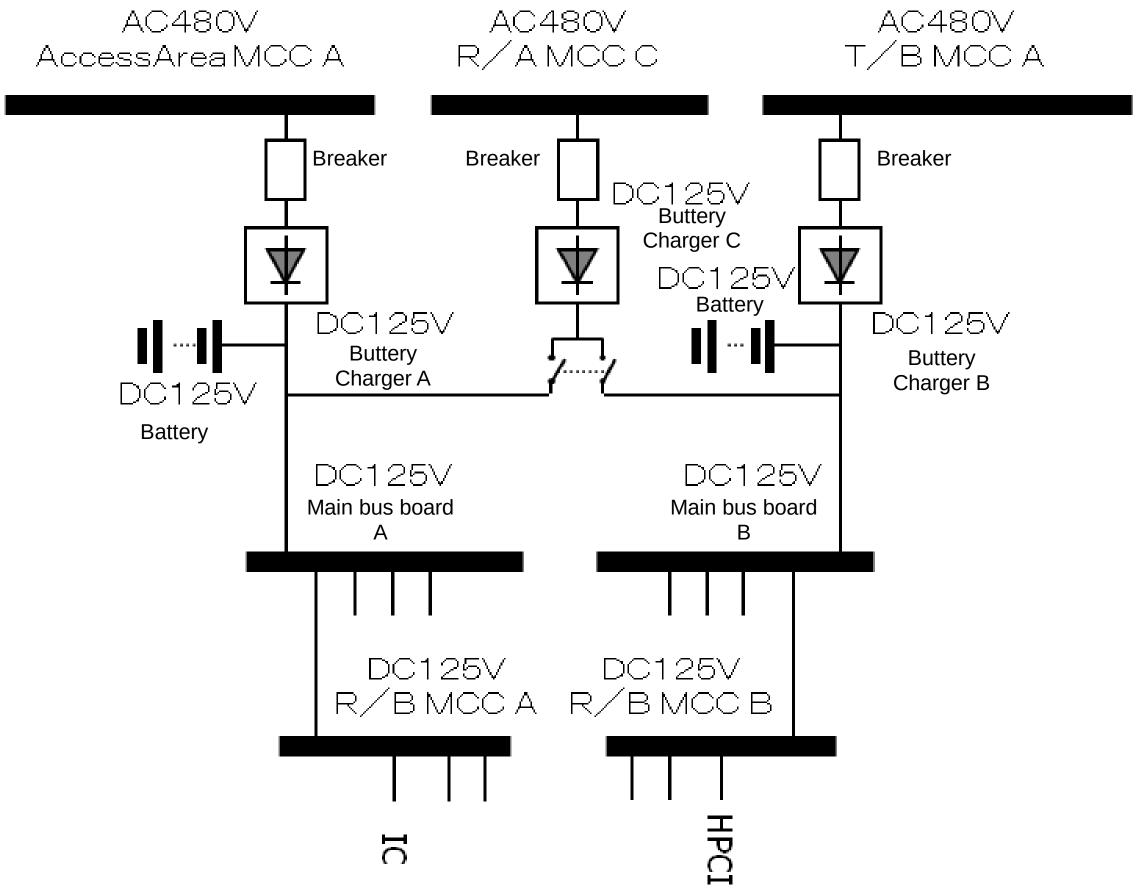


Fig. 4-1　DC power supply system (Unit 1)

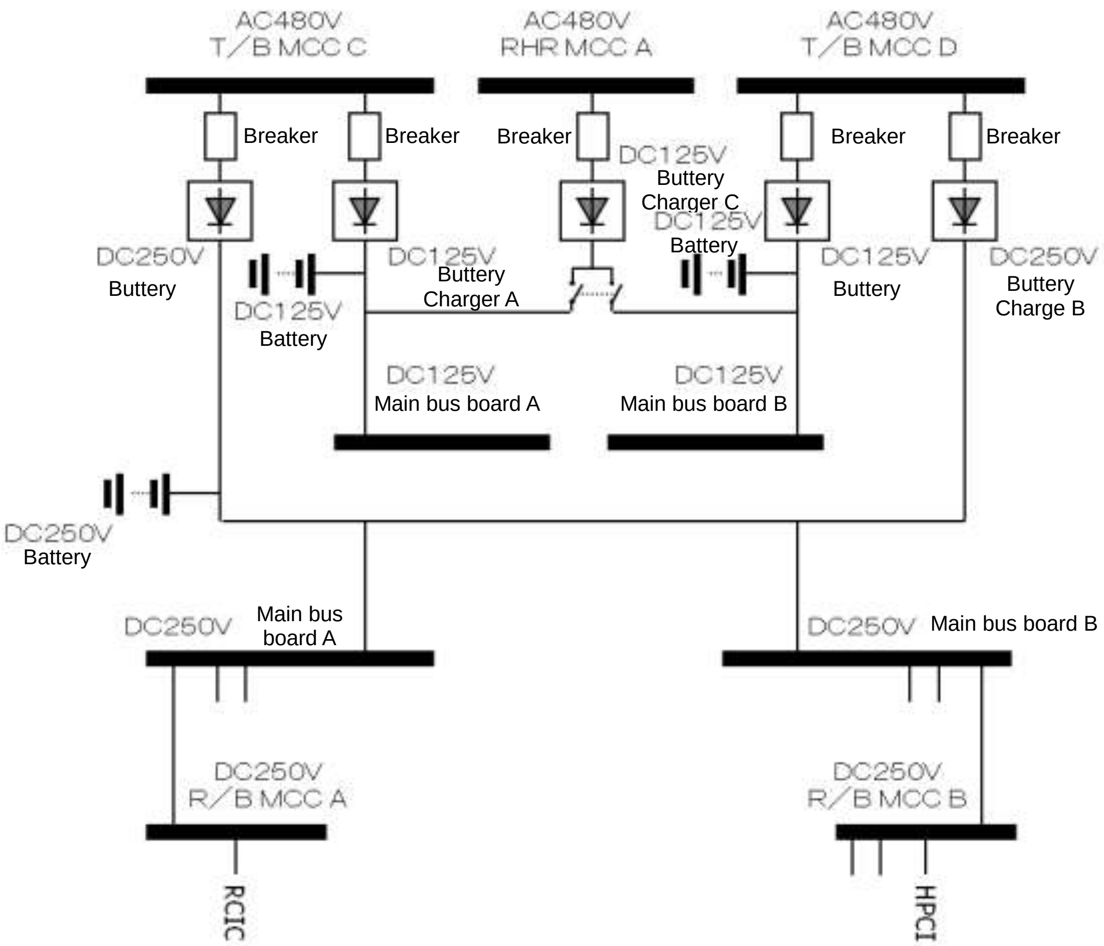


Fig. 4-2 DC power supply system (Units 2 & 3)

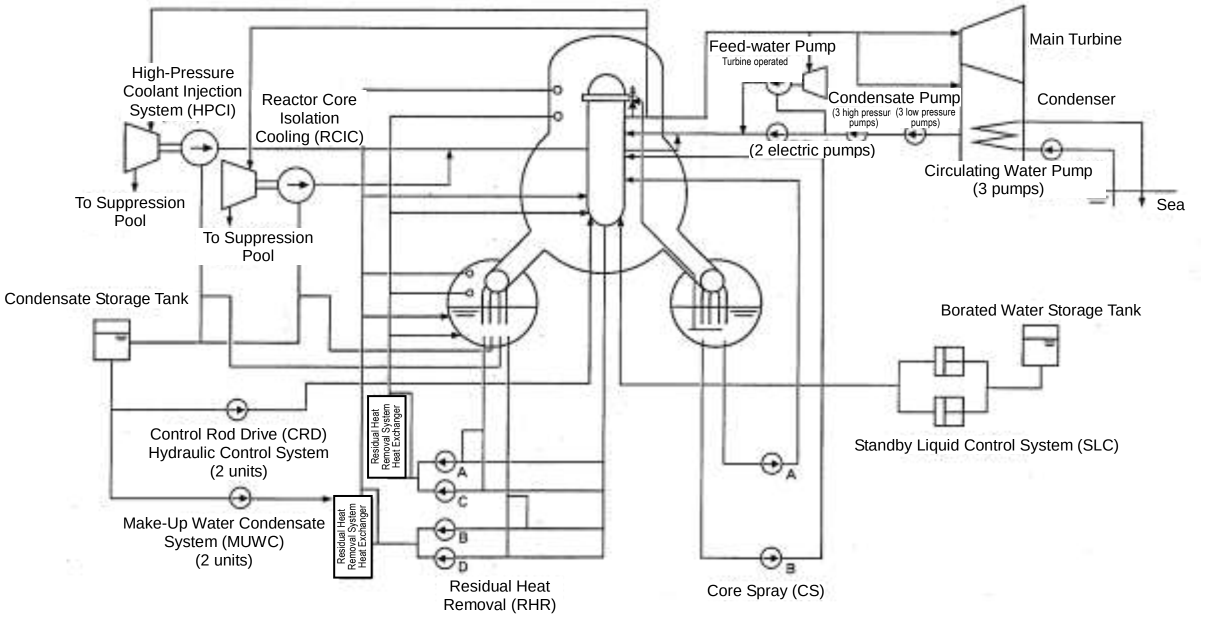


Fig. 5-1 System configuration for Units 4 and 5, Fukushima Dai-ichi NPS

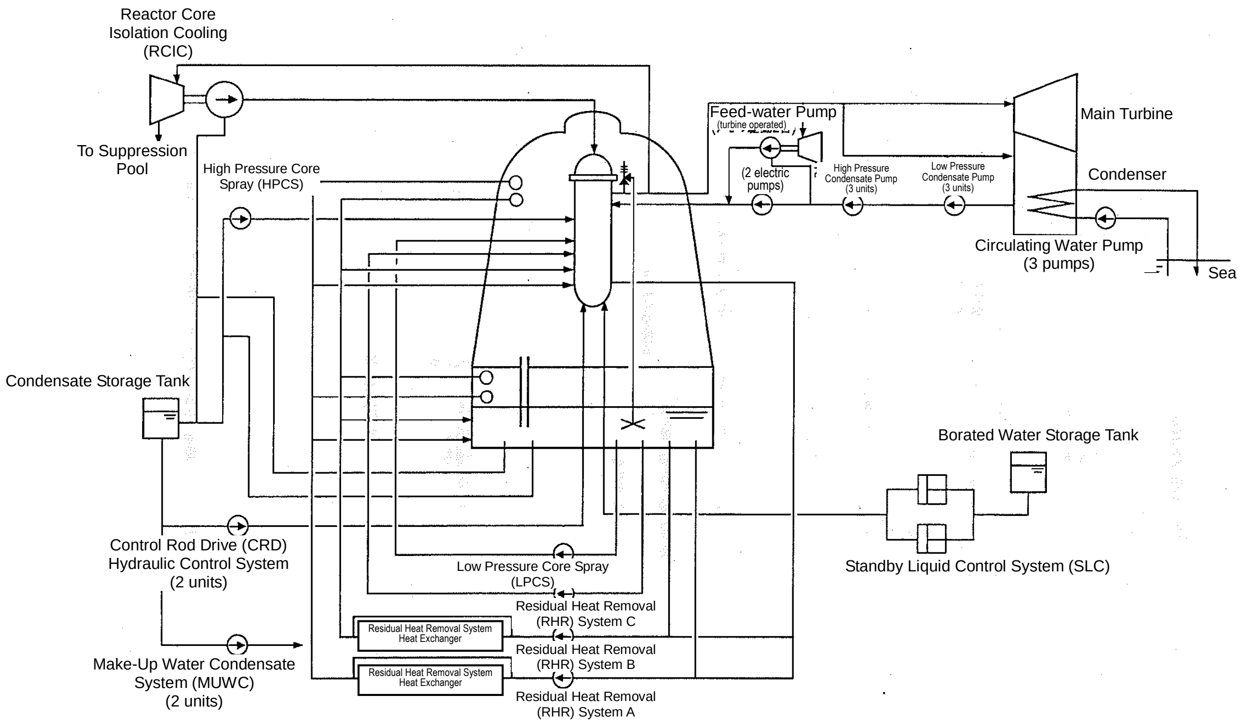


Fig. 5-2 System configuration for Unit 6, Fukushima Daiichi NPS, and Units 1 to 4, Fukushima Dai-ni NPS

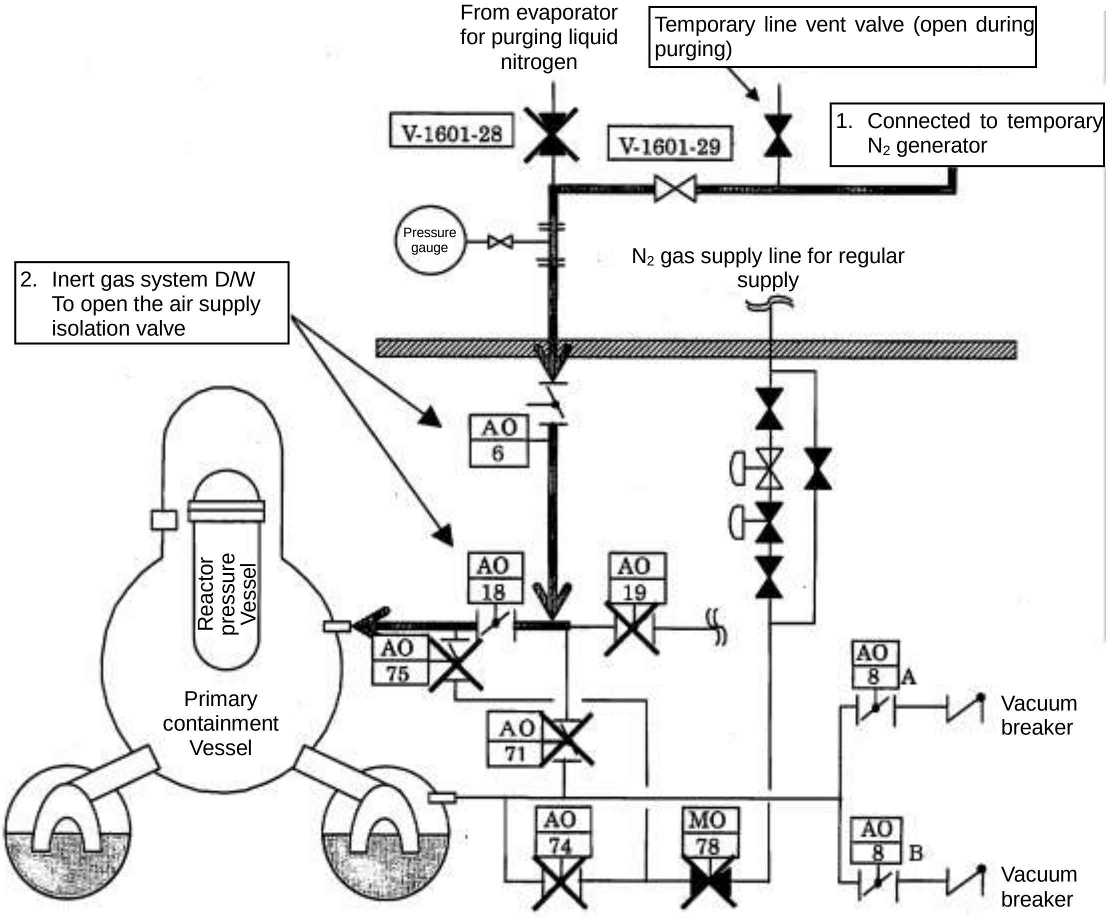


Fig. 6 System outline diagram: Nitrogen gas injection into the PCV

Table 1-1 Status of equipment, etc. for 1F-1 Emergency Core Cooling System (ECCS System)

			Location of installation	Seismic class	Status at seismic scram	Status during period from seismic scram to immediately before attack of tsunami	After attack of tsunami	Remarks
Cooling function	ECCS system	CS (A)	R/B basement (OP. -1230)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		CS (C)	R/B basement (OP. -1230)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		CCS (A)	R/B basement (OP. -1230)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; both the power supply and seawater system (CCSW) were lost after the tsunami.
		CCS (B)	R/B basement (OP. -1230)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; both the power supply and seawater system (CCSW) were lost after the tsunami.
		CCSW (A)	Outdoors (OP. 4000)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; the main body was submerged and the power supply was lost at the tsunami.
		CCSW (B)	Outdoors (OP. 4000)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; the main body was submerged and the power supply was lost at the tsunami.
		CS (B)	R/B basement (OP. -1230)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		CS (D)	R/B basement (OP. -1230)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		CCS (C)	R/B basement (OP. -1230)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; both the power supply and seawater system (CCSW) were lost after the tsunami.
		CCS (D)	R/B basement (OP. -1230)	A	○	⊙		The operation was confirmed by manual activation (S/P cooling) before the tsunami; both the power supply and seawater system (CCSW) were lost after the tsunami.
		CCSW (C)	Outdoors (OP. 4000)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; the main body was submerged and the power supply was lost at the tsunami.
		CCSW (D)	Outdoors (OP. 4000)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; the main body was submerged and the power supply was lost at the tsunami.
		HPCI	R/B basement (OP. -1230)	A	○	○ Note 1	×	The power supply was lost after the tsunami (oil pump).
		IC (A)	R/B 4th floor (OP. 31000)	A	○	⊙	-	The operation was confirmed by automatic activation (high reactor pressure) before the tsunami; the status of the valve could not be confirmed because the power supply was lost after the tsunami.
		IC (B)	R/B 4th floor (OP. 31000)	A	○	⊙	-	The operation was confirmed by automatic activation (high reactor pressure) before the tsunami; the status of the valve could not be confirmed because the power supply was lost after the tsunami.
	Injection into reactor	MUWC (Alternative water injection)	T/B basement (OP. 3200)	B	⊙	⊙	×	The power supply was lost after the tsunami.
	Cooling pool	SFP cooling (FPC system)	R/B 3rd floor (OP. 25900)	B	⊙	△	×	The power supply was lost after the earthquake; the seawater system (SW) was lost after the tsunami.
		SFP cooling (SHC system)	R/B 1st floor (OP. 10200)	A	○	○	×	The power supply and the seawater system (SW) were lost after the tsunami.
Containing function	Containment facility	Reactor building		A	⊙	⊙	×	Negative pressure was maintained by the operation of the regular air-conditioning system until the scram and by the operation of the SGTS after the scram until the tsunami attack. The R/B was damaged due to explosion.
		Reactor containment		A	○	○	×	The reactor containment pressure showed no indication of damage before the tsunami attack.

(Legends) ⊙: Operating ○: Standby △: Stop due to loss of regular power supply ×: Function loss or removal from standby

Note 1: Unit 5, where a relatively large tremor was observed at the main shock, used the residual heat removal system on March 19 after the earthquake occurred. Major damage on each system and facility was also not found by patrols by the shift personnel. In addition, the maximum acceleration in the observation records lately obtained in the basement of the reactor building, where those apparatuses were installed, was sufficiently less than the acceleration at which it had been confirmed that the dynamic functionality of the apparatuses had been maintained.
Accordingly, each function was assumed to be generally ensured.
* JEAC4601-2008 Rules of 'Seismic Design Technology for NPS'

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

Table 1-2 Status of equipment, etc. for 1F-2 Emergency Core Cooling System (ECCS System)

			Location of installation	Seismic class	Status at seismic scram	Status during period from seismic scram to immediately before attack of tsunami	After attack of tsunami	Remark
Cooling function	ECCS system	RHR (A)	R/B basement (OP. -1030)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHR (B)	R/B basement (OP. -1030)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHR (C)	R/B basement (OP. -1030)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHR (D)	R/B basement (OP. -1030)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHRS (A)	Outdoors (OP. 4000)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; the main body was submerged and the power supply was lost at the tsunami.
		RHRS (B)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater and the power supply was lost at the tsunami attack.
		RHRS (C)	Outdoors (OP. 4000)	A	○	⊙	×	The operation was confirmed by manual activation (S/P cooling) before the tsunami; the main body was submerged and the power supply was lost at the tsunami.
		RHRS (D)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater and the power supply was lost at the tsunami attack.
		CS (A)	R/B basement (OP. -1000)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		CS (B)	R/B basement (OP. -1000)	A	○	○ Note 1		Both the power supply and seawater system (CCSW) were lost after the tsunami.
		HPCI	R/B basement (OP. -2060)	A	○	○ Note 1	×	The power supply was lost after the tsunami (auxiliary oil pump).
	Injection into reactor	RCIC	R/B basement (OP. -2060)	A	○	⊙	⊙	The system was manually activated after the earthquake and the tsunami. After a while, high pressure steam was lost.
		MUWC (Alternative water injection)	T/B basement (OP. 1900)	B	⊙	⊙	×	The power supply was lost after the tsunami.
	Cooling pool	SFP cooling (FPC system)	R/B 3rd floor (OP. 26900)	B	⊙	△	×	The power supply was lost after the earthquake; the seawater system (SW) was lost after the tsunami.
		SFP cooling (RHR system)	R/B basement (OP. -1030)	A	○	○ Note 1	×	Both the power supply and the seawater system were lost after the tsunami.
Containing function	Containment facility	Reactor building		A	○	○ Note 1	×	The blowout panel was opened.
		Reactor containment		A	○	○	×	The reactor containment pressure showed no indication of damage before the tsunami attack.

(Legends) ⊙: Operating ○: Standby △: Stop due to loss of regular power supply ×: Function loss or removal from standby

Note 1: Unit 5, where a relatively large tremor was observed at the main shock, used the residual heat removal system on March 19 after the earthquake occurred. Major damage on each system and facility was also not found by patrols by the shift personnel. In addition, the maximum acceleration in the observation records lately obtained in the basement of the reactor building, where those apparatuses were installed, was sufficiently less than the acceleration at which it had been confirmed that the dynamic functionality of the apparatuses had been maintained.
Accordingly, each function was assumed to be generally ensured.
* JEAC4601-2008 Rules of 'Seismic Design Technology for NPS'

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

Table 1-3 Status of equipment, etc. for 1F-3 Emergency Core Cooling System (ECCS System)

			Location of installation	Seismic class	Status at seismic scram	Status during period from seismic scram to immediately before attack of tsunami	After attack of tsunami	Remarks
Cooling function	ECCS system	RHR (A)	R/B basement (OP. -1030)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHR (B)	R/B basement (OP. -1030)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHR (C)	R/B basement (OP. -1030)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHR (D)	R/B basement (OP. -1030)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHRS (A)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater due to the tsunami, and the power supply was lost at the tsunami attack.
		RHRS (B)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater, and the power supply was lost at the tsunami attack.
		RHRS (C)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater, and the power supply was lost at the tsunami attack.
		RHRS (D)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater, and the power supply was lost at the tsunami attack.
		CS (A)	R/B basement (OP. -1000)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		CS (B)	R/B basement (OP. -1000)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		HPCI	R/B basement (OP. -2060)	A	○	○	⊙	The system was automatically activated when the reactor water level decreased after the tsunami. After a while, the high pressure steam was lost.
	Injection into reactor	RCIC	R/B basement (OP. -2060)	A	○	○	⊙	The system was activated after the tsunami, and after a while, tripped to fall into a condition where it was impossible to reactivate it.
		MUWC (Alternative water injection)	T/B basement (OP. 2420)	B	⊙	⊙	×	The power supply was lost after the tsunami.
	Cooling pool	SFP cooling (FPC system)	R/B 3rd floor (OP. 26900)	B	⊙	△	×	The power supply was lost after the earthquake; the seawater system (SW) was lost after the tsunami.
		SFP cooling (RHR system)	R/B basement (OP. -1030)	A	○	○ Note 1	×	Both the power supply and the seawater system were lost after the tsunami.
Containing function	Containment facility	Reactor building		A	○	○ Note 1	×	The building was damaged due to explosion.
		Reactor containment		A	○	○	×	The reactor containment pressure showed no indication of damage before the tsunami attack.

(Legends) ⊙: Operating ○: Standby △: Stop due to loss of regular power supply ×: Function loss or removal from standby

Note 1: Unit 5, where a relatively large tremor was observed at the main shock, used the residual heat removal system on March 19 after the earthquake occurred. Major damage on each system and facility was also not found by patrols by the shift personnel. In addition, the maximum acceleration in the observation records lately obtained in the basement of the reactor building, where those apparatuses were installed, was sufficiently less than the acceleration at which it had been confirmed that the dynamic functionality of the apparatuses had been maintained.
Accordingly, each function was assumed to be generally ensured.
* JEAC4601-2008 Rules of 'Seismic Design Technology for NPS'

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

Table 1-4 Status of equipment, etc. for 1F-4 Emergency Core Cooling System (ECCS System)

			Location of installation	Seismic class	Status at seismic scram	Status during period from seismic scram to immediately before attack of tsunami	After attack of tsunami	Remarks
Cooling function	ECCS system	RHR (A)	R/B basement (OP. -1110)	A	-	-	-	
		RHR (B)	R/B basement (OP. -1110)	A	○	○ Note 1	×	Both the power supply and seawater system (CCSW) were lost after the tsunami.
		RHR (C)	R/B basement (OP. -1110)	A	-	-	-	
		RHR (D)	R/B basement (OP. -1110)	A	⊙ (SFP cooling)	○ Note 1	×	The system was stopped due to blackout at the earthquake. The manipulation on the site was necessary before activation, but the tsunami arrived before activation. Both the power supply and the seawater system (RHRS B/D) were lost after the tsunami.
		RHRS (A)	Outdoors (OP. 4000)	A	-	-	-	
		RHRS (B)	Outdoors (OP. 4000)	A	⊙ (SFP cooling)	○ Note 1	×	The system was stopped due to blackout at the earthquake. The manipulation on the site was necessary before activation, but the tsunami arrived before activation. Both the power supply and the seawater system (RHRS B/D) were lost after the tsunami.
		RHRS (C)	Outdoors (OP. 4000)	A	-	-	×	
		RHRS (D)	Outdoors (OP. 4000)	A	⊙ (SFP cooling)	○ Note 1	×	The system was stopped due to blackout at the earthquake. The manipulation on the site was necessary before activation, but the tsunami arrived before activation. Both the power supply and the seawater system (RHRS B/D) were lost after the tsunami.
		CS (A)	R/B basement (OP. -1110)	A	-	-	-	
		CS (B)	R/B basement (OP. -1110)	A	-	-	-	
		HPCI	R/B basement (OP. -2060)	A	-	-	-	
	Injection into reactor	RCIC	R/B basement (OP. -2060)	A	-	-	-	
		MUWC (Alternative water injection)	T/B basement (OP. 1900)	B	⊙	⊙	×	The power supply was lost after the tsunami.
	Cooling pool	SFP cooling (FPC system)	R/B 3rd floor (OP. 26900)	B	⊙	△	×	One system was under inspection, and the other was in operation before the earthquake and stopped because the regular power supply was cut after the earthquake.
		SFP cooling (RHR system)	R/B basement (OP. -1110)	A	⊙	○ Note 1	×	The system was stopped due to blackout at the earthquake. The manipulation on the site was necessary before activation, but the tsunami arrived before activation. Both the power supply and the seawater system (RHRS B/D) were lost after the tsunami.
Containing function	Containment facility	Reactor building		A	○	○ Note 1	×	The building was damaged due to explosion.
		Reactor containment		A	-	-	-	The reactor containment was under periodical inspection, so that all the fuel was removed, the MSIV was closed, and the well was filled with water.

(Legends) ⊙: Operating ○: Standby △: Stop due to loss of regular power supply
×: Function loss or removal from standby -: Stopped for periodical inspection (no function required)

Note 1: Unit 5, where a relatively large tremor was observed at the main shock, used the residual heat removal system on March 19 after the earthquake occurred. Major damage on each system and facility was also not found by patrols by the shift personnel. In addition, the maximum acceleration in the observation records lately obtained in the basement of the reactor building, where those apparatuses were installed, was sufficiently less than the acceleration at which it had been confirmed that the dynamic functionality of the apparatuses had been maintained.
Accordingly, each function was assumed to be generally ensured.
* JEAC4601-2008 Rules of 'Seismic Design Technology for NPS'

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

Table 1-5 Status of equipment, etc. for 1F-5 Emergency Core Cooling System (ECCS System)

			Location of installation	Seismic class	Status at seismic scram	Status during period from seismic scram to immediately before attack of tsunami	After attack of tsunami	Remarks
Cooling function	ECCS system	RHR (A)	R/B basement (OP. -940)	A	○	○ Note 1	○	Both the power supply and seawater system (CCSW) were lost after the tsunami.
Cooling function	ECCS system	RHR (B)	R/B basement (OP. -940)	A	○	○ Note 1	○	Both the power supply and seawater system (CCSW) were lost after the tsunami.
Cooling function	ECCS system	RHR (C)	R/B basement (OP. -940)	A	○	○	⊙	Both the power supply and the seawater system (RHRS A/C) were lost after the tsunami. A temporary submerged pump was installed on March 19 (recovery of power supply), has been in operation since then, and is now operating in the SHC and the emergency heat load mode alternately.
Cooling function	ECCS system	RHR (D)	R/B basement (OP. -940)	A	○	○ Note 1	○	Both the power supply and seawater system (CCSW) were lost after the tsunami.
Cooling function	ECCS system	RHRS (A)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater, and the power supply was lost after the tsunami.
Cooling function	ECCS system	RHRS (B)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater, and the power supply was lost after the tsunami.
Cooling function	ECCS system	RHRS (C)	Outdoors (OP. 4000)	A	○	○	⊙	The main body was submerged into seawater, and the power supply was lost after the tsunami. A temporary submerged pump was installed on March 18 and can be used by receiving power from temporary power source (one unit for RHRS A/C).
Cooling function	ECCS system	RHRS (D)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater, and the power supply was lost at the tsunami.
Cooling function	ECCS system	CS (A)	R/B basement (OP. -940)	A	○	○ Note 1	○	Both the power supply and seawater system (CCSW) were lost after the tsunami.
Cooling function	ECCS system	CS (B)	R/B basement (OP. -940)	A	○	○ Note 1	○	Both the power supply and seawater system (CCSW) were lost after the tsunami.
Cooling function	ECCS system	HPCI	R/B basement (OP. -940)	A	-	-	-	Stopped for periodical inspection
Cooling function	Injection into reactor	RCIC	R/B basement (OP. -940)	A	-	-	-	Stopped for periodical inspection
Cooling function	Injection into reactor	MUWC (Alternative water injection)	T/B basement (OP. 4900)	B	⊙	⊙	⊙	The system was operating after the earthquake, and the power was lost after the tsunami.
Cooling function	Cooling pool	SFP cooling (FPC system)	R/B 3rd floor (OP. 32700)	B	⊙	△	○	The system was stopped because the regular power source was cut after the earthquake. The seawater system (SW) was lost after the tsunami.
Cooling function	Cooling pool	SFP cooling (RHR system)	R/B basement (OP. -940)	A	○	○	⊙	Both the power supply and the seawater system (RHRS A/C) were lost after the tsunami. A temporary submerged pump was installed on March 19 (recovery of power supply), has been in operation since then, and is now operating in the SHC and the emergency heat load mode alternately.
Containing function	Containment facility	Reactor building		A	○	○ Note 1	×	Holes were made on the roof top on March 18 after the tsunami (prevention of hydrogen accumulation: preventive maintenance).
Containing function	Containment facility	Reactor containment		A	○	○	○	The reactor containment pressure showed no indication of damage.

(Legends) ⊙: Operating ○: Standby △: Stop due to loss of regular power supply
×: Function loss or removal from standby -: Stopped for periodical inspection (no function required)

Note 1: Unit 5, where a relatively large tremor was observed at the main shock, used the residual heat removal system on March 19 after the earthquake occurred. Major damage on each system and facility was also not found by patrols by the shift personnel. In addition, the maximum acceleration in the observation records lately obtained in the basement of the reactor building, where those apparatuses were installed, was sufficiently less than the acceleration at which it had been confirmed that the dynamic functionality of the apparatuses had been maintained.
Accordingly, each function was assumed to be generally ensured.
* JEAC4601-2008 Rules of 'Seismic Design Technology for NPS'

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

Table 1-6 Status of equipment, etc. for 1F-6 Emergency Core Cooling System (ECCS System)

			Location of installation	Seismic class	Status at seismic scram	Status during period from seismic scram to immediately before attack of tsunami	After attack of tsunami	Remarks
Cooling function	ECCS system	RHR (A)	R/B basement 2nd floor (OP. -1000)	A	○	○ Note 1	○	Both the power supply and seawater system (CCSW) were lost after the tsunami.
Cooling function	ECCS system	RHR (B)	R/B basement 2nd floor (OP. -1000)	A	⊙ SHC operation	○	⊙	Both the power supply and the seawater system (RHRS A/C) were lost after the tsunami. A temporary submerged pump was installed on March 19 (recovery of power supply), has been in operation since then, and is now operating in the SHC and the emergency heat load mode alternately.
Cooling function	ECCS system	RHR (C)	R/B basement 2nd floor (OP. -1000)	A	○	○ Note 1	○	The seawater system (RHRS B/D) was lost after the tsunami. The installation of a temporary submerged pump made it possible for the system to operate.
Cooling function	ECCS system	RHRS (A)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater, and the power supply was lost after the tsunami.
Cooling function	ECCS system	RHRS (B)	Outdoors (OP. 4000)	A	⊙ SHC operation	○	⊙	The main body was submerged into seawater, and the power supply was lost after the tsunami. A temporary submerged pump was installed on March 18 and can be used by receiving power from temporary power source (one unit for RHRS A/C).
Cooling function	ECCS system	RHRS (C)	Outdoors (OP. 4000)	A	○	○ Note 1	×	The main body was submerged into seawater, and the power supply was lost after the tsunami.
Cooling function	ECCS system	RHRS (D)	Outdoors (OP. 4000)	A	⊙ SHC operation	○	⊙	The main body was submerged into seawater, and the power supply was lost after the tsunami. A temporary submerged pump was installed on March 18 and can be used by receiving power from temporary power source (one unit for RHRS A/C).
Cooling function	ECCS system	LPCS	R/B basement 2nd floor (OP. -1000)	A	○	○ Note 1	○	Both the power supply and seawater system (CCSW) were lost after the tsunami.
Cooling function	ECCS system	HPCS	R/B basement 2nd floor (OP. -1000)	A	○	○ Note 1	○	Both the power supply and seawater system (CCSW) were lost after the tsunami.
Cooling function	Injection into reactor	RCIC	R/B basement 2nd floor (OP. -1000)	A	-	-	-	Stopped for periodical inspection
Cooling function	Injection into reactor	MUWC (Alternative water injection)	T/B basement (OP. -3400)	B	⊙	⊙	⊙	B system is D/G. The system is operating by the activation of system B and the reception of power from the system D power supply.
Cooling function	Cooling pool	SFP cooling (FPC system)	R/B 4th floor (OP. 34000)	B	⊙	△	○	The regular power supply was lost after the earthquake; the seawater system (SW) was lost after the tsunami.
Cooling function	Cooling pool	SFP cooling (RHR system)	R/B basement 2nd floor (OP. -1000)	A	○	○ Note 1	×	A temporary submerged pump was installed on March 18 and can be used by receiving power from temporary power source (one unit for RHRS A/C). * The pump is now operating in the SHC and the emergency heat load mode alternately.
Containing function	Containment facility	Reactor building		A	○	○ Note 1	×	Holes were made on the roof top on March 18 after the tsunami (prevention of hydrogen accumulation: preventive maintenance).
Containing function	Containment facility	Reactor containment		A	○	○	○	The reactor containment pressure showed no indication of damage.
Other facilities								

(Legends) ⊙: Operating ○: Standby ×: Function loss or removal from standby -: Stopped for periodical inspection (no function required)

Note 1: Unit 5, where a relatively large tremor was observed at the main shock, used the residual heat removal system on March 19 after the earthquake occurred. Major damage on each system and facility was also not found by patrols by the shift personnel. In addition, the maximum acceleration in the observation records lately obtained in the basement of the reactor building, where those apparatuses were installed, was sufficiently less than the acceleration at which it had been confirmed that the dynamic functionality of the apparatuses had been maintained.
Accordingly, each function was assumed to be generally ensured.
* JEAC4601-2008 Rules of 'Seismic Design Technology for NPS'

Source: "Analysis of Operating Records and Accident Records for Fukushima Daiichi NPS at the Time of the Tohoku-Pacific Ocean Earthquake and an Evaluation of its Effects" (May 23, 2011, TEPCO)

Attachment V-1

Instructions of Evacuation, etc. Issued by
the Director General of the Nuclear Emergency Response Headquarters

1) Instructions of Evacuation, etc. Issued by the Director General of the Nuclear Emergency Response Headquarters Regarding Fukushima Dai-ichi Nuclear Power Station

March 11 [21:23] Instruction of evacuation to the residents living within a radius of 3 km from the NPS was issued.
Instruction of stay in-house to the residents living within a radius of 3 to 10 km from the NPS was issued.

March 12 [05:44] Instruction of evacuation to the residents living within a radius of 10 km from the NPS was issued.
[18:25] Instruction of evacuation to the residents living within a radius of 20 km from the NPS was issued.

March 15 [11:00] Instruction of stay in-house to the residents living within a radius of 20 to 30 km from the NPS was issued.

April 21 [11:00] Instruction to designate the evacuation area as the restricted area in accordance with the Basic Law on Natural Disasters was issued.

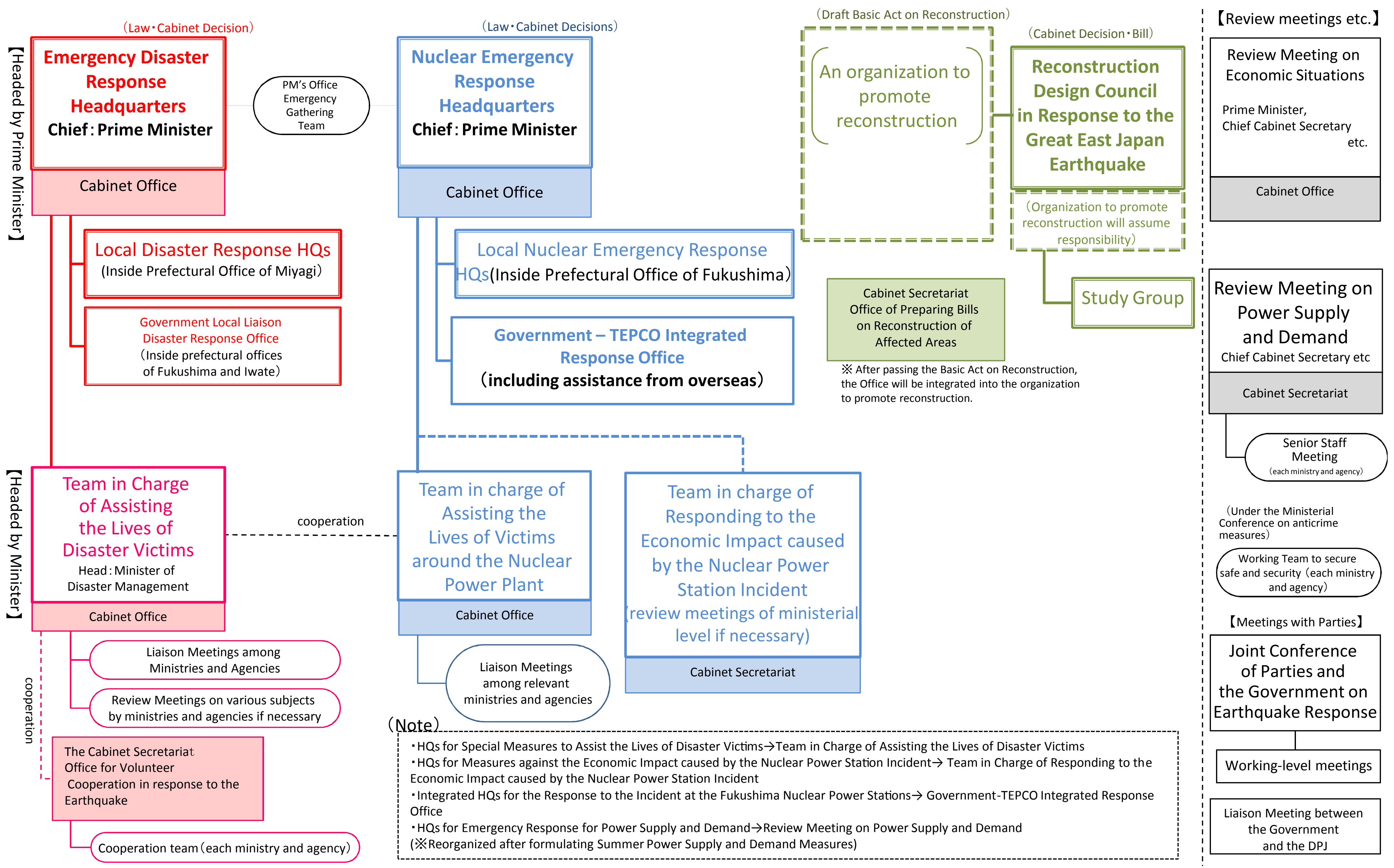
April 22 [09:44] The stay in-house instructions were lifted and the Deliberate Evacuation Area and Evacuation-Prepared Area in Case of Emergency were established.

2) Instructions of Evacuation, etc. Issued by the Director General of the Nuclear Emergency Response Headquarters Regarding Fukushima Dai-ni Nuclear Power Station

March 12 [07:45] Instruction of evacuation to the residents living within a radius of 3 km from the NPS was issued.
Instruction of stay in-house to the residents living within a radius of 3 to 10 km from the NPS was issued.
[17:39] Instruction of evacuation to the residents living within a radius of

		10 km from the NPS was issued.
April 21	[11:00]	The evacuation area was changed from a 10-km radius to an 8-km radius from the NPS.

Ⅴ-2. Outline of Government Headquarters in response to the Great East Japan Earthquake (As of 9th of May)



[Information in confidential category 2] May 13, 2011

Attachment V-3

The opinion and advice given to the director of Nuclear Disaster Countermeasures Headquarters based on Paragraphs 5 and 6 of Article 20 of the “Act on Special Measures Concerning Nuclear Emergency Preparedness” respectively

1. Items required the Nuclear Safety Commission’s opinion based on Paragraph 5 of Article 20 of the Nuclear Disaster Special Measures Law
(Opinion on areas where emergency countermeasures should be taken)

1) Fukushima dai-ichi Nuclear Power Plant

Date	Items	Areas and Subjects of Public Announcement
March 11	Change in the public announcement on people’s evacuation	Evacuation areas within the radius 10km zone: 3km; Indoor Sheltering areas: it should be 3km up to 10km
March 12	Change in the public announcement on people’s evacuation	Evacuation areas within the radius 10km zone: it should be 10km
March 12	Change in the public announcement on people’s evacuation	Evacuation areas within the radius 20km: it should be 20km
March 15	Change in the public announcement on people’s evacuation	Indoor Sheltering area within the radius 30km: it should be 20km up to 30km
March 21	Changes in the shipment and ingestion restriction	Withholding shipment of raw milk, spinach and brassica vegetable in prefectural areas of Fukushima, Ibaraki, Tochigi and Gunma
March 22	Changes in the shipment and ingestion restriction	Ingestion restriction to food significantly exceeding the provisional regulation value in the prefectural areas of Fukushima, Ibaraki, Tochigi and Gunma
April 4	Changes in the shipment and ingestion restriction	Withholding , for the time being, the ingestion and shipment of some food in prefectural areas of Fukushima, Ibaraki, Tochigi and Gunma and Cities of Katori, Asahi and Tako Town in Chiba Prefecture based on the instruction given to the Governors concerned
April 10	Change in the public announcement on people’s evacuation	Neighboring areas beyond the radius 20km zone where integrated radiation dose might reach 20mSv within one year from the accident, should be designated as the planned evacuation areas, and areas other than above mentioned within the Indoor sheltering areas should be designated as the emergency evacuation preparatory areas
April 21	Change in the public announcement on people’s evacuation	Areas within the radius 20km zone should be the alarming areas
April 22	Change in the public announcement on the rice cropping restriction	Withholding the rice cropping for 2011 in areas within the radius 20km zone, the planned evacuation areas and the emergency evacuation preparatory areas

2) Fukushima dai-ni Nuclear Power Plant

Date	Items	Areas and Subjects of Public Announcement
March 12	Change in the public announcement on people's evacuation	Evacuation areas within the radius 10km zone:
April 20	Change in the public announcement on people's evacuation	Areas beyond the radius 8km zone should be excluded from the evacuation areas

2. Advice based on Paragraph 6 of Article 20 of the Nuclear Disaster Special Measures Law
(Advice on technological matters to implement the emergency countermeasures)

1) Fukushima dai-ichi Nuclear Power Plant

Date	Types of Advice	Subjects of Advice (Summary)
March 16	Advice on shipment and ingestion restriction	Handing radioactively-contaminated food; ("Having replied as reasonable that indicator on food ingestion restriction" described in "Disaster prevention countermeasures for nuclear facilities, partly revised in August 2010 by the Nuclear Safety Commission should be the provisional regulation value, and food containing radiation exceeding this value should not be ingested)
March 31	Advice on shipment and ingestion restriction	Decision to make the existing regulation value as provisional regulation value for the time being; (Having replied as reasonable that the current value will be provisional regulation value for the time being taking "Urgent summarization on radioactive materials" March 2011 by the Food Safety Commission into consideration)
April 4	Advice on shipment and ingestion restriction	Basic policy for inspection programs, restriction item of goods, designation of restriction areas and release from shipment restriction and others; (Having replied as reasonable to the revised results such as conditions to release from the shipment restriction should be observation value, which is less than the provisional regulation value for consecutive 3 weeks)
April 5	Advice on shipment and ingestion restriction	Decision to make the radioactive iodine ingestion regulation value for seafood as 2,000Bq/kg; (Having replied as reasonable that indicator for radioactive iodine ingestion regulation value for seafood is reasonable to use 2,000Bq/kg, which is the standard value for vegetables)
April 7	Advice on the rice cropping restriction	Basic policy on the rice cropping; (Having replied as reasonable that the basic policy to restrict the rice cropping by using results of survey on radioactive cesium concentration in soils of rice fields and using by transition indicator (0.1) of radioactive cesium from soils of rice fields to rice is reasonable)

Nuclear Safety Commission

[Information in confidential category 2] May 13, 2011

Attachment V-4

Summary of advice on various matters given by the Nuclear Safety Commission responding to demands from the nuclear emergency local response headquarters and the local governments concerned (expect the opinions and advice based on Paragraphs 5 and 6 of Article 20 of the Act on Special Measures Concerning Nuclear Emergency Preparedness**)**

1) Monitoring Plan

Requirement and advice have been given on matters such as objective location, measurement items and points to keep in mind at the time of measurement for the environmental monitoring activities in land, sea and sky areas, reflecting evaluation of monitoring results.

2) People's life in indoors evacuation areas

Advice has been given on provisional policy of life of remaining indoors, temporary returning to home in the evacuation areas, and using of school buildings and grounds in Fukushima Prefecture.

3) Discharge of low level radioactive wastewater into sea

When the radioactive materials are discharged into sea as an unavoidable emergency measure, advice has been given on matters to keep in mind to make impact of the discharged radioactive materials minimum.

4) Standards and methods for screening and decontamination

Advice has been given on standards for decontamination of people's body surface, and standards and specific methods for the screening and the decontamination necessity on human radiation exposure and contamination of vehicles.

5) Necessity and precaution of use of stable iodine preparation

Advice has been given to recommend administering the stable iodine preparation to people remaining within the evacuation areas (the radius 20km zone) and hospitalized patients whose evacuation are delayed. And alerting people on taking the stable iodine preparation, which should not be blindly taken with own judgment.

6) Countermeasures for emergency work

Advice has been given on effectiveness of radiation protection measures to prevent exposure, and the steady implementation of the measures.

7) Provisional policy of using school buildings and grounds in Fukushima Prefecture

Advice has been given on “the provisional policy ofusing school buildings and grounds in Fukushima Prefecture” shown by the nuclear emergency response headquarters. Nuclear Safety Commission required to report about results of continuous monitoring in schools at interval approximately more than one time in 2 weeks and to keep mind to check exposure of students by distributing, at least, one pocket dosimeter to each school and making one teacher or one staff likely to represent student’s activities equip the pocket dosimeter.

8) Work of fishery involved persons

Advice has been given on work of fishery involved persons in the sea neighboring the Fukushima Daiichi Nuclear Power Plant. Further monitoring should be continued and the results should be accordingly reported to the Nuclear Safety Commission, and also it should be needed to make efforts to reduce radiation dose exposure as much as possible.

9) Diffusion of radioactive materials caused by measures to reduce radioactive material concentration in the nuclear reactor building

Advice has been given on diffusion of radioactive materials caused by opening the nuclear reactor No. 1 building’s opening of the Fukushima dai-ichi Nuclear Power Plant[1]. Every effort should be made to reduce the radiation dose exposure for workers in and around the area, and the monitoring should be continued in neighboring areas and accordingly report the results to the Nuclear Safety Commission.

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[1] Tokyo Electric Power Co., Inc. opened the opening of the building on May 8, 2011 to enter the building to carry out alternative cooling facilities construction work for the nuclear reactor after improvement of the working environment had been made by measures to reduce radioactive material concentration in the nuclear reactor building.

Nuclear Safety Commission

[Information in confidential category 2] May 13, 2011

Attachment V-5

Activity of advices for the prevention of widening of accident

1)Operation of Ventilation of Containment vessel

The Nuclear Safety Commission received the information about the total loss of AC power supply of the Fukushima Dai-ichi Nuclear Power Plant Unit 1 to Unit 3 on March 11 15;59, and also received the information about impossibility of injecting water with emergency core cooling system of the Fukushima Dai-ichi Nuclear Power Plant Unit 1 and Unit 2 (Article 15ofAct on Special Measures concerning Nuclear Emergency Preparedness) on March 11 16:45. The Nuclear Emergency Headquarters was set up in the Prime Minister's Official Residence at after 19:00 on March 11, and the chairman of the Nuclear Safety Commission entered into the official residence. Thereafter, until March 12, the chairman of the Nuclear Safety Commission made proposals for the Prime Minister, and the Minister of Economy, Trade and Industry several times, that there is no alternative but to perform containment vessel ventilation to prevent the containment vessel from a damage caused by overpressure, under the recognition that accident managements such as the venting operation to prevent the damage of the containment vessel, and the water injecting including the seawater for core cooling is necessary in the conditions with as much control as possible.

2) Seismic reinforcement measures

The Fukushima dai-ichi Nuclear Power Plant had a damage on the nuclear reactor building after the hydrogen explosion, therefore, the plant function group of the Nuclear Safety Commission advised the Nuclear and Industrial Safety Agency that evaluation on the earthquake-resistance strength of its spent nuclear fuel storage pools, nuclear reactor systems, and containment vessels etc. should be performed and the countermeasures for them must be studied. (April 8)

3) Measures for the tsunami to be caused by the aftershock

The power plant function group of the Nuclear Safety Commission advised the Nuclear and Industrial Safety Agency that the urgent safety measures in various nuclear power plants should be studied, because the earthquake occurrence with the big tsunami is possible as an aftershock of The Great East Japan Earthquake which occurred on March 11.

Version May 26, 2011
33rd Nuclear Safety Commission
Reference No.6

Commission's views as the basis of advices on radiation protection

May 19, 2011
Nuclear Safety Commission

Introduction

The Nuclear Safety Commission (NSC) and its Emergency Technical Advisory Body established shortly after the occurrence of the accident at the Fukushima Dai-ichi Nuclear Power Station (NPS) of Tokyo Electric Power Co. Inc. (TEPCO) on March 11, with technical support provided by the members of the NSC Emergency Countermeasures Investigative Committee and other committees, have been advising the Government Nuclear Emergency Response Headquarters (NERH) and individual government ministries on radiation protection of the public. The state of the said NPS still requiring much caution, though stabilizing as a whole, the prolonging and wide-spread influence of the accident is raising various social issues having relation to radiation protection of the public in the affected areas. The Commission will then continue to provide technical advice on radiation protection, as necessary, to support administrative decision-making by the Government NERH and the concerned ministries for resolution of issues. In this memorandum, the Commission, recognizing the importance of achieving its accountability, presents the Commission's views on which the Commission's advice has been and will be based.

1. Necessity of administrative decision-making in conformance with radiation protection strategy

Any administrative decisions affecting the living conditions of the inhabitants (including those who have evacuated), industrial activities and land use in the affected areas surrounding the Fukushima Dai-ichi NPS should ensure an adequate level of protection of public health against radiation exposure, without unduly restricting the daily lives or social activities of the public. For this purpose, it is important that the decisions are made in conformance with a radiation protection strategy based on up-to-date scientific knowledge and international standards, and through comprehensive deliberation of the environmental, health, social, economic, political and ethical aspects of the individual issues.

2. Particularity of the current situations from the radiation protection point of view: (Transitional co-existence of emergency, existing, and planned exposure situations as defined by International Commission on Radiological Protection[i])

The unsettled state at the Fukushima Dai-ichi NPS may continue for months. In the surrounding, affected areas where different levels of environmental dose rate are observed, meanwhile, daily lives and social activities of the public are continuing in normal or close-to-normal manner. Human and material flows take place between areas with different levels of contamination. That is, areas with different radiation levels lay side-by-side without being separated clearly, while the conditions in each area are changing with time, making social issues in these areas complicated. Appropriate consideration of such circumstances should be given in administrative decisions that can concern the radiation protection of the public.

3. Efforts toward optimized radiation protection under the co-existence of different exposure situations

Administrative decisions concerning the living conditions of the residents, industrial activities and land use in the affected areas would have to deal with a trade-off between two different kinds of individual's burden, i.e. restriction on freedom in daily life, such as evacuation or limited social activities, and acceptance of off-normal, even though much lower than excessive, radiation exposure. In order to limit radiation exposure as low as reasonably achievable without excessively restricting daily lives or social activities of the public, reduction of radiation doses should be considered by implementing such measures as appropriate management, decontamination and remediation. After the accident becomes settled and controlled in the future, decontamination and remediation can play a particularly important role in enlarging habitable areas and restoring social and economic activities.

4. Stakeholder involvement, process transparency and synthetic judgment

It is desirable that administrative trade-off decisions are made through consultation and exchanges of information and opinions with the local governments and communities in a transparent manner. Regarding implementation of measures for protection, decontamination and remediation, consideration should be given to the economic, social and mental consequences of implementation as well as to the late effects of radiation on human health.

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[i] Excerpt from recommendation of International Commission on Radiological Protection (ICRP) (ICRP Publ. 103: 176):
ICRP recommendation classified the exposure situations into the following three categories intending to apply to persons exposed to radiation, all radiation sources and all conceivable circumstance;

- Planned exposure situation: An exposure situation accompanied with intentional introduction and operation of radiation sources. The planned exposure situation may cause both the expected exposure (normal exposure) and unexpected exposure (potential exposure).

- Emergency exposure situation: An exposure situation requires emergency measures to avoid or reduce undesirable results, which may occur during operation of the planned situation, or be caused by vicious acts or arise from unpredictable situations.

- Existing exposure situation: An exposure situation, which has already existed at the time of decision making for the management including long term exposure situation after emergency.

Attachment V-7　Monitoring at normal operation

1.Control of Radioactive Liquid Waste of Fukushima Daiichi NPS

(1)Monitoring of Radioactive Liquid Waste

Measuring item	Measuring instrument	Frequency of measurement
Gamma emitter	Gamma ray spectrometer	each time of release
H-3	Liquid scintillation counter	1/month

(2)Release Control of Radioactive Liquid Waste

Target value of radioactive liquid waste except H-3	2.2E+11 Bq/year
Reference value of H-3	2.2E+13 Bq/year

2.Control of Radioactive Gaseous Waste of Fukushima Daiichi NPS

(1)Monitoring of Radioactive Gaseous Waste

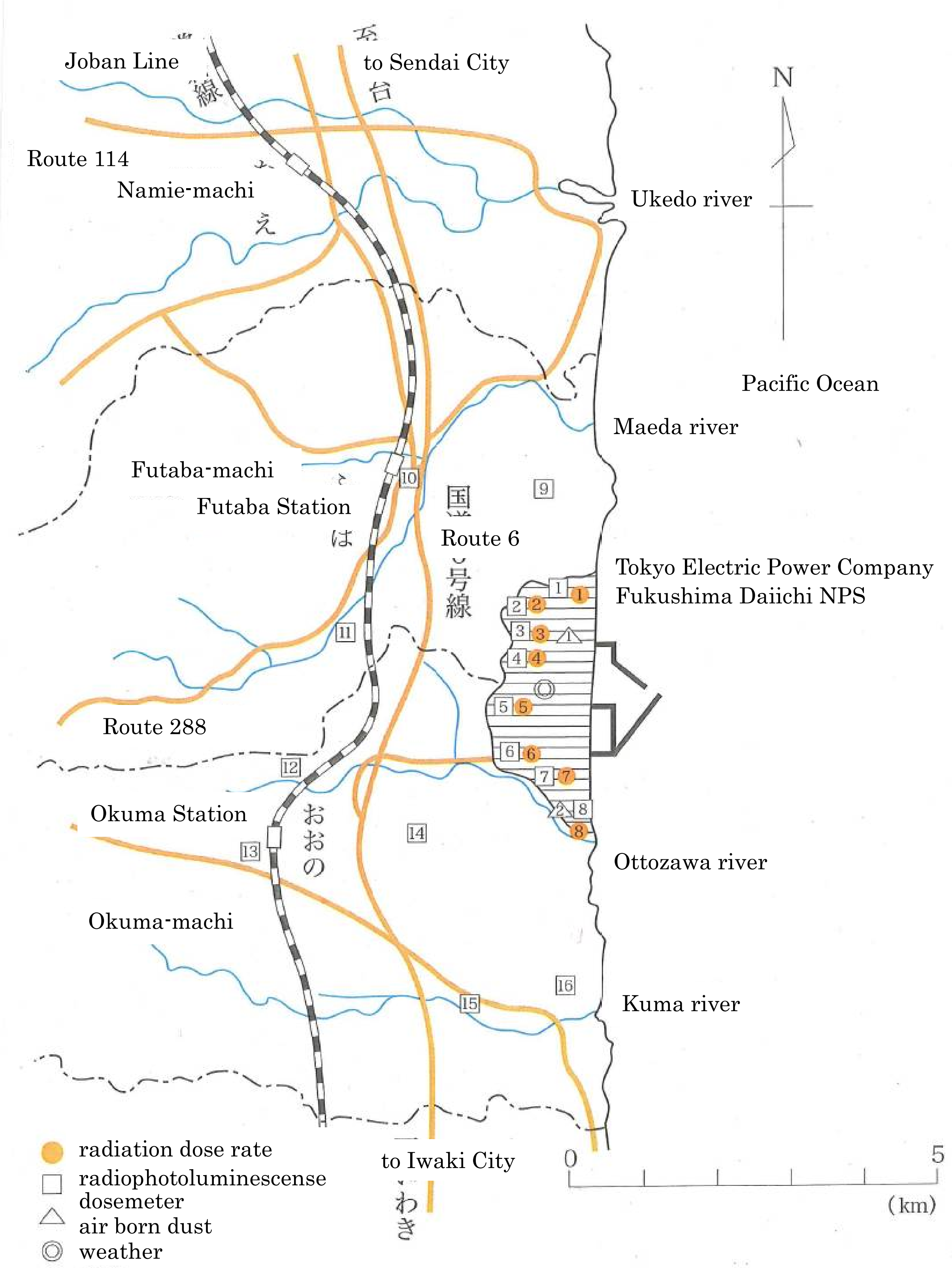
Measuring point	Measuring item	Measuring instrument	Frequency of measurement
R/B stack, T/B stack, Central RW/B stack, Common SFP	Noble gas	Stack monitor	continuously
	Gamma emitter; I-131, particulate	Gamma ray spectrometer	1/week
Incinerator, HTI	Gamma emitter; I-131, particulate	Gamma ray spectrometer	1/week
Solid waste storage	Gamma emitter; particulate	Gamma ray spectrometer	1/week
SGTS	Noble gas	Stack monitor	continuously (SGTS operating)
	Gamma emitter; I-131, particulate	Gamma ray spectrometer	1/week (SGTS operating)

(2)Release control of Radioactive Gaseous Waste

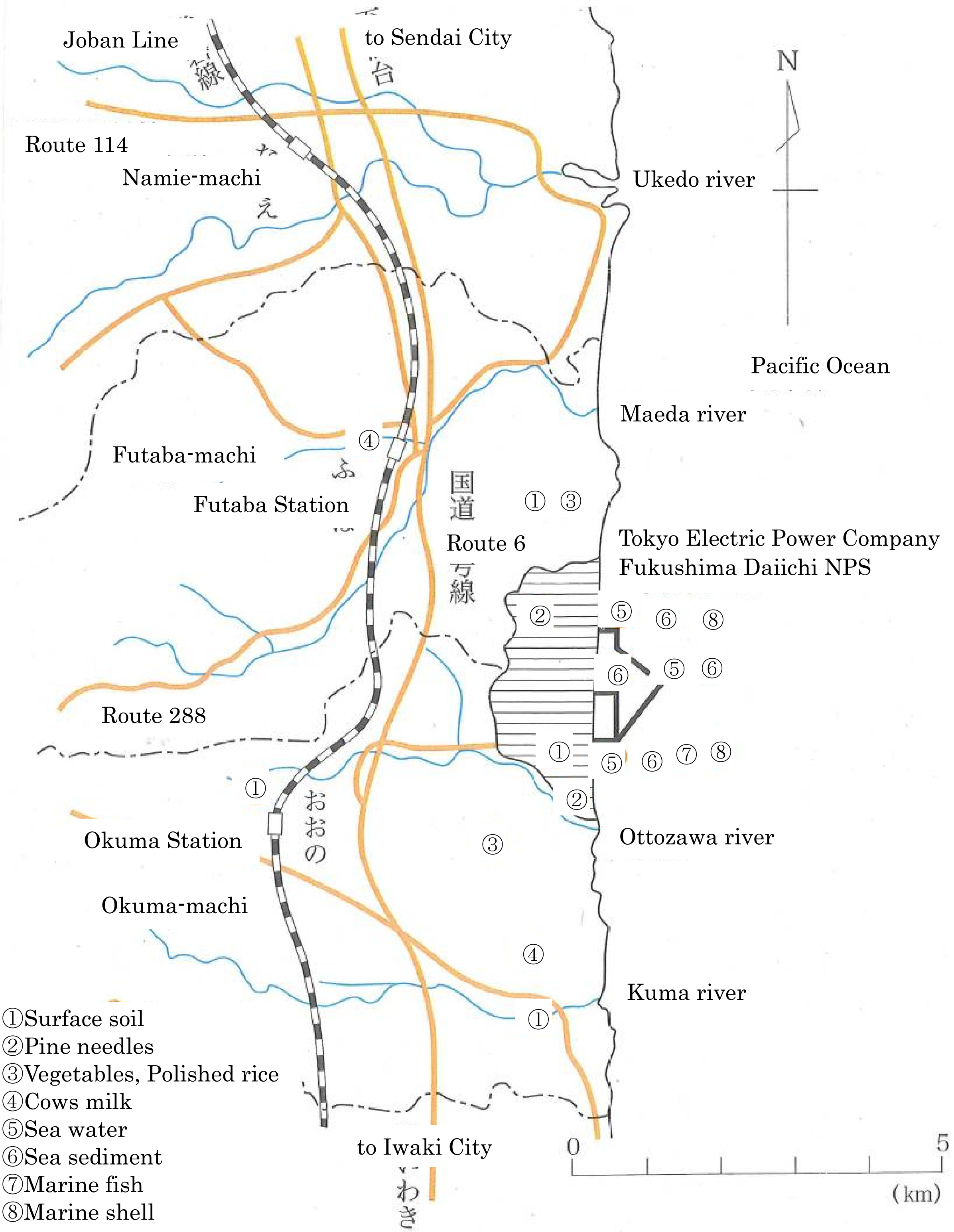
Target value of Noble Gas	8.8E+15 Bq/year
Target value of I-131	4.8E+11 Bq/year

Monitoring of Environmental Radioactivity

Monitoring Point



Sampling Point



①Surface soil
②Pine needles
③Vegetables, Polished rice
④Cows milk
⑤Sea water
⑥Sea sediment
⑦Marine fish
⑧Marine shell

Attachment V-8　Emergency Monitoring

TEPCO has the emergency response plan for environment monitoring.

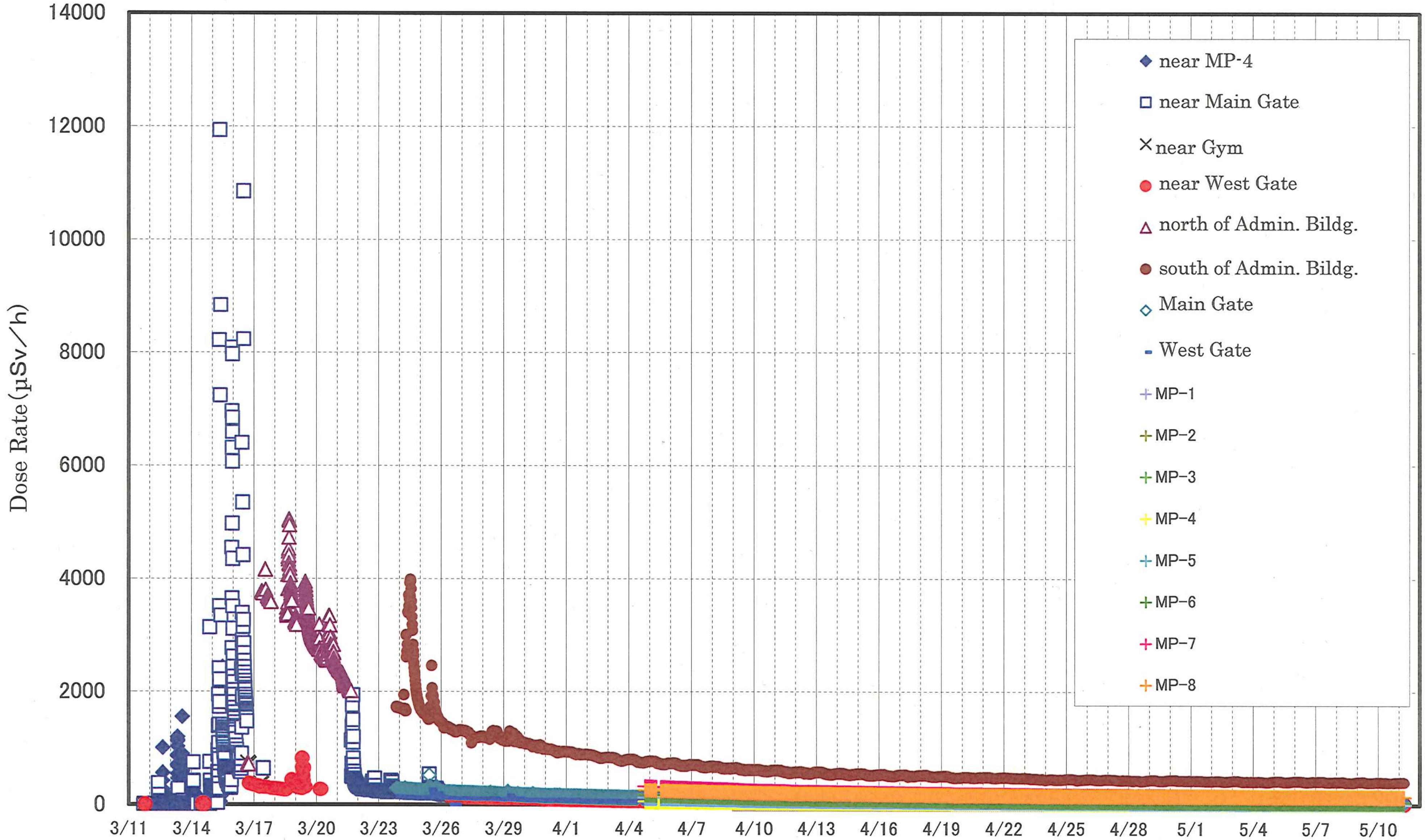
○ Monitoring of radiation dose rate and radioactivity of on-site and around the site

○ Estimating the environmental impact of radiation and radioactivity, for on-site monitoring data, weather observation data and emergency monitoring data

○ Sending the team for environmental monitoring to the Off-Site Center

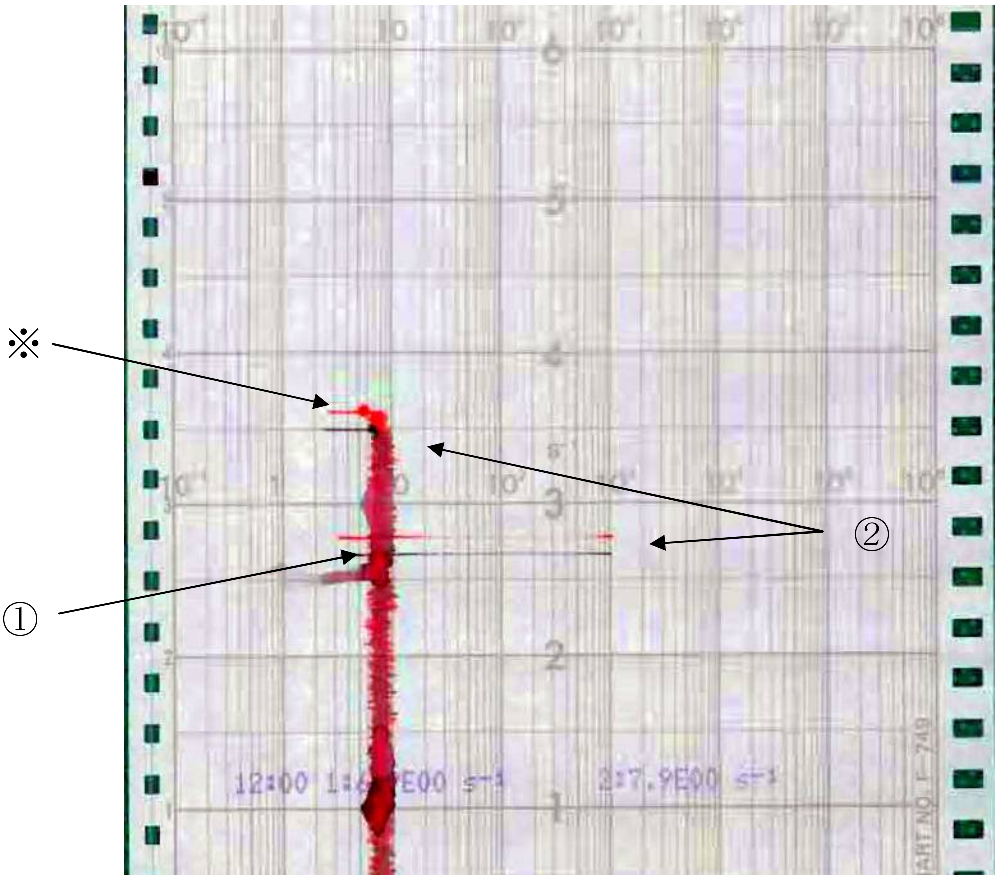
○ Upon request from the other nuclear operator, emergency of own nuclear site, sending the team for environmental monitoring to the area around the site

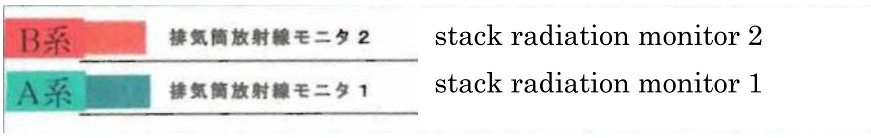
Attachment V-9 Trend of on-site Radiation Level



Attachment V-10　Trend of Stack Monitor

【#1　Stack Radiation Monitor】



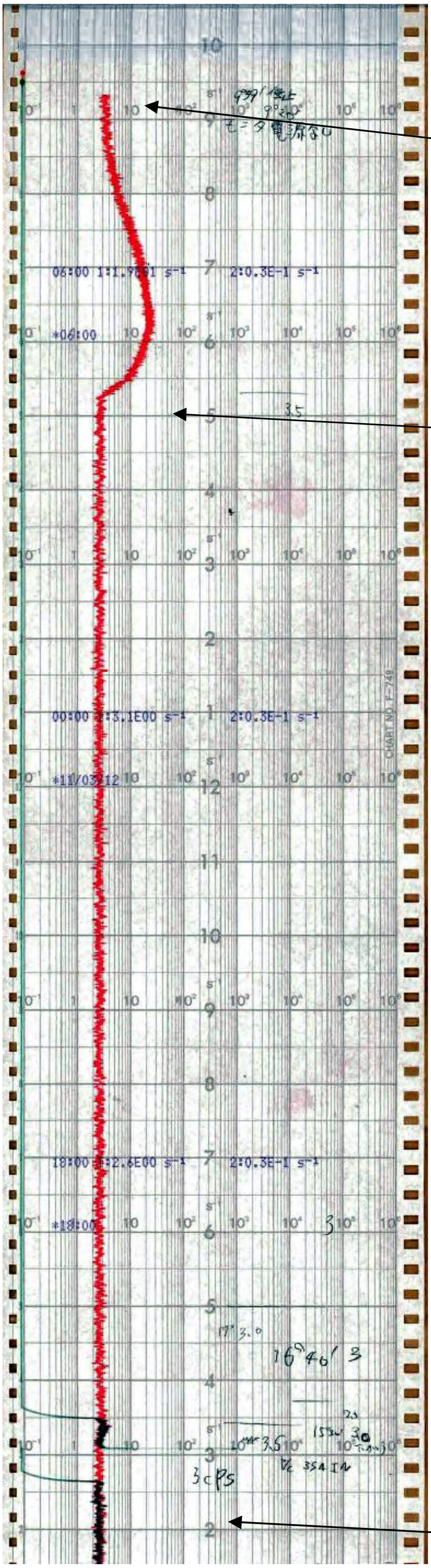


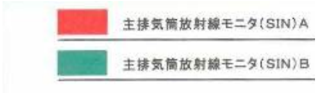
① 14:46　shut down by earthquake

② noise

※ end of recording by tsunami

【#3 Stack Radiation Monitor】





stack radiation monitor A

stack radiation monitor B

※

①

②

① rising by influence of high radiation level in site

② downscale by black out

※ end of recording by black out

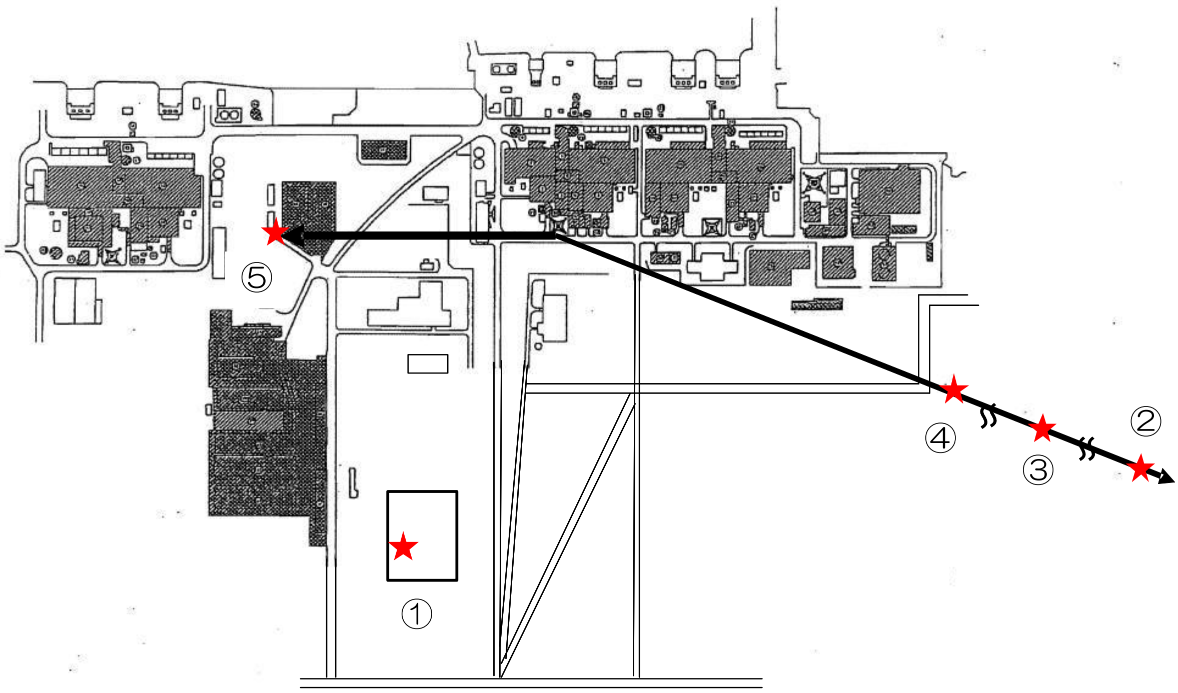
Attachment V-11　Concentration of Radioactive Materials in Soil Samples

(Unit: Bq/kg･dry soil)

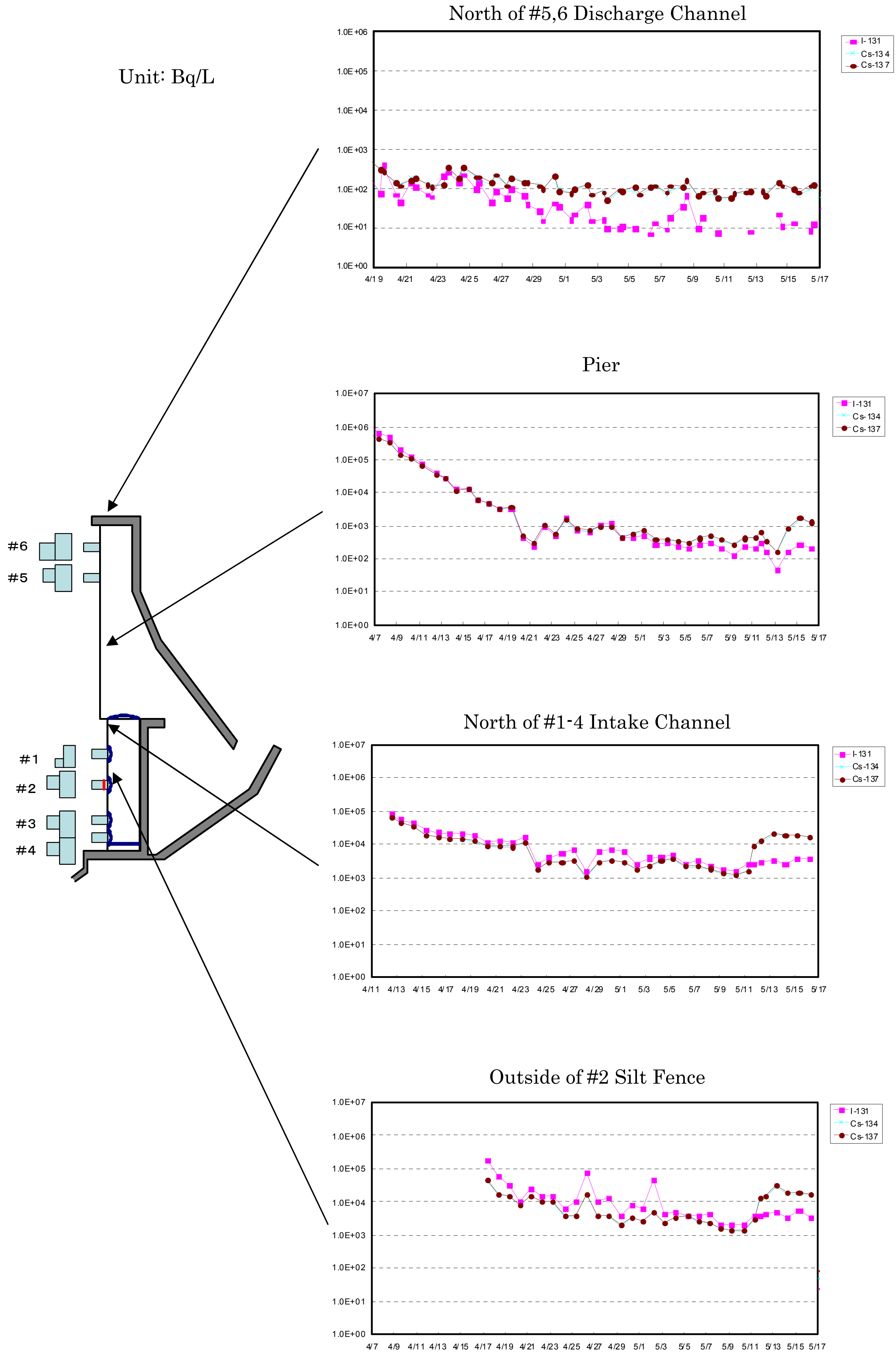
Sampling Point	Sampling Date	Pu-238	Pu-239,Pu-240
①sports ground	March 21　13:30	(5.4±0.62)E-1	(2.7±0.42)E-1
②approx. 1km from #1,2 main stack	March 22　7:00	N.D.	(2.6±0.58)E-1
③approx. 0.75km from #1,2 main stack	March 22　7:10	N.D.	1.2±0.12
④approx. 0.5km from #1,2 main stack	March 22　7:18	N.D.	1.2±0.11
⑤in front of Radioactive Solid Waste Storage	March 22　7:45	(1.8±0.33)E-1	(1.9±0.34)E-1
Soil in Japan※		N.D.~1.5E-1	N.D.~4.5

※ Environmental Radiation Data Base (1978~2008), MEXT

Sampling Point

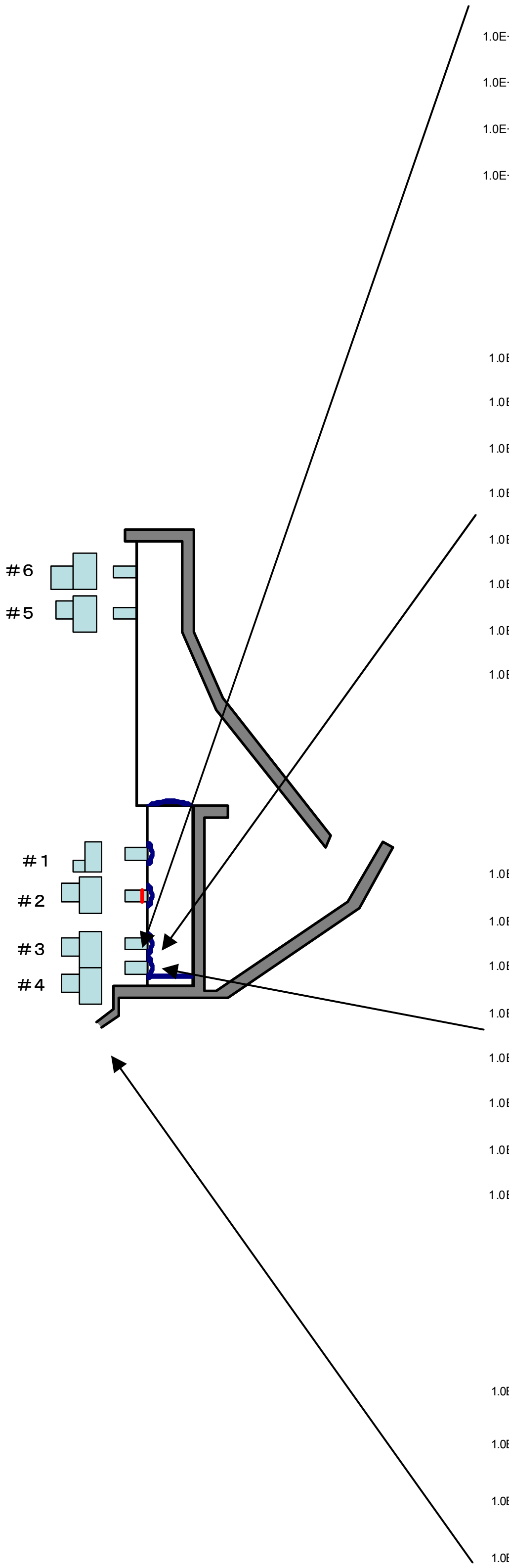


Attachment V-12 Radioactivity Concentration of Seawater (1/2)

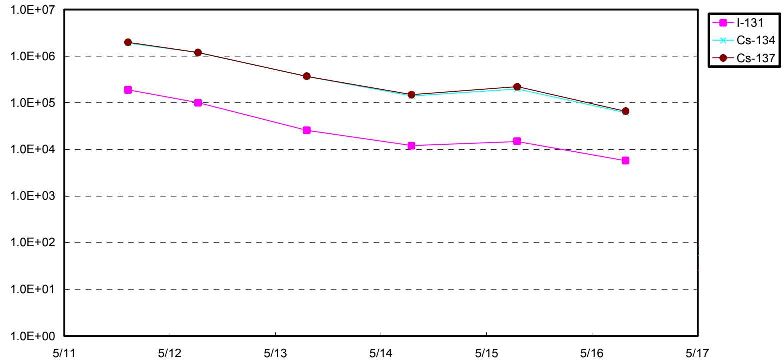


Attachment V-12 Radioactivity Concentration of Seawater (2/2)

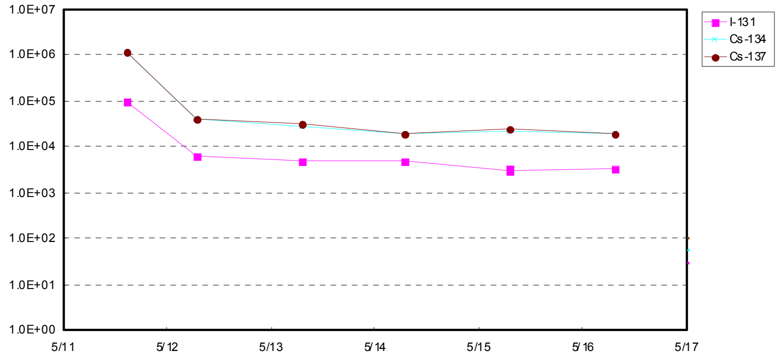
Unit: Bq/L



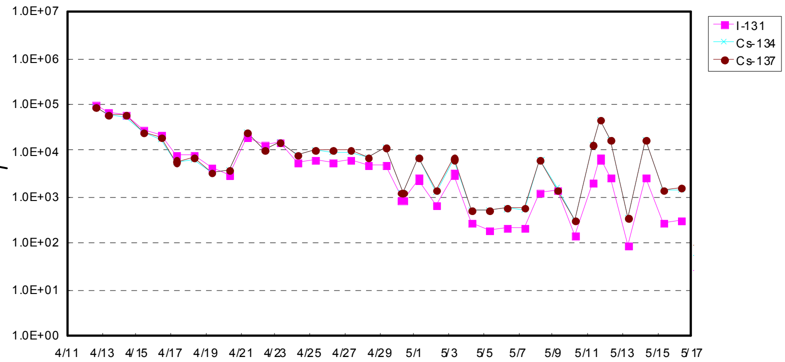
Inside of #3 Silt Fence



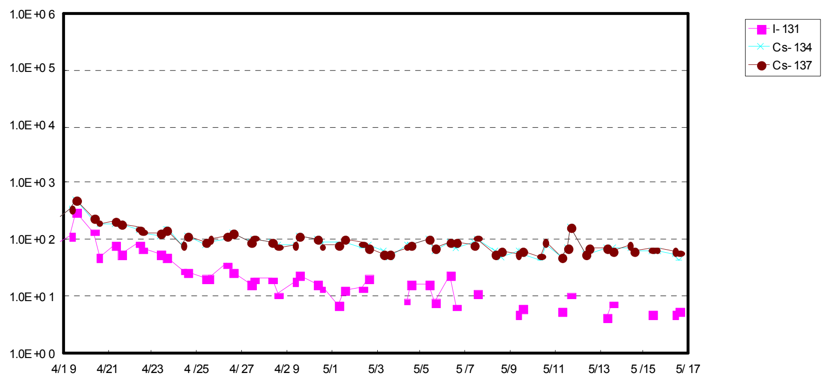
Outside of #3 Silt Fence



South of #1-4 Intake Channel



South Discharge Channel of #1-4



Results of radiation dose measurement by using the monitoring car around the Fukushima Dai-ichi and Fukushima Dai-ni nuclear power plants by the Ministry of Education, Culture, Sports, Science and Technology - Japan.

March 16, 2011

Ministry of Education, Culture, Sports, Science and Technology - Japan

1. Background

The Ministry of Education, Culture, Sports, Science and Technology- Japan (hereinafter referred to as MEXT) carried out the radiation dose monitoring using the monitoring car in the area where taking shelter indoors is recommended within 20 to 30 km from Fukushima Dai-ichi Nuclear Power Plant, in order to ensure safety and peace of mind of the sheltering residents and the inhabitants living in the surrounding area (see appendix).

2. Measurement conditions

- Date: March 15, 2011 20:40-20:50
- Equipment: GM survey meter and ionization chamber
- Place: Around Namie Town (20km NW from Fukushima Dai-ichi Nuclear Power Plant)
- Position: Inside or outside the monitoring car

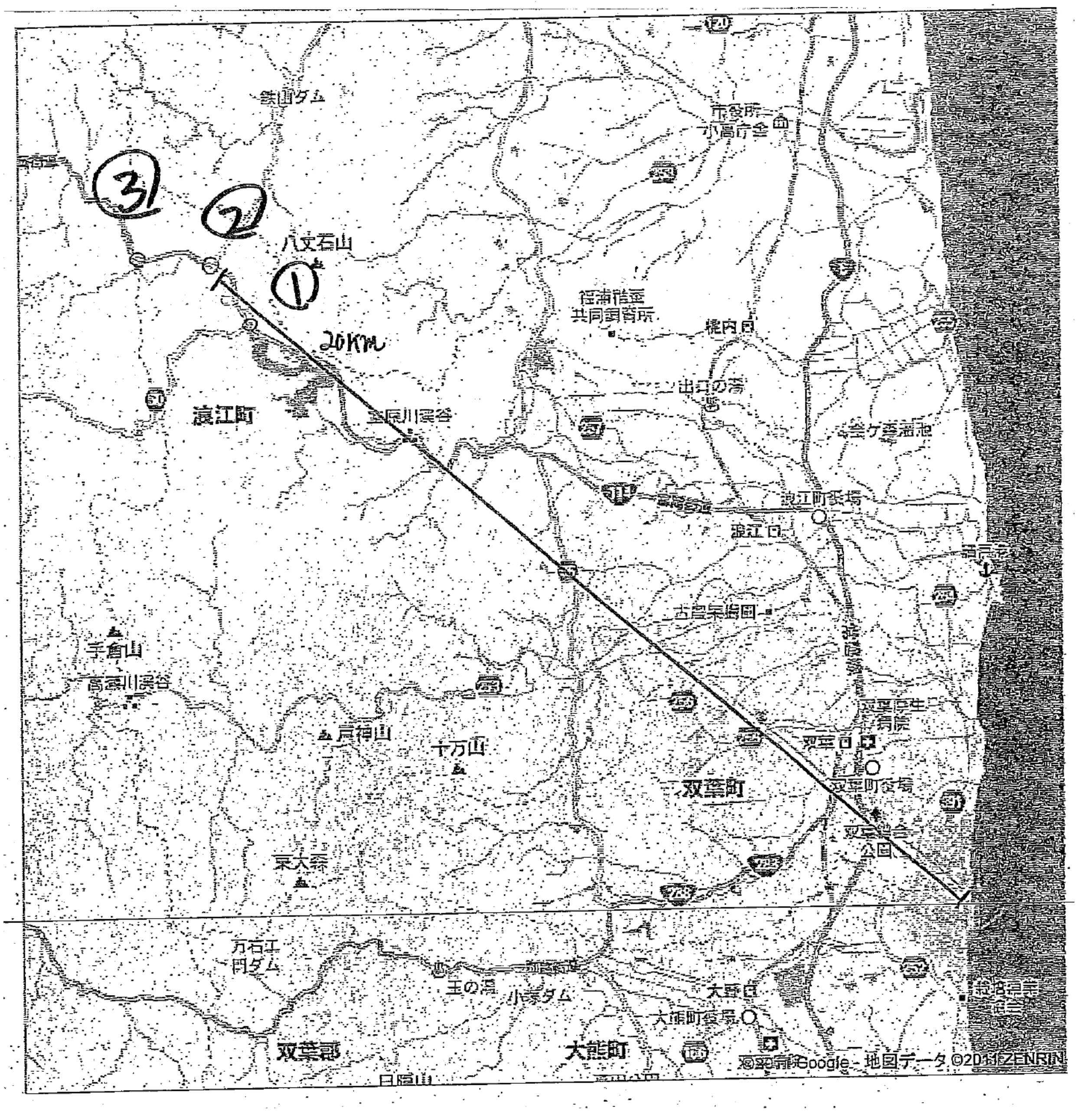
3. Results

The results of measurement carried out today are shown in the following table.

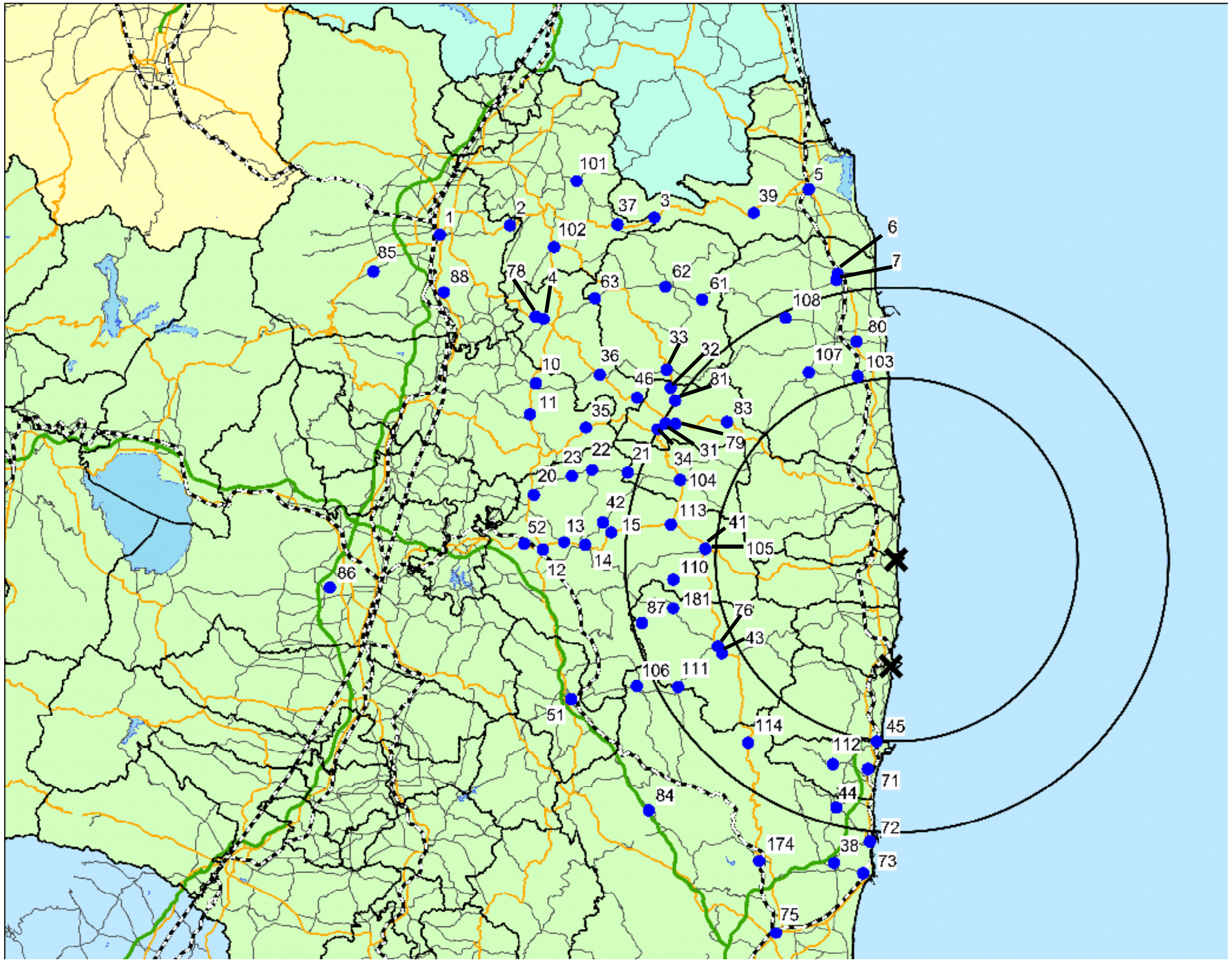
(μSv/h)

Measurement Point	Measurement Position (Inside or outside the monitoring car)	Equipments	
		GM survey meter	ionization chamber
①	Inside	223	260
	Outside	255	300
②	Inside	220	195
	Outside	270	240
③	Inside	300	210
	Outside	330	240

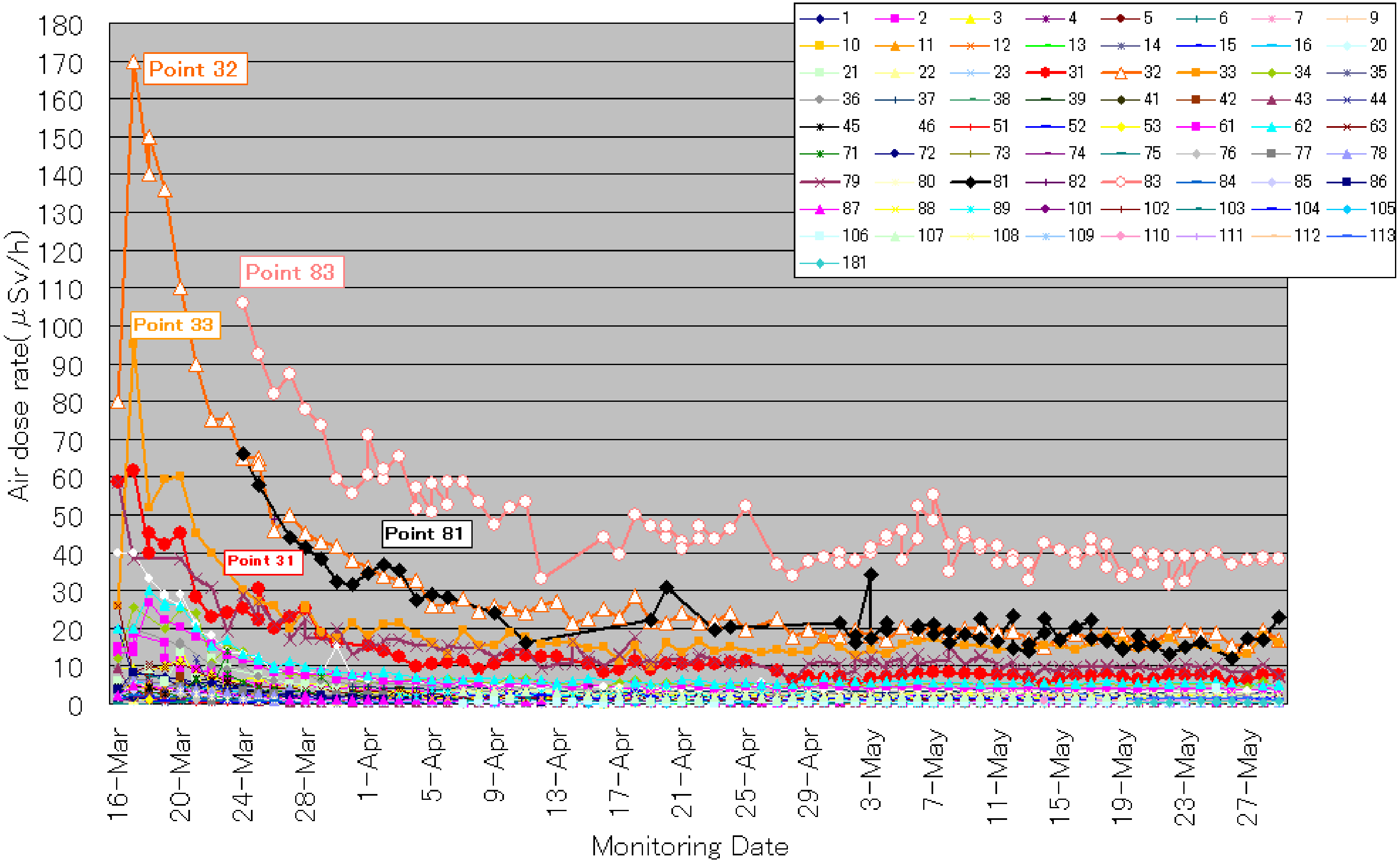
Attachment V-13-1-(1)
Appendix



Attachment V-13-1-(2)

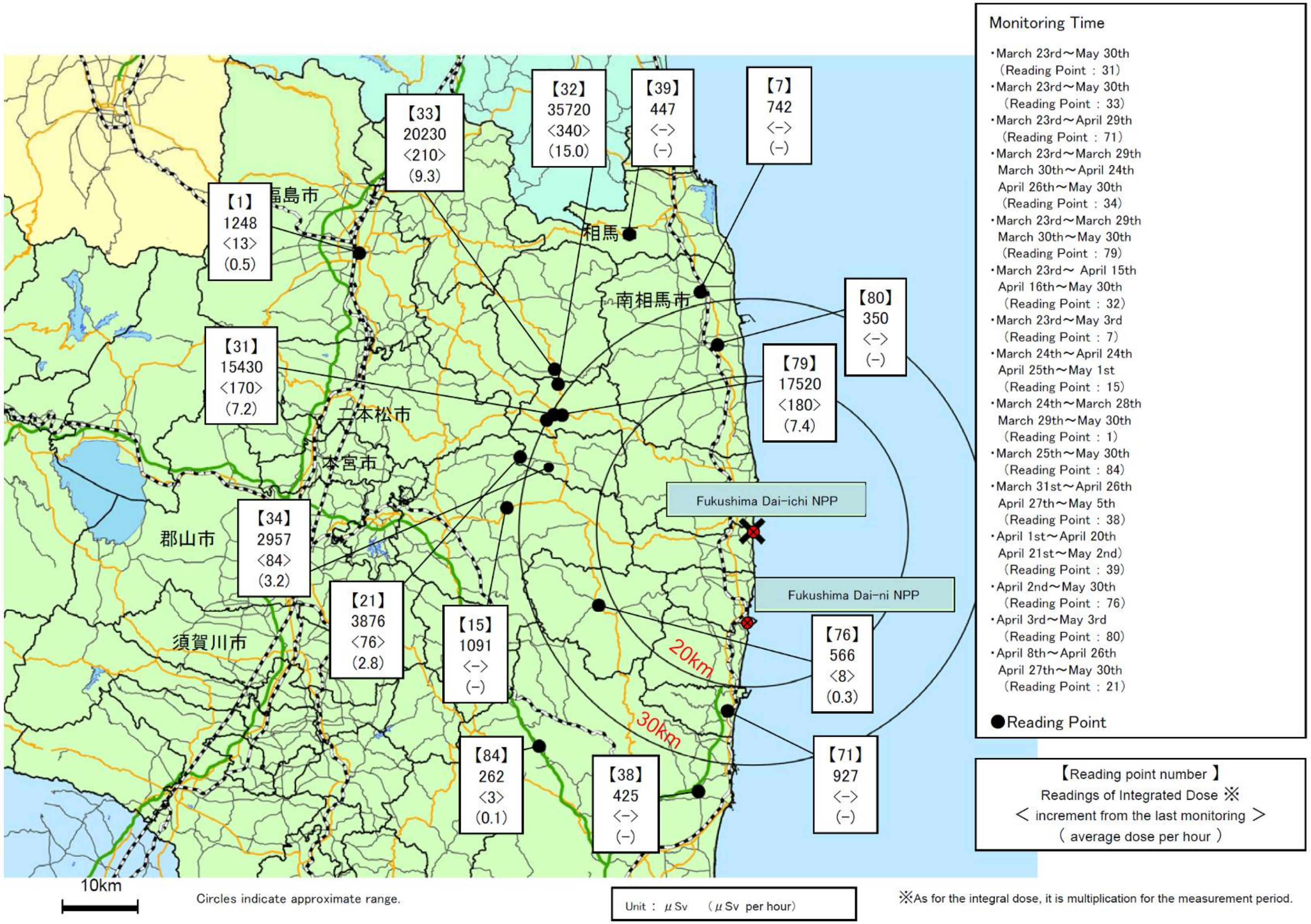


Reading points of Air Dose Rate out of Fukushima Dai-ichi NPP



Time Dependence of Air Dose rate at Reading point out of 20 Km Zone of Fukushima Dai-ichi NPP

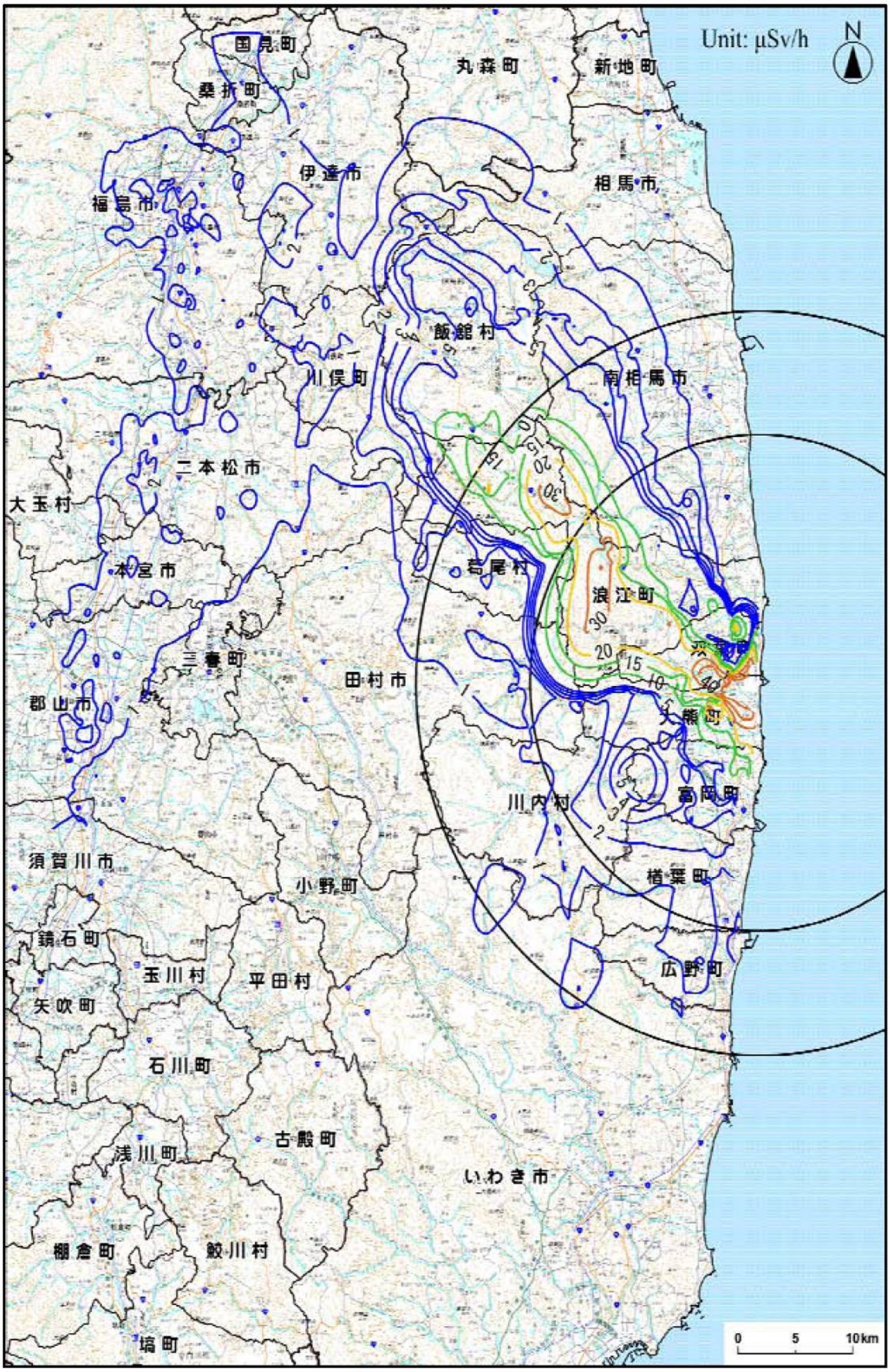
Attachment V-13-1-(3)



Readings of Integrated Dose at Reading point out of Fukushima Dai-ichi NPP

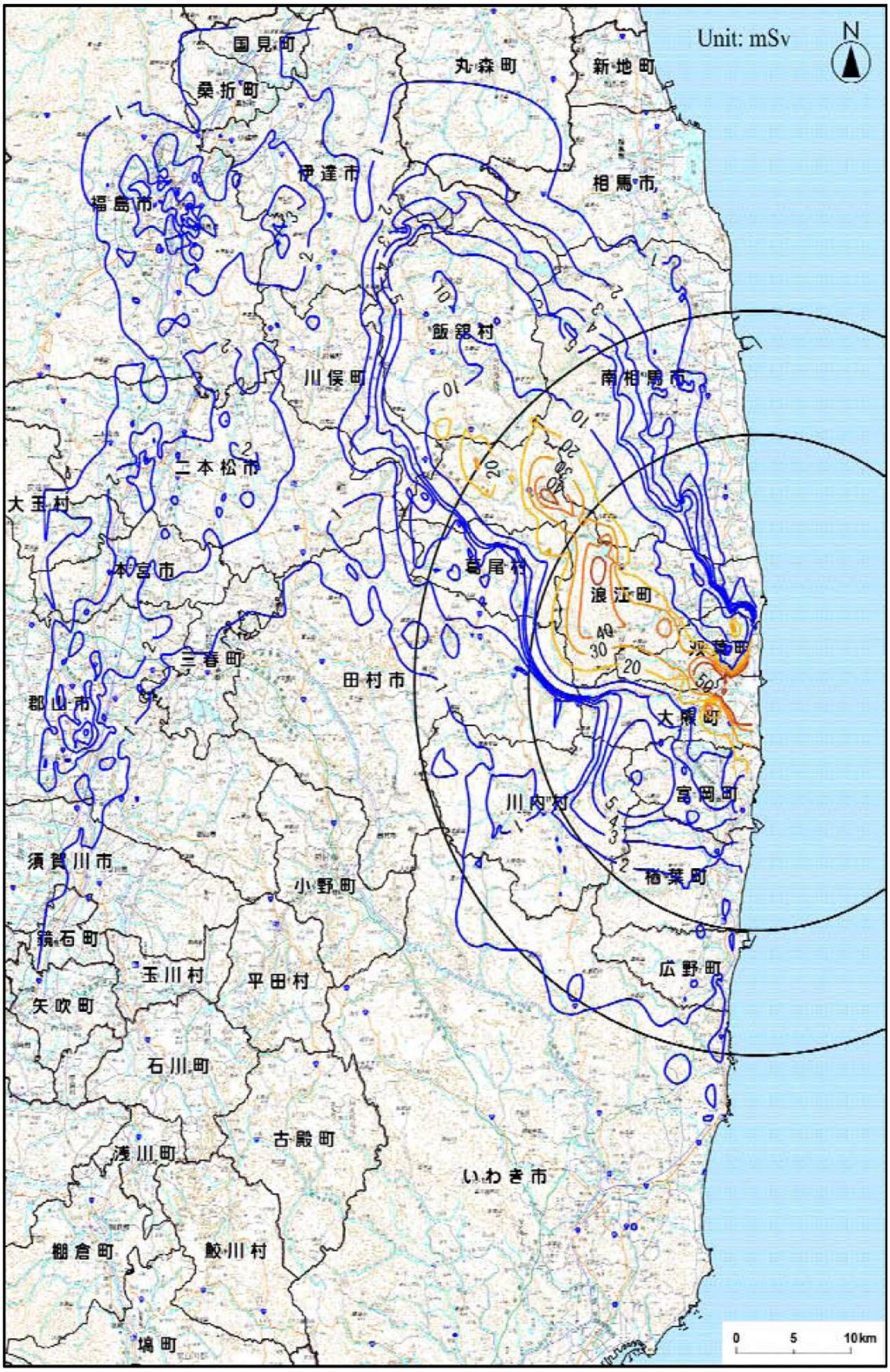
Attachment V-13-1-(4)

Attachment V-13-2



Based on actual values observed up to 24:00, May 11, 2011.

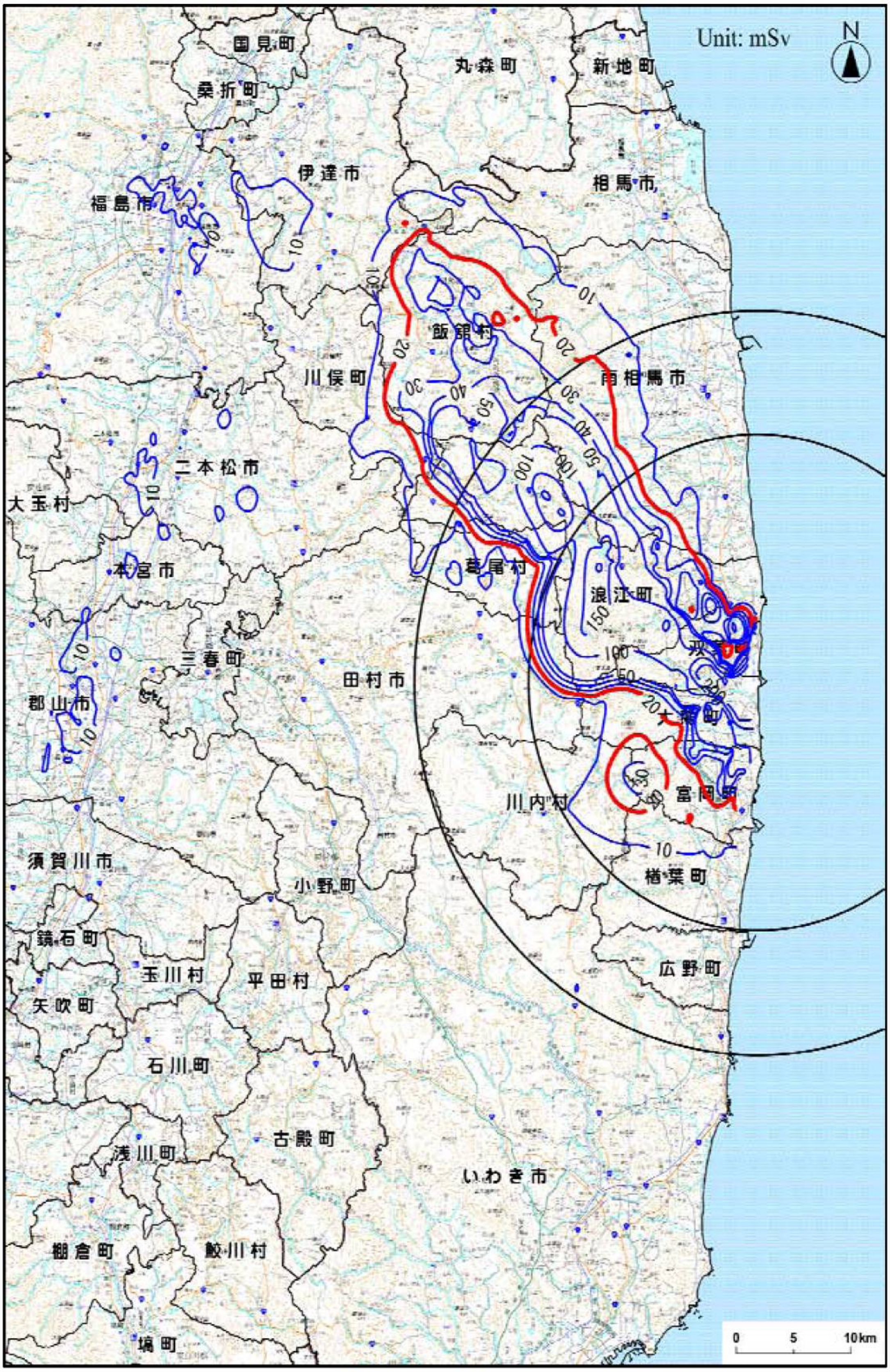
Dose Readings Map (Estimated values)
(as of May 11,2011)



Based on actual values observed up to 24:00, May 11, 2011.

Integrated Dose Estimation Map
(Integrated dose up until May 11,2011)

Attachment V-13-2



Based on actual values observed up to 24:00, May 11, 2011

Integrated Dose Estimation Map
(Integrated dose up until March 11,2012)

Attachment V-13-2

Estimates of Integrated Dose at Each Continuous Monitoring Location based on Measured Values（1／4）

Location Number	Location (Motiroring Area)【※10】	From Fukushima Dai-ichi NPP		Starting Date of Monitoring Air Dose Rate	Estimates of Integrated Dose【※1】		Latest Readings (mSv/h)【※3】		Estimates of Integrated Dose as of March 11, 2012 (mSv)【※4】
		Direction	Distance		(mSv)	Note	(mSv/h)	Note	
(1) Planned evacuation zones									
83	Futaba county Namie town Akougi Kunugidaira	North/West	24km	2011/3/24	56.6	【※2】	0.0371		219.5
32	Futaba county Namie town Akougi Teshichiro	North/West	31km	2011/3/16	29.5	【※5】	0.0172		105.3
81	Futaba county Namie town Akougi Ishikoya	North/West	31km	2011/3/24	31.2	【※2】	0.0164		103.3
79	Futaba county Namie town shimotsushima kayabuka	West/North/West	29km	2011/3/16	13.3	【※5】	0.0084		50.3
31	Futaba county Namie town Tsushima Nakaoki	West/North/West	30km	2011/3/17	12.0	【※5】	0.0072		43.4
34	Futaba county Namie town Tsushima Taikougi	West/North/West	30km	2011/3/19	5.8	【※2】【※5】	0.0035		21.4
21	Futaba County Katsurao Village Kaminogawa	West/North/West	32km	2011/3/17	3.4	【※5】	0.0029		16.0
104	Futaba county Katsurao Village Oaza Ochiai aza Ochiai	North/West	25km	2011/4/7	3.0	【※2】	0.0013		8.8
33	Soma county Iitate Village Nagadoro	North/West	33km	2011/3/16	16.5	【※5】	0.0092		57.1
62	Soma county Iitate Village Kusano Taishido	North/West	39km	2011/3/17	7.0		0.0050		29.0
61	Soma county Iitate Village Yagisawa	North/West	36km	2011/3/17	5.5		0.0041		23.5
63	Soma county Iitate Village Nimaibashi	North/West	44km	2011/3/17	2.5		0.0015		9.0
46	Date county Kawamata town Yamakiya Mukaideyama	West/North/West	34km	2011/3/17	6.6		0.0036		22.4
36	Date county Kawamata town Yamakiya Oonukari	West/North/West	40km	2011/3/20	4.5	【※2】	0.0028		16.8
(2) Other zones									
108	Minami Soma city Haramachi ward Ohara Daihata	North/North/West	30km	2011/4/7	4.2	【※2】	0.0028		16.4
107	Minami Soma city Haramachi ward Baba shimo nakouchi	North/North/West	25km	2011/4/7	3.6	【※2】	0.0021		13.0
6	Minami Soma city Kashima ward Nishimachi	North	32km	2011/3/17	1.1		0.0008		4.5
103	Minami Soma city Haramachi ward Taka Mamegaurauchi	North	20km	2011/4/7	0.8	【※2】	0.0005		3.0
7	Minami Soma city Kashima ward Terauchi Motoyashiki	North/North/West	32km	2011/3/17	0.8	【※5】	0.0008		4.1
80	Minami Soma city Haramachi ward Takami town	North	24km	2011/3/20	0.9	【※2】【※5】	0.0004		2.7
78	Date county kawamata town Tsurusawa	North/West	48km	2011/3/20	1.5		0.0016	【※6】	8.7
4	Date county Kawamata town oaza Tsurusawa aza Kawabata	North/West	47km	2011/3/17	1.4	【※2】	0.0010		5.8
37	Date city Ryozen town Ishida Hojizawa	North/West	48km	2011/3/31	4.4	【※2】	0.0039		21.7
3	Date city Ryozen town Ishida Hikohei	North/West	46km	2011/3/17	3.1		0.0023		13.1
102	Date city Tsukidate town	North/West	50km	2011/4/7	1.7	【※2】	0.0013		7.5
101	Date city Ryozen town Oishi aza Minowa	North/West	55km	2011/4/7	1.6	【※2】	0.0011		6.3
2	Fukushima city Onami Takinoiri	North/West	56km	2011/3/17	3.2		0.0022		12.9
88	Fukushima city Hikarigaoka	West/North/West	55km	2011/4/3	2.5	【※2】	0.0017		10.0
1	Fukushima city Sugitsuma town	North/West	62km	2011/3/16	1.6	【※5】	0.0006		4.1
85	Fukushima city Arai Harajiku	West/North/West	66km	2011/3/27	0.6	【※2】	0.0005		2.8
77	Iwaki city Ogawa town Kamiogawa	South/West	26km	2011/3/20	1.6	【※2】	0.0009		5.5
44	Iwaki city Ohisa town Ohisa Yanomezawa	South/South/West	28km	2011/3/17	1.1		0.0004		2.7
72	Iwaki city Hisanohama town Hisanohama aza Kitaaramaki	South	31km	2011/3/20	0.9	【※2】	0.0003		2.2
38	Iwaki City Yotsukura town Shiraiwa Hokita	South/South/West	34km	2011/3/31	0.8	【※2】【※5】	0.0003		1.9
106	Iwaki city Kawamae town Ojiroi aza Syokangoya	South/West	30km	2011/4/7	0.3	【※2】	0.0003		1.7
73	Iwaki City Yotsukura town Shiraiwa Hokita	South	35km	2011/3/20	0.7	【※2】	0.0002		1.6
74	Iwaki city Ogawa town Takahagi	South/South/West	36km	2011/3/20	0.5	【※2】	0.0001		1.0
84	Iwaki city Miwa-town Saiso	South/West	39km	2011/3/26	0.3	【※2】【※5】	0.0001		0.9
75	Iwaki city Uchigoumiyamaya town	South/South/West	43km	2011/3/20	0.3	【※2】	0.0000		0.3
45	Futaba county Naraha town Yamadaoka Utsukushimori	South	20km	2011/3/17	1.3		0.0006		3.8
71	Futaba county Hirono town Shimokitaba Nawashirogae	South	23km	2011/3/20	1.1	【※2】【※5】	0.0003		2.3
11	Nihonmatsu city Ota aza Shimoda	West/North/West	43km	2011/3/17	1.5		0.0011		6.4
10	Nihonmatsu city Harimichi Nakajima	West/North/West	44km	2011/3/17	1.1		0.0008		4.4
35	Nihonmatsu city Tazawa Hagidaira	West/North/West	37km	2011/3/19	0.8	【※2】	0.0006	【※6】	3.6

Attachment V-13-2

Estimates of Integrated Dose at Each Continuous Monitoring Location based on Measured Values(2／4)

Location Number	Location (Motiroring Area)【※10】	From Fukushima Dai-ichi NPP		Starting Date of Monitoring Air Dose Rate	Estimates of Integrated Dose【※1】		Latest Readings (mSv/h)【※3】	Estimates of Integrated Dose as of March 11, 2012 (mSv)【※4】
		Direction	Distance		(mSv)	Note		
89	Koriyama city Toyota town	West	60km	2011/4/3	2.5	【※2】	0.0010	6.9
86	Koriyama city Ootsuki town Choemonbayashi	West	63km	2011/3/27	1.4	【※2】	0.0007	4.5
87	Futaba county Kawauchi Village Kamikawauchi Hananouchi	West/South/West	29km	2011/3/27	1.1	【※2】	0.0007	4.2
76	Futaba county Kawauchi Village Kamikawauchi Hayawata	West/South/West	22km	2011/3/20	0.7	【※2】【※5】	0.0003	2.1
43	Futaba county Kawauchi Village Shimokawauchi Miyawata	West/South/West	22km	2011/3/16	0.6		0.0003	2.0
15	Tamura city Tokiwa town Yamane Kashima	West	32km	2011/3/17	1.1	【※5】	0.0008	4.4
42	Tamura city Tokiwa town Yamane Tomioka	West	33km	2011/3/17	1.0		0.0007	3.8
23	Tamura city Funehiki town Minamiutsushi Suichu-uchi	West/North/West	39km	2011/3/17	0.8		0.0007	3.8
41	Tamura City Miyakoji town Furumichi	West	21km	2011/3/17	0.9		0.0005	3.0
20	Tamura city Funehiki town Niitate shimo	West	41km	2011/3/17	0.7		0.0005	2.7
22	Tamura city Funehiki town Kamiutsushi aza Ushirota	West/North/West	35km	2011/3/17	0.6		0.0004	2.1
105	Tamura city Miyakoji town Furumichi aza Teranomae	West	25km	2011/4/7	0.4	【※2】	0.0003	1.9
13	Tamura city Tokiwa town Tokiwa UchimachiTamura city Tokiwa to	West	37km	2011/3/17	0.5		0.0003	1.7
12	Tamura city Funehiki town Funehiki aza Ozawakawashiro	West	39km	2011/3/17	0.3		0.0003	1.7
14	Tamura city Tokiwa town Tokiwa Uchimachi	West	34km	2011/3/17	0.4		0.0003	1.5
52	Tamura city Funehiki town funehiki Babakawara	West	41km	2011/3/17	0.3		0.0002	1.2
39	Soma city Yamakami Kaminamiki	North/North/West	41km	2011/4/1	1.0	【※2】【※5】	0.0006	3.8
5	Soma city Nakanoteramae	North/North/West	42km	2011/3/17	0.7		0.0005	3.0
51	Tamura county Ono town Ononiimachi Tatemawari	West/South/West	39km	2011/3/17	0.3		0.0002	1.2

This table was jointly compiled by the Nuclear Safety Commission, MEXT, and the Nuclear and Industrial Safety Agency.

*1 Shown values are integrated values monitored from 6:00, March 12 through 24:00, April 21. The same estimation method as that used by the Nuclear Safety Commission on March 28, 2011 is used, whereby the values are estimated by multiplying the monitored values by 0.6 in consideration of the reduction effect of wooden buildings (0.4) when staying outdoors for eight hours and indoors for 16 hours.

*2 For locations where the monitoring was started on or after March 19, the dose data for the period from March 16 to the day before the start of monitoring has been derived by assuming that the dose has changed in proportion to changes at Location No. 32, where the steepest dose change has been observed.

*3 Shown values are the latest air dose rates monitored by the time of the press release at 10:00, May 12. As for locations [*5] where actual values have been obtained by a simple integrating dosimeter, the values are the integrated values monitored since the time of the previous data sampling divided by the time lapsed.

*4 Shown values have been obtained by the same method as that mentioned in *1, while supposing that the latest monitored values [*3] will stay unchanged on and after MAy 12.

*5 For the period where actual values monitored by a simple integrating dosimeter are available, such values are indicated.

Estimates of Integrated Dose at Each Continuous Monitoring Location based on Measured Values (3／4)

Location Number	Location (Motiroring Area)【※10】	From Fukushima Dai-ichi NPP		Starting Date of Monitoring Air Dose Rate	Estimates of Integrated Dose (mSv)【※7、8】	Estimated values as of May 11 (mSv/h)	Estimates of Integrated Dose as of March 11, 2012 (mSv)【※4】
		Direction	Distance				
(3)Planned evacuation zones (added point)							
i28	Soma county Iitate Village Hiso	North/West	34km	2011/4/26	28.2	0.0147	92.9
i27	Soma county Iitate Village Nagadoro	North/West	33km	2011/4/26	21.5	0.0159	91.3
i26	Soma county Iitate Village Nagadoro	North/West	31km	2011/4/26	17.3	0.0109	65.3
i24	Soma county Iitate Village Komiya	North/West	32km	2011/4/26	15.3	0.0095	57.2
i25	Soma county Iitate Village Warabidaira	North/West	29km	2011/4/26	14.8	0.0095	56.4
i4	Soma county Iitate Village Fukaya	North/West	41km	2011/4/25	14.1	0.0085	51.2
i22	Soma county Iitate Village Komiya	North/West	35km	2011/4/26	11.8	0.0079	46.5
i20	Soma county Iitate Village Sekisawa	North/West	36km	2011/4/26	9.6	0.0079	44.3
i13	Soma county Iitate Village Maeta	North/West	43km	2011/4/25	12.0	0.0068	41.8
i19	Soma county Iitate Village Sekisawa	North/West	38km	2011/4/26	10.9	0.0070	41.5
i29	Soma county Iitate Village Hiso	North/West	38km	2011/4/26	10.1	0.0063	37.9
i23	Soma county Iitate Village Komiya	North/West	36km	2011/4/26	9.8	0.0063	37.3
i21	Soma county Iitate Village Komiya	North/West	33km	2011/4/26	9.5	0.0062	36.8
i14	Soma county Iitate Village Kusano	North/West	40km	2011/4/25	8.9	0.0054	32.4
i10	Soma County Iitate Village Sasu	North/West	46km	2011/4/25	8.9	0.0052	31.8
i9	Soma county Iitate Village Maeta	North/West	45km	2011/4/25	9.6	0.0048	30.8
i2	Soma county Iitate Village Itamizawa	North/West	39km	2011/4/25	7.9	0.0052	30.6
i31	Soma county Iitate VillageIitoi	North/West	38km	2011/4/26	7.8	0.0049	29.4
i7	Soma county Iitate Village Usuishi	North/West	42km	2011/4/25	8.0	0.0048	29.2
i3	Soma county Iitate Village Kusano	North/West	39km	2011/4/25	8.0	0.0048	28.9
i6	Soma county Iitate VillageFukaya	North/West	41km	2011/4/25	11.0	0.0040	28.8
i32	Soma county Iitate Village Iitoi	North/West	37km	2011/4/26	6.4	0.0049	28.1
i30	Soma county Iitate Village Iitoi	North/West	40km	2011/4/26	7.3	0.0045	27.1
i5	Soma county Iitate Village Fukaya	North/West	41km	2011/4/25	7.5	0.0045	27.1
i18	Soma county Iitate Village Yagisawa	North/West	36km	2011/4/25	6.1	0.0044	25.5
i11	Soma County Iitate Village Sasu	North/West	46km	2011/4/25	7.0	0.0041	24.9
i1	Soma county Iitate Village Itamizawa	North/West	39km	2011/4/25	7.0	0.0040	24.7
i17	Soma county Iitate Village Kusano	North/West	38km	2011/4/25	6.5	0.0038	23.3
i12	Soma County Iitate Village Sasu	North/West	43km	2011/4/25	4.8	0.0031	18.3
i8	Soma county Iitate Village Nimaibashi	North/West	44km	2011/4/25	4.0	0.0031	17.5
i15	Soma county Iitate Village Ookura	North/West	40km	2011/4/25	5.1	0.0028	17.3
i16	Soma county Iitate Village Ookura	North/West	40km	2011/4/25	3.7	0.0027	15.4
K8	Futaba-country Katsurao-Village Katsurao	North/West	21km	2011/4/25	32.3	0.0190	115.8
K7	Futaba-country Katsurao-Village Katsurao	North/West	23km	2011/4/25	16.3	0.0097	59.1
K6	Futaba-country Katsurao-Village Katsurao	West/North/West	26km	2011/4/25	15.8	0.0097	58.6
K9	Futaba-country Katsurao-Village Ochiai	West/North/West	21km	2011/4/25	5.6	0.0024	16.1
K4	Futaba County Katsurao Village Nogawa	West/North/West	28km	2011/4/25	4.5	0.0026	15.8
K1	Futaba-country Katsurao-Village Katsurao	West/North/West	32km	2011/4/25	3.7	0.0020	12.6
K2	Futaba-country Katsurao-Village Katsurao	West/North/West	30km	2011/4/25	3.1	0.0020	12.0
K11	Futaba-country Katsurao-Village Ochiai	West/North/West	21km	2011/4/25	3.6	0.0017	11.2
K3	Futaba-country Katsurao-Village Katsurao	West/North/West	28km	2011/4/25	2.8	0.0017	10.4
K10	Futaba-country Katsurao-Village Ochiai	West/North/West	24km	2011/4/25	2.4	0.0017	9.9
K5	Futaba County Katsurao Village Nogawa	West/North/West	29km	2011/4/25	3.0	0.0015	9.7
kw6	Date county Kawamata town Yamakiya	North/West	33km	2011/4/26	13.2	0.0079	48.1
kw4	Date county Kawamata town Yamakiya	North/West	37km	2011/4/26	4.8	0.0029	17.3
kw3	Date county Kawamata town Yamakiya	West/North/West	40km	2011/4/26	3.2	0.0019	11.7
kw5	Date county Kawamata town Yamakiya	West/North/West	34km	2011/4/26	3.2	0.0019	11.7
ms6	Minami Soma city Haramachi ward Baba	North/West	21km	2011/4/26	18.4	0.0111	67.1
ms4	Minami Soma city Haramachi ward Takanokura	North/West	27km	2011/4/26	7.5	0.0045	27.4

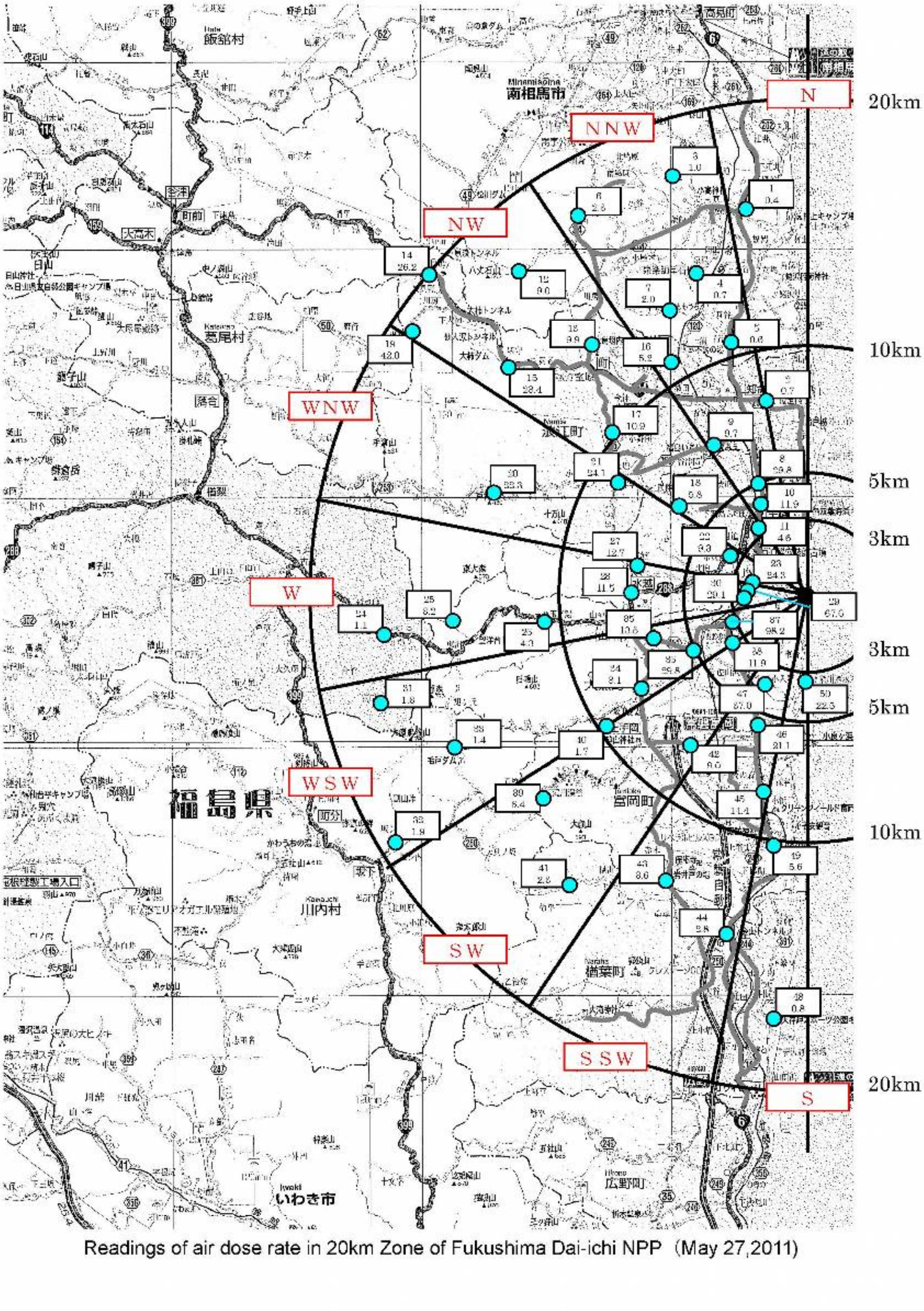
Estimates of Integrated Dose at Each Continuous Monitoring Location based on Measured Values (4／4)

Location Number	Location (Motiroring Area)【※10】	From Fukushima Dai-ichi NPP Direction	From Fukushima Dai-ichi NPP Distance	Starting Date of Monitoring Air Dose Rate	Estimates of Integrated Dose (mSv)【※7、8】	Estimated values as of May 11 (mSv/h)	Estimates of Integrated Dose as of March 11, 2012 (mSv)【※4】
n5	Futaba county Namie town Hirusone	North/West	22km	2011/4/27	31.7	0.0441	225.4
n11	Futaba county Namie town Hirusone	North/West	20km	2011/5/2	24.6	0.0282	148.5
n1	Futaba county Namie town Akougi	North/West	31km	2011/4/27	18.5	0.0255	130.5
n2	Futaba county Namie town Akougi	North/West	28km	2011/4/27	16.2	0.0243	123.0
n7	Futaba county Namie town Minamitsushima	North/West	23km	2011/4/27	17.4	0.0231	119.0
n4	Futaba county Namie town Akougi	North/West	26km	2011/4/27	15.0	0.0224	113.3
n9	Futaba county Namie town shimotsushima	North/West	29km	2011/4/27	7.9	0.0236	111.7
n6	Futaba county Namie town Minamitsushima	North/West	25km	2011/4/27	13.8	0.0152	80.4
n3	Futaba county Namie town Akougi	North/West	28km	2011/4/27	11.0	0.0155	79.0
n8	Futaba county Namie town shimotsushima	North/West	27km	2011/4/27	11.8	0.0152	78.4
n10	Futaba county Namie town Hatsuke	West/North/West	33km	2011/4/27	1.5	0.0021	10.7
(4)Other zones(added point)							
kw1	Date county kawamata town Kotunagi-aza-awahukuji	North/West	42km	2011/4/26	2.5	0.0015	8.9
kw2	Date county kawamata town Kotunagi-aza-awahukuji	North/West	42km	2011/4/26	2.2	0.0013	7.8
ms1	Minami Soma city Haramachi ward Ohara	North/North/West	33km	2011/4/26	5.4	0.0032	19.6
ms5	Minami Soma city Haramachi ward Takanokura	North/North/West	25km	2011/4/26	4.6	0.0028	16.8
ms11	Minami Soma city Haramachi ward Ohara	North/North/West	29km	2011/4/26	3.7	0.0022	13.4
ms2	Minai Soma city Kashima ward Koike	North/North/West	32km	2011/4/26	2.8	0.0017	10.1
ms7	Minami Soma city Haramachi ward Baba	North/North/West	22km	2011/4/26	1.5	0.0009	5.6
ms3	Minai Soma city Kashima ward Kamitochikubo	North/North/West	36km	2011/4/26	1.4	0.0008	5.0
ms8	Minami Soma city Haramachi ward Kanezawa	North	20km	2011/4/26	0.2	0.0001	0.6
ms10	Minami Soma city Haramachi ward Taka	North/North/West	21km	2011/4/26	0.2	0.0001	0.6
ni1	Nihonmatsu city Shimokawasaki	West/North/West	50km	2011/4/25	2.2	0.0013	7.8
ni2	Nihonmatsu city Tazawa	West/North/West	36km	2011/4/26	1.7	0.0010	6.2
mo1	Motomiya City Wada	West/North/West	52km	2011/4/25	2.5	0.0015	9.0
ko1	Koriyama city Hayama	South/West	59km	2011/4/25	4.0	0.0024	14.5
ko2	Koriyama city Kaisei	South/West	59km	2011/4/25	2.0	0.0012	7.3
d4	Date city Ryozen town Kamioguni	North/West	55km	2011/4/27	2.3	0.0027	14.1
d5	Date city Ryozen town Ishida	North/West	48km	2011/4/27	2.0	0.0024	12.8
d2	Date city Ryozen town Shimooguni	North/West	55km	2011/4/27	2.1	0.0023	12.7
d3	Date city Ryozen town Kamioguni	North/West	55km	2011/4/27	1.7	0.0019	10.0
d13	Fukushima city Oguraji	North/West	59km	2011/4/27	1.4	0.0016	8.2
d6	Fukushima city Irie town	North/West	62km	2011/4/27	1.2	0.0014	7.3
d11	Fukushima city Koshihama town	North/West	61km	2011/4/27	1.2	0.0014	7.3
d1	Fukushima city Kitayanome	North/West	66km	2011/4/27	1.0	0.0011	5.9
d12	Fukushima city Watari	North/West	61km	2011/4/27	1.0	0.0011	5.9
d7	Fukushima city Kasuga town	North/West	63km	2011/4/27	0.8	0.0009	4.5
d10	Fukushima city Hamada town	North/West	61km	2011/4/27	0.8	0.0009	4.5
d8	Fukushima city Shinhama town	North/West	63km	2011/4/27	0.7	0.0008	4.2
d9	Fukushima city Sugitsuma town	North/West	62km	2011/4/27	0.5	0.0006	3.1

※7: The integrated dose from 6'oclock on March 12 to 24 o'clock May 11. Radioactive decay by wooden houses ,assuming people stayed 16 hours in the houses, are taken int
*8: The dose data for the period from March 16 to the day before the start of monitoring has been derived by assuming that the dose has changed in proportion to changes at
*9: Values have been obtained while supposing that the estimated values for May 11 will stay unchanged on and after May 12.
*10: Information on the latitude and longitude of each monitoring spot is available on the MEXT website.

To prepare the isogram map of estimated integrated doses, the values for a total of 2,448 locations were used (the 151 locations mentioned above plus the air dose monitoring locations mentioned below [2,297 locations]).

(1) Air dose rates observed in the emergency environmental monitoring conducted by Fukushima Prefecture from March 30 to MAY 1: 91 locations
2) Air dose rates observed in monitoring conducted by MEXT on April 9 in Katsurao Village and Namie Town: 16 locations
3) Air dose rates observed in monitoring conducted by MEXT on April 12 and April 14 in Iitate Village, Iwaki City, Katsurao Village, Kawauchi Village, Namie Town, Hirono Town,
4) Air dose rates observed within the area covered by the isogram map in the grid survey conducted by Fukushima Prefecture from April 12 to April 16: 1,790 locations
5) Air dose rates observed inside the 20 km zone in monitoring conducted by MEXT and TEPCO on March 30 and 31, and April 2, 18 and 19: 228 locations



Readings of air dose rate in 20km Zone of Fukushima Dai-ichi NPP (May 27,2011)

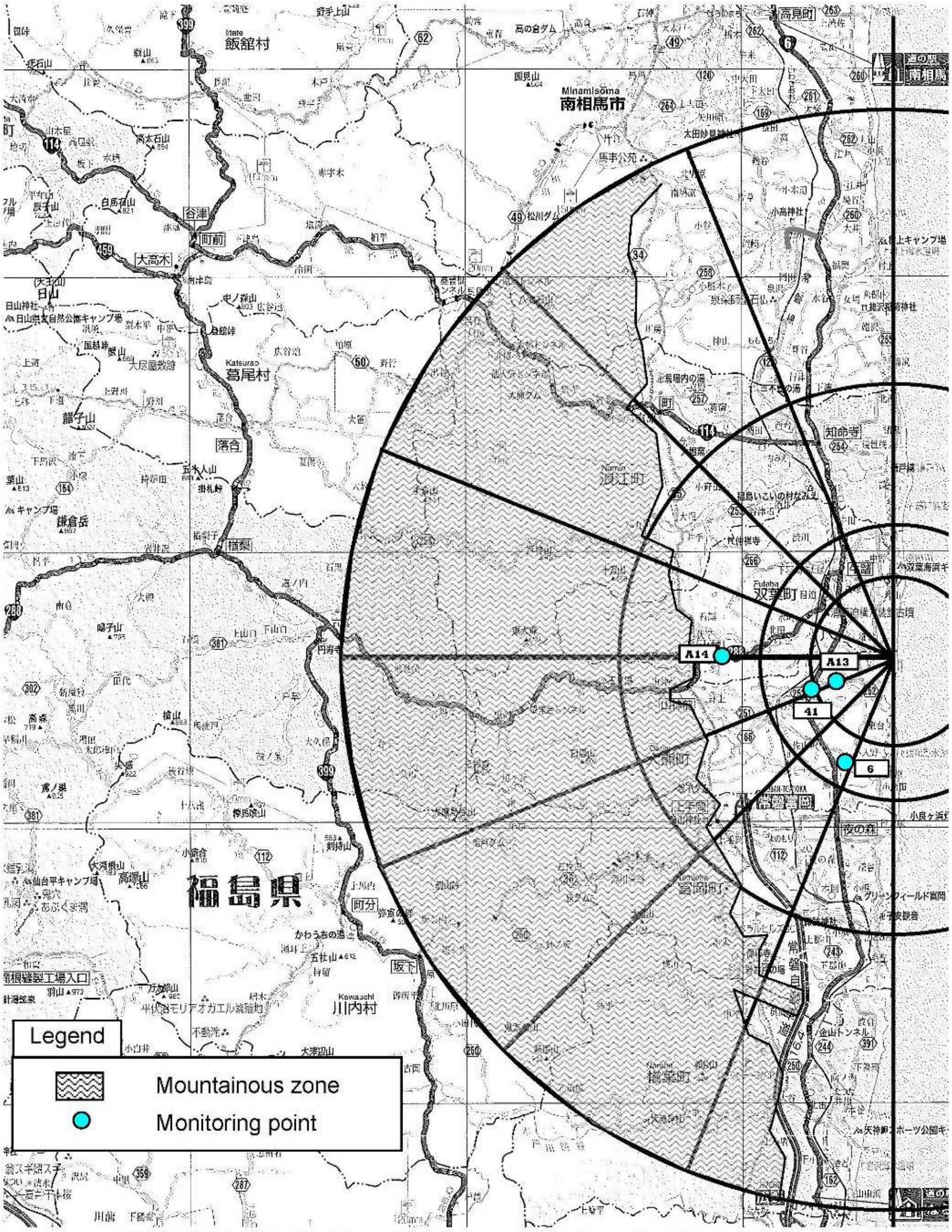
* The upper measurement points, and the lower shows the measured dose rate. (μSv/h)

Readings of air dose rate in 20km Zone of Fukushima Dai-ichi NPP (May 27,2011)

＊1　measured by ionization chamber type survey meter
＊2　measured by NaI scintillator detector

No.	Reading Post(length from NPP)	Monitoring Time	Reading (unit : μSv/h)
1	Minami Soma city Odaka ward Ooi (16kmNorth)	2011/5/27 10:35	0.4 *2
2	Futaba county Namie town Kitakiyohashi (8kmNorth)	2011/5/27 12:30	0.7 *2
3	Minami Soma city Odaka ward Katakusa (18kmNorth/North/West)	2011/5/27 10:45	1.0 *2
4	Minami Soma city Odaka ward Izumisawa (14kmNorth/North/West)	2011/5/27 11:00	0.7 *2
5	Minami Soma city Odaka ward Namezu (11kmNorth/North/West)	2011/5/27 11:25	0.6 *2
6	Minami Soma city Odaka ward Otomi (19kmNorth/North/West)	2011/5/27 13:25	2.3 *2
7	Minami Soma city Odaka ward Kamiyama (13kmNorth/North/West)	2011/5/27 11:05	2.0 *2
8	Futaba county Futaba town oaza Nagatsuka (5kmNorth/North/West)	2011/5/27 10:51	29.8 *1
9	Futaba county Namie town Sakai (7kmNorth/North/West)	2011/5/27 12:15	9.7 *2
10	Futaba county Futaba town oaza Nagatsuka (4kmNorth/North/West)	2011/5/27 11:00	11.9 *2
11	Futaba county Futaba town oaza Shinzan (3.5kmNorth/West)	2011/5/27 11:08	4.6 *2
12	Minami Soma city Odaka ward Kanaya (18kmNorth/West)	2011/5/27 13:09	9.0 *2
13	Futaba county Namie town oaza Tatsuno (14kmNorth/West)	2011/5/27 12:50	9.9 *2
14	Futaba county Namie town Hirusone (20kmNorth/West)	2011/5/27 12:29	26.2 *1
15	Futaba county Namie town Murohara (16kmNorth/West)	2011/5/27 11:30	23.4 *2
16	Futaba county Namie town oaza Tatsuno (11kmNorth/North/West)	2011/5/27 11:15	5.2 *2
17	Futaba county Namie town oaza Suenomori (11kmNorth/West)	2011/5/27 11:50	10.9 *2
18	Futaba county Futaba town Terasawa (7kmNorth/West)	2011/5/27 11:00	5.8 *2
19	Futaba county Namie town Kawabusa (20kmNorth/West)	2011/5/27 11:10	42 *1
20	Futaba county Namie town oaza Omaru (12kmWest/North/West)	2011/5/27 11:40	22.3 *2
21	Futaba county Namie town oaza Ide (9kmWest/North/West)	2011/5/27 11:20	24.1 *2
22	Futaba county Futaba town oaza Maeda (3.5kmWest/North/West)	2011/5/27 10:30	9.3 *2
23	Futaba county Okuma town oaza Ottozawa (2.5kmWest/North/West)	2011/5/27 11:18	24.3 *1
24	Tamura city Miyakoji Town Furumichi (17kmWest)	2011/5/27 12:00	1.1 *2
25	Futaba county Okuma town oaza Nogami (14kmWest)	2011/5/27 12:10	3.2 *2
26	Futaba county Okuma town oaza Nogami (11kmWest)	2011/5/27 12:30	4.3 *2
27	Futaba county Futaba town Ishikuma (7kmWest)	2011/5/27 10:20	12.7 *2
28	Futaba county Futaba town oaza Yamada (7kmWest)	2011/5/27 10:00	11.5 *2
29	Futaba county Okuma town Ottozawa (2.5kmWest)	2011/5/27 11:23	67.6 *1
30	Futaba county Okuma town oaza Ottozawa (2.5kmWest)	2011/5/27 11:31	29.1 *1
31	Tamura city Miyakoji Town Furumichi (18kmWest/South/West)	2011/5/27 11:50	1.3 *2
32	Futaba county Kawauchi town Shimokawauchi (19kmWest/South/West)	2011/5/27 10:52	1.9 *2
33	Futaba county Kawauchi town Shimokawauchi (16kmWest/South/West)	2011/5/27 11:20	1.4 *2
34	Futaba county Okuma town Ogawara (8kmWest/South/West)	2011/5/27 11:25	3.1 *2
35	Futaba county Okuma town Nogami (7kmWest/South/West)	2011/5/27 11:16	13.5 *2
36	Futaba county Okuma town Shimonogami (5kmWest/South/West)	2011/5/27 10:46	29.8 *1
37	Futaba county Okuma town Koirino (3kmWest/South/West)	2011/5/27 11:40	98.2 *1
38	Futaba county Okuma town Koirino (3.5kmWest/South/West)	2011/5/27 10:56	11.9 *2
39	Futaba county Tomioka town Kamiteoka (13kmSouth/West)	2011/5/27 11:54	6.4 *2
40	Futaba county Tomioka town Kamiteoka (10km West/South/West)	2011/5/27 11:53	1.7 *2
41	Futaba county Naraha town oaza Ide (15km South/West)	2011/5/27 11:20	2.3 *2
42	Futaba county Tomioka town oaza Kamiteoka (8km South/West)	2011/5/27 12:07	9.0 *2
43	Futaba county Tomioka town oaza Kamikooriyama (13km South/South/West)	2011/5/27 12:42	3.6 *2
44	Futaba county Naraha town Kamishigeoka (14kmSouth/South/West)	2011/5/27 12:05	2.8 *2
45	Futaba county Tomioka town oaza Motooka (7kmSouth/South/West)	2011/5/27 10:51	14.4 *2
46	Futaba county Tomioka town oaza Oragahama (6kmSouth/South/West)	2011/5/27 10:40	21.1 *2
47	Futaba county Okuma town oaza Kumagawa (4km South/South/West)	2011/5/27 10:28	37 *1
48	Futaba county Naraha town oaza Ide (16kmSouth)	2011/5/27 11:40	0.8 *2
49	Futaba county Tomioka town oaza Kobama (10kmSouth)	2011/5/27 11:05	5.6 *2
50	Futaba county Okuma town oaza Kumagawa (4kmSouth)	2011/5/27 10:13	22.5 *2

Reading by Electric power company



Monitoring points for the radioactive concentration of nuclides in the soil within 20 km of Fukushima Dai-ichi NPP
(Sample collection dates: April 29-May 1, 2011)

* Figures in boxes are monitoring point numbers.

Attachment V-13-3-(2)

Analysis Results of Soil Samples Taken inside 20 km Zone of Fukushima Dai-ichi NPP

May 31, 2011

Ministry of Education, Culture, Sports, Science and Technology

1. Analysis results

Location Number	Soil Sample Sampling Location	Sampling Date	Radioactive Concentration (Bq/kg)													Notes
			^{89}Sr	^{90}Sr	^{131}I	^{134}Cs	^{136}Cs	^{137}Cs	^{129m}Te	^{234}U	^{235}U	^{238}U	^{238}Pu	$^{239+240}Pu$	Other Detected Nuclides	
6	Okuma Town Oaza Kumagawa (About 4km South/South/West)	30-Apr	18	4.1	9,500	18,000	250	17,000	8,800	6.2	0.21	5.8	Not detectable (0.00089±0.00089)	Not detectable (0.0067±0.0026)	Not detectable	
41	Okuma Town Oaza Ottozawa (About 3km West/South/West)	29-Apr	63	12.0	11,000	52,000	760	49,000	23,000	18.0	0.82	17.0	Not detectable (0.0051±0.0023)	0.05	Not detectable	
A13	Okuma Town Oaza Ottozawa (About 2km West/South/West)	1-May	430	68.0	110,000	270,000	3,400	270,000	180,000	11.0	0.47	10.0	Not detectable (0.0029±0.0021)	0.027	Not detectable	
A14	Futaba Town Oaza Yamada (About 7km West)	1-May	13	2.5	7,200	5,000	87	5,000	7,300	5.2	0.22	5.9	Not detectable (0.0009±0.0015)	0.020	Not detectable	

☐ (Data that was added in this round)

2. Outline of result – Regarding strontium –

Regarding strontium, ^{89}Sr that has half life of 50.5 days, was detected. It is thought to be released from the site of Fukushima Dai-ichi NPP. The ^{90}Sr / ^{137}Cs radioactivity concentration ratio was about 1/4,000 to 1/2,000.

3. Date of analysis start

May 3,2011

(Reference 1) The concentration ratio indicated as the effect of past nuclear tests in the atmosphere is 0.026.
(Reference 2) For the detection standards, it is deemed to have been detected if A is at least three times larger than B in A±B.
(Reference 3) Analysis was conducted by the Japan Chemical Analysis Center.

Results of Radionuclide Analysis of Dust (1/13)

As of 10:00 May 31 ,2011
MEXT

Sampling Point		Sampling Time and Date	Radioactivity Concentration(Bq/m³)						Air dose rate (μSv/h)	Monitoring Point by monitoring car
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	other detected nuclides		
【1-1】(46kmNorth/West)	Soma County Iitate Village Sasu Nameri	3/23 10:45~10:55	4.0	<0.94	1.2				5.5	【3】
【1-2】(40kmWest/North/West)	Date county Kawamata town Yamakiya	3/23 10:50~11:10	5.2	<1.1	<1.2				9.0	【36】
【1-3】(32kmWest/North/West)	Futaba County Katsurao Village Kaminogawa	3/23 13:54~14:17	8.0	<1.0	<1.4				9.4	【21】
【1-4】(32kmWest)	Tamura city Tokiwa town Yamane	3/23 12:40~13:02	2.8	1.2	<1.1				2.3	【15】
【1-4】(32kmWest)1st		3/24 10:58~11:09	3.1	<0.86	<0.99				2	
【1-4】(32kmWest)6th		3/24 15:58~16:09	2.1	<0.94	<1.0				2.2	
【1-5】(23kmSouth) Survey 1st	Futaba county Hirono town Shimokitaba	3/23 13:15~13:58	530.0	6.5	6.6				5.5~14.0	【71】
【1-5】(23kmSouth) Survey 2nd		3/23 14:30~15:10	180.0	1.4	2.3				5.5~14.0	
【1-5】(23kmSouth) Survey 3rd		3/23 15:20~15:59	110.0	<1.4	2.1				5.5~14.0	
【1-5】(23kmSouth) Survey 1st		3/24 10:06~10:44	5.9	<0.53	<0.66				5.6	
【1-5】(23kmSouth) Survey 2nd		3/24 10:53~11:33	9.2	<0.63	<0.71				5.6	
【1-5】(23kmSouth) Survey 3rd		3/24 11:44~12:26	12.0	<0.92	1.1				5.6	
【1-5】(23kmSouth) Vehicle-Borne Survey		3/25 11:51~12:38	43.0	1.4	2.0				4.1~5.5	
【1-5】(23kmSouth) 1st		3/25 13:12~13:42	23.0	0.68	1.4				2	
【1-5】(23kmSouth) 2nd		3/25 14:12~14:42	19.0	1.0	1.3				2.8	
【1-5】(23kmSouth) 3rd		3/25 15:12~15:42	24.0	2.3	2.5				2.5	
【1-5】(23kmSouth) 4th		3/25 16:12~16:42	10.0	0.74	1.3				2.2	
【1-5】(23kmSouth) 1st		3/26 12:47~13:21	13.0	<1.2	<1.3				3.9	
【1-5】(23kmSouth) 2nd		3/26 14:21~14:57	10.0	<0.97	1.5				3.9	
【1-5】(23kmSouth) Survey 1st		3/27 12:36~13:26	20.0	0.90	0.8				2.8~3.8	
【1-5】(23kmSouth) 4th		3/31 15:00~15:44	13.0	<0.61	<0.79				2.0	
【1-7】(32kmNorth/North/West) 1st	Minami Soma city Kashima ward	3/25 12:58~13:09	3.5	<0.63	<0.99				3.2	【7】
【1-7】(32kmNorth/North/West) 2nd		3/25 13:58~14:09	4.3	1.4	1.6				3.2	
【1-7】(32kmNorth/North/West) 3rd		3/25 14:57~15:08	15.0	<0.78	<0.98				3.2	
【1-7】(32kmNorth/North/West) 4th		3/25 15:58~16:09	22.0	0.9	1.1				3.2	
【1-7】(32kmNorth/North/West) 5th		3/26 11:27~11:38	2.9	<0.85	<0.96				1.5	
【1-7】(32kmNorth/North/West) 6th		3/26 13:00~13:11	2.2	<0.82	1.3				1.5	
【1-8】(42kmNorth/North/West) 1st	Soma City Nakano	3/28 13:00~16:00	19.0	2.7	3.2				0.6~1.2	【5】
【2-1】(36kmNorth/West) 1st	Soma county Iitate village Yagisawa	3/29 12:50~13:45	4.2	<0.57	0.73				7.0	【61】
【2-1】(36kmNorth/West) 2nd		3/29 13:49~14:46	3.4	<0.6	0.79				7.0	
【2-1】(36kmNorth/West) 3rd		3/29 14:47~15:50	2.9	<0.66	<0.74				7.0	
【2-1】(36kmNorth/West) 1st		3/30 11:15~11:35	4.8	<1.4	<1.8				6.7	
【2-1】(36kmNorth/West) 5th		3/30 15:15~15:35	7.7	<1.8	1.90				7.5	
【2-4】(24kmNorth) 1st	Minami Soma city Haramachi ward Takami town	3/29 11:17~12:15	75.0	35.0	46.0				1.7	【80】
【2-4】(24kmNorth) 2nd		3/29 12:15~13:15	29.0	24.0	34.0				0.4	
【2-4】(24kmNorth) 3rd		3/29 13:15~14:15	32.0	18.0	23.0				0.6	
【2-4】(24kmNorth) 4th		3/29 14:15~15:00	29.0	20.0	25.0				0.5	
【2-4】(24kmNorth) 1st		3/30 11:09~11:29	1.8	<0.45	<0.45				0.0	
【2-4】(24kmNorth) 4th		4/1 15:33~15:53	1.7	0.67	1.0				1.2	
【2-7】(34kmWest/North/West)	Date county Kawamata town Yamakiya	3/29 12:00~13:00	0.95	<0.45	0.59				8.0	【46】
【2-7】(34kmWest/North/West)		3/29 13:00~14:00	0.66	<0.60	<0.70				8.0	
【2-7】(34kmWest/North/West)		3/29 14:00~15:00	0.75	<0.58	<0.76				8.0	
【2-7】(34kmWest/North/West)		3/29 15:00~16:00	0.90	<0.51	<0.58				8.0	
【2-7】(34kmWest/North/West)		3/29 16:00~17:00	0.69	<0.52	<0.59				8.0	
【2-7】(34kmWest/North/West) 4th		3/30 15:11~15:32	180.0	120.0	140.0				15.0	
【3-1】(33kmNorth/West) 1st	Soma county Iitate village Nagadoro	3/24 11:20~11:41	43.0	<0.98	2.0				30	【33】
【3-1】(33kmNorth/West) 5th		3/24 15:20~15:42	3.3	1.1	1.7				30	
【3-1】(33kmNorth/West) 1st		3/26 11:38~12:00	5.8	<3.4	<4.8				26	
【3-1】(33kmNorth/West) 2nd		3/26 13:18~13:39	5.2	1.9	2.2				26	
【3-1】(33kmNorth/West) 1st		3/28 11:31~11:52	2.6	2.1	1.8				26	
【3-1】(33kmNorth/West) 2nd		3/28 12:53~13:15	2.7	<0.97	<1.2				26	
【3-1】(33kmNorth/West) 1st		3/29 11:18~11:40	2.4	<0.98	1.1				26	
【3-1】(33kmNorth/West) 2nd		3/29 13:23~13:50	1.9	<0.81	<1.0				26	
【76】(22kmWest/South/West) 1st	Futaba county Kawauchi village Kamikawauchi	4/2 11:22~11:47	4.5	0.72	1.1				1.0	【76】
【76】(22kmWest/South/West) 2nd		4/2 11:54~12:36	2.0	0.49	<0.39				1.0	
【76】(22kmWest/South/West) 3rd		4/2 12:42~13:47	1.3	0.36	0.45				1.0	
【76】(22kmWest/South/West) 4th		4/2 13:50~14:56	1.6	<0.26	<0.33				1.0	
【76】(22kmWest/South/West) 5th		4/2 14:59~16:03	1.6	<0.3	<0.33				1.0	
【76】(22kmWest/South/West) 1st		4/3 11:35~12:34	2.1	0.50	0.56				0.7	
【76】(22kmWest/South/West) 2nd		4/3 12:36~13:35	1.4	<0.31	<0.31				0.7	
【76】(22kmWest/South/West) 3rd		4/3 13:38~14:37	2.4	<0.37	<0.39				0.7	
【76】(22kmWest/South/West) 1st		4/4 12:00~13:00	1.3	1.2	1.60				0.8	
【76】(22kmWest/South/West) 2nd		4/4 13:08~13:57	2.0	0.94	1.10				0.8	
【76】(22kmWest/South/West) 3rd		4/4 14:01~14:50	2.3	1.0	0.94				0.8	

Readings are already announced in "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP"

Blanks of ^{132}I, ^{132}Te and other detected nuclides are being confirmed.

The measurement published in here is being by executed JAEA(Japan Atomic Energy Agency),

Results of Radionuclide Analysis of Dust (2/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration(Bq/m³)						Air dose rate (μSv/h)	Note
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides		
【1】(62km North/West)	Fukushima city Sugitsuma town	3/19 18:30~18:50	1.22	Not Detectable	Not Detectable				7.2	
		3/20 18:30~18:50	203.00	26.0	32.20				5.0	
		3/21 18:30~18:50	2.50	Not Detectable	Not Detectable				4.5	
		3/22 18:30~18:50	3.06	Not Detectable	Not Detectable				5.2	
		3/23 19:38~19:58	3.69	1.71	1.20				4.0	
		3/24 18:30~18:55	Not Detectable	Not Detectable	Not Detectable				3.6	
		3/25 19:10~19:20	24.00	16.1	14.20				2.5	
		3/26 18:30~18:40	1.75	Not Detectable	Not Detectable				2.5	
		3/27 18:30~18:50	0.87	Not Detectable	Not Detectable				3.5	
		3/28 18:33~18:43	1.13	Not Detectable	Not Detectable				3.2	
		3/29 18:30~18:50	1.56	Not Detectable	Not Detectable				2.1	
		3/30 18:40~19:00	0.91	Not Detectable	Not Detectable				2.0	
		3/31 18:30~18:45	2.34	Not Detectable	0.56				2.6	
		4/1 18:30~18:40	2.92	1.83	1.28				2.7	
		4/2 18:37~18:50	2.36	Not Detectable	0.52				1.9	
		4/3 18:30~18:40	1.86	Not Detectable	Not Detectable				2.0	
		4/4 18:33~18:43	0.72	Not Detectable	Not Detectable				1.5	
		4/5 19:09~19:19	1.99	Not Detectable	Not Detectable				0.9	
		4/6 18:48~18:58	0.70	Not Detectable	Not Detectable				0.9	
		4/7 18:30~18:40	0.84	0.876	Not Detectable				0.8	
		4/8 18:30~18:40	1.94	1.77	2.28				0.8	
		4/9 18:30~18:40	1.12	0.573	0.874				0.5	
		4/10 18:30~18:40	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/11 18:32~18:42	0.626	Not Detectable	Not Detectable				0.4	
		4/12 18:30~18:40	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/13 18:30~18:50	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/14 18:45~19:05	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/15 18:30~18:40	Not Detectable	Not Detectable	0.766				0.8	
		4/16 18:30~18:40	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/17 18:30~18:40	Not Detectable	Not Detectable	Not Detectable				*1	
		4/18 18:30~18:40	Not Detectable	Not Detectable	0.684				*1	
		4/19 18:30~18:40	Not Detectable	Not Detectable	Not Detectable				*1	
		4/20 18:30~18:40	Not Detectable	0.916	1.02				*1	
		4/21 10:07~10:27	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/22 10:00~10:20	4.00	1.10	1.26				0.6	
		4/23 10:00~10:23	0.62	Not Detectable	Not Detectable				0.8	
		4/24 10:00~10:20	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/25 10:01~10:21	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/26 10:00~10:20	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/27 10:40~11:00	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/28 10:10~10:30	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/29 10:15~10:35	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/30 10:11~10:32	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/1 10:00~10:20	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/2 10:01~10:21 (5/3 18:26)	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/3 10:00~10:20 (5/4 16:05)	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/4 10:28~10:48 (5/4 12:15)	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/5 10:00~10:20 (5/5 13:44)	Not Detectable	Not Detectable	Not Detectable				0.6	
		5/6 10:00~10:20	Not Detectable	Not Detectable	Not Detectable				0.6	
		5/7 10:05~10:25	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/10 10:10~10:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/11 10:01~10:21	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/12 10:00~10:20	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/13 10:00~10:20	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/14 10:00~10:20	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/15 10:00~10:20	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/16 10:05~10:25	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/17 10:00~10:20	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/18 10:05~10:18	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/19 10:00~10:11	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/20 10:10~10:25	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/21 10:00~10:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/22 10:00~10:13	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/23 10:00~10:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/24 10:10~10:25	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/25 10:00~10:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/26 10:00~10:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/27 10:05~10:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/28 10:15~10:35	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/29 10:00~10:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	

Attachment V-13-4-(1)

Results of Radionuclide Analysis of Dust (3/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m^3)						Air dose rate ($\mu Sv/h$)	Note
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides		
【2-1】(38 km North/west)	Soma county Iitate village Yagisawa	3/20 13:20~13:40	270	38.8	42.1				20.4	
		3/21 13:00~13:20	12.80	1.93	2.37				4.1	
		3/22 12:26~12:46	5.87	Not Detectable	Not Detectable				4.2	
		3/23 12:50~13:10	2.99	Not Detectable	Not Detectable				16.8	
		3/24 13:30~13:50	5.80	Not Detectable	1.51				10.0	
		3/25 12:45~13:05	5.87	Not Detectable	Not Detectable				12.3	
		3/26 12:26~12:46	5.39	1.94	1.33				7.8	
		3/27 12:06~12:26	2.22	Not Detectable	Not Detectable				11.2	
		3/28 12:05~12:25	1.66	Not Detectable	Not Detectable				9.6	
		3/29 12:07~12:27	24.2	6.04	6.79				9.2	
		3/30 13:22~13:42	3.47	1.11	Not Detectable				8.5	
		3/31 11:50~12:10	1.74	Not Detectable	Not Detectable				8.0	
		4/1 12:00~12:20	1.78	1.55	1.69				7.7	
		4/2 11:46~12:06	0.84	Not Detectable	Not Detectable				8.6	
		4/3 11:18~11:38	Not Detectable	Not Detectable	0.78				7.7	
		4/4 11:07~11:27	Not Detectable	Not Detectable	1.36				7.2	
		4/5 11:55~12:15	Not Detectable	Not Detectable	Not Detectable				4.1	
		4/6 11:45~12:05	Not Detectable	Not Detectable	Not Detectable				3.9	
		4/7 11:29~11:49	Not Detectable	Not Detectable	Not Detectable				4.1	
		4/8 11:45~12:05	0.995	Not Detectable	Not Detectable				4.5	
		4/9 11:40~12:00	1.26	Not Detectable	Not Detectable				4.1	
		4/10 14:10~14:30	Not Detectable	Not Detectable	Not Detectable				4.2	
		4/11 12:32~12:52	2.12	Not Detectable	Not Detectable				3.9	
		4/12 12:04~12:24	Not Detectable	Not Detectable	Not Detectable				4.7	
		4/13 11:25~11:45	Not Detectable	Not Detectable	Not Detectable				3.4	
		4/14 11:35~11:55	Not Detectable	Not Detectable	0.960				4.4	
		4/15 11:50~12:10	5.95	1.79	1.470				4.4	
		4/16 11:17~11:37	Not Detectable	Not Detectable	Not Detectable				4.1	
		4/17 11:42~12:02	Not Detectable	Not Detectable	0.871				3.8	
		4/18 11:23~11:43	Not Detectable	Not Detectable	Not Detectable				4.1	
		4/19 11:43~12:03	Not Detectable	Not Detectable	Not Detectable				3.7	
		4/20 11:13~11:31	Not Detectable	Not Detectable	0.929				3.3	
		4/21 11:26~11:46	Not Detectable	Not Detectable	Not Detectable				3.7	
		4/22 11:11~11:31	Not Detectable	Not Detectable	Not Detectable				3.8	
		4/23 11:38~11:58	Not Detectable	Not Detectable	Not Detectable				4.1	
		4/24 11:17~11:37	Not Detectable	Not Detectable	Not Detectable				4.6	
		4/25 12:36~12:56	Not Detectable	Not Detectable	Not Detectable				3.6	
		4/26 11:45~12:05	Not Detectable	Not Detectable	Not Detectable				3.6	
		4/27 11:27~11:47	Not Detectable	Not Detectable	Not Detectable				4.0	
		4/28 11:24~11:44	Not Detectable	Not Detectable	Not Detectable				3.8	
		4/29 11:25~11:45	Not Detectable	Not Detectable	Not Detectable				4.1	
		4/30 12:13~12:33	Not Detectable	Not Detectable	Not Detectable				4.3	
		5/1 11:47~12:07	Not Detectable	Not Detectable	Not Detectable				3.1	
		5/2 11:42~12:02 (5/3 18:33)	Not Detectable	Not Detectable	Not Detectable				3.9	
		5/3 11:50~12:10 (5/4 17:26)	0.95	1.100	1.100				3.8	
		5/4 11:30~11:50 (5/5 18:51)	Not Detectable	Not Detectable	Not Detectable				3.1	
		5/5 11:28~11:48 (5/7 10:02)	Not Detectable	Not Detectable	Not Detectable				3.2	
		5/6 11:50~12:10 (5/8 9:48)	0.44	0.51	0.92				3.2	
		5/7 11:43~12:03	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	4.1	
		5/10 11:42~11:52	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.4	
		5/11 12:00~12:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.6	
		5/12 11:52~12:02	Not Detectable	Not Detectable	0.737	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/13 11:19~11:29	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/14 11:21~11:31 (5/15 13:54)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/15 11:15~11:25	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/16 11:08~11:18	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.6	
		5/17 11:26~11:36	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.5	
		5/18 11:42~11:52	Not Detectable	Not Detectable	1.14	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/19 11:42~11:52	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/20 11:40~11:51	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.4	
		5/21 10:52~11:02	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.9	
		5/22 11:15~11:25	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/23 11:36~11:46	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.5	
		5/24 11:03~11:13	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/25 11:01~11:11	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.8	
		5/26 11:19~11:29	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.7	
		5/27 11:21~11:31	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.5	
		5/28 11:28~11:38	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.3	

Results of Radionuclide Analysis of Dust (4/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m³)						Air dose rate (μSv/h)	Note
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides		
【2-2】(45kmNorth/west)	Date county Kawamata town	3/22 11:10~11:30	10.50	Not Detectable	Not Detectable				7.8	
		3/23 11:31~11:51	1.47	Not Detectable	Not Detectable				6.0	
		3/24 11:20~11:40	1.47	Not Detectable	Not Detectable				20	
		3/25 11:25~11:45	2.15	Not Detectable	Not Detectable				7.5	
		3/26 11:10~11:30	1.19	Not Detectable	Not Detectable				4.3	
		3/27 10:50~11:10	2.97	Not Detectable	Not Detectable				5.5	
		3/28 11:00~11:20	1.66	1.37	0.87				5.5	
		3/29 11:30~11:23	1.10	2.47	2.02				4.8	
		3/30 11:37~11:57	1.38	1.56	1.11				4.6	
		3/31 10:40~11:00	1.36	0.88	Not Detectable				4.8	
		4/1 10:40~11:00	Not Detectable	Not Detectable	Not Detectable				3.3	
		4/2 10:31~10:51	Not Detectable	Not Detectable	Not Detectable				3.2	
		4/3 10:12~10:32	Not Detectable	Not Detectable	Not Detectable				3.7	
		4/4 10:05~10:25	Not Detectable	Not Detectable	Not Detectable				3.1	
		4/5 10:45~11:05	4.07	Not Detectable	Not Detectable				1.4	
		4/6 10:37~10:57	Not Detectable	Not Detectable	Not Detectable				1.7	
		4/7 10:21~10:41	Not Detectable	Not Detectable	Not Detectable				1.4	
		4/8 10:45~11:05	Not Detectable	Not Detectable	Not Detectable				1.4	
		4/9 10:29~10:49	Not Detectable	Not Detectable	Not Detectable				1.2	
		4/10 10:35~10:55	Not Detectable	Not Detectable	Not Detectable				1.4	
		4/11 11:03~11:23	Not Detectable	Not Detectable	Not Detectable				1.2	
		4/12 10:40~11:00	1.38	Not Detectable	Not Detectable				0.9	
		4/13 10:22~10:42	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/14 10:31~10:51	Not Detectable	Not Detectable	0.868				1.2	
		4/15 10:45~11:05	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/16 10:08~10:28	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/17 10:37~10:57	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/18 10:17~10:37	1.47	Not Detectable	Not Detectable				1.2	
		4/19 10:41~11:01	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/20 10:07~10:27	Not Detectable	Not Detectable	Not Detectable				1.0	
		4/21 10:20~10:40	Not Detectable	Not Detectable	Not Detectable				1.2	
		4/22 10:09~10:29	1.26	1.40	1.47				1.0	
		4/23 10:30~10:50	Not Detectable	1.08	1.58				1.0	
		4/24 10:09~10:29	Not Detectable	Not Detectable	Not Detectable				1.0	
		4/25 11:02~11:22	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/26 10:33~10:53	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/27 10:20~10:40	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/28 10:15~10:35	Not Detectable	Not Detectable	Not Detectable				1.2	
		4/29 10:20~10:40	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/30 10:50~11:10	Not Detectable	0.77	Not Detectable				1.4	
		5/1 10:30~10:50	Not Detectable	Not Detectable	Not Detectable				1.3	
		5/2 10:30~10:50 (5/3 18:30)	Not Detectable	Not Detectable	Not Detectable				1.3	
		5/3 10:30~10:50 (5/4 15:51)	Not Detectable	Not Detectable	Not Detectable				1.2	
		5/4 10:18~10:38 (5/5 18:49)	Not Detectable	Not Detectable	Not Detectable				1.1	
		5/5 10:20~10:40 (5/7 9:49)	Not Detectable	Not Detectable	Not Detectable				1.1	
		5/6 10:33~10:53 (5/8 9:48)	Not Detectable	Not Detectable	Not Detectable				1.1	
		5/7 10:20~10:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/10 10:26~10:36	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/11 10:50~11:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/12 10:37~10:47	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	
		5/13 10:20~10:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/14 10:19~10:29 (5/15 13:44)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/15 10:12~10:22	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/16 10:08~10:18	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/17 10:27~10:37	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/18 10:31~10:41	Not Detectable	Not Detectable	0.61	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/19 10:37~10:47	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/20 10:25~10:35	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/21 10:01~10:11	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/22 10:10~10:20	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/23 10:30~10:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/24 10:04~10:14	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/25 10:08~10:18	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/26 10:18~10:28	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/27 10:16~10:26	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/28 10:17~10:27	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	

Attachment V-13-4-(1)

Results of Radionuclide Analysis of Dust (5/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m³)						Air dose rate (μSv/h)	Note
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides		
【2-3】(41km west)	Tamura city Funehiki town Funehiki	3/20 12:40～13:00	33.7	8.31	8.47				1.1	
		3/21 12:30～12:50	3.74	Not Detectable	Not Detectable				0.9	
		3/22 11:32～11:52	3.92	Not Detectable	Not Detectable				2.2	
		3/23 11:50～12:10	1.75	Not Detectable	Not Detectable				1.0	
		3/24 12:12～12:32	0.97	Not Detectable	Not Detectable				–	
		3/25 13:33～13:53	37.00	Not Detectable	1.45				0.8	
		3/26 11:52～12:12	1.77	Not Detectable	Not Detectable				0.8	
		3/27 11:48～12:08	1.07	Not Detectable	Not Detectable				0.8	
		3/28 11:39～11:59	Not Detectable	Not Detectable	Not Detectable				0.4	
		3/29 13:44～13:54	2.29	Not Detectable	0.63				0.7	
		3/30 12:25～12:35	1.59	Not Detectable	Not Detectable				0.5	
		3/31 12:05～12:15	2.07	Not Detectable	Not Detectable				0.5	
		4/1 12:11～12:31	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/2 11:24～11:44	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/3 11:18～11:38	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/4 11:17～11:37	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/5 11:45～11:55	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/6 11:28～11:38	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/7 11:28～11:38	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/8 11:27～11:37	Not Detectable	1.11	0.905				0.4	
		4/9 11:21～11:31	Not Detectable	Not Detectable	0.654				0.3	
		4/10 11:07～11:17	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/11 11:01～11:11	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/12 11:18～11:28	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/13 11:13～11:23	Not Detectable	Not Detectable	0.696				0.3	
		4/14 11:26～11:36	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/15 11:26～11:36	Not Detectable	Not Detectable	0.613				0.3	
		4/16 11:13～11:23	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/17 11:06～11:16	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/18 11:02～11:12	0.91	Not Detectable	Not Detectable				0.3	
		4/19 13:12～13:22	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/20 11:23～11:33	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/21 11:41～11:51	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/22 11:20～11:30	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/23 11:22～11:32	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/24 11:05～11:15	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/25 13:40～13:55	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/26 12:25～12:40	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/27 11:50～12:00	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/28 11:55～12:05	Not Detectable	1.90	2.65				0.2	
		4/29 11:29～11:39	Not Detectable	Not Detectable	0.707				0.2	
		4/30 11:49～11:59	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/1 11:45～11:55	Not Detectable	Not Detectable	Not Detectable				0.3	
		5/2 11:13～11:23 (5/3 18:28)	Not Detectable	Not Detectable	Not Detectable				0.3	
		5/3 11:37～11:47 (5/4 15:49)	Not Detectable	Not Detectable	Not Detectable				0.3	
		5/4 11:26～11:36 (5/5 17:17)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/5 11:35～11:45 (5/7 9:47)	Not Detectable	Not Detectable	Not Detectable				0.3	
		5/6 11:44～11:54 (5/8 11:16)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/7 11:45～11:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/10 11:44～11:54	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/11 11:50～12:00	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/12 12:37～12:52	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/13 11:41～11:56	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/14 11:13～11:28 (5/15 13:42)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/15 11:10～11:25	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/16 11:15～11:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/17 11:55～12:05	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/18 12:20～12:35	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/19 11:55～12:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/20 11:40～11:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/21 11:25～11:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/22 11:30～11:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/23 11:48～12:03	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/24 11:40～11:50	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/25 11:39～11:54	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/26 11:21～11:36	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/27 11:12～11:27	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/28 11:03～11:18	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	

Attachment V-13-4-(1)

Results of Radionuclide Analysis of Dust (6/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m³) ^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides	Air dose rate (μSv/h)	Note
【2-4】(24kmNorth)	Minami soma city Haramachi ward Takami town	3/20 15:05～15:25	13.2	Not Detectable	1.09				3.4	
		3/21 14:20～14:40	13.20	0.923	0.74				2.8	
		3/22 13:35～13:55	3.81	Not Detectable	Not Detectable				1.8	
		3/23 14:10～14:30	2.62	Not Detectable	Not Detectable				1.1	
		3/24 14:55～15:15	193.00	3.36	2.94				1.2	
		3/25 14:20～14:40	16.10	Not Detectable	Not Detectable				0.7	
		3/26 13:57～14:17	2.62	Not Detectable	Not Detectable				1.3	
		3/27 13:38～13:58	1.31	Not Detectable	Not Detectable				1.4	
		3/28 13:30～13:50	16.40	2.00	2.80				0.7	
		3/29 13:30～13:50	63.40	31.1	38.60				1.0	
		3/30 14:50～15:10	Not Detectable	1.18	Not Detectable				0.0～1.3	
		3/31 13:20～13:40	5.02	2.25	1.63				1.4	
		4/1 13:40～14:00	2.66	Not Detectable	Not Detectable				1.2	
		4/2 13:14～13:34	0.80	Not Detectable	Not Detectable				1.2	
		4/3 12:38～12:58	Not Detectable	Not Detectable	Not Detectable				1.0	
		4/4 12:26～12:46	0.85	1.76	1.80				0.7	
		4/5 13:07～13:27	6.99	1.85	1.43				0.7	
		4/6 12:01～12:21	8.81	2.35	2.68				0.6	
		4/7 12:46～13:06	35.90	4.99	4.40				0.6	
		4/8 12:55～13:15	1.05	Not Detectable	Not Detectable				0.7	
		4/9 12:57～13:17	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/10 12:55～13:15	1.15	Not Detectable	Not Detectable				0.6	
		4/11 14:03～14:23	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/12 13:35～13:55	Not Detectable	Not Detectable	0.839				0.6	
		4/13 12:38～12:58	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/14 12:56～13:16	5.51	1.68	1.71				0.5	
		4/15 13:05～13:25	7.39	Not Detectable	1.74				0.6	
		4/16 12:33～12:53	13.60	3.75	2.54				0.5	
		4/17 13:04～13:24	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/18 12:39～12:59	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/19 12:55～13:15	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/20 12:24～12:44	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/21 12:33～12:53	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/22 12:19～12:39	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/23 13:02～13:22	7.14	1.87	2.15				0.5	
		4/24 12:31～12:51	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/25 14:32～14:52	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/26 13:35～13:55	0.808	Not Detectable	Not Detectable				0.6	
		4/27 13:06～13:26	1.55	Not Detectable	Not Detectable				0.6	
		4/28 13:03～13:23	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/29 12:55～13:15	0.73	Not Detectable	Not Detectable				0.6	
		4/30 14:04～14:24	1.16	Not Detectable	Not Detectable				0.5	
		5/1 13:35～13:55	Not Detectable	Not Detectable	Not Detectable				0.6	
		5/2 13:36～13:56 (5/3 18:27)	Not Detectable	Not Detectable	Not Detectable				0.6	
		5/3 13:45～14:05 (5/4 15:50)	Not Detectable	Not Detectable	Not Detectable				0.5	
		5/4 13:11～13:31 (5/5 17:18)	Not Detectable	Not Detectable	Not Detectable				0.6	
		5/5 13:30～13:50 (5/7 9:47)	Not Detectable	Not Detectable	Not Detectable				0.6	
		5/6 13:58～14:18 (5/8 9:49)	Not Detectable	Not Detectable	Not Detectable				0.0～1.3	
		5/7 13:18～13:38	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/10 13:35～13:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/11 13:30～13:40	1.86	4.71	3.80	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/12 13:34～13:44	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/13 12:26～12:36	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/14 12:33～12:43 (5/15 13:43)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/15 12:35～12:45 (5/15 13:43)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/16 12:20～12:30	1.92	1.90	1.76	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/17 12:38～12:48	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/18 13:33～13:43	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/19 13:31～13:41	Not Detectable	0.988	1.11	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/20 14:03～14:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/21 12:05～12:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/22 13:05～13:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/23 13:24～13:34	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/24 12:16～12:26	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/25 12:09～12:19	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/26 11:35～11:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/27 12:45～12:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/28 12:35～12:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	

Attachment V-13-4-(1)

Results of Radionuclide Analysis of Dust (7/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m^3)						Air dose rate (μSv/h)	Note
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides		
【2-5】 (39km west/south/west)	Tamura county Ono town Ononiimachi	3/20 13:57～14:17	24.00	2.44	1.75				0.6	
		3/21 13:37～13:57	2.69	Not Detectable	Not Detectable				0.5	
		3/22 12:32～12:52	6.29	Not Detectable	Not Detectable				0.4	
		3/23 12:50～13:10	1.86	Not Detectable	Not Detectable				0.5	
		3/24 13:21～13:41	1.19	Not Detectable	Not Detectable				–	
		3/25 13:35～13:55	12.40	Not Detectable	Not Detectable				0.4	
		3/26 11:55～12:15	Not Detectable	Not Detectable	Not Detectable				0.6	
		3/27 11:05～11:25	1.04	Not Detectable	Not Detectable				0.5	
		3/28 11:25～11:45	0.82	Not Detectable	Not Detectable				–	
		3/29 11:25～11:45	0.89	Not Detectable	Not Detectable				0.3	
		3/30 11:00～11:20	Not Detectable	Not Detectable	Not Detectable				0.3	
		3/31 11:07～11:27	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/1 10:49～11:09	0.74	Not Detectable	Not Detectable				0.3	
		4/2 10:42～11:02	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/3 10:21～10:41	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/4 10:19～10:39	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/5 10:51～11:11	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/6 10:35～10:55	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/7 10:51～11:11	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/8 10:38～10:58	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/9 10:53～11:13	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/10 10:40～11:00	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/11 10:45～11:05	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/12 10:51～11:11	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/13 10:36～10:56	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/14 10:56～11:16	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/15 10:57～11:17	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/16 10:30～10:50	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/17 10:35～10:55	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/18 10:24～10:44	0.95	Not Detectable	Not Detectable				0.2	
		4/19 11:00～11:20	3.020	Not Detectable	Not Detectable				0.2	
		4/20 10:37～10:57	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/21 10:44～11:04	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/22 10:26～10:46	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/23 10:43～11:03	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/24 10:13～10:33	1.33	Not Detectable	Not Detectable				0.2	
		4/25 11:09～11:29	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/26 10:51～11:11	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/27 10:50～11:10	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/28 10:40～11:00	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/29 10:34～10:54	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/30 10:54～11:14	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/2 10:53～11:14 (5/3 18:42)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/3 12:34～12:54 (5/4 15:52)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/4 10:25～10:45 (5/5 18:49)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/5 10:46～11:06 (5/7 9:51)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/6 10:39～10:59 (5/8 9:50)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/7 10:40～11:00	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/10 10:50～11:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/11 10:50～11:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/12 10:36～10:56	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/13 10:40～11:00	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/14 10:20～10:40 (5/15 13:46)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/15 10:15～10:35	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/16 10:26～10:46	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/17 10:27～10:47	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/18 10:35～10:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/19 10:23～10:43	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/20 10:58～11:18	Not Detectable	Not Detectable	0.869	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/22 10:29～10:49	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/23 11:01～11:21	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/24 10:25～10:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/25 10:30～10:50	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/26 10:26～10:46	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/27 10:17～10:37	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/28 10:28～10:48	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	

Results of Radionuclide Analysis of Dust (8/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m³)						Air dose rate (μSv/h)	Note
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides		
【2-6】 (43km south/southwest)	Iwaki City Taira Aza Umemoto	3/20 15:25～15:45	6.89	Not Detectable	Not Detectable				0.6	
		3/21 15:00～15:20	28.90	Not Detectable	Not Detectable				1.5	
		3/22 14:00～14:20	17.00	Not Detectable	Not Detectable				0.6	
		3/23 14:15～14:35	6.93	Not Detectable	Not Detectable				1.0	
		3/24 15:12～15:32	8.25	Not Detectable	Not Detectable				1.4	
		3/25 13:47～14:07	40.60	Not Detectable	Not Detectable				1.1	
		3/27 12:30～12:50	1.55	Not Detectable	Not Detectable				0.8	
		3/28 13:10～13:30	3.56	Not Detectable	Not Detectable				0.3	
		3/29 12:55～13:15	2.68	Not Detectable	Not Detectable				0.7	
		3/30 12:32～12:52	4.59	1.44	1.56				0.3	
		3/31 12:42～13:02	1.65	Not Detectable	Not Detectable				0.7	
		4/1 12:16～12:36	1.00	Not Detectable	Not Detectable				0.8	
		4/2 12:02～12:22	47.3	6.49	5.93				1.4	
		4/3 11:42～12:02	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/4 11:43～12:03	0.9	Not Detectable	Not Detectable				0.7	
		4/5 12:12～12:32	0.9	Not Detectable	Not Detectable				0.4	
		4/6 11:55～12:15	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/7 12:10～12:30	1.8	Not Detectable	Not Detectable				0.4	
		4/8 12:02～12:22	0.938	Not Detectable	Not Detectable				0.3	
		4/9 12:18～12:38	1.53	Not Detectable	Not Detectable				0.3	
		4/10 12:09～12:29	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/11 12:18～12:38	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/12 12:14～12:34	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/13 12:00～12:20	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/14 12:28～12:48	1.00	Not Detectable	Not Detectable				0.3	
		4/15 12:34～12:54	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/16 12:01～12:21	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/17 12:01～12:21	1.20	Not Detectable	Not Detectable				0.3	
		4/18 11:53～12:13	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/19 12:24～12:44	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/20 12:05～12:25	1.59	Not Detectable	0.661				0.2	
		4/21 12:14～12:34	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/22 11:50～12:10	1.18	Not Detectable	Not Detectable				0.2	
		4/23 12:09～12:29	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/24 11:32～11:52	0.887	Not Detectable	Not Detectable				0.2	
		4/25 12:18～12:38	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/26 12:31～12:51	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/27 12:26～12:46	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/28 12:15～12:35	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/29 12:03～12:23	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/30 12:33～12:53	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/1 12:13～12:33	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/2 12:31～12:51 (5/3 18:27)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/3 10:57～11:17 (5/4 15:55)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/4 11:56～12:16 (5/5 17:16)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/5 12:25～12:45 (5/7 9:46)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/6 12:09～12:29 (5/8 11:14)	Not Detectable	Not Detectable	Not Detectable				0.2	
		5/7 12:17～12:37	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/10 12:30～12:50	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/11 12:35～12:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/12 12:20～12:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/13 12:25～12:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/14 11:50～12:10 (5/15 13:41)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/15 11:48～12:08	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/16 12:01～12:21	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/17 12:25～12:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/18 12:05～12:25	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/19 11:53～12:13	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/20 12:55～13:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/22 12:08～12:28	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/23 13:10～13:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/24 11:59～12:19	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/25 12:14～12:34	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/26 12:08～12:28	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/27 11:56～12:16	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/28 12:01～12:21	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	

Attachment V-13-4-(1)

Results of Radionuclide Analysis of Dust (9/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration(Bq/m³)						Air dose rate (μSv/h)	Note
			131I	134Cs	137Cs	132I	132Te	Other detected nuclides		
【2-7】 (34kmwest/North/west)	Date county Kawamata town Yamakiya	3/25 15:05～15:22	555.00	11.4	12.40				12.0	
		3/26 14:06～14:26	1.54	Not Detectable	Not Detectable				8.8	
		3/27 13:51～14:11	1.02	Not Detectable	Not Detectable				8.7	
		3/28 13:39～13:59	2.14	Not Detectable	Not Detectable				8.4	
		3/29 15:02～15:12	3.51	Not Detectable	1.46				8.0	
		3/30 14:05～14:15	1.33	Not Detectable	0.89				13.9～15.4	
		3/31 13:35～13:45	2.49	1.98	1.38				6.9	
		4/1 14:13～14:33	Not Detectable	Not Detectable	Not Detectable				6.5	
		4/2 13:22～13:42	Not Detectable	Not Detectable	Not Detectable				6.5	
		4/3 13:12～13:32	Not Detectable	Not Detectable	Not Detectable				6.1	
		4/4 13:15～13:35	Not Detectable	Not Detectable	Not Detectable				5.8	
		4/5 13:43～13:53	Not Detectable	Not Detectable	Not Detectable				3.0	
		4/6 13:01～13:11	1.26	1.47	1.34				3.0	
		4/7 13:06～13:16	Not Detectable	Not Detectable	Not Detectable				－	
		4/8 13:03～13:13	0.871	Not Detectable	Not Detectable				2.6	
		4/9 12:50～13:00	1.13	Not Detectable	Not Detectable				2.4	
		4/10 12:38～12:48	Not Detectable	Not Detectable	Not Detectable				2.4	
		4/11 12:25～12:35	Not Detectable	Not Detectable	Not Detectable				2.4	
		4/12 12:31～12:41	Not Detectable	Not Detectable	Not Detectable				3.0	
		4/13 12:46～12:56	Not Detectable	Not Detectable	Not Detectable				2.9	
		4/14 12:44～12:55	Not Detectable	Not Detectable	Not Detectable				2.8	
		4/15 12:37～12:47	Not Detectable	Not Detectable	Not Detectable				2.9	
		4/16 12:34～12:44	Not Detectable	Not Detectable	Not Detectable				2.7	
		4/17 12:20～12:30	Not Detectable	Not Detectable	Not Detectable				2.8	
		4/18 12:15～12:25	Not Detectable	Not Detectable	Not Detectable				2.2	
		4/19 14:55～15:05	Not Detectable	Not Detectable	Not Detectable				2.1	
		4/20 12:50～13:00	Not Detectable	Not Detectable	Not Detectable				2.5	
		4/21 13:12～13:22	Not Detectable	Not Detectable	Not Detectable				2.4	
		4/22 12:50～13:00	1.23	0.759	Not Detectable				2.6	
		4/23 12:55～13:05	Not Detectable	Not Detectable	Not Detectable				2.2	
		4/24 13:07～13:18	Not Detectable	Not Detectable	0.730				2.2	
		4/25 16:00～16:15	Not Detectable	Not Detectable	Not Detectable				1.5	
		4/26 14:15～14:30	Not Detectable	Not Detectable	Not Detectable				2.2	
		4/27 13:25～13:35	Not Detectable	Not Detectable	Not Detectable				2.1	
		4/28 13:25～13:35	Not Detectable	Not Detectable	Not Detectable				2.0	
		4/29 12:53～13:03	Not Detectable	Not Detectable	Not Detectable				2.2	
		4/30 13:14～13:24	Not Detectable	Not Detectable	Not Detectable				2.0	
		5/1 13:01～13:11	Not Detectable	Not Detectable	Not Detectable				2.0	
		5/2 12:24～12:34 (5/3 18:31)	Not Detectable	Not Detectable	Not Detectable				2.4	
		5/3 13:01～13:11 (5/4 15:53)	0.81	1.200	1.400				2.4	
		5/4 13:05～13:15 (5/5 18:49)	Not Detectable	Not Detectable	Not Detectable				2.0	
		5/5 13:03～13:13 (5/7 9:49)	Not Detectable	Not Detectable	Not Detectable				2.3	
		5/6 13:21～13:31 (5/8 11:17)	0.31	Not Detectable	0.36				2.4	
		5/7 13:13～13:23	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/10 13:24～13:34	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.9	
		5/11 13:12～13:22	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.9	
		5/12 14:10～14:24	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.6	
		5/13 13:14～13:29	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.8	
		5/14 13:03～13:18 (5/15 13:45)	Not Detectable	1.00	1.00	Not Detectable	Not Detectable	Not Detectable	2.8	
		5/15 12:52～13:07	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.8	
		5/16 12:52～13:07	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.8	
		5/17 13:25～13:35	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.6	
		5/18 14:15～14:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.9	
		5/19 14:15～14:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.6	
		5/20 13:53～14:08	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.5	
		5/21 14:00～14:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.7	
		5/22 13:52～14:07	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.7	
		5/23 13:45～14:00	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.8	
		5/24 13:32～13:42	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.8	
		5/25 13:40～13:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.5	
		5/26 12:22～12:37	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.7	
		5/27 12:32～12:47	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.7	
		5/28 12:04～12:19	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.7	

Attachment V-13-4-(1)

Results of Radionuclide Analysis of Dust (10/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m³)						Air dose rate (μSv/h)	Note
			131I	134Cs	137Cs	132I	132Te	Other detected nuclides		
【2-8】(50km North/West)	Date city Tsukidate town	3/24 12:05～12:25	2.71	Not Detectable	Not Detectable				–	
		3/25 16:13～16:33	34.00	Not Detectable	Not Detectable				–	
		3/26 15:15～15:35	Not Detectable	Not Detectable	Not Detectable				–	
		3/27 14:52～15:12	Not Detectable	Not Detectable	Not Detectable				–	
		3/28 14:38～14:58	Not Detectable	Not Detectable	Not Detectable				–	
		3/29 15:59～16:09	1.60	Not Detectable	Not Detectable				1.6	
		3/30 16:05～16:15	2.09	Not Detectable	0.77				–	
		3/31 14:25～14:35	1.04	Not Detectable	Not Detectable				–	
		4/1 15:09～15:29	Not Detectable	Not Detectable	Not Detectable				–	
		4/2 14:18～14:38	Not Detectable	Not Detectable	Not Detectable				–	
		4/3 14:07～14:27	Not Detectable	Not Detectable	Not Detectable				–	
		4/4 14:10～14:30	Not Detectable	Not Detectable	Not Detectable				–	
		4/5 14:24～14:34	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/6 13:43～13:53	Not Detectable	Not Detectable	0.74				1.3	
		4/7 13:48～13:58	Not Detectable	Not Detectable	Not Detectable				1.4	
		4/8 13:50～14:00	Not Detectable	Not Detectable	Not Detectable				1.4	
		4/9 13:36～13:46	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/10 13:21～13:31	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/11 13:06～13:16	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/12 13:12～13:22	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/13 13:36～13:56	Not Detectable	Not Detectable	Not Detectable				1.2	
		4/14 13:31～13:41	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/15 13:22～13:32	Not Detectable	Not Detectable	Not Detectable				1.2	
		4/16 13:24～13:34	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/17 13:04～13:14	Not Detectable	0.844	0.65				1.2	
		4/18 12:56～13:06	0.85	Not Detectable	Not Detectable				1.1	
		4/19 15:58～16:08	Not Detectable	Not Detectable	Not Detectable				1.2	
		4/20 13:36～13:46	Not Detectable	Not Detectable	Not Detectable				1.3	
		4/21 14:05～14:15	2.31	1.16	Not Detectable				1.1	
		4/22 13:40～13:50	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/23 13:47～13:57	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/24 13:56～14:06	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/25 17:05～17:20	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/26 15:10～15:25	Not Detectable	Not Detectable	Not Detectable				1.0	
		4/27 14:20～14:30	Not Detectable	Not Detectable	Not Detectable				1.0	
		4/28 14:15～14:25	Not Detectable	Not Detectable	Not Detectable				1.0	
		4/29 13:40～13:50	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/30 14:14～14:24	Not Detectable	Not Detectable	Not Detectable				1.1	
		5/1 13:53～14:03	Not Detectable	Not Detectable	Not Detectable				1.0	
		5/2 13:10～13:20 (5/3 18:29)	Not Detectable	Not Detectable	Not Detectable				1.1	
		5/3 14:02～14:12 (5/4 15:45)	0.430	0.420	Not Detectable				1.1	
		5/4 14:06～14:16 (5/5 18:48)	Not Detectable	Not Detectable	Not Detectable				1.0	
		5/5 13:59～14:09 (5/7 9:47)	Not Detectable	Not Detectable	Not Detectable				1.0	
		5/6 14:18～14:28 (5/8 11:17)	0.25	0.41	0.39				1.0	
		5/7 14:12～14:22	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/10 14:23～14:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/11 14:21～14:31	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	
		5/12 15:01～15:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/13 14:03～14:18	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	
		5/14 14:32～14:47 (5/15 13:42)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/15 13:57～14:12	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	
		5/16 13:42～13:57	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/17 14:20～14:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/18 10:25～10:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/19 15:30～15:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/20 14:50～15:05	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	
		5/21 15:00～15:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/22 14:58～15:13	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/23 14:50～15:05	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/24 14:35～14:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/25 14:40～14:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/26 13:29～13:44	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	
		5/27 13:53～14:08	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/28 12:52～13:07	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	

Attachment V-13-4-(1)

Results of Radionuclide Analysis of Dust (11/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m^3) ^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides	Air dose rate ($\mu Sv/h$)	Note
【2-9】 (45km West/North/West)	Nihonmatsu City Kanairo	3/25 11:32～11:52	8.67	Not Detectable	Not Detectable				–	
		3/26 10:10～10:30	7.98	Not Detectable	Not Detectable				–	
		3/27 10:28～10:48	Not Detectable	Not Detectable	Not Detectable				–	
		3/28 10:12～10:32	0.78	Not Detectable	Not Detectable				–	
		3/29 11:56～12:06	2.53	0.814	0.59				–	
		3/30 11:00～11:10	1.54	Not Detectable	Not Detectable				–	
		3/31 10:40～10:50	1.34	Not Detectable	0.92				–	
		4/1 10:52～11:12	Not Detectable	Not Detectable	Not Detectable				–	
		4/2 9:59～10:19	Not Detectable	Not Detectable	Not Detectable				–	
		4/3 10:00～10:20	Not Detectable	Not Detectable	Not Detectable				–	
		4/4 9:56～10:16	Not Detectable	Not Detectable	Not Detectable				–	
		4/5 10:39～10:49	0.82	Not Detectable	Not Detectable				1.9	
		4/6 10:18～10:28	1.00	Not Detectable	0.69				2.3	
		4/7 10:18～10:28	Not Detectable	Not Detectable	Not Detectable				1.7	
		4/8 10:16～10:26	0.643	Not Detectable	Not Detectable				1.7	
		4/9 10:11～10:21	Not Detectable	Not Detectable	Not Detectable				1.4	
		4/10 10:03～10:13	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/11 10:00～10:10	Not Detectable	Not Detectable	Not Detectable				1.7	
		4/12 10:16～10:26	Not Detectable	Not Detectable	Not Detectable				1.7	
		4/13 10:07～10:17	Not Detectable	Not Detectable	Not Detectable				1.1	
		4/14 10:09～10:19	Not Detectable	Not Detectable	Not Detectable				1.8	
		4/15 10:20～10:30	Not Detectable	Not Detectable	Not Detectable				2.5	
		4/16 9:56～10:08	Not Detectable	Not Detectable	Not Detectable				1.5	
		4/17 9:56～10:06	Not Detectable	Not Detectable	Not Detectable				2.0	
		4/18 10:00～10:10	1.79	Not Detectable	Not Detectable				1.8	
		4/19 11:15～11:25	Not Detectable	Not Detectable	Not Detectable				1.7	
		4/20 10:02～10:12	Not Detectable	Not Detectable	Not Detectable				2.1	
		4/21 10:26～10:36	Not Detectable	Not Detectable	Not Detectable				1.9	
		4/22 10:07～10:17	0.807	Not Detectable	Not Detectable				2.0	
		4/23 10:11～10:21	Not Detectable	Not Detectable	Not Detectable				2.1	
		4/24 9:50～10:01	Not Detectable	Not Detectable	0.605				2.0	
		4/25 10:55～11:10	Not Detectable	Not Detectable	Not Detectable				2.1	
		4/26 10:20～10:35	Not Detectable	Not Detectable	Not Detectable				1.8	
		4/27 10:10～10:20	Not Detectable	Not Detectable	0.662				2.4	
		4/28 9:58～10:08	Not Detectable	Not Detectable	Not Detectable				1.7	
		4/29 9:52～10:02	Not Detectable	Not Detectable	Not Detectable				2.5	
		4/30 10:07～10:17	Not Detectable	Not Detectable	Not Detectable				2.0	
		5/1 9:52～10:02	Not Detectable	Not Detectable	Not Detectable				2.5	
		5/2 9:46～9:56 (5/3 18:27)	Not Detectable	Not Detectable	Not Detectable				1.9	
		5/3 9:51～10:01 (5/4 15:56)	Not Detectable	Not Detectable	Not Detectable				1.9	
		5/4 9:40～9:50 (5/5 17:17)	Not Detectable	Not Detectable	Not Detectable				2.4	
		5/5 9:53～10:03 (5/7 9:44)	Not Detectable	Not Detectable	Not Detectable				2.2	
		5/6 9:57～10:07 (5/8 11:08)	Not Detectable	Not Detectable	Not Detectable				2.1	
		5/7 9:54～10:04	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.1	
		5/10 9:55～10:05	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.7	
		5/11 10:06～10:16	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/12 10:38～10:52	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/13 9:57～10:12	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.7	
		5/14 9:40～9:55 (5/15 13:42)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.9	
		5/15 9:31～9:46	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.9	
		5/16 9:40～9:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/17 10:00～10:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/18 10:15～10:30	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/19 9:55～10:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.6	
		5/20 9:47～10:02	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.7	
		5/21 9:40～9:55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/22 9:45～10:00	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.9	
		5/23 9:55～10:10	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/24 9:46～9:56	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/25 9:43～9:58	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/26 9:44～9:59	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/27 9:35～9:50	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.7	
		5/28 9:30～9:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.6	
【2-10】(50km North)	Soma County Shinchi Town	3/25 16:25～16:45	33.60	Not Detectable	0.84				–	
【4-1】(80km south/west)	Sirakawa City	4/7 14:53～15:13	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/8 14:45～15:05	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/9 13:38～13:56	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/10 13:40～14:00	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/11 13:50～14:10	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/12 13:55～14:10	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/13 14:49～15:09	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/14 14:25～14:40	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/15 14:25～14:40	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/16 13:20～13:35	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/17 13:20～13:35	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/18 13:55～14:10	1.15	0.761	Not Detectable				0.5	
		4/19 13:55～14:10	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/20 13:30～13:45	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/22 14:30～14:45	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/23 14:25～14:40	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/24 13:05～13:20	Not Detectable	Not Detectable	Not Detectable				0.4	

Results of Radionuclide Analysis of Dust (12/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/m³)						Air dose rate (μSv/h)	Note
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides		
【4-2】(60km west)	Sukagawa City Hachiman Town	4/7 12:49～13:09	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/8 11:45～12:05	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/9 11:35～11:54	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/10 11:15～11:35	Not Detectable	Not Detectable	Not Detectable				0.4	
		4/11 11:32～11:52	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/12 11:40～11:55	Not Detectable	Not Detectable	0.710				0.4	
		4/13 12:20～12:40	Not Detectable	Not Detectable	1.11				0.4	
		4/14 11:45～12:00	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/15 12:00～12:15	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/16 11:15～11:30	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/17 11:25～11:40	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/18 11:45～12:00	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/19 11:45～12:00	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/20 11:30～11:45	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/22 11:55～12:10	Not Detectable	Not Detectable	Not Detectable				0.2	
		4/23 11:55～12:10	Not Detectable	Not Detectable	Not Detectable				0.3	
		4/24 11:05～11:20	Not Detectable	Not Detectable	Not Detectable				0.2	
【4-3】(60km west)	Adachi County Ootama Village	4/7 10:40～11:00	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/8 10:35～10:55	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/9 10:20～10:40	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/10 10:09～10:27	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/11 10:15～10:35	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/12 10:25～10:40	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/13 10:46～11:06	0.927	Not Detectable	1.53				0.7	
		4/14 10:30～10:40	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/15 10:35～10:50	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/16 9:55～10:10	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/17 10:10～10:25	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/18 10:10～10:25	1.62	Not Detectable	Not Detectable				0.7	
		4/19 10:30～10:45	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/20 10:05～10:20	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/21 10:34～10:44	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/22 10:30～10:45	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/23 10:30～10:45	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/24 10:00～10:15	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/25 11:55～12:10	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/26 11:00～11:15	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/27 10:45～10:55	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/28 10:37～10:47	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/29 10:29～10:39	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/30 10:49～10:59	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/1 10:39～10:49	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/2 10:14～10:24 (5/3 18:31)	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/3 10:30～10:40 (5/4 15:54)	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/4 10:22～10:32 (5/5 18:50)	Not Detectable	Not Detectable	Not Detectable				0.7	
		5/5 10:32～10:42 (5/7 9:50)	Not Detectable	Not Detectable	Not Detectable				0.6	
		5/6 10:40～10:50 (5/8 11:15)	Not Detectable	Not Detectable	Not Detectable				0.6	
		5/7 10:39～10:49	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/10 10:36～10:46	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/11 10:51～11:01	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/12 11:13～11:27	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/13 10:39～10:54	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/14 10:13～10:28 (5/15 13:43)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/15 10:04～10:19	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/16 10:13～10:28	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/17 10:38～10:48	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/18 11:05～11:20	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/19 10:37～10:52	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/20 10:25～10:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/21 10:18～10:33	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/22 10:20～10:35	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/23 10:33～10:48	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/24 10:30～10:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/25 10:25～10:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/26 10:18～10:33	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.6	
		5/27 10:08～10:23	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/28 10:02～10:17	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	

Results of Radionuclide Analysis of Dust (13/13)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration(Bq/m^3)						Air dose rate (μ Sv/h)	Note
			^{131}I	^{134}Cs	^{137}Cs	^{132}I	^{132}Te	Other detected nuclides		
【4-4】(70km south/west)	Sirakawa County Izumizaki Village	4/7 14:00～14:20 (5/11 10:55)	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/8 13:35～13:55	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/9 13:00～13:18	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/10 12:55～13:15	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/11 13:00～13:20	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/12 13:15～13:30	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/13 14:00～14:20	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/14 13:40～13:55	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/15 13:40～13:55	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/16 12:40～12:55	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/17 12:45～13:00	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/18 12:35～12:50	0.496	Not Detectable	Not Detectable				0.5	
		4/19 13:10～13:25	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/20 12:30～12:45	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/22 13:45～14:00	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/23 12:50～13:05	Not Detectable	Not Detectable	Not Detectable				0.5	
		4/24 12:30～12:45	Not Detectable	Not Detectable	Not Detectable				0.4	
【4-5】(80km south/west)	Nishishirakawa County Saigou Village	4/8 15:23～15:43	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/9 14:10～14:28	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/10 14:10～14:30	1.03	Not Detectable	0.542				0.8	
		4/11 14:30～14:45	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/12 14:30～14:45	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/13 15:36～15:56	0.876	Not Detectable	Not Detectable				0.7	
		4/14 14:55～15:10	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/15 15:00～15:15	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/16 13:55～14:10	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/17 13:55～14:10	Not Detectable	Not Detectable	Not Detectable				0.9	
		4/18 14:30～14:45	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/19 14:25～14:40	Not Detectable	Not Detectable	Not Detectable				0.7	
		4/20 14:05～14:20	Not Detectable	Not Detectable	Not Detectable				0.8	
		4/22 15:05～15:20	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/23 15:00～15:15	Not Detectable	Not Detectable	Not Detectable				0.6	
		4/24 13:40～13:55	Not Detectable	Not Detectable	Not Detectable				0.4	

The government requests Fukushima Prefecture to gain the readings above.

Air dose rates since April 5 are the readings of Environmental Radiation Level in emergency monitoring by Fukushima Pref.

・Blanks of ^{132}I, ^{132}Te and other detected nuclides are being confirmed.

・1 : Not measured

・2 Radioactive decay is not taken into account from sampling to measurement for the radioactive concentration of the samples with measurement date and time in parentheses.

The measurement published in here is being executed by JCAC(Japan Chemical Analysis Center) and ERMCF(Environmental Radioactivity Monitoring Center of Fukushima).

Results of Radionuclide Analysis of Soil (1/11)

As of 10:00 May 31, 2011
MEXT

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/kg)								Air dose rate (μSv/h)	Monitoring Point by monitoring car
			^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides		
[1] (62kmNorth/West)	Fukushima city Sugitsuma town	4/14 18:08	6,100	7,900	9,300						0.8	[1]
		4/15 15:53	11,000	16,000	19,000						1.3	
		4/16 15:03	5,100	9,100	11,000						2.1	
		4/18 15:43	7,500	18,000	21,000						1.2	
		4/20 15:54	7,700	13,000	16,000						1.3	
		4/21 15:12	4,800	9,700	12,000						1.3	
		4/22 15:06	4,300	15,000	17,000						1.7	
		4/23 16:11	3,200	9,400	11,000						1.1	
		4/24 8:50	3,400	9,500	12,000						1.0	
		4/25 8:47	3,800	10,000	12,000						0.8	
		4/26 8:37	2,900	11,000	13,000						0.9	
		4/27 8:55	4,800	27,000	32,000						1.0	
		4/28 8:48	2,100	5,700	7,000						0.9	
		4/29 14:17	2,900	16,000	20,000						1.2	
		4/30 15:12	2,200	12,000	14,000						0.8	
		5/1 14:59	1,500	8,200	10,000						0.6	
		5/2 17:39	1,700	10,000	12,000						1.0	
		5/3 16:47	1,200	4,500	5,200						1.3	
		5/4 17:19	1,300	6,200	7,500						1.1	
		5/5 15:43	1,400	11,000	13,000						0.5	
		5/6 17:41	1,200	9,900	12,000						0.7	
		5/7 17:30	1,100	6,300	7,700						0.9	
		5/8 16:05	420	2,400	2,800						0.7	
		5/9 15:33	640	6,500	7,800						1.6	
		5/10 16:38	910	11,000	13,000	4,700	Not Detectable	110	24	^{95}Nb : 41	0.9	
		5/11 15:38	540	6,600	8,200	3,700	Not Detectable	73	18	Not Detectable	1.2	
		5/12 15:44	490	7,600	9,300	3,800	Not Detectable	67	Not Detectable	^{95}Nb : 30	1.0	
		5/13 17:00	690	9,500	12,000	3,500	Not Detectable	90	Not Detectable	Not Detectable	1.0	
		5/14 8:55	750	12,000	14,000	4,200	Not Detectable	130	Not Detectable	Not Detectable	0.9	
		5/15 8:43	440	7,900	9,500	2,500	Not Detectable	80	Not Detectable	Not Detectable	1.0	
		5/16 8:33	670	13,000	16,000	5,600	Not Detectable	110	Not Detectable	^{95}Nb : 59	0.9	
		5/17 8:44	520	12,000	15,000	3,400	Not Detectable	140	22	^{95}Nb : 48	1.0	
		5/18 15:43	360	7,300	8,600	3,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/19 8:28	400	8,700	11,000	3,400	Not Detectable	79	Not Detectable	Not Detectable	0.9	
		5/20 8:31	430	13,000	16,000	2,900	Not Detectable	92	Not Detectable	Not Detectable	1.0	
		5/21 8:29	380	10,000	12,000	2,900	Not Detectable	Not Detectable	Not Detectable	^{95}Nb : 45	1.0	
		5/22 8:19	370	10,000	13,000	3,100	Not Detectable	79	Not Detectable	Not Detectable	0.9	
		5/23 8:18	500	18,000	23,000	5,400	Not Detectable	160	Not Detectable	Not Detectable	1.0	
		5/24 8:32	190	5,900	7,100	2,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/25 8:25	410	18,000	21,000	8,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	
		5/26 8:50	170	5,700	6,900	2,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/27 8:37	340	12,000	15,000	3,600	Not Detectable	62	Not Detectable	Not Detectable	0.9	
		5/28 8:27	100	1,800	2,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
[1-1] (46kmNorth/West)	Soma County Iitate Village Sasu Namari	3/31 11:19	29,000	8,100	9,400						4.8	[3]
		4/1 10:18	11,000	2,600	2,900						3.3	
		4/2 10:59	25,000	7,900	9,000						2.8	
[1-2] (40kmWest/North/West)	Date county Kawamata town Yamakiya	4/3 9:52	41,000	18,000	21,000						5.4	[36]
		4/27 14:40	4,400	14,000	16,000						2.3	
[13] (37kmWest)	Tamura city Tokiwa town Nishimuki	4/1 11:58	3,300	1,000	1,200						0.5	[13]
[2] (56kmNorth/West)	Fukushima city Onami	3/31 10:20	48,000	13,000	15,000						4.1	[2]
		3/31 14:35	16,000	5,300	6,300						2.1	
		4/1 9:22	31,000	7,400	8,800						3.8	
		4/1 9:42	13,000	4,800	5,700						3.8	
		4/2 9:33	53,000	17,000	20,000						3.5	
[2-4] (24kmNorth)	Minami Soma city Haramachi ward Takami town	4/3 11:57	7,300	3,000	3,600						1.0	[80]
		4/4 12:09	4,400	2,100	2,500						1.0	
		4/15 12:48	2,000	2,000	2,400						0.2	
		4/16 11:59	2,000	2,500	2,900						0.3	
		4/18 12:25	1,900	3,000	3,700						0.3	
		4/20 13:17	1,500	2,900	3,500						0.3	
		4/21 12:02	1,300	2,300	2,800						0.3	
		4/22 11:45	2,400	3,300	4,000						0.7	
		4/23 13:20	1,200	2,600	3,200						0.6	
		4/24 14:03	1,200	2,600	3,200						0.2	
		4/25 12:16	2,200	1,600	2,000						0.3	
		4/26 11:52	2,300	2,500	3,100						0.5	
		4/27 11:50	2,100	2,200	2,700						0.5	
		4/28 13:18	990	1,400	1,800						0.3	
		4/29 11:13	1,100	2,900	3,600						0.7	
		4/30 11:52	540	740	860						0.3	
		5/1 11:17	960	1,100	1,400						0.5	
		5/2 11:31	580	1,500	1,800						0.3	
		5/3 12:13	540	1,500	1,800						0.3	
		5/4 12:23	630	1,400	1,800						0.3	
		5/5 10:10	390	640	870						0.2	
		5/6 11:23	480	820	990						0.3	
		5/7 13:05	680	1,700	2,200						0.5	
		5/8 11:07	500	1,100	1,300						0.2	
		5/9 11:24	260	710	880						0.5	
		5/10 11:40	460	1,500	1,900	1,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/11 11:10	140	1,300	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/12 12:00	180	1,600	2,000	840	Not Detectable	19	Not Detectable	Not Detectable	0.4	
		5/13 12:58	120	1,200	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/14 12:37	330	3,900	4,700	1,600	Not Detectable	36	Not Detectable	Not Detectable	0.4	
		5/15 12:30	240	2,700	3,300	1,400	Not Detectable	26	Not Detectable	Not Detectable	0.4	
		5/16 11:33	87	1,100	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/17 12:41	120	1,300	1,500	660	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/18 11:18	190	1,500	2,000	810	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/19 12:30	190	3,200	3,900	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/20 11:26	190	3,700	4,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/21 11:11	66	990	1,300	670	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/22 11:08	94	2,500	3,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/23 11:23	210	4,600	5,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/24 11:56	140	3,000	3,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/25 11:27	110	3,000	3,800	1,500	Not Detectable	27	Not Detectable	Not Detectable	0.4	
		5/26 13:45	150	4,700	5,700	2,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/27 11:46	85	2,700	3,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/28 12:06	Not Detectable	1,100	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	

Results of Radionuclide Analysis of Soil (2/11)

Attachment V-13-4-(2)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/kg)								Air dose rate (μSv/h)	Monitoring Point by monitoring car
			^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides		
【3-1】(33kmNorth/West)	Soma county Iitate village Nagadoro	3/23 11:10	200,000	39,000	45,000						103.0	【33】
		3/25 14:45	251,000	60,700	60,100						27.0	
		3/25 14:45	341,000*1	70,800	68,500*1						27.0	
		3/26 10:55	15,000	2,860	3,000						26.0	
		3/27 12:15	93,000	28,300	29,000						20.0	
		3/28 11:18	110,000	35,900	36,000						43.0	
		3/29 11:18	220,000	66,600	65,000						18.9	
		3/30 11:30	190,000	70,900	70,000						17.3	
		3/31 11:23	160,000	65,700	67,000						18.2	
		4/1 11:36	130,000	40,100	40,000						18.2	
		4/2 12:10	61,000	5,530	6,200						21.0	
		4/3 11:11	69,000	16,000	18,000						21.3	
		4/4 11:12	125,510	66,086	76,429						18.6	
		4/5 11:15	88,243	50,432	55,001						16.3	
		4/6 12:19	90,816	60,493	66,192						13.2	
		4/7 11:03	74,481	52,912	58,104						19.5	
		4/8 11:35	72,500	59,000	63,600						15.5	
		4/10 11:18	66,007	64,788	75,832						18.7	
		4/11 14:07	62,639	56,170	64,093						17.5	
		4/12 16:42	41,103	48,613	52,164						15.6	
		4/14 10:13	43,000	45,886	65,000						16.0	
		4/15 10:04	30,000	40,000	53,000						14.5	
		4/16 10:33	10,000	15,000	17,000						15.2	
		4/17 11:15	21,000	28,000	34,000						11.2	
		4/18 10:28	38,000	78,000	90,000						15.5	
		4/20 16:09	22,000	52,000	63,000						16.3	
		4/21 10:43	36,000	95,000	110,000						13.5	
		4/22 11:06	40,000	120,000	140,000						16.5	
		4/24 10:44	26,000	82,000	97,000						15.1	
		4/27 10:15	24,000	110,000	130,000						14.1	
		4/28 10:19 (4/29 16:28)	11,000	79,000	84,000						16.1	
		4/29 10:26 (4/30 16:57)	12,000	74,000	85,000						13.8	
		4/30 11:24 (5/1 14:47)	9,800	70,000	74,000						17.1	
		5/1 10:40 (5/2 17:31)	5,200	39,000	41,000						15.2	
		5/2 10:59 (5/3 19:16)	7,900	56,000	63,000						12.6	
		2011/5/2 10:59	9,700	58,000	71,000						12.6	
		5/3 10:25 (5/6 9:44)	7,400	68,000	79,000						14.1	
		5/4 11:53 (5/6 18:33)	9,200	110,000	120,000						13.3	
		2011/5/5 10:36	15,000	120,000	140,000						15.4	
		5/5 10:36 (5/8 11:07)	9,000	110,000	120,000						15.4	
		5/6 9:41 (5/8 15:27)	3,200	38,000	40,000	16,000	Not Detectable	430	Not Detectable	^{110m}Ag : 140	13.1	
		5/7 14:34 (5/9 16:10)	5,700	66,000	74,000	31,000	Not Detectable	600	Not Detectable	^{110m}Ag : 210	15.3	
		5/8 9:27 (5/10 16:18)	3,700	44,000	50,000	16,000	Not Detectable	480	Not Detectable	Not Detectable	13.0	
		5/9 9:41 (5/11 17:03)	4,100	52,000	59,000	20,000	Not Detectable	430	Not Detectable	^{110m}Ag : 150	15.3	
		5/10 9:50 (5/12 16:23)	3,700	59,000	71,000	27,000	Not Detectable	500	Not Detectable	^{110m}Ag : 190	15.6	
		5/11 9:39 (5/14 15:47)	3,100	63,000	73,000	25,000	Not Detectable	470	Not Detectable	^{110m}Ag : 210	14.3	
		5/12 10:17 (5/14 16:19)	2,600	52,000	59,000	19,000	Not Detectable	420	Not Detectable	Not Detectable	14.8	
		5/13 10:12 (5/15 14:37)	2,200	48,000	56,000	20,000	Not Detectable	380	Not Detectable	Not Detectable	14.2	
		5/14 10:00 (5/16 17:42)	1,600	30,000	35,000	11,000	Not Detectable	200	Not Detectable	Not Detectable	15.5	
		5/15 10:55 (5/18 15:52)	4,700	140,000	160,000	51,000	Not Detectable	1,000	Not Detectable	^{110m}Ag : 460	15.5	
		5/16 9:44 (5/19 18:26)	2,400	76,000	85,000	28,000	Not Detectable	530	Not Detectable	Not Detectable	14.3	
		5/17 11:11 (5/19 18:44)	2,200	49,000	56,000	17,000	Not Detectable	320	Not Detectable	^{110m}Ag : 160	16.0	

Attachment V-13-4-(2)

Results of Radionuclide Analysis of Soil (3/11)

Sampling Point		Sampling Time and Date (Monitoring Time) ※2	Radioactivity Concentration(Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	Air dose rate (μSv/h)	Monitoring Point by monitoring car
【3-2】(30kmWest/North/West)	Futaba county Namie town Tsushima	3/23 13:17	92,000	13,000	15,000						15.0	【34】
		4/14 11:38	12,000	11,000	12,000						5.4	
		4/15 11:20	15,000	17,000	21,000						4.7	
		4/16 11:30	1,700	21,000	2,300						4.4	
		4/17 9:41	11,000	17,000	21,000						5.8	
		4/18 11:30	6,900	3,900	4,800						6.4	
		4/20 15:03	11,000	19,000	23,000						5.7	
		4/21 11:51	12,000	21,000	25,000						5.0	
		4/22 12:01	5,100	8,400	10,000						5.4	
		4/24 12:03	9,300	22,000	27,000						4.9	
		4/26 15:42	4,800	16,000	19,000						5.5	
		4/28 11:58	3,700	23,000	27,000						4.0	
		4/29 12:27	8,900	75,000	89,000						5.1	
		4/30 12:46	1,600	7,300	8,900						5.1	
		5/1 11:45	1,700	6,600	7,500						5.1	
		5/2 14:30	4,600	13,000	16,000						4.8	
		5/3 13:25	3,400	26,000	32,000						4.8	
		5/4 13:52	1,800	14,000	17,000						4.1	
		5/5 12:01	4,600	40,000	50,000						5.7	
		5/6 10:59	2,200	8,300	10,000						5.0	
		5/7 15:36	4,900	21,000	27,000						5.3	
		5/8 14:18	2,900	32,000	40,000						4.5	
		5/9 11:37	1,900	15,000	18,000						5.0	
		5/10 11:06	1,500	24,000	30,000	10,000	Not Detectable	250	65	^{95}Nb : 74	5.1	
		5/11 10:50	1,500	15,000	19,000	8,000	Not Detectable	160	44	^{95}Nb : 57	5.1	
		5/12 11:43	1,200	15,000	19,000	7,200	Not Detectable	170	33	Not Detectable	5.2	
		5/13 12:45	690	6,500	8,000	3,400	Not Detectable	40	Not Detectable	Not Detectable	4.8	
		5/14 14:29	920	16,000	19,000	7,600	Not Detectable	120	29	Not Detectable	4.9	
		5/15 13:40	1,200	25,000	31,000	11,000	Not Detectable	260	48	^{95}Nb : 60	4.9	
		5/16 13:55	1,800	36,000	44,000	16,000	Not Detectable	290	61	Not Detectable	4.8	
		5/17 13:17	1,000	27,000	33,000	13,000	Not Detectable	190	53	^{110m}Ag : 100	5.4	
		5/19 11:11	1,200	23,000	28,000	12,000	Not Detectable	190	Not Detectable	Not Detectable	5.0	
		5/20 12:04	800	17,000	21,000	7,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	4.9	
		5/21 12:07	580	15,000	18,000	6,500	Not Detectable	110	Not Detectable	Not Detectable	4.9	
		5/22 10:24	1,300	37,000	46,000	19,000	Not Detectable	260	52	Not Detectable	5.4	
		5/23 10:17	860	28,000	35,000	11,000	Not Detectable	Not Detectable	33	Not Detectable	5.1	
		5/24 10:21	950	28,000	34,000	10,000	Not Detectable	110	Not Detectable	Not Detectable	5.3	
		5/25 10:45	820	25,000	31,000	10,000	Not Detectable	120	Not Detectable	Not Detectable	5.3	
		5/26 11:28	490	18,000	22,000	8,300	Not Detectable	81	Not Detectable	Not Detectable	5.0	
		5/27 12:03	550	30,000	37,000	11,000	Not Detectable	Not Detectable	31	Not Detectable	4.4	
		5/28 12:03	230	14,000	17,000	5,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	6.0	
【3-3】(32kmWest)	Tamura city Tokiwa town Yamane	3/23 12:50	11,000	2,800	3,300						2.3	【15】
		3/24 12:58	4,900	170	220						2.5	
		4/14 11:42	1,600	2,200	2,800						0.5	
		4/15 11:40	1,700	2,200	2,400						1.0	
		4/16 11:37	2,400	2,200	2,700						0.5	
		4/17 11:36	2,800	4,500	5,400						0.4	
		4/18 10:47	1,900	3,800	4,400						1.0	
		4/20 11:26	2,200	3,200	3,900						0.3	
		4/21 11:25	1,400	2,100	2,600						0.4	
		4/22 11:27	1,600	3,500	4,200						0.8	
		4/23 11:15	1,200	2,400	2,800						0.4	
		4/24 11:18	1,300	3,000	3,600						0.5	
		4/28 14:43	1,300	4,300	5,200						0.4	
		4/29 11:16	570	2,000	2,500						0.9	
		4/30 12:22	790	3,400	4,000						0.6	
		5/1 11:12	710	3,200	3,800						0.6	
		5/2 11:32	200	1,000	1,200						1.0	
		5/3 12:37	840	5,100	6,000						0.7	
		5/4 12:38	500	2,500	3,100						0.5	
		5/5 13:49	450	3,100	3,700						1.1	
		5/6 14:07	420	2,300	2,800						0.7	
		5/7 11:46	190	1,100	1,400						1.0	
		5/8 12:04	230	1,900	2,200						0.7	
		5/9 11:54	350	3,200	3,800						0.9	
		5/10 11:51	230	2,300	2,900	960	Not Detectable	30	Not Detectable	Not Detectable	0.9	
		5/11 11:57	200	2,300	2,700	820	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/12 13:34	220	2,800	3,300	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/13 12:30	160	1,800	2,200	710	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/14 14:05	61	540	660	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/15 12:51	150	2,100	2,500	1,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/16 11:00	150	1,300	1,600	810	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/17 12:22	120	1,900	2,200	640	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/18 12:21	130	2,700	3,200	910	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/19 11:19	130	2,000	2,500	830	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/20 10:36	230	4,900	6,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/21 10:26	110	2,400	3,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/22 10:55	170	2,600	3,200	1,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/23 10:00	52	990	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/24 10:47	96	2,400	2,900	900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/25 10:45	95	2,200	2,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/26 10:21	48	1,600	1,900	810	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/27 11:05	38	1,600	1,900	670	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/28 12:50	61	3,400	4,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
【3-4】(43kmWest/North/West)	Nihonmatsu city Ota	3/23 11:08	33,000	7,200	8,600						2.8	【11】
【3-5】(47kmNorth/West)	Date county Kawamata town	3/23 10:30	4,200	660	770						2.8	【4】

Results of Radionuclide Analysis of Soil (4/11)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/kg)								Air dose rate (μSv/h)	Monitoring Point by monitoring car
			^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides		
【3-6】(32kmWest/North/West)	Futaba County Katsurao Village Kaminogawa	3/23 14:00	70,000	9,500	12,000						9.4	[21]
		3/26 15:33	13,000	2,500	2,900						6.5	
		3/28 11:03	14,000	4,000	4,600						5.3	
		3/29 11:34	25,000	6,000	7,100						–	
		4/8 13:20	11,000	6,400	7,600						3.7	
		4/10 10:37	25,000	21,000	25,000						5.9	
		4/11 12:58	14,000	10,000	12,000						4.2	
		4/14 12:04	8,200	8,200	9,300						3.8	
		4/15 12:04	6,300	3,900	4,600						3.1	
		4/16 12:20	1,800	2,000	2,300						3.0	
		4/17 13:33	12,000	14,000	17,000						3.5	
		4/18 12:10	12,000	15,000	17,000						4.2	
		4/20 14:19	4,400	8,800	11,000						3.6	
		4/21 12:43	3,700	8,300	9,700						3.2	
		4/22 14:10	4,800	11,000	14,000						3.0	
		4/24 13:25	1,500	3,500	4,100						3.2	
		4/25 11:30	2,500	6,300	7,500						3.2	
		4/26 16:20	3,200	12,000	14,000						3.1	
		4/28 12:24	2,800	11,000	13,000						1.9	
		4/29 13:17	3,100	11,000	13,000						2.1	
		4/30 13:51	4,500	22,000	25,000						1.8	
		5/1 13:23	1,600	2,500	3,000						2.9	
		5/2 13:52	630	2,300	2,700						2.6	
		5/3 14:55	2,600	9,800	12,000						3.6	
		5/4 15:22	310	1,100	1,300						3.0	
		5/5 11:25	1,100	3,600	4,400						2.4	
		5/6 11:30	1,500	11,000	13,000						2.8	
		5/7 12:50	1,000	7,200	8,700						2.2	
		5/8 13:49	760	5,800	6,900						2.6	
		5/9 12:19	470	3,700	4,500						2.5	
		5/10 11:41	960	9,800	12,000	2,900	Not Detectable	92	Not Detectable	^{95}Nb : 44	2.5	
		5/11 11:40	650	7,300	9,000	2,800	Not Detectable	86	70	^{95}Nb : 30	2.7	
		5/12 13:27	340	4,100	4,900	1,600	Not Detectable	42	Not Detectable	Not Detectable	2.8	
		5/13 14:48	370	5,400	6,400	1,800	Not Detectable	51	Not Detectable	Not Detectable	2.5	
		5/14 14:02	540	7,700	8,900	3,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.5	
		5/15 14:38	1,100	16,000	19,000	4,900	Not Detectable	130	Not Detectable	^{95}Nb : 61	2.2	
		5/16 14:30	430	8,800	11,000	3,000	Not Detectable	76	Not Detectable	Not Detectable	2.4	
		5/17 14:00	340	7,400	9,200	1,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.4	
		5/18 13:47	360	6,900	8,400	1,900	Not Detectable	Not Detectable	20	Not Detectable	2.5	
		5/19 9:59	440	11,000	13,000	3,100	Not Detectable	96	Not Detectable	^{95}Nb 59	2.5	
		5/20 9:56	69	1,400	1,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.6	
		5/21 10:01	220	9,900	12,000	3,200	Not Detectable	52	Not Detectable	Not Detectable	2.3	
		5/22 9:52	420	14,000	17,000	5,800	Not Detectable	100	21	^{95}Nb : 53	2.7	
		5/23 9:40	380	13,000	17,000	4,300	Not Detectable	78	Not Detectable	^{95}Nb : 63	2.6	
		5/24 9:50	350	15,000	18,000	4,100	Not Detectable	100	Not Detectable	^{95}Nb : 68	2.6	
		5/25 10:08	290	11,000	14,000	4,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.5	
		5/26 10:11	150	4,900	6,200	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.6	
		5/27 9:47	170	7,500	9,000	2,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.6	
		5/28 15:11	110	4,200	5,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.9	
【3-7】(23kmSouth)	Futaba county Hirono town Shimokitaba	3/23 13:00	69,000	2,100	2,600						14.0	[71]
		4/14 13:13	4,100	1,100	1,300						0.6	
		4/15 14:25	13,000	1,200	1,400						1.2	
		4/16 14:07	8,100	2,700	3,100						0.6	
		4/17 12:58	1,700	170	190						1.0	
		4/21 12:35	5,100	3,100	3,700						1.7	
		4/22 12:28	4,200	2,200	2,700						0.4	
		4/23 12:20	4,600	1,900	2,200						0.7	
		4/26 12:31	2,600	1,700	1,900						0.6	
		4/27 11:15	1,500	990	1,100						0.3	
		4/28 12:29	710	410	480						0.7	
		4/29 13:20	1,800	1,400	1,700						0.2	
		4/30 12:06	1,700	1,400	1,700						0.4	
		5/1 10:57	1,800	1,500	1,900						1.3	
		5/2 14:40	2,300	2,600	3,000						0.1	
		5/3 14:03	2,600	3,900	4,700						0.2	
		5/4 13:39	1,800	2,600	2,900						0.6	
		5/5 13:37	390	590	700						0.1	
		5/6 13:00	1,300	1,400	1,700						0.1	
		5/7 12:16	1,600	2,700	3,300						1.0	
		5/8 13:41	940	1,400	1,700						0.8	
		5/9 12:43	750	1,400	1,700						0.4	
		5/10 12:17	500	2,500	3,200	2,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/11 12:30	910	1,300	1,600	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/12 12:46	940	1,700	2,100	3,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/14 13:38	480	1,200	1,400	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/15 12:43	650	2,200	2,600	5,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/16 12:17	580	1,800	2,200	4,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/17 12:25	580	2,600	3,000	6,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/18 12:12	430	1,700	2,100	2,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/19 12:03	570	2,900	3,500	6,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/21 11:55	540	2,900	3,400	6,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/22 12:11	500	2,600	3,200	4,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/24 11:38	160	990	1,300	1,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/26 12:10	230	1,800	2,200	3,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/28 11:48	190	2,500	2,900	4,500	Not Detectable	Not Detectable	Not Detectable	^{95}Nb : 32	0.5	
【3-8】(23kmSouth)	Futaba county Hirono town Shimokitaba	3/23 16:22	140,000	2,600	2,900						14.0	[71]
【112】(23kmSouth)		5/22 12:40	160	290	370	810	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	[112]
【3-9】(42kmNorth/North/West)	Soma City Nakano	3/25 11:24	6,900	1,300	1,600						2.7	[5]
		3/26 10:48	6,900	1,300	1,600						1.0	
		3/26 12:30	110,000	2,500	2,800						1.0	
		3/28 13:00	12,000	3,700	4,100						0.6～1.2	
【3-10】(32kmNorth)	Minami Soma city Kashima ward	3/25 12:18	11,000	2,800	3,300						3.7	[6]
		3/26 11:12	14,000	3,200	3,800						1.5	
		3/28 10:32	11,000	3,000	3,600						1.2	
		3/29 15:20	8,400	2,700	3,200						1.3	
		3/30 15:54	6,100	1,800	2,000						1.4	
		3/31 12:18	9,600	3,900	4,700						1.3	
		4/1 11:35	5,400	2,400	2,800						1.0	
		4/2 12:49	7,800	3,700	4,400						1.0	
		4/3 11:15	4,900	1,400	1,700						1.1	
		4/4 11:18	5,500	3,700	4,300						1.2	
		4/5 11:21	4,600	3,200	3,900						1.3	
		4/6 11:56	5,100	3,200	3,900						1.0	
		4/7 11:18	4,200	3,000	3,600						0.6	
		4/8 11:29	3,600	3,100	3,800						0.6	
		4/10 10:46	2,400	2,300	2,900						1.2	
		4/11 10:45	4,800	4,100	5,000						1.8	
		4/13 17:08	2,600	3,900	4,800						1.0	
		4/15 11:35	2,000	2,800	3,400						0.6	
		4/16 11:13	1,800	2,900	3,300						0.7	
		4/18 11:32	1,500	2,100	2,500						0.7	
		4/20 12:39	1,400	4,600	5,500						0.7	
		4/21 11:21	1,300	2,500	3,000						1.0	
		4/22 11:05	1,400	4,400	5,200						1.3	
		4/23 12:07	930	2,900	3,500						0.8	
		4/24 12:20	920	3,200	3,700						0.8	
		4/25 11:33	1,100	4,100	5,100						0.5	
		4/26 10:54	790	2,500	3,000						0.5	
		4/27 11:13	1,700	6,600	8,100						0.7	
		4/28 11:48	550	1,900	2,400						0.7	

Results of Radionuclide Analysis of Soil (5/11)

Sampling Point		Sampling Time and Date (Monitoring Time) ※2	Radioactivity Concentration(Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	Air dose rate (μSv/h)	Monitoring Point by monitoring car
【3-11】 (32km North/North/West)	Minami Soma city Kashima ward	3/25 12:33	8,000	1,100	1,300						3.2	[7]
		3/26 11:33	13,000	3,500	4,300						1.5	
		3/28 10:38	8,200	1,600	2,000						3.3	
		4/15 11:53	1,700	2,400	2,900						0.4	
		4/16 11:30	1,900	1,600	2,000						0.6	
		4/18 11:55	3,000	2,100	3,200						0.4	
		4/20 12:52	1,600	4,600	2,600						0.5	
		4/21 11:36	1,200	1,200	1,500						0.6	
		4/22 11:21	930	1,300	1,700						0.6	
		4/23 12:18	600	630	850						0.5	
		4/24 12:52	600	830	1,000						0.7	
		4/25 11:47	1,100	2,000	2,600						1.0	
		4/26 11:00	980	1,800	2,200						0.5	
		4/27 11:26	1,500	2,500	2,900						0.5	
		4/28 12:12	630	1,600	2,000						0.6	
		4/29 10:53	380	940	1,200						0.8	
		4/30 11:07	850	1,800	2,300						0.3	
		5/1 10:59	550	960	1,300						0.6	
		5/2 10:58	320	1,100	1,300						0.5	
		5/3 11:39	470	1,700	2,200						0.6	
		5/4 11:41	590	2,400	2,900						0.6	
		5/6 10:55	170	440	560						0.4	
		5/7 12:44	120	420	510						0.5	
		5/8 10:44	110	590	690						0.4	
		5/9 11:01	130	540	630						0.8	
		5/10 11:17	240	1,100	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	
		5/11 10:41	180	910	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/12 11:35	170	2,300	2,800	810	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/13 11:52	110	1,400	1,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
		5/14 12:09	52	380	440	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/15 12:10	100	720	880	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/16 11:12	230	2,600	3,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/17 12:26	170	1,900	2,300	860	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/18 10:58	150	1,600	2,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/19 12:06	130	1,300	1,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/20 11:07	69	770	1,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/21 10:49	120	4,200	5,300	1,700	Not Detectable	28	Not Detectable	Not Detectable	0.7	
		5/22 10:48	64	1,200	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/23 11:03	85	850	980	610	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/24 11:33	74	2,400	3,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/25 11:03	31	730	880	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/26 12:56	89	2,400	3,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/27 12:53	90	2,300	2,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		5/28 12:52	60	1,200	1,600	1,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.9	
【3-12】 (30km West/North/West)	Futaba county Namie town Tsushima	3/25 14:13	29,000	20,000	627						30.5	[31]
		3/26 10:15	22,000	1,550	1,600						17.8	
		3/27 11:30	120,000	25,500	27,000						25.0	
		3/28 10:29	120,000	27,900	28,000						23.0	
		3/29 9:59	710,000	212,000	220,000						18.3	
		3/30 10:50	710,000	282,000	290,000						16.3	
		3/31 10:45	50,000	14,200	15,000						–	
		4/1 10:39	79,000	27,400	29,000						15.4	
		4/2 11:42	21,000	5,270	5,400						14.0	
		4/3 10:36	60,000	26,000	27,000						12.5	
		4/4 10:27	143,900	5,931	6,907						9.8	
		4/5 10:42	103,970	62,836	68,209						10.6	
		4/6 11:45	84,819	47,948	51,942						10.9	
		4/7 10:30	78,581	48,547	51,167						11.4	
		4/8 10:55	36,900	18,000	20,300						9.0	
		4/10 10:17	59,758	62,813	74,220						12.8	
		4/11 13:32	58,558	58,212	67,722						12.6	
		4/12 16:06	54,507	40,408	46,235						12.3	
		4/14 11:06	33,000	64,000	76,000						10.7	
		4/15 10:45	18,000	18,000	22,000						10.5	
		4/16 10:00	13,000	18,000	21,000						8.3	
		4/17 10:40	17,000	13,000	15,000						9.2	
		4/18 9:53	6,700	8,000	9,100						11.4	
		4/20 16:48	29,000	51,000	62,000						10.5	
		4/21 9:58	33,000	73,000	87,000						10.5	
		4/22 10:29	44,000	180,000	210,000						10.1	
		4/24 10:04	4,000	5,500	6,800						10.8	
		4/25 10:10	11,000	24,000	29,000						11.2	
		4/27 14:43	3,800	9,000	11,000						8.6	
		4/28 9:49 (4/29 16:32)	7,400	39,000	42,000						7.8	
		4/29 9:54 (4/30 16:55)	8,200	50,000	56,000						7.5	
		4/30 10:59 (5/1 14:45)	3,100	14,000	14,000						6.8	
		5/1 9:55 (5/2 17:29)	4,500	26,000	29,000						7.3	
		5/2 10:35 (5/3 19:14)	3,600	26,000	27,000						5.4	
		2011/5/2 10:35	5,200	25,000	30,000						5.4	
		5/3 9:51 (5/6 9:43)	4,700	31,000	34,000						6.9	
		5/4 11:20 (5/6 18:29)	6,200	50,000	56,000						7.1	
		2011/5/5 10:00	5,000	33,000	40,000						7.2	
		5/5 10:00 (5/8 11:06)	2,200	20,000	21,000						7.2	
		5/6 10:09 (5/8 15:07)	2,400	14,000	14,000	5,500	Not Detectable	140	Not Detectable	Not Detectable	7.2	
		5/7 14:54 (5/9 16:10)	2,200	14,000	14,000	7,600	Not Detectable	130	Not Detectable	Not Detectable	7.8	
		5/8 10:05 (5/10 16:20)	4,100	38,000	44,000	21,000	Not Detectable	490	Not Detectable	Not Detectable	6.6	
		5/9 10:05 (5/11 17:03)	4,700	56,000	60,000	23,000	Not Detectable	580	Not Detectable	Not Detectable	7.9	
		5/10 10:18 (5/12 16:21)	4,700	62,000	70,000	30,000	Not Detectable	510	Not Detectable	Not Detectable	7.9	
		5/11 10:03 (5/14 15:52)	3,200	38,000	45,000	17,000	Not Detectable	220	Not Detectable	Not Detectable	7.6	
		5/12 10:49 (5/14 16:17)	3,300	42,000	48,000	21,000	Not Detectable	270	Not Detectable	^{110m}Ag : 140	7.5	
		5/13 10:59 (5/15 14:29)	1,200	16,000	18,000	6,300	Not Detectable	110	Not Detectable	Not Detectable	6.9	
		5/14 10:39 (5/16 17:42)	1,400	22,000	26,000	7,600	Not Detectable	200	Not Detectable	Not Detectable	5.3	
		5/15 11:39 (5/18 15:48)	480	4,000	4,800	2,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	6.7	
		5/16 10:25 (5/19 18:24)	1,100	27,000	30,000	11,000	Not Detectable	260	Not Detectable	Not Detectable	7.5	
		5/17 11:49 (5/19 18:23)	1,100	10,000	12,000	4,800	Not Detectable	74	Not Detectable	Not Detectable	7.0	

Results of Radionuclide Analysis of Soil (6/11)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration(Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	Air dose rate (μSv/h)	Monitoring Point by monitoring car
[3-13] (31kmNorth/West)	Futaba county Namie town Akougi	3/25 14:30	88,700	9,550	9,260						65.0	[32]
		3/26 10:40	290,000	33,400	33,000						46.0	
		3/27 11:55	550,000	78,000	80,000						45.0	
		3/28 10:51	210,000	8,930	9,200						50.0	
		3/29 10:57	660,000	93,300	94,000						43.0	
		3/30 11:08	260,000	53,500	52,000						41.6	
		3/31 11:04	91,000	39,700	40,000						38.0	
		4/1 11:01	250,000	122,000	130,000						36.2	
		4/2 11:55	120,000	31,800	35,000						34.0	
		4/3 10:56	280,000	110,000	110,000						32.7	
		4/4 10:50	157,730	89,234	98,551						32.7	
		4/5 10:59	201,800	93,531	103,390						26.0	
		4/6 11:59	125,200	53,806	58,761						25.8	
		4/7 10:47	139,810	65,462	73,554						27.8	
		4/8 11:23	85,800	63,000	64,300						24.6	
		4/10 10:54	43,605	37,613	42,820						25.2	
		4/11 13:53	114,330	120,180	140,550						23.9	
		4/12 16:25	102,450	77,991	86,040						26.4	
		4/14 10:50	69,000	64,000	73,000						21.3	
		4/15 10:24	24,000	25,000	29,000						22.5	
		4/16 10:16	58,000	75,000	87,000						25.3	
		4/17 10:55	17,000	8,700	10,000						23.1	
		4/18 10:15	10,000	16,000	18,000						28.6	
		4/20 16:27	26,000	46,000	55,000						21.3	
		4/21 10:22	35,000	66,000	78,000						24.0	
		4/22 10:50	48,000	180,000	220,000						21.6	
		4/24 10:28	36,000	88,000	110,000						24.2	
		4/25 10:38	19,000	82,000	98,000						19.4	
		4/27 14:26	23,000	110,000	130,000						22.4	
		4/28 10:07 (4/29 16:34)	5,700	22,000	24,000						18.7	
		4/29 10:11 (4/30 16:56)	12,000	48,000	52,000						19.5	
		4/30 11:12 (5/1 14:46)	18,000	110,000	110,000						18.1	
		5/1 10:24 (5/2 17:30)	6,300	55,000	58,000						17.8	
		5/2 10:49 (5/3 19:15)	11,000	64,000	67,000						19.7	
		2011/5/2 10:49	15,000	78,000	92,000						19.7	
		5/3 10:11 (5/6 9:43)	2,900	7,300	8,200						18.2	
		5/4 11:36 (5/6 18:32)	6,000	57,000	60,000						16.9	
		2011/5/5 10:21	1,800	7,600	9,300						18.9	
		5/5 10:21 (5/8 11:06)	5,500	30,000	31,000						18.9	
		5/6 9:55 (5/8 15:26)	8,900	130,000	140,000	56,000	Not Detectable	1,500	Not Detectable	^{110m}Ag : 420	18.6	
		5/7 14:38 (5/9 16:09)	10,000	93,000	97,000	60,000	Not Detectable	1,100	Not Detectable	Not Detectable	19.4	
		5/8 9:41 (5/10 16:15)	6,200	58,000	63,000	35,000	Not Detectable	740	Not Detectable	^{110m}Ag : 180	17.6	
		5/9 9:53 (5/11 17:04)	6,600	71,000	75,000	39,000	Not Detectable	780	Not Detectable	^{110m}Ag : 240	20.1	
		5/10 10:05 (5/12 16:16)	7,900	100,000	110,000	57,000	Not Detectable	1,100	Not Detectable	^{110m}Ag : 270	20.3	
		5/11 9:51 (5/14 15:52)	4,600	73,000	80,000	33,000	Not Detectable	610	Not Detectable	^{110m}Ag : 330	19.3	
		5/12 10:31 (5/14 16:18)	3,700	59,000	65,000	28,000	Not Detectable	500	Not Detectable	Not Detectable	19.0	
		5/13 10:36 (5/15 14:37)	3,700	67,000	71,000	32,000	Not Detectable	540	Not Detectable	^{110m}Ag : 210	17.2	
		5/14 10:16 (5/16 17:42)	3,100	60,000	64,000	29,000	Not Detectable	470	Not Detectable	^{110m}Ag : 190	15.2	
		5/15 11:21 (5/18 15:49)	3,100	40,000	47,000	24,000	Not Detectable	310	Not Detectable	Not Detectable	17.3	
		5/16 10:04 (5/19 18:19)	3,600	83,000	91,000	34,000	Not Detectable	630	Not Detectable	^{110m}Ag : 290	18.5	
		5/17 11:27 (5/19 18:24)	1,500	17,000	20,000	9,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	17.8	

Results of Radionuclide Analysis of Soil (7/11)

Sampling Point		Sampling Time and Date (Monitoring Time) ※2	Radioactivity Concentration(Bq/kg)								Air dose rate (μSv/h)	Monitoring Point by monitoring car
			^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides		
【3-14】(40kmWest/North/West)	Date county Kawamata town Yamakiya	3/25 15:35	73,000	15,000	18,000						7.0	【36】
		3/26 19:30	49,000	8,100	9,300						7.8	
		3/28 9:15	65,000	18,000	21,000						8.0	
		3/29 9:41	63,000	17,000	21,000						6.0	
		3/30 10:18	71,000	20,000	24,000						5.6	
		3/31 10:21	59,000	24,000	28,000						5.3	
		4/1 10:11	54,000	20,000	23,000						5.7	
		4/2 11:20	54,000	22,000	26,000						5.1	
		4/4 9:52	6,600	3,100	3,300						5.2	
		4/5 9:26	31,000	17,000	20,000						4.6	
		4/6 11:05	41,000	21,000	25,000						4.1	
		4/7 10:02	39,000	24,000	29,000						4.1	
		4/8 10:07	27,000	21,000	24,000						3.8	
		4/10 9:41	14,000	10,000	12,000						4.6	
		4/11 10:36	22,000	21,000	25,000						4.0	
		4/13 12:07	15,000	17,000	20,000						4.5	
		4/14 9:57	17,000	20,000	24,000						4.2	
		4/15 9:39	5,600	6,700	7,800						3.3	
		4/16 9:37	6,000	7,000	8,100						2.9	
		4/17 9:22	9,900	13,000	15,000						3.1	
		4/18 9:31	17,000	28,000	34,000						4.5	
		4/20 11:03	4,600	6,900	8,400						3.2	
		4/21 9:32	9,100	19,000	22,000						3.4	
		4/22 10:10	4,300	9,200	11,000						3.7	
		4/24 9:39	3,800	7,800	9,200						4.0	
		4/28 9:35	1,500	2,700	3,100						2.5	
		4/29 9:35	2,400	6,100	7,300						2.6	
		4/30 10:33	2,200	6,600	7,800						3.1	
		5/1 9:32	2,600	23,000	27,000						2.8	
		5/2 9:48	2,800	15,000	19,000						2.7	
		5/3 9:30	2,400	16,000	19,000						3.0	
		5/4 10:58	2,600	9,500	11,000						3.0	
		5/5 9:39	2,000	11,000	13,000						3.1	
		5/6 9:21	2,200	15,000	18,000						3.3	
		5/7 14:08	1,700	14,000	16,000						3.2	
		5/8 9:04	1,900	18,000	21,000						3.3	
		5/9 9:20	1,700	18,000	23,000						3.0	
		5/10 9:29	1,100	11,000	13,000	5,100	Not Detectable	120	Not Detectable	Not Detectable	2.7	
		5/11 9:20	1,100	14,000	18,000	6,700	Not Detectable	110	29	^{95}Nb : 51	2.8	
		5/12 9:40	220	3,600	4,300	Not Detectable	Not Detectable	26	Not Detectable	Not Detectable	3.1	
		5/13 9:45	640	7,600	9,400	3,500	Not Detectable	89	18	Not Detectable	2.8	
		5/14 9:43	1,300	22,000	26,000	8,100	Not Detectable	160	39	Not Detectable	2.6	
		5/15 10:00	1,100	20,000	24,000	8,700	Not Detectable	200	41	Not Detectable	2.7	
		5/16 9:22	330	4,200	5,000	1,400	Not Detectable	30	Not Detectable	Not Detectable	3.0	
		5/17 10:35	400	5,200	6,500	2,600	Not Detectable	34	Not Detectable	Not Detectable	2.4	
		5/24 13:50	570	17,000	21,000	5,200	Not Detectable	140	Not Detectable	Not Detectable	2.8	
【3-15】(23kmSouth)	Futaba county Hirono town Shimokitaba	3/25 14:15	560	390	410						5.5	【71】
		3/26 12:55	31,000	1,600	1,800						3.9	
		3/28 9:54	42,000	1,200	1,500						3.0	
【3-16】(45kmNorth/West)	Soma city Yamakami	3/28 16:18	7,800	3,000	3,500						1.7	−
【37】(48kmNorth/West)	Date city Ryozen town	4/1 9:59	15,000	15,000	16,000						4.6	【37】
		4/2 10:40	20,000	16,000	20,000						4.3	
【38】(34kmSouth/South/West)	Iwaki City Yotsukura town	4/14 12:05	8,700	1,800	2,100						0.8	【38】
		4/15 13:41	4,900	1,200	1,400						0.9	
		4/16 15:50	4,600	1,000	1,200						0.9	
		4/17 11:37	5,300	1,100	1,300						0.3	
		4/20 11:46	4,800	1,800	2,000						1.3	
		4/21 11:46	4,400	1,700	1,900						1.0	
		4/22 11:42	3,300	1,400	1,700						0.7	
		4/23 11:32	4,600	2,400	3,000						0.7	
		4/26 11:31	2,800	1,500	1,600						0.3	
		4/28 11:28	970	630	760						0.3	
		4/29 12:33	3,700	2,800	3,200						0.8	
		4/30 11:18	1,700	1,200	1,400						0.2	
		5/1 12:18	1,800	1,800	2,100						0.8	
		5/2 13:42	1,900	2,700	3,000						0.3	
		5/3 12:20	2,500	2,700	3,200						0.3	
		5/4 12:29	1,900	2,500	2,800						0.5	
		5/5 12:17	2,100	20,000	22,000						0.2	
		5/6 11:57	1,100	1,400	1,700						0.6	
		5/7 11:41	1,800	2,200	2,500						1.0	
		5/8 12:28	1,300	2,200	2,700						0.8	
		5/9 11:59	630	1,200	1,400						0.7	
		5/10 11:23	790	1,500	1,700	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/11 11:18	750	1,600	1,900	2,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/12 12:03	650	1,200	1,500	1,800	Not Detectable	Not Detectable	Not Detectable	^{95}Nb : 19	0.3	
		5/14 12:49	420	1,300	1,600	1,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/15 11:39	520	1,800	2,300	1,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/16 11:28	490	1,700	2,100	1,500	Not Detectable	Not Detectable	Not Detectable	^{95}Nb : 26	0.3	
		5/17 11:33	590	2,100	2,500	2,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/18 11:13	470	1,600	1,900	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/19 11:07	310	1,500	1,800	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/21 11:12	670	4,000	5,100	2,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/22 11:12	460	2,300	2,800	4,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/24 11:00	190	1,100	1,300	1,700	Not Detectable	Not Detectable	Not Detectable	^{95}Nb : 30	0.3	
		5/26 11:06	320	2,400	2,800	3,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/28 10:56	110	1,000	1,200	1,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	

Results of Radionuclide Analysis of Soil (8/11)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration (Bq/kg)								Air dose rate (μSv/h)	Monitoring Point by monitoring car
			^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides		
【39】 (41kmNorth/North/West)	Soma city Yamakami Kaminamiki	4/15 10:46	1,900	3,800	4,500						0.5	【39】
		4/16 10:28	3,100	5,600	6,500						0.8	
		4/18 10:42	1,700	4,500	5,300						0.6	
		4/20 11:05	1,300	4,800	6,000						0.6	
		4/21 10:40	1,100	3,500	4,200						0.6	
		4/22 10:26	860	4,600	5,700						1.4	
		4/24 11:10	1,000	4,300	5,000						0.3	
		4/25 10:46	990	5,700	7,100						0.3	
		4/26 10:16	650	3,600	4,100						0.6	
		4/27 10:37	660	4,400	5,100						0.3	
		4/28 10:59	1,500	2,700	3,300						0.3	
		4/29 10:11	520	2,800	3,300						1.0	
		4/30 10:22	420	2,800	3,600						0.5	
		5/1 10:16	460	3,300	4,000						0.5	
		5/2 10:13	370	2,900	3,600						0.7	
		5/3 10:32	300	3,100	3,800						0.6	
		5/4 10:41	350	3,500	4,200						0.7	
		5/6 10:06	340	3,400	4,200						0.6	
		5/7 11:35	290	2,700	3,200						0.6	
		5/8 9:58	310	2,500	3,100						1.3	
		5/9 10:19	260	2,000	2,600						0.6	
		5/10 10:24	160	2,500	3,000	1,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.0	
		5/11 10:00	150	2,000	2,500	640	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/12 10:45	99	1,400	1,700	600	Not Detectable	19	Not Detectable	Not Detectable	0.7	
		5/13 10:50	120	1,800	2,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/14 10:57	150	3,900	4,500	2,100	Not Detectable	43	Not Detectable	Not Detectable	0.7	
		5/15 10:48	190	3,000	3,600	1,200	Not Detectable	38	Not Detectable	Not Detectable	0.6	
		5/16 10:31	190	3,600	4,500	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/17 11:25	73	2,100	2,700	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/18 10:12	140	4,700	6,100	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/19 11:12	87	3,700	4,400	1,800	Not Detectable	34	Not Detectable	Not Detectable	0.6	
		5/20 10:27	94	3,500	4,600	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/21 10:12	93	3,900	4,700	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/22 9:55	81	3,600	4,500	1,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/23 10:22	60	3,000	3,700	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/24 10:34	45	1,100	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/25 10:17	84	3,600	4,300	1,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/26 11:48	Not Detectable	3,400	4,200	980	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
		5/27 13:44	41	3,200	3,900	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	
		5/28 13:30	Not Detectable	2,900	3,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	
【72】(31kmSouth)	Iwaki city Hisanohama town Hisanohama	3/31 12:00	18,000	1,300	1,500						1.5	【72】
		4/1 12:46	24,000	2,000	2,400						1.6	
		4/3 13:33	22,000	1,800	2,200						1.2	
		4/4 12:51	19,000	1,400	1,700						1.5	
【73】(35kmSouth)	Iwaki City Yotsukura town	3/31 12:39	13,000	940	1,100						1.3	【73】
		4/1 12:02	14,000	960	1,100						1.4	
		4/3 12:57	9,900	1,200	1,400						1.2	
		4/4 12:30	8,200	650	800						1.1	
【74】 (36kmSouth/South/West)	Iwaki city Ogawa town Takahagi	3/31 13:18	4,300	290	330						0.5	【74】
		4/1 11:13	5,900	600	710						0.3	
		4/3 11:51	3,700	290	410						0.4	
		4/4 11:26	4,300	400	440						0.6	
【75】 (43kmSouth/South/West)	Iwaki city Uchigoumiyamaya town	3/31 14:03	14,000	550	650						0.7	【75】
		4/1 10:34	20,000	1,100	1,300						0.8	
		4/3 11:19	14,000	990	1,200						0.4	
		4/4 10:50	14,000	1,200	1,300						0.7	
【76】 (22kmWest/South/West)	Futaba county Kawauchi village Kamikawauchi	4/4 12:04	5,500	1,500	1,800						0.8	【76】
		4/14 13:03	2,300	1,300	1,600						0.1	
		4/15 10:51	1,600	970	1,100						0.1	
		4/16 10:42	2,300	1,400	1,900						0.0	
		4/17 10:46	1,600	940	1,200						0.3	
		4/20 10:42	2,500	2,000	2,400						0.6	
		4/21 10:40	1,100	1,100	1,300						0.6	
		4/22 10:35	430	300	370						0.5	
		4/24 10:28	1,300	1,600	1,900						0.7	
		4/27 12:46	840	1,400	1,800						0.5	
		4/28 15:18	500	1,000	1,300						0.5	
		4/29 10:28	550	1,200	1,400						0.4	
		4/30 11:39	580	1,200	1,400						0.4	
		5/1 10:33	400	950	1,200						1.1	
		5/2 10:40	140	230	280						0.2	
		5/3 10:54	540	1,500	1,900						0.2	
		5/4 10:59	450	1,300	1,500						0.2	
		5/5 10:23	360	1,200	1,500						0.3	
		5/6 14:49	490	1,600	1,900						0.4	
		5/7 10:22	380	1,500	1,700						0.5	
		5/8 10:18	270	1,100	1,200						0.4	
		5/9 10:17	270	1,500	1,900						0.4	
		5/10 10:16	200	1,100	1,400	540	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/11 10:18	220	1,700	2,000	580	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/12 11:20	190	980	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/13 10:46	170	1,100	1,400	510	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
		5/14 11:32	160	1,300	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/15 11:08	200	1,000	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/16 13:12	130	1,000	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.5	
		5/17 10:52	160	1,500	2,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/18 10:48	77	730	860	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/19 13:29	120	1,200	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/20 11:57	120	2,200	2,600	Not Detectable	Not Detectable	29	Not Detectable	Not Detectable	0.3	
		5/21 12:02	87	820	1,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/22 12:20	110	1,900	2,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/23 11:23	120	1,300	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/24 12:09	87	1,200	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/25 13:04	85	1,400	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/26 11:50	73	1,400	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/27 12:10	75	1,300	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.4	
		5/28 11:07	28	690	830	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	

Results of Radionuclide Analysis of Soil (9/11)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration(Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	Air dose rate (μSv/h)	Monitoring Point by monitoring car
[79] (29kmWest/North/West)	Futaba county Namie town shimotsushima kayabuka	4/14 11:24	51,000	34,000	43,000						10.7	[79]
		4/15 11:00	44,000	40,000	49,000						10.9	
		4/16 11:01	9,900	14,000	16,000						10.0	
		4/17 10:12	56,000	75,000	86,000						12.7	
		4/18 10:54	14,000	23,000	27,000						17.5	
		4/20 15:18	49,000	99,000	120,000						11.5	
		4/21 11:14	20,000	50,000	61,000						11.5	
		4/22 11:49	14,000	29,000	34,000						12.0	
		4/24 11:16	31,000	93,000	110,000						10.1	
		4/28 10:46	17,000	71,000	88,000						6.0	
		4/29 11:03	9,400	32,000	39,000						10.5	
		4/30 12:36	9,500	45,000	52,000						11.1	
		5/1 11:34	8,500	53,000	63,000						10.5	
		5/2 14:15	9,000	31,000	38,000						11.0	
		5/3 13:02	10,000	80,000	97,000						10.2	
		5/5 11:43	7,100	47,000	56,000						10.1	
		5/6 10:25	8,700	78,000	95,000						10.1	
		5/7 15:04	4,700	52,000	64,000						10.3	
		5/8 10:13	3,400	29,000	37,000						10.0	
		5/9 10:14	5,300	79,000	99,000						10.1	
		5/10 10:29	5,600	66,000	82,000	35,000	Not Detectable	760	110	^{95}Nb : 170	9.0	
		5/11 10:13	3,000	52,000	65,000	26,000	Not Detectable	590	110	^{95}Nb : 120	10.3	
		5/12 11:30	2,600	40,000	49,000	16,000	Not Detectable	450	46	^{95}Nb : 77	10.0	
		5/13 11:21	5,800	63,000	78,000	36,000	Not Detectable	640	100	^{95}Nb : 130 ^{110m}Ag : 230	9.4	
		5/14 10:53	3,800	68,000	85,000	29,000	Not Detectable	680	81	^{95}Nb : 110	7.4	
		5/15 13:29	2,300	57,000	70,000	27,000	Not Detectable	490	69	^{95}Nb : 110	9.3	
		5/16 13:40	2,100	47,000	57,000	37,000	Not Detectable	360	52	Not Detectable	9.7	
		5/17 12:02	2,100	57,000	70,000	24,000	Not Detectable	500	50	^{95}Nb : 110	10.0	
		5/18 12:07	1,000	35,000	43,000	13,000	Not Detectable	250	45	Not Detectable	10.2	
		5/19 11:24	1,800	48,000	59,000	22,000	Not Detectable	350	66	Not Detectable	9.7	
		5/20 12:14	2,300	64,000	79,000	25,000	Not Detectable	440	Not Detectable	Not Detectable	9.5	
		5/21 12:19	1,800	51,000	63,000	18,000	Not Detectable	270	46	Not Detectable	9.1	
		5/22 10:38	2,000	80,000	99,000	31,000	Not Detectable	500	Not Detectable	Not Detectable	10.2	
		5/23 10:26	1,200	46,000	59,000	17,000	Not Detectable	280	Not Detectable	Not Detectable	10.6	
		5/24 10:58	1,200	65,000	82,000	24,000	Not Detectable	290	Not Detectable	Not Detectable	9.7	
		5/25 10:57	1,500	70,000	89,000	24,000	Not Detectable	300	51	^{95}Nb : 110	10.4	
		5/26 11:42	1,800	58,000	72,000	23,000	Not Detectable	320	Not Detectable	^{95}Nb : 150 ^{140}Ba : 650	8.4	
		5/27 11:48	1,000	67,000	83,000	23,000	Not Detectable	280	63	^{95}Nb : 94	8.4	
		5/28 10:56	1,100	68,000	83,000	23,000	Not Detectable	310	53	^{110m}Ag : 150	10.4	
[83] (24kmNorth/West)	Futaba county Namie town Akougi Kunugidaira	3/30 15:40	340,000	170,000	170,000						59.3	[83]*3
		4/8 12:10	210,000	230,000	270,000						53.5	
		4/10 14:51	130,000	130,000	150,000						52.0	
		4/11 14:45	190,000	260,000	310,000						53.5	
		5/6 10:40	31,000	350,000	430,000						41.6	
		5/7 15:22	19,000	230,000	290,000						45.0	
		5/8 10:25	18,000	210,000	250,000						42.2	
		5/9 10:49	20,000	270,000	320,000						43.8	
		5/10 10:48	14,000	180,000	230,000	94,000	Not Detectable	2,000	640	^{95}Nb : 500 , ^{110m}Ag : 1,200	40.8	
		5/25 11:24	2,800	170,000	210,000	60,000	Not Detectable	770	260	^{110m}Ag : 1,100	35.0	
[84] (39kmSouth/West)	Iwaki city Miwa-town Saiso	4/14 10:22	1,700	720	810						0.2	[84]
		4/15 10:14	860	640	760						0.2	
		4/16 10:32	810	530	650						0.2	
		4/17 9:58	1,200	1,300	1,500						0.4	
		4/20 10:13	1,200	870	950						0.2	
		4/21 10:12	650	780	910						0.7	
		4/22 10:13	400	550	670						0.2	
		4/26 9:55	230	390	430						0.2	
		4/27 10:08	170	320	380						0.0	
		4/28 9:55	270	590	700						0.5	
		4/29 9:59	330	650	820						1.0	
		4/30 9:47	180	420	520						1.1	
		5/1 9:59	250	820	910						1.2	
		5/2 10:10	130	320	410						0.4	
		5/3 9:51	250	1,100	1,300						1.2	
		5/4 10:08	88	300	420						0.2	
		5/5 10:01	95	390	390						0.2	
		5/6 9:37	170	1,000	1,200						1.8	
		5/7 9:32	110	580	750						0.5	
		5/8 9:35	89	570	680						0.2	
		5/9 9:35	120	720	820						0.2	
		5/10 9:49	79	510	590	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/11 9:41	100	760	900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/12 9:44	17	240	290	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/14 9:59	67	670	780	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/15 9:59	51	360	420	380	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/16 10:05	70	990	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/17 9:58	47	570	700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/18 9:52	48	440	530	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/19 9:45	33	550	660	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/21 9:50	37	570	610	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		5/28 9:32	Not Detectable	370	400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.3	
[101] (55kmNorth/West)	Date city Ryozen town	4/8 9:40	2,600	2,000	2,400						1.3	[101]
		4/10 9:17	3,900	1,700	2,100						1.5	
		4/11 9:19	4,000	2,100	2,500						2.2	
		4/13 10:56	3,500	4,500	5,400						0.9	
		4/15 9:33	2,800	3,600	4,200						1.0	
		4/16 9:25	3,300	4,900	5,800						1.2	
		4/18 9:40	1,200	2,000	2,500						1.0	
[102] (50kmNorth/West)	Date city Tsukidate town	4/8 15:00	7,000	5,300	6,400						1.2	[102]
		4/10 13:46	5,800	4,400	5,300						1.2	
		4/11 14:12	4,500	3,200	3,800						1.5	
		4/14 17:07	2,700	2,600	3,000						0.8	
		4/15 15:03	4,200	5,400	6,600						1.3	
		4/16 14:12	3,100	4,800	5,200						1.7	
		4/18 14:58	5,300	6,900	8,300						1.1	
[103] (20kmNorth)	Minami Soma city Haramachi ward	4/8 12:45	2,000	1,400	1,800						0.6	[103]
		4/10 12:16	1,300	570	700						0.5	
		4/11 12:20	2,000	2,200	2,800						1.5	
		4/13 18:05	2,400	2,800	3,400						0.3	
		4/15 13:13	910	820	990						0.6	
		4/18 12:45	3,000	4,700	5,600						0.6	

Attachment V-13-4-(2)

Results of Radionuclide Analysis of Soil (10/11)

Sampling Point		Sampling Time and Date (Monitoring Time) ※2	Radioactivity Concentration (Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	Air dose rate (μSv/h)	Monitoring Point by monitoring car
【104】(25kmWest/North/West)	Futaba County Katsurao Village	4/8 12:41	13,000	8,300	9,700						1.7	【104】
		4/10 16:00	8,000	6,700	7,800						2.8	
		4/11 13:10	11,000	8,000	9,500						2.6	
		4/12 13:14	11,000	10,000	12,000						2.4	
		4/17 9:53	5,400	5,600	6,600						1.6	
		4/18 11:47	3,900	5,300	6,200						3.4	
		4/20 14:45	3,700	9,500	11,000						1.6	
		4/21 12:20	4,000	8,000	9,800						1.8	
		4/22 13:55	5,800	8,900	10,000						1.2	
		4/24 12:24	2,800	8,400	9,900						1.7	
		4/25 11:55	4,100	9,200	11,000						1.7	
		4/28 12:12	2,000	6,700	8,100						0.8	
		4/29 12:09	2,700	11,000	13,000						1.6	
		4/30 13:01	2,700	10,000	13,000						1.3	
		5/1 12:06	3,500	13,000	16,000						1.7	
		5/2 14:42	1,800	8,400	10,000						1.1	
		5/3 13:51	2,400	18,000	22,000						1.1	
		5/4 15:53	1,300	7,100	8,400						1.3	
		5/5 12:18	1,800	16,000	19,000						1.7	
		5/6 11:15	1,900	14,000	18,000						1.6	
		5/7 12:24	800	6,100	7,100						1.2	
		5/8 14:03	1,700	11,000	14,000						1.4	
		5/9 12:04	910	8,800	11,000						1.3	
		5/10 11:20	1,100	8,800	11,000	5,000	Not Detectable	110	Not Detectable	Not Detectable	1.4	
		5/11 11:06	720	5,800	7,200	2,900	Not Detectable	80	Not Detectable	Not Detectable	1.3	
		5/12 13:43	500	4,600	5,600	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	
		5/13 14:04	360	5,900	7,100	1,200	Not Detectable	73	24	Not Detectable	1.3	
		5/14 13:37	400	4,500	5,400	1,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/15 14:00	580	6,800	8,300	2,700	Not Detectable	64	Not Detectable	Not Detectable	1.5	
		5/16 14:14	310	4,800	5,700	1,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/17 13:36	540	8,800	11,000	3,000	Not Detectable	63	Not Detectable	Not Detectable	1.3	
		5/18 13:14	740	14,000	17,000	5,500	Not Detectable	81	Not Detectable	Not Detectable	1.4	
		5/19 10:11	500	7,900	9,800	4,700	Not Detectable	60	Not Detectable	Not Detectable	1.3	
		5/20 10:38	560	7,300	8,800	3,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/21 10:14	540	12,000	15,000	4,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	
		5/22 10:06	450	11,000	13,000	4,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/23 9:52	440	12,000	15,000	5,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	
		5/24 10:05	170	3,500	4,300	920	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	
		5/25 10:29	120	2,300	2,800	1,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	
		5/26 10:28	170	5,100	6,200	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	
		5/27 10:20	180	5,300	6,800	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.1	
		5/28 12:23	320	12,000	14,000	2,200	Not Detectable	Not Detectable	Not Detectable	^{95}Nb : 65	1.5	
【105】(21kmWest)	Tamura city Miyakoji town	4/8 11:20	5,100	2,000	2,400						1.1	【105】
		4/10 12:00	4,400	2,100	2,600						1.5	
		4/11 10:59	4,400	2,000	2,400						0.5	
		4/13 13:18	2,300	1,300	1,600						0.3	
【106】(30kmWest/South/West)	Iwaki city Kawamae town	4/8 12:06	1,300	940	1,200						0.6	【106】
		4/10 12:46	770	1,100	1,400						1.2	
		4/11 10:11	700	870	1,100						0.6	
		4/13 12:20	610	840	970						0.5	
【107】(23kmNorth/North/West)	Minami Soma city Haramachi ward	4/8 13:21	5,800	4,400	5,300						2.8	【107】
		4/10 12:32	8,000	9,600	12,000						2.2	
		4/11 12:39	6,000	8,900	11,000						3.3	
		4/13 18:45	13,000	17,000	21,000						3.1	
		4/15 13:37	4,600	7,000	8,200						2.3	
		4/17 12:31	4,800	9,000	11,000						2.4	
		4/18 13:17	5,200	10,000	12,000						1.6	
		4/20 14:08	3,800	8,400	10,000						1.4	
		4/21 13:22	1,800	6,800	8,500						1.9	
		4/22 13:21	2,600	8,600	11,000						1.2	
		4/24 14:38	1,800	8,000	9,700						2.2	
		4/25 13:50	3,100	13,000	15,000						2.2	
		4/26 12:54	3,100	9,000	11,000						1.6	
		4/27 13:08	2,500	11,000	14,000						1.3	
		4/28 14:04	1,200	12,000	15,000						2.0	
		4/29 12:32	2,000	11,000	14,000						2.3	
		4/30 13:12	990	6,300	7,600						1.7	
		5/1 12:01	920	6,100	7,600						1.9	
		5/2 12:09	460	760	990						1.8	
		5/3 12:51	380	1,400	1,900						1.6	
		5/4 13:11	940	7,400	8,800						1.8	
		5/5 10:39	610	5,900	7,100						1.7	
		5/6 12:33	840	7,800	9,700						1.8	
		5/7 14:10	260	1,900	2,400						1.2	
		5/8 12:16	340	3,400	4,100						1.7	
		5/9 12:30	230	3,000	3,600						1.6	
		5/10 13:06	760	11,000	14,000	4,300	Not Detectable	100	39	Not Detectable	2.3	
		5/11 12:37	500	8,200	10,000	3,100	Not Detectable	98	Not Detectable	^{110m}Ag : 85	2.1	
		5/12 13:32	360	6,100	7,700	3,000	Not Detectable	64	21	^{110m}Ag : 60	2.0	
		5/13 13:37	270	6,800	8,400	2,600	Not Detectable	78	21	^{110m}Ag : 50	2.0	
		5/14 13:33	220	6,700	8,100	2,600	Not Detectable	49	Not Detectable	Not Detectable	1.8	
		5/15 13:13	270	6,300	7,900	3,300	Not Detectable	Not Detectable	21	Not Detectable	1.8	
		5/16 12:49	390	9,200	12,000	5,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.0	
		5/17 13:12	320	8,400	10,000	3,000	Not Detectable	54	28	^{110m}Ag : 67	1.7	
		5/18 12:59	150	3,800	4,800	1,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		5/19 14:02	310	10,000	13,000	3,900	Not Detectable	77	Not Detectable	Not Detectable	1.7	
		5/20 12:26	150	7,200	9,000	2,300	Not Detectable	42	28	^{110m}Ag : 59	1.9	
		5/21 12:22	310	11,000	14,000	4,100	Not Detectable	80	Not Detectable	^{110m}Ag : 130	1.8	
		5/22 12:05	130	7,300	9,100	2,200	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 89	1.7	
		5/23 12:50	310	11,000	14,000	3,800	Not Detectable	Not Detectable	25	^{110m}Ag : 110	1.7	
		5/24 13:00	51	1,900	2,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.7	
		5/25 13:04	160	11,000	14,000	2,800	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 110	1.8	
		5/26 14:17	290	8,100	11,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 68	1.9	
		5/27 11:15	130	10,000	13,000	2,600	Not Detectable	54	Not Detectable	Not Detectable	1.9	
		5/28 11:34	57	4,500	5,600	2,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	

Results of Radionuclide Analysis of Soil (11/11)

Sampling Point		Sampling Time and Date (Monitoring Time) *2	Radioactivity Concentration(Bq/kg)								Air dose rate (μSv/h)	Monitoring Point by monitoring car
			^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides		
【108】(30kmNorth/North/West)	Minami Soma city Haramachi ward	4/8 13:52	3,500	9,300	11,000						3.5	【108】
		4/10 12:51	8,500	12,000	15,000						2.7	
		4/11 12:55	5,500	11,000	14,000						3.7	
		4/15 13:57	2,400	6,000	6,800						2.6	
		4/17 12:14	2,700	9,000	11,000						4.1	
		4/18 13:58	5,400	11,000	13,000						2.9	
		4/20 14:26	2,400	7,700	9,500						3.4	
		4/21 13:42	2,400	6,800	8,300						2.6	
		4/22 13:40	1,900	6,700	7,900						2.6	
		4/23 14:04	2,500	9,600	11,000						2.1	
		4/24 14:56	1,500	6,800	7,900						2.2	
		4/25 14:08	3,900	5,600	7,100						2.5	
		4/26 13:10	2,200	11,000	13,000						2.8	
		4/27 13:26	2,600	12,000	14,000						2.5	
		4/28 14:25	2,800	11,000	14,000						2.5	
		4/29 12:47	1,100	8,200	10,000						3.4	
		4/30 13:28	1,300	12,000	14,000						2.4	
		5/1 12:31	750	6,600	7,800						2.2	
		5/2 13:07	1,100	10,000	13,000						2.1	
		5/3 13:08	690	4,100	5,100						2.9	
		5/4 13:28	720	7,200	8,800						1.8	
		5/5 10:52	490	4,700	5,700						2.1	
		5/6 12:53	740	10,000	12,000						2.4	
		5/7 14:42	460	7,300	9,000						2.8	
		5/8 12:34	370	4,000	4,700						2.0	
		5/9 12:47	170	2,100	2,400						2.5	
		5/10 13:28	440	8,000	9,700	3,700	Not Detectable	84	60	^{110m}Ag : 71	2.7	
		5/11 12:52	350	8,900	11,000	2,900	Not Detectable	82	44	^{110m}Ag : 77	2.8	
		5/12 13:58	340	6,000	7,500	2,700	Not Detectable	81	36	^{95}Nb : 37	2.9	
		5/13 13:55	290	5,800	7,000	2,400	Not Detectable	Not Detectable	18	^{110m}Ag : 61	2.9	
		5/14 13:52	310	12,000	15,000	3,600	Not Detectable	83	41	^{110m}Ag : 120	2.6	
		5/15 13:29	260	9,600	12,000	3,400	Not Detectable	81	34	^{110m}Ag : 82	2.6	
		5/16 13:07	320	12,000	15,000	4,100	Not Detectable	110	48	^{110m}Ag : 69	2.8	
		5/17 13:25	300	11,000	14,000	4,400	Not Detectable	85	30	^{110m}Ag : 95	2.5	
		5/18 13:16	290	8,000	9,900	2,400	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 96	2.6	
		5/19 14:24	180	7,600	9,400	2,000	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 83	1.9	
		5/20 12:41	210	9,400	12,000	3,600	Not Detectable	72	23	^{110m}Ag : 67	2.4	
		5/21 12:37	290	13,000	16,000	3,700	Not Detectable	62	47	^{110m}Ag : 130	2.6	
		5/22 12:21	120	6,000	7,600	1,800	Not Detectable	54	Not Detectable	^{110m}Ag : 55	2.4	
		5/23 13:09	160	5,800	7,200	2,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.5	
		5/24 13:33	180	13,000	17,000	3,600	Not Detectable	Not Detectable	30	^{110m}Ag : 92	2.5	
		5/25 13:28	240	13,000	16,000	3,000	Not Detectable	Not Detectable	40	^{110m}Ag : 130	2.4	
		5/26 14:33	Not Detectable	11,000	13,000	3,400	Not Detectable	Not Detectable	38	^{110m}Ag : 130	2.9	
		5/27 10:55	88	6,700	8,300	1,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.4	
		5/28 11:09	86	8,800	11,000	2,400	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 110	2.4	
【110】(25kmWest)	Tamura city Miyakoji town Furumichi	5/23 10:37	120	4,500	5,400	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	【110】
【111】(28kmWest/South/West)	Futaba county Kawauchi village Kamikawauchi	5/24 13:28	110	1,100	1,300	750	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.7	【111】
【113】(25kmWest)	Tamura city Miyakoji town Iwaisawa	5/8 11:44	760	8,000	9,600	3,400	Not Detectable	130	1,900	^{140}Ba : 1,600	1.5	【113】
		5/9 11:35	560	4,700	5,600	2,000	Not Detectable	57	Not Detectable	^{95}Nb : 42	1.5	
		5/10 11:36	940	8,400	10,000	3,500	Not Detectable	94	32	Not Detectable	1.2	
		5/11 11:39	1,100	7,000	8,400	2,000	Not Detectable	63	27	Not Detectable	1.4	
		5/12 13:15	570	7,500	9,000	Not Detectable	Not Detectable	57	30	Not Detectable	1.3	
		5/13 12:09	2,500	30,000	36,000	6,800	Not Detectable	250	87	^{95}Nb : 110	1.4	
		5/14 13:40	1,100	16,000	19,000	3,700	Not Detectable	160	39	^{95}Nb : 70	1.5	
		5/15 12:35	620	3,900	4,600	1,000	Not Detectable	44	Not Detectable	Not Detectable	1.4	
		5/16 11:37	1,200	14,000	16,000	3,400	Not Detectable	120	39	^{95}Nb : 43	1.3	
		5/17 12:06	1,400	31,000	38,000	5,100	Not Detectable	200	59	^{95}Nb : 140	1.5	
		5/18 12:02	200	3,400	4,100	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.6	
		5/19 11:42	440	7,000	8,600	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	
		5/20 10:48	2,800	69,000	83,000	19,000	Not Detectable	500	170	^{95}Nb : 160	1.3	
		5/21 10:48	150	2,500	2,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.5	
		5/22 11:09	460	11,000	13,000	2,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	
		5/25 11:04	250	2,200	2,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	
【114】(26kmSouth/West)	Iwaki city Ogawa town Kamiogawa	5/28 10:31	100	5,200	6,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.2	【114】
【181】(25kmWest/South/West)	Futaba county Kawauchi village Kamikawauchi	5/26 11:30	63	970	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.6	【181】
【K1】(32kmWest/North/West)	Futaba County Katsurao Village Katsurao	5/19 10:31	510	11,000	14,000	4,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.9	【K1】
【K2】(30kmWest/North/West)	Futaba County Katsurao Village Katsurao	5/19 10:42	540	13,000	16,000	3,900	Not Detectable	97	Not Detectable	Not Detectable	1.8	【K2】
【K3】(28kmWest/North/West)	Futaba County Katsurao Village Katsurao	5/19 10:54	170	2,700	3,400	810	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	【K3】
【K4】(28kmWest/North/West)	Futaba County Katsurao Village Nogawa	5/20 10:31	470	16,000	19,000	3,300	Not Detectable	91	Not Detectable	Not Detectable	2.5	【K4】
【K5】(29kmWest/North/West)	Futaba County Katsurao Village Nogawa	5/20 10:07	260	5,200	6,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.4	【K5】
【K6】(27kmWest/North/West)	Futaba County Katsurao Village Katsurao	5/20 11:43	1,900	44,000	55,000	18,000	Not Detectable	240	60	Not Detectable	9.5	【K6】
【K7】(23kmWest/North/West)	Futaba County Katsurao Village Katsurao	5/20 11:00	1,700	74,000	92,000	34,000	Not Detectable	510	99	Not Detectable	9.4	【K7】
【K8】(21kmNorth/West)	Futaba County Katsurao Village Katsurao	5/21 11:40	3,800	110,000	130,000	47,000	Not Detectable	750	80	Not Detectable	17.2	【K8】
【K9】(21kmWest/North/West)	Futaba County Katsurao Village Ochiai	5/21 11:29	310	5,600	6,700	2,200	Not Detectable	40	Not Detectable	Not Detectable	2.5	【K9】
【K10】(24kmWest/North/West)	Futaba County Katsurao Village Ochiai	5/21 10:46	280	3,800	4,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.3	【K10】
【K11】(21kmWest/North/West)	Futaba County Katsurao Village Ochiai	5/21 10:25	290	5,700	7,000	1,500	Not Detectable	49	Not Detectable	Not Detectable	1.7	【K11】
【n1】(31kmNorth/West)	Futaba county Namie town Akougi	5/22 12:58	2,200	68,000	86,000	25,000	Not Detectable	420	79	^{95}Nb : 180 ^{110m}Ag : 190	21.5	【n1】
【n2】(28kmNorth/West)	Futaba county Namie town Akougi	5/22 10:58	1,800	87,000	110,000	34,000	Not Detectable	580	110	^{110m}Ag : 310	24.6	【n2】
【n3】(28kmNorth/West)	Futaba county Namie town Akougi	5/22 11:11	1,500	63,000	77,000	22,000	Not Detectable	400	110	^{110m}Ag : 380	13.9	【n3】
【n4】(26kmNorth/West)	Futaba county Namie town Akougi	5/23 10:50	1,700*3	95,000*3	120,000*3	35,000*3	Not Detectable	510*3	160*3	^{110m}Ag : 460*3	25.3	【n4】
【n5】(22kmNorth/West)	Futaba county Namie town Hirusone	5/23 11:07	6,600*3	330,000*3	410,000*3	120,000*3	Not Detectable	1,700*3	630*3	^{95}Nb : 530*3 ^{110m}Ag : 1,400*3	35.0	【n5】
【n6】(25kmNorth/West)	Futaba county Namie town Minamitsushima	5/23 11:53	1,400	45,000	56,000	17,000	Not Detectable	250	51	Not Detectable	16.9	【n6】
【n7】(33kmNorth/West)	Futaba county Namie town Minamitsushima	5/23 12:15	2,500	98,000	120,000	35,000	Not Detectable	590	76	^{110m}Ag : 210	24.5	【n7】
【n8】(27kmNorth/West)	Futaba county Namie town Shimotsushima	5/24 11:13	620	4,100	4,800	2,800	Not Detectable	40	Not Detectable	^{95}Nb : 41	15.6	【n8】
【n10】(33kmWest/North/West)	Futaba county Namie town Hatsuka	5/24 10:32	170	5,500	6,700	2,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.2	【n10】
【n11】(20kmNorth/West)	Futaba county Namie town Hirusone	5/23 11:15	2,700*3	160,000*3	200,000*3	52,000*3	Not Detectable	860*3	200*3	^{95}Nb : 260*3 ^{110m}Ag : 760*3	24.8	【n11】
【i1】(39kmNorth/West)	Soma county Iitate Village Itamizawa	5/24 13:06	900	39,000	48,000	14,000	Not Detectable	250	62	^{110m}Ag : 260	4.3	【i1】
【i6】(41kmNorth/West)	Soma county Iitate Village Komiya	5/23 13:47	930	35,000	44,000	13,000	Not Detectable	210	Not Detectable	^{95}Nb : 120 ^{110m}Ag : 200	5.9	【i6】
【i8】(45kmNorth/West)	Soma county Iitate village Nagadoro	5/26 11:01	450	18,000	22,000	5,600	Not Detectable	66	Not Detectable	Not Detectable	5.5	【i8】
【i10】(46kmNorth/West)	Soma county Iitate Village Hiso	5/26 10:42	470	28,000	34,000	9,900	Not Detectable	100	59	^{110m}Ag : 200	5.4	【i10】
【i11】(46kmNorth/West)	Soma county Iitate Village Hiso	5/26 10:29	380	23,000	28,000	8,300	Not Detectable	100	49	^{110m}Ag : 160	4.6	【i11】
【i12】(43kmNorth/West)	Soma County Iitate Village Iitoi	5/27 9:55	170	6,200	7,900	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.8	【i12】
【i13】(43kmNorth/West)	Soma County Iitate Village Iitoi	5/27 9:44	44	230	280	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	6.6	【i13】
【i14】(40kmNorth/West)	Soma County Iitate Village Iitoi	5/27 10:15	600	34,000	43,000	12,000	Not Detectable	200	68	^{110m}Ag : 200	5.5	【i14】
【i15】(40kmNorth/West)	Soma county Iitate Village Ookura	5/27 10:27	120	5,200	6,300	1,600	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 73	3.1	【i15】
【i16】(40kmNorth/West)	Soma county Iitate Village Ookura	5/28 10:34	Not Detectable	1,000	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	2.6	【i16】
【i17】(38kmNorth/West)	Soma county Iitate Village Kusano	5/28 10:10	160	2,900	3,400	1,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	3.3	【i17】
【i18】(36kmNorth/West)	Soma county Iitate village Yagisawa	5/28 10:50	180	14,000	17,000	4,300	Not Detectable	Not Detectable	39	^{110m}Ag : 94	3.9	【i18】
【i20】(36kmNorth/West)	Soma county Iitate Village Sekisawa Hashiba	5/28 9:56	340	22,000	26,000	7,200	Not Detectable	100	53	^{110m}Ag : 190	6.3	【i20】
【i25】(29kmNorth/West)	Soma county Iitate Village Warabidaira	5/25 12:53	1,600	64,000	80,000	29,000	Not Detectable	300	130	^{95}Nb : 180 ^{110m}Ag : 520	9.2	【i25】
【i26】(31kmNorth/West)	Soma county Iitate village Nagadoro	5/25 12:39	1,600	75,000	95,000	26,000	Not Detectable	280	130	^{110m}Ag : 260	11.2	【i26】
【i28】(34kmNorth/West)	Soma county Iitate Village Hiso	5/25 13:15	4,100	90,000	110,000	35,000	Not Detectable	480	63	^{95}Nb : 210 ^{110m}Ag : 170	14.1	【i28】
【i29】(38kmNorth/West)	Soma county Iitate Village Hiso	5/25 13:26	120	15,000	19,000	5,800	Not Detectable	Not Detectable	25	^{95}Nb : 70	6.9	【i29】
【i30】(40kmNorth/West)	Soma County Iitate Village Iitoi	5/23 14:07	810	28,000	36,000	11,000	Not Detectable	160	Not Detectable	Not Detectable	4.0	【i30】
【i31】(38kmNorth/West)	Soma County Iitate Village Iitoi	5/23 14:29	520	15,000	19,000	5,500	Not Detectable	110	Not Detectable	Not Detectable	5.4	【i31】
【i32】(37kmNorth/West)	Soma County Iitate Village Iitoi	5/23 14:51	430	25,000	31,000	6,500	Not Detectable	130	Not Detectable	Not Detectable	5.3	【i32】

*Blanks of ^{129m}Te, ^{132}Te, ^{136}Cs, ^{140}La and other detected nuclides are being confirmed.

*1 For reference, the sample is collected from about 5mm of soil. (Samples are usually collected from about 5cm of soil)
*2 Radioactive decay is not taken into account from sampling to measurement for the radioactive concentration of the samples with measurement date and time in parentheses.
*3 Radioactive concentration is deemed as a reference value due to large dead time.
The measurement published in here is being executed by JAEA(Japan Atomic Energy Agency).

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (1/23)

As of 10:00 May 31 ,2011
MEXT

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)＊2	Radioactivity concentration (Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	other detected nuclides	Air dose rate (μSv/h)	Note
[2-1] (36 km North West)	Soma county Iitate village Yagisawa	Weed	Leaf Vegetable	3/18 12:20	2,520,000	1,880,000	1,900,000		over 30	
		Weed	Leaf Vegetable	3/19 11:40	845,000	981,000	1,010,000		26.5	
		Weed	Leaf Vegetable	3/20 12:40	2,540,000	2,580,000	2,650,000		25.8	
		Weed	Leaf Vegetable	3/21 12:32	1,330,000	1,170,000	1,240,000		20.4	
		Weed	Leaf Vegetable	3/22 12:00	1,110,000	1,570,000	1,600,000		15.3	
		Weed	Leaf Vegetable	3/23 12:25	819,000	1,580,000	1,620,000		16.8	
		Weed	Leaf Vegetable	3/24 13:05	805,000	985,000	1,050,000		13.2	
		Weed	Leaf Vegetable	3/25 12:20	400,000	389,000	398,000		12.3	
		Weed	Leaf Vegetable	3/26 12:00	1,030,000	2,810,000	2,870,000		10.2	
		Weed	Leaf Vegetable	3/27 11:40	508,000	912,000	910,000		11.2	
		Weed	Leaf Vegetable	3/28 11:50	381,000	460,000	480,000		9.6	
		Weed	Leaf Vegetable	3/29 11:10	330,000	303,000	311,000		9.2	
		Weed	Leaf Vegetable	3/30 12:25	576,000	1,820,000	1,890,000		8.5	
		Weed	Leaf Vegetable	3/31 11:30	303,000	1,570,000	1,620,000		8.0	
		Weed	Leaf Vegetable	4/1 11:30	219,000	704,000	725,000		7.7	
		Weed	Leaf Vegetable	4/2 11:24	171,000	828,000	863,000		8.6	
		Weed	Leaf Vegetable	4/3 10:55	301,000	1,390,000	1,420,000		7.7	
		Weed	Leaf Vegetable	4/4 10:05	192,000	259,000	275,000		7.2	
		Weed	Leaf Vegetable	4/5 11:31	297,000	1,390,000	1,440,000		10.6	
		Weed	Leaf Vegetable	4/6 11:23	161,000	1,060,000	1,070,000		9.5	
		Weed	Leaf Vegetable	4/7 11:07	107,000	612,000	627,000		9.1	
		Weed	Leaf Vegetable	4/8 11:30	30,900	84,100	329,000		10.2	
		Weed	Leaf Vegetable	4/9 11:15	55,700	303,000	313,000		7.8	
		Weed	Leaf Vegetable	4/10 11:20	10,100	28,800	29,200		9.5	
		Weed	Leaf Vegetable	4/11 12:05	30,900	321,000	329,000		3.9	
		Weed	Leaf Vegetable	4/12 11:42	18,900	103,000	104,000		6.4	
		Weed	Leaf Vegetable	4/13 11:04	109,000	900,000	941,000		7.2	
		Weed	Leaf Vegetable	4/14 11:15	24,100	250,000	257,000		7.7	
		Weed	Leaf Vegetable	4/15 11:30	30,900	84,100	329,000		9.4	
		Weed	Leaf Vegetable	4/16 10:55	9,180	147,000	158,000		7.3	
		Weed	Leaf Vegetable	4/17 11:20	3,160	22,000	22,500		8.4	
		Weed	Leaf Vegetable	4/18 11:05	7,090	43,500	43,500		8.5	
		Weed	Leaf Vegetable	4/19 11:23	41,200	355,000	377,000		7.4	
		Weed	Leaf Vegetable	4/20 10:52	7,030	131,000	139,000		6.6	
		Weed	Leaf Vegetable	4/21 11:05	9,590	214,000	221,000		9.4	
		Weed	Leaf Vegetable	4/22 10:51	3,040	45,100	46,400		9.3	
		Weed	Leaf Vegetable	4/23 11:15	2,150	34,800	35,700		7.0	
		Weed	Leaf Vegetable	4/24 10:55	800	19,500	20,900		6.5	
		Weed	Leaf Vegetable	4/25 12:00	1,700	48,800	50,200		6.6	
		Weed	Leaf Vegetable	4/26 11:20	2,060	58,300	62,900		7.1	
		Weed	Leaf Vegetable	4/27 11:05	1,290	40,100	43,100		7.0	
		Weed	Leaf Vegetable	4/28 11:00	796	34,700	35,800		6.7	
		Weed	Leaf Vegetable	4/29 11:05	524	9,310	9,280		7.2	
		Weed	Leaf Vegetable	4/30 11:52	1,960	48,200	50,700		8.0	
		Weed	Leaf Vegetable	5/1 11:25	1,590	58,500	62,900		8.0	
		Weed	Leaf Vegetable	5/2 11:19 (5/3 18:35)	1,200	76,000	78,000		7.4	
		Weed	Leaf Vegetable	5/3 11:19 (5/4 19:17)	630	37,000	38,000		7.5	
		Weed	Leaf Vegetable	5/4 11:10 (5/5 15:19)	190	5,000	5,500		7.2	
		Weed	Leaf Vegetable	5/5 11:06 (5/6 18:31)	Not Detectable	3,200	3,500		8.3	
		Weed	Leaf Vegetable	5/6 11:25 (5/8 10:43)	620	36,000	38,000		8.6	
		Weed	Leaf Vegetable	5/7 11:15 (5/8 15:33)	Not Detectable	11,000	11,000	^{136}Cs : 140	7.7	
		Weed	Leaf Vegetable	5/8 11:16 (5/9 16:12)	100	3,400	3,400	Not Detectable	8.1	
		Weed	Leaf Vegetable	5/9 11:04 (5/10 16:42)	950	61,000	63,000	^{136}Cs:670, ^{129m}Te:15,000, ^{110m}Ag: 440	7.1	
		Weed	Leaf Vegetable	5/10 11:12 (5/11 16:43)	510	31,000	31,000	^{136}Cs:290, ^{129m}Te:6,400, ^{110m}Ag: 220	7.4	
		Weed	Leaf Vegetable	5/11 11:45 (5/12 15:40)	Not Detectable	2,600	2,600	Not Detectable	7.1	
		Weed	Leaf Vegetable	5/12 11:29 (5/14 15:34)	530	45,000	48,000	^{136}Cs:340, ^{129m}Te:9,000	6.9	
		Weed	Leaf Vegetable	5/13 10:56 (5/14 16:05)	Not Detectable	2,600	2,800	Not Detectable	7.5	
		Weed	Leaf Vegetable	5/14 10:58 (5/15 14:29)	Not Detectable	4,700	4,500	Not Detectable	7.6	
		Weed	Leaf Vegetable	5/15 10:55 (5/16 17:37)	Not Detectable	5,500	5,800	Not Detectable	7.4	
		Weed	Leaf Vegetable	5/16 10:50 (5/18 15:49)	Not Detectable	5,000	5,100	Not Detectable	7.3	
		Weed	Leaf Vegetable	5/17 11:10 (5/19 13:59)	Not Detectable	1,800	1,800	Not Detectable	6.9	
		Weed	Leaf Vegetable	5/18 11:17 (5/19 19:01)	Not Detectable	5,300	5,800	Not Detectable	6.9	
		Weed	Leaf Vegetable	5/19 11:22 (5/21 13:34)	Not Detectable	7,200	7,800	Not Detectable	6.9	
		Weed	Leaf Vegetable	5/20 11:15 (5/21 14:02)	Not Detectable	3,200	3,400	Not Detectable	6.5	
		Weed	Leaf Vegetable	5/21 10:38 (5/22 12:21)	Not Detectable	2,800	2,700	Not Detectable	7.3	
		Weed	Leaf Vegetable	5/22 10:55	Not Detectable	1,350	1,560	Not Detectable	7.6	
		Weed	Leaf Vegetable	5/23 11:11	Not Detectable	8,080	8,500	Not Detectable	7.4	
		Weed	Leaf Vegetable	5/24 10:45	Not Detectable	6,680	7,150	Not Detectable	7.2	
		Weed	Leaf Vegetable	5/25 10:42	Not Detectable	3,030	3,320	Not Detectable	7.3	
		Weed	Leaf Vegetable	5/26 10:58	Not Detectable	2,270	2,540	Not Detectable	6.8	
		Weed	Leaf Vegetable	5/27 10:59	Not Detectable	3,120	3,430	Not Detectable	7.0	
		Weed	Leaf Vegetable	5/28 10:55	Not Detectable	11,900	12,400	^{110m}Ag : 80.1	6.2	
		Weed	Leaf Vegetable	5/29 10:47	Not Detectable	3,280	3,650	Not Detectable	6.6	

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (2/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*2	Radioactivity concentration (Bq/kg)				Air dose rate ($\mu Sv/h$)	Note
					^{131}I	^{134}Cs	^{137}Cs	other detected nuclides		
[2-2] (45 km North/West)	Date county Kawamata town	Weed	Leaf Vegetable	3/18 11:45	173,000	73,000	72,900		–	
		Weed	Leaf Vegetable	3/19 11:00	184,000	63,800	65,100		–	
		Weed	Leaf Vegetable	3/20 12:05	308,000	134,000	138,000		4.2	
		Weed	Leaf Vegetable	3/21 12:03	315,000	118,000	120,000		3.5	
		Weed	Leaf Vegetable	3/22 11:00	180,000	86,200	89,000		7.8	
		Weed	Leaf Vegetable	3/23 11:30	170,000	70,800	73,700		5.5	
		Weed	Leaf Vegetable	3/23 11:30	74,400	23,500	23,100		5.5	No Washed*1
		Weed	Leaf Vegetable	3/23 11:30	46,200	15,800	16,000		5.5	Washed*1
		Weed	Leaf Vegetable	3/24 11:20	141,000	40,600	43,200		5.0	
		Weed	Leaf Vegetable	3/25 11:30	155,000	52,200	53,000		7.5	
		Weed	Leaf Vegetable	3/26 11:20	79,500	53,400	54,700		4.3	
		Weed	Leaf Vegetable	3/27 10:45	50,000	32,400	32,900		5.5	
		Weed	Leaf Vegetable	3/28 11:05	46,000	32,500	33,600		5.5	
		Weed	Leaf Vegetable	3/29 11:00	71,900	66,800	67,900		4.8	
		Weed	Leaf Vegetable	3/30 11:35	33,500	26,000	27,500		4.6	
		Weed	Leaf Vegetable	3/31 10:35	33,000	33,400	34,100		4.8	
		Weed	Leaf Vegetable	4/1 10:35	52,600	45,800	45,300		3.3	
		Weed	Leaf Vegetable	4/2 10:34	34,100	36,800	36,200		3.2	
		Weed	Leaf Vegetable	4/3 10:10	16,500	16,200	16,700		3.7	
		Weed	Leaf Vegetable	4/4 10:05	46,500	57,900	61,000		3.1	
		Weed	Leaf Vegetable	4/5 10:39	31,200	56,400	60,900		1.4	
		Weed	Leaf Vegetable	4/6 10:38	31,200	58,100	61,200		1.7	
		Weed	Leaf Vegetable	4/7 10:24	6,470	12,100	11,900		1.4	
		Weed	Leaf Vegetable	4/8 10:50	7,000	14,900	15,100		1.4	
		Weed	Leaf Vegetable	4/9 10:34	9,800	24,400	25,500		1.2	
		Weed	Leaf Vegetable	4/10 10:40	5,840	12,000	12,100		1.4	
		Weed	Leaf Vegetable	4/11 11:10	7,770	22,400	22,500		1.2	
		Weed	Leaf Vegetable	4/12 10:40	6,140	19,100	20,000		0.9	
		Weed	Leaf Vegetable	4/13 10:25	24,900	71,900	73,400		1.1	
		Weed	Leaf Vegetable	4/14 10:31	62,500	168,000	180,000		1.2	
		Weed	Leaf Vegetable	4/15 10:50	7,770	6,380	22,500		1.3	
		Weed	Leaf Vegetable	4/16 10:10	1,710	4,470	4,860		1.1	
		Weed	Leaf Vegetable	4/17 10:40	690	6,900	6,870		1.1	
		Weed	Leaf Vegetable	4/18 10:15	891	2,510	2,410		1.2	
		Weed	Leaf Vegetable	4/19 10:34	817	3,280	3,050		0.9	
		Weed	Leaf Vegetable	4/20 10:07	884	3,670	3,710		1.0	
		Weed	Leaf Vegetable	4/21 10:15	675	1,760	1,680		1.2	
		Weed	Leaf Vegetable	4/22 10:08	1,030	1,680	1,900		1.0	
		Weed	Leaf Vegetable	4/23 10:29	301	1,070	1,070		1.0	
		Weed	Leaf Vegetable	4/24 10:09	392	2,900	3,190		1.0	
		Weed	Leaf Vegetable	4/25 11:02	381	2,320	2,400		1.3	
		Weed	Leaf Vegetable	4/26 10:37	321	1,570	1,570		1.3	
		Weed	Leaf Vegetable	4/27 10:20	430	1,950	2,100		1.3	
		Weed	Leaf Vegetable	4/28 10:15	171	1,800	1,810		1.2	
		Weed	Leaf Vegetable	4/29 10:20	251	2,590	2,770		1.3	
		Weed	Leaf Vegetable	4/30 10:51	305	2,670	2,730		1.4	
		Weed	Leaf Vegetable	5/1 10:37	1,300	19,900	20,100		1.3	
		Weed	Leaf Vegetable	5/2 10:32 (5/3 18:35)	180	3,700	3,300		1.3	
		Weed	Leaf Vegetable	5/3 10:43 (5/4 19:05)	Not Detectable	640	660		1.2	
		Weed	Leaf Vegetable	5/4 10:30 (5/5 15:18)	Not Detectable	1,300	1,300		1.1	
		Weed	Leaf Vegetable	5/5 10:32 (5/6 18:27)	Not Detectable	810	880		1.1	
		Weed	Leaf Vegetable	5/6 10:44 (5/8 10:43)	58	380	360		1.1	
		Weed	Leaf Vegetable	5/7 10:32 (5/8 15:30)	Not Detectable	1,200	1,400	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/8 10:32 (5/9 16:14)	Not Detectable	730	790	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/9 10:22 (5/10 16:41)	230	6,200	6,500	^{136}Cs : 88	1.4	
		Weed	Leaf Vegetable	5/10 10:46 (5/11 16:56)	190	7,100	8,300	^{136}Cs : 120	1.2	
		Weed	Leaf Vegetable	5/11 11:12 (5/12 15:37)	47	820	820	Not Detectable	1.3	
		Weed	Leaf Vegetable	5/12 10:55 (5/14 15:22)	Not Detectable	680	620	Not Detectable	1.4	
		Weed	Leaf Vegetable	5/13 10:35 (5/14 15:53)	Not Detectable	620	610	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/14 10:20 (5/15 14:01)	Not Detectable	1,400	1,400	Not Detectable	1.3	
		Weed	Leaf Vegetable	5/15 10:20 (5/16 17:24)	Not Detectable	6,300	6,200	Not Detectable	1.3	
		Weed	Leaf Vegetable	5/16 10:10 (5/18 15:40)	Not Detectable	2,000	2,000	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/17 10:30 (5/19 13:58)	Not Detectable	440	540	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/18 10:35 (5/19 18:48)	Not Detectable	500	510	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/19 10:40 (5/21 13:35)	Not Detectable	570	790	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/20 10:30 (5/21 13:50)	Not Detectable	5,800	5,900	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/21 10:05 (5/22 12:18)	Not Detectable	970	930	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/22 10:13	Not Detectable	2,220	2,530	Not Detectable	1.3	
		Weed	Leaf Vegetable	5/23 10:31	Not Detectable	245	348	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/24 10:07	Not Detectable	559	622	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/25 10:10	Not Detectable	678	708	Not Detectable	1.3	
		Weed	Leaf Vegetable	5/26 10:16	Not Detectable	1,450	1,480	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/27 10:18	Not Detectable	485	534	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/28 10:20	Not Detectable	2,130	2,260	Not Detectable	1.0	
		Weed	Leaf Vegetable	5/29 10:17	Not Detectable	55.4	66.3	Not Detectable	1.2	

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (3/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*2	Radioactivity concentration (Bq/kg)				Air dose rate (μSv/h)	Note
					^{131}I	^{134}Cs	^{137}Cs	other detected nuclides		
[2-3] (41kmWest)	Tamura city Funehiki town Funehiki	Weed	Leaf Vegetable	3/18 11:50	36,000	39,700	40,100		1.6	
		Weed	Leaf Vegetable	3/19 11:35	68,000	35,500	36,500		0.8	
		Weed	Leaf Vegetable	3/20 12:40	75,700	49,200	50,000		0.7	
		Weed	Leaf Vegetable	3/21 12:30	30,800	24,200	25,000		0.7	
		Weed	Leaf Vegetable	3/22 11:30	43,200	25,300	25,000		1.4	
		Weed	Leaf Vegetable	3/23 11:50	24,100	16,200	17,000		1.0	
		Weed	Leaf Vegetable	3/24 11:35	29,400	31,800	32,600		0.5	
		Weed	Leaf Vegetable	3/25 13:28	23,400	13,800	13,700		0.8	
		Weed	Leaf Vegetable	3/26 11:35	33,100	10,800	10,700		0.6	
		Weed	Leaf Vegetable	3/27 11:45	33,300	18,900	19,800		0.4	
		Weed	Leaf Vegetable	3/28 11:36	37,000	22,600	22,400		0.7	
		Weed	Leaf Vegetable	3/29 13:35	24,800	33,800	34,500		0.7	
		Weed	Leaf Vegetable	3/30 12:30	18,600	18,900	18,800		0.5	
		Weed	Leaf Vegetable	3/31 12:10	15,500	11,300	11,500		0.5	
		Weed	Leaf Vegetable	4/1 12:21	15,800	17,800	17,200		0.3	
		Weed	Leaf Vegetable	4/2 11:29	15,500	14,900	14,500		0.3	
		Weed	Leaf Vegetable	4/3 11:28	9,640	5,880	6,140		0.3	
		Weed	Leaf Vegetable	4/4 11:25	8,760	6,940	6,810		0.3	
		Weed	Leaf Vegetable	4/5 11:42	7,450	6,990	7,480		0.4	
		Weed	Leaf Vegetable	4/6 11:24	6,380	7,690	8,020		0.4	
		Weed	Leaf Vegetable	4/7 11:24	2,600	2,440	2,330		0.4	
		Weed	Leaf Vegetable	4/8 11:39	9,620	3,510	3,630		0.4	
		Weed	Leaf Vegetable	4/9 11:23	1,140	1,710	1,720		0.3	
		Weed	Leaf Vegetable	4/10 11:00	1,520	1,680	1,750		0.4	
		Weed	Leaf Vegetable	4/11 11:00	709	384	390		0.4	
		Weed	Leaf Vegetable	4/12 11:17	773	1,070	1,200		0.4	
		Weed	Leaf Vegetable	4/13 11:13	1,460	2,940	2,980		0.3	
		Weed	Leaf Vegetable	4/14 11:28	1,280	6,290	6,250		0.3	
		Weed	Leaf Vegetable	4/15 11:30	709	606	390		0.3	
		Weed	Leaf Vegetable	4/16 11:15	243	948	927		0.3	
		Weed	Leaf Vegetable	4/17 11:06	229	662	650		0.3	
		Weed	Leaf Vegetable	4/18 11:04	1,840	8,230	8,540		0.3	
		Weed	Leaf Vegetable	4/19 13:13	801	3,530	3,780		0.2	
		Weed	Leaf Vegetable	4/20 11:15	227	439	334		0.3	
		Weed	Leaf Vegetable	4/21 11:40	251	518	508		0.3	
		Weed	Leaf Vegetable	4/22 11:23	206	443	436		0.3	
		Weed	Leaf Vegetable	4/23 11:23	218	846	856		0.3	
		Weed	Leaf Vegetable	4/24 11:08	111	159	195		0.3	
		Weed	Leaf Vegetable	4/25 13:40	67	121	170		0.3	
		Weed	Leaf Vegetable	4/26 12:30	255	2,700	2,830		0.2	
		Weed	Leaf Vegetable	4/27 11:50	Not Detectable	278	273		0.2	
		Weed	Leaf Vegetable	4/28 11:55	266	4,920	5,000		0.2	
		Weed	Leaf Vegetable	4/29 11:30	Not Detectable	3,070	2,920		0.2	
		Weed	Leaf Vegetable	4/30 11:50	Not Detectable	547	581		0.2	
		Weed	Leaf Vegetable	5/1 11:47	266	3,880	4,150		0.3	
		Weed	Leaf Vegetable	5/2 11:16 (5/3 18:39)	Not Detectable	740	700		0.3	
		Weed	Leaf Vegetable	5/3 11:38 (5/4 18:54)	Not Detectable	110	160		0.3	
		Weed	Leaf Vegetable	5/4 11:23 (5/5 15:07)	Not Detectable	2,300	2,400		0.2	
		Weed	Leaf Vegetable	5/5 11:35 (5/6 18:15)	Not Detectable	130	110		0.3	
		Weed	Leaf Vegetable	5/6 11:46 (5/8 10:47)	100	95	83		0.2	
		Weed	Leaf Vegetable	5/7 11:45 (5/8 15:27)	68	280	320	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/8 11:47 (5/9 16:11)	74	81	120	Not Detectable	0.3	
		Weed	Leaf Vegetable	5/9 12:10 (5/10 16:17)	Not Detectable	120	140	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/10 11:46 (5/11 17:18)	Not Detectable	270	300	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/11 11:50 (5/12 15:30)	Not Detectable	110	99	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/12 12:37 (5/14 15:19)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/13 11:42 (5/14 15:51)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/14 13:10 (5/15 13:58)	Not Detectable	45	62	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/15 11:20 (5/16 17:22)	Not Detectable	140	100	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/16 11:25 (5/18 15:26)	Not Detectable	89	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/17 12:05 (5/19 13:52)	Not Detectable	1,800	1,700	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/18 12:20 (5/19 18:46)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/19 11:50 (5/21 13:32)	Not Detectable	120	180	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/20 11:40 (5/21 13:49)	Not Detectable	120	92	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/21 11:28 (5/22 12:16)	Not Detectable	71	86	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/22 10:21	Not Detectable	101	120	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/23 11:50	Not Detectable	47.1	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/24 11:42	Not Detectable	Not Detectable	172	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/25 11:43	Not Detectable	298	326	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/26 11:22	Not Detectable	84.3	113	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/27 11:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/28 11:07	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/29 10:56	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	

Results of Radionuclide Analysis of Environmental Monitoring Samples (4/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*2	Radioactivity concentration (Bq/kg)				Air dose rate (μSv/h)	Note
					^{131}I	^{134}Cs	^{137}Cs	other detected nuclides		
【2-4】(25km North)	Minami Soma city Haramachi ward Takami town	Weed	Leaf Vegetable	3/18 13:30	88,600	16,700	17,800		–	
		Weed	Leaf Vegetable	3/19 13:00	455,000	23,800	24,900		–	
		Weed	Leaf Vegetable	3/20 14:30	497,000	23,500	24,700		3.4	
		Weed	Leaf Vegetable	3/21 14:07	289,000	12,700	13,400		2.8	
		Weed	Leaf Vegetable	3/22 13:35	140,000	16,100	17,200		1.8	
		Weed	Leaf Vegetable	3/23 14:10	185,000	16,400	17,200		1.1	
		Weed	Leaf Vegetable	3/24 14:40	184,000	25,500	27,900		1.2	
		Weed	Leaf Vegetable	3/25 14:20	217,000	16,500	16,800		0.7	
		Weed	Leaf Vegetable	3/26 13:50	83,700	9,770	10,500		1.3	
		Weed	Leaf Vegetable	3/27 13:25	161,000	37,400	39,900		1.4	
		Weed	Leaf Vegetable	3/28 13:27	113,000	23,000	23,900		0.7	
		Weed	Leaf Vegetable	3/29 13:30	109,000	15,800	17,000		1.0	
		Weed	Leaf Vegetable	3/30 14:45	113,000	12,200	13,100		0.0~1.3	
		Weed	Leaf Vegetable	3/31 13:15	65,100	20,500	20,600		1.4	
		Weed	Leaf Vegetable	4/1 13:40	44,900	11,900	12,400		1.2	
		Weed	Leaf Vegetable	4/2 13:13	89,200	26,600	28,400		0.5	
		Weed	Leaf Vegetable	4/3 12:35	170,000	79,600	84,200		1.0	
		Weed	Leaf Vegetable	4/4 12:20	55,500	20,200	21,500		0.7	
		Weed	Leaf Vegetable	4/5 13:05	68,900	52,900	55,200		0.7	
		Weed	Leaf Vegetable	4/6 13:03	45,700	21,400	22,900		0.6	
		Weed	Leaf Vegetable	4/7 12:48	21,200	14,400	15,000		0.6	
		Weed	Leaf Vegetable	4/8 13:00	22,800	8,500	8,700		0.7	
		Weed	Leaf Vegetable	4/9 13:00	9,560	4,510	4,890		0.8	
		Weed	Leaf Vegetable	4/10 13:00	15,600	11,100	12,300		0.6	
		Weed	Leaf Vegetable	4/11 14:00	24,800	21,100	22,300		0.6	
		Weed	Leaf Vegetable	4/12 13:26	14,100	9,970	10,500		0.6	
		Weed	Leaf Vegetable	4/13 12:44	7,550	7,030	7,360		0.6	
		Weed	Leaf Vegetable	4/14 12:58	8,430	2,530	2,630		0.5	
		Weed	Leaf Vegetable	4/15 13:00	24,800	2,770	22,300		0.6	
		Weed	Leaf Vegetable	4/16 12:35	13,600	11,200	12,700		0.5	
		Weed	Leaf Vegetable	4/17 13:05	4,730	3,010	2,890		0.6	
		Weed	Leaf Vegetable	4/18 12:40	4,080	2,720	2,780		0.6	
		Weed	Leaf Vegetable	4/19 12:55	3,420	2,690	2,960		0.5	
		Weed	Leaf Vegetable	4/20 12:24	4,460	6,580	7,210		0.5	
		Weed	Leaf Vegetable	4/21 12:33	3,500	3,440	3,580		0.6	
		Weed	Leaf Vegetable	4/22 12:20	4,010	1,750	1,820		0.6	
		Weed	Leaf Vegetable	4/23 13:01	3,270	1,410	1,590		0.5	
		Weed	Leaf Vegetable	4/24 12:31	5,970	2,570	2,900		0.6	
		Weed	Leaf Vegetable	4/25 14:35	4,140	1,850	1,850		0.5	
		Weed	Leaf Vegetable	4/26 13:41	6,770	2,580	2,600		0.6	
		Weed	Leaf Vegetable	4/27 13:06	3,430	2,020	2,180		0.6	
		Weed	Leaf Vegetable	4/28 13:03	4,790	2,770	2,920		0.5	
		Weed	Leaf Vegetable	4/29 12:55	2,470	1,750	1,920		0.6	
		Weed	Leaf Vegetable	4/30 14:05	1,510	1,480	1,660		0.5	
		Weed	Leaf Vegetable	5/1 13:40	2,040	1,480	1,910		0.6	
		Weed	Leaf Vegetable	5/2 13:39 (5/3 18:36)	1,600	1,300	1,400		0.6	
		Weed	Leaf Vegetable	5/3 13:52 (5/4 19:02)	730	780	840		0.5	
		Weed	Leaf Vegetable	5/4 13:25 (5/5 15:14)	1,000	1,200	1,200		0.6	
		Weed	Leaf Vegetable	5/5 13:54 (5/6 18:16)	1,100	1,000	1,100		0.6	
		Weed	Leaf Vegetable	5/6 14:08 (5/8 10:44)	920	940	1,100		0.6	
		Weed	Leaf Vegetable	5/7 13:27 (5/8 15:29)	1,600	1,300	1,400	Not Detectable	0.6	
		Weed	Leaf Vegetable	5/8 13:45 (5/9 16:13)	480	680	880	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/9 12:58 (5/10 16:19)	560	850	810	Not Detectable	0.6	
		Weed	Leaf Vegetable	5/10 13:42 (5/11 17:01)	560	1,000	1,000	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/11 13:36 (5/12 15:31)	490	760	890	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/12 13:50 (5/14 15:20)	610	1,800	1,600	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/13 12:38 (5/14 15:51)	290	940	900	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/14 12:33 (5/15 13:59)	370	730	890	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/15 12:40 (5/16 17:23)	170	630	530	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/16 12:25 (5/18 15:33)	190	560	560	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/17 12:40 (5/19 13:53)	240	320	310	Not Detectable	0.4	
		Weed	Leaf Vegetable	5/18 13:10 (5/19 18:40)	160	670	520	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/19 13:33 (5/21 13:33)	420	990	1,200	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/20 14:10 (5/21 13:50)	240	510	520	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/21 12:06 (5/22 12:27)	310	1,200	1,200	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/22 13:10	144	286	288	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/23 13:25	324	461	516	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/24 12:18	391	642	666	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/25 12:10	387	473	473	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/26 12:33	282	360	495	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/27 12:45	412	795	825	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/28 12:43	352	2,290	2,360	Not Detectable	0.5	
		Weed	Leaf Vegetable	5/29 12:10	105	1,080	1,150	Not Detectable	0.4	

Results of Radionuclide Analysis of Environmental Monitoring Samples (5/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*2	Radioactivity concentration (Bq/kg)				Air dose rate (μSv/h)	Note
					^{131}I	^{134}Cs	^{137}Cs	other detected nuclides		
【2-5】 (39kmWest/South/West)	Tamura county onotown ononiimachi	Weed	Leaf Vegetable	3/18 12:35	161,000	28,900	28,300		0.9	
		Weed	Leaf Vegetable	3/19 12:15	201,000	70,400	73,800		0.7	
		Weed	Leaf Vegetable	3/20 13:50	36,900	11,500	11,700		0.6	
		Weed	Leaf Vegetable	3/21 13:40	20,300	11,300	11,200		0.4	
		Weed	Leaf Vegetable	3/22 12:40	32,000	8,100	8,120		0.5	
		Weed	Leaf Vegetable	3/23 12:50	22,300	10,100	10,300		0.5	
		Weed	Leaf Vegetable	3/24 13:18	29,700	4,900	4,900		0.4	
		Weed	Leaf Vegetable	3/25 11:39	21,800	7,550	8,040		0.4	
		Weed	Leaf Vegetable	3/26 11:50	25,800	5,100	5,150		0.6	
		Weed	Leaf Vegetable	3/27 11:10	16,600	5,310	4,970		0.5	
		Weed	Leaf Vegetable	3/28 11:25	16,700	4,270	4,550		−	
		Weed	Leaf Vegetable	3/29 11:30	16,700	3,840	3,770		0.3	
		Weed	Leaf Vegetable	3/30 11:08	10,300	6,200	6,280		0.3	
		Weed	Leaf Vegetable	3/31 11:11	9,960	6,740	6,600		0.3	
		Weed	Leaf Vegetable	4/1 10:52	9,390	5,320	5,470		0.3	
		Weed	Leaf Vegetable	4/2 10:46	6,590	3,370	3,830		0.3	
		Weed	Leaf Vegetable	4/3 10:20	5,400	3,190	3,160		0.3	
		Weed	Leaf Vegetable	4/4 10:17	4,080	3,890	4,090		0.3	
		Weed	Leaf Vegetable	4/5 10:52	5,170	3,310	3,570		0.3	
		Weed	Leaf Vegetable	4/6 10:38	4,230	2,670	2,780		0.3	
		Weed	Leaf Vegetable	4/7 10:54	2,690	2,290	2,300		0.2	
		Weed	Leaf Vegetable	4/8 10:44	933	978	962		0.2	
		Weed	Leaf Vegetable	4/9 10:53	601	421	499		0.3	
		Weed	Leaf Vegetable	4/10 10:40	637	375	420		0.2	
		Weed	Leaf Vegetable	4/11 10:44	357	291	323		0.2	
		Weed	Leaf Vegetable	4/12 10:51	695	546	446		0.2	
		Weed	Leaf Vegetable	4/13 10:30	620	526	520		0.2	
		Weed	Leaf Vegetable	4/14 10:56	336	364	383		0.2	
		Weed	Leaf Vegetable	4/15 10:57	357	452	323		0.2	
		Weed	Leaf Vegetable	4/16 10:30	165	241	194		0.3	
		Weed	Leaf Vegetable	4/17 10:32	115	209	182		0.2	
		Weed	Leaf Vegetable	4/18 10:21	171	197	146		0.2	
		Weed	Leaf Vegetable	4/19 10:54	726	211	299		0.2	
		Weed	Leaf Vegetable	4/20 10:33	362	258	200		0.2	
		Weed	Leaf Vegetable	4/21 10:45	248	163	144		0.2	
		Weed	Leaf Vegetable	4/22 10:26	279	280	285		0.2	
		Weed	Leaf Vegetable	4/23 10:48	180	217	156		0.2	
		Weed	Leaf Vegetable	4/24 10:20	118	89.5	98.5		0.2	
		Weed	Leaf Vegetable	4/25 11:20	72.2	Not Detectable	81.9		0.2	
		Weed	Leaf Vegetable	4/26 10:51	97.3	92.2	111		0.2	
		Weed	Leaf Vegetable	4/27 10:55	95.6	92.8	81.4		0.2	
		Weed	Leaf Vegetable	4/28 10:45	75.3	155	174		0.2	
		Weed	Leaf Vegetable	4/29 14:34	Not Detectable	60.7	57.5		0.2	
		Weed	Leaf Vegetable	4/30 11:05	59.3	83.8	98.8		0.2	
		Weed	Leaf Vegetable	5/1 10:45	Not Detectable	Not Detectable	77.8		0.2	
		Weed	Leaf Vegetable	5/2 11:01 (5/3 18:31)	Not Detectable	Not Detectable	Not Detectable		0.2	
		Weed	Leaf Vegetable	5/3 11:04 (5/4 19:08)	Not Detectable	200.0	210.0		0.2	
		Weed	Leaf Vegetable	5/4 10:33 (5/5 15:22)	Not Detectable	Not Detectable	Not Detectable		0.2	
		Weed	Leaf Vegetable	5/5 10:59 (5/6 18:30)	Not Detectable	300	310		0.2	
		Weed	Leaf Vegetable	5/6 10:42 (5/8 10:45)	Not Detectable	140	Not Detectable		0.2	
		Weed	Leaf Vegetable	5/7 10:42 (5/8 15:32)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/8 10:35 (5/9 16:13)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/9 10:50 (5/10 16:40)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/10 10:55 (5/11 16:21)	Not Detectable	Not Detectable	56	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/11 11:00 (5/11 15:39)	Not Detectable	130	120	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/12 10:45 (5/14 15:23)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/13 10:44 (5/14 15:55)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/14 11:20 (5/15 14:03)	Not Detectable	2,000	1,800	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/15 10:20 (5/16 17:25)	Not Detectable	Not Detectable	56	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/16 10:31 (5/18 15:41)	Not Detectable	70	93	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/17 10:34 (5/19 14:02)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/18 10:40 (5/19 18:59)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/19 10:30 (5/21 13:33)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/20 11:09 (5/21 13:51)	Not Detectable	66	65	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/21 10:26 (5/22 12:20)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/22 10:30	Not Detectable	Not Detectable	73.0	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/23 11:15	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/24 10:35	Not Detectable	Not Detectable	60.3	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/25 10:35	Not Detectable	Not Detectable	28.8	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/26 10:28	Not Detectable	27.8	42.3	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/27 10:20	Not Detectable	33.4	45.3	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/28 10:40	Not Detectable	47.4	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/29 10:36	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	

Results of Radionuclide Analysis of Environmental Monitoring Samples (6/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*2	Radioactivity concentration (Bq/kg)				Air dose rate (μSv/h)	Note
					^{131}I	^{134}Cs	^{137}Cs	other detected nuclides		
【2-6】 (43kmSouth/South/West)	Iwaki city Taira Aza Umemoto	Weed	Leaf Vegetable	3/18 13:40	468,000	10,100	10,100		–	
		Weed	Leaf Vegetable	3/19 13:15	690,000	17,400	17,400		–	
		Weed	Leaf Vegetable	3/20 15:25	548,000	17,200	17,500		0.6	
		Weed	Leaf Vegetable	3/21 15:10	115,000	2,470	2,380		1.5	
		Weed	Leaf Vegetable	3/22 13:50	448,000	29,400	18,600		0.6	
		Weed	Leaf Vegetable	3/23 14:20	451,000	19,100	30,300		1.0	
		Weed	Leaf Vegetable	3/24 15:00	454,000	6,590	6,210		1.4	
		Weed	Leaf Vegetable	3/25 13:45	170,000	6,800	6,660		1.1	
		Weed	Leaf Vegetable	3/26 13:50	291,000	11,800	12,800		1.0	
		Weed	Leaf Vegetable	3/27 12:30	126,000	6,760	7,470		0.8	
		Weed	Leaf Vegetable	3/28 12:50	71,800	4,460	4,370		0.3	
		Weed	Leaf Vegetable	3/29 13:06	132,000	8,920	9,310		0.7	
		Weed	Leaf Vegetable	3/30 12:30	121,000	9,630	10,100		0.3	
		Weed	Leaf Vegetable	3/31 12:51	81,600	4,910	4,990		0.7	
		Weed	Leaf Vegetable	4/1 12:19	166,000	7,300	7,180		0.8	
		Weed	Leaf Vegetable	4/2 12:03	99,200	3,040	2,980		1.4	
		Weed	Leaf Vegetable	4/3 11:45	35,600	3,540	3,320		0.4	
		Weed	Leaf Vegetable	4/4 11:46	110,000	13,000	13,300		0.7	
		Weed	Leaf Vegetable	4/5 12:10	46,800	4,060	4,190		0.4	
		Weed	Leaf Vegetable	4/6 12:04	37,500	5,140	5,150		0.4	
		Weed	Leaf Vegetable	4/7 12:22	15,000	1,970	1,890		0.4	
		Weed	Leaf Vegetable	4/8 12:07	11,600	2,700	2,620		0.3	
		Weed	Leaf Vegetable	4/9 12:18	10,300	2,310	2,340		0.3	
		Weed	Leaf Vegetable	4/10 12:09	18,600	3,970	4,150		0.4	
		Weed	Leaf Vegetable	4/11 12:18	12,300	2,390	2,170		0.3	
		Weed	Leaf Vegetable	4/12 12:14	10,400	3,210	3,310		0.3	
		Weed	Leaf Vegetable	4/13 12:00	9,950	1,900	1,970		0.3	
		Weed	Leaf Vegetable	4/14 12:28	7,080	1,830	1,790		0.3	
		Weed	Leaf Vegetable	4/15 12:35	12,300	1,050	2,170		0.3	
		Weed	Leaf Vegetable	4/16 11:56	12,700	3,730	4,050		0.3	
		Weed	Leaf Vegetable	4/17 12:00	2,490	1,300	1,250		0.3	
		Weed	Leaf Vegetable	4/18 11:48	3,740	1,100	1,110		0.3	
		Weed	Leaf Vegetable	4/19 12:20	1,890	687	744		0.3	
		Weed	Leaf Vegetable	4/20 12:02	2,460	678	683		0.2	
		Weed	Leaf Vegetable	4/21 12:12	2,550	749	822		0.2	
		Weed	Leaf Vegetable	4/22 11:50	1,720	553	562		0.2	
		Weed	Leaf Vegetable	4/23 12:14	1,090	418	463		0.2	
		Weed	Leaf Vegetable	4/24 11:32	1,380	656	644		0.2	
		Weed	Leaf Vegetable	4/25 12:30	975	621	580		0.2	
		Weed	Leaf Vegetable	4/26 12:31	1,030	633	667		0.2	
		Weed	Leaf Vegetable	4/27 12:27	881	758	774		0.3	
		Weed	Leaf Vegetable	4/28 12:20	589	466	428		0.2	
		Weed	Leaf Vegetable	4/29 12:10	467	531	513		0.3	
		Weed	Leaf Vegetable	4/30 12:35	234	445	369		0.2	
		Weed	Leaf Vegetable	5/1 12:19	296	472	394		0.2	
		Weed	Leaf Vegetable	5/2 12:36 (5/3 18:38)	170	480	330		0.2	
		Weed	Leaf Vegetable	5/3 12:44 (5/4 18:58)	270	370	490		0.2	
		Weed	Leaf Vegetable	5/4 12:05 (5/5 15:08)	400	550	500		0.2	
		Weed	Leaf Vegetable	5/5 12:40 (5/6 18:14)	52	510	540		0.2	
		Weed	Leaf Vegetable	5/6 12:12 (5/8 10:44)	110	410	390		0.2	
		Weed	Leaf Vegetable	5/7 12:22 (5/8 15:27)	120	270	350	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/8 12:10 (5/9 16:11)	80	340	290	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/9 12:18 (5/10 16:15)	91	490	540	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/10 12:30 (5/11 17:06)	160	270	290	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/11 12:50 (5/12 15:27)	110	350	430	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/12 12:22 (5/14 15:18)	79	240	190	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/13 12:27 (5/14 15:49)	Not Detectable	270	250	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/14 12:00 (5/15 13:57)	46	290	250	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/15 11:55 (5/16 17:20)	Not Detectable	170	170	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/16 12:07 (5/18 15:27)	Not Detectable	200	210	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/17 12:30 (5/19 13:49)	Not Detectable	150	210	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/18 12:08 (5/19 18:44)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/19 12:00 (5/21 13:31)	Not Detectable	150	220	Not Detectable	0.3	
		Weed	Leaf Vegetable	5/20 13:04 (5/21 13:48)	Not Detectable	240	190	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/21 12:08 (5/22 12:14)	Not Detectable	190	200	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/22 12:10	83.8	182	146	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/23 13:25	120	375	412	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/24 12:07	Not Detectable	195	208	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/25 12:21	89.4	274	277	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/26 12:11	77.8	708	860	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/27 12:06	33.8	180	163	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/28 12:11	Not Detectable	94.8	116	Not Detectable	0.2	
		Weed	Leaf Vegetable	5/29 11:59	Not Detectable	125	127	Not Detectable	0.2	

Results of Radionuclide Analysis of Environmental Monitoring Samples (7/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*2	Radioactivity concentration (Bq/kg)				Air dose rate (μSv/h)	Note
					^{131}I	^{134}Cs	^{137}Cs	other detected nuclides		
[2-7] (34kmWest/North/West)	Date county Kawamata town Yamakiya	Weed	Leaf Vegetable	3/25 15:07	663,000	491,000	497,000		12.0	
		Weed	Leaf Vegetable	3/26 14:03	488,000	561,000	571,000		8.8	
		Weed	Leaf Vegetable	3/27 13:44	402,000	484,000	490,000		8.7	
		Weed	Leaf Vegetable	3/28 13:39	443,000	674,000	689,000		8.4	
		Weed	Leaf Vegetable	3/29 14:50	242,000	381,000	383,000		8.0	
		Weed	Leaf Vegetable	3/30 14:00	267,000	330,000	338,000		13.9～15.4	
		Weed	Leaf Vegetable	3/31 13:40	227,000	451,000	465,000		6.9	
		Weed	Leaf Vegetable	4/1 14:23	503,000	959,000	968,000		6.5	
		Weed	Leaf Vegetable	4/2 13:30	256,000	776,000	811,000		6.5	
		Weed	Leaf Vegetable	4/3 13:22	153,000	361,000	373,000		6.0	
		Weed	Leaf Vegetable	4/4 13:24	119,000	374,000	367,000		5.8	
		Weed	Leaf Vegetable	4/5 13:40	189,000	395,000	409,000		3.0	
		Weed	Leaf Vegetable	4/6 12:57	162,000	270,000	275,000		3.0	
		Weed	Leaf Vegetable	4/7 13:02	90,000	206,000	211,000		－	
		Weed	Leaf Vegetable	4/8 13:13	50,100	169,000	173,000		2.6	
		Weed	Leaf Vegetable	4/9 12:51	18,700	36,300	37,500		2.4	
		Weed	Leaf Vegetable	4/10 12:37	33,900	110,000	113,000		2.4	
		Weed	Leaf Vegetable	4/11 12:22	4,800	17,700	17,900		2.4	
		Weed	Leaf Vegetable	4/12 12:28	36,600	128,000	129,000		3.0	
		Weed	Leaf Vegetable	4/13 12:46	21,500	90,200	97,400		2.9	
		Weed	Leaf Vegetable	4/14 12:55	26,700	160,000	166,000		2.8	
		Weed	Leaf Vegetable	4/15 12:42	4,800	130,000	17,900		2.9	
		Weed	Leaf Vegetable	4/16 12:35	22,800	85,700	92,700		2.7	
		Weed	Leaf Vegetable	4/17 12:23	15,500	75,500	80,800		2.8	
		Weed	Leaf Vegetable	4/18 12:16	12,500	62,600	66,000		2.2	
		Weed	Leaf Vegetable	4/19 14:56	2,120	35,100	36,600		2.1	
		Weed	Leaf Vegetable	4/20 12:45	12,500	101,000	105,000		2.5	
		Weed	Leaf Vegetable	4/21 13:15	12,400	93,300	98,300		2.4	
		Weed	Leaf Vegetable	4/22 12:55	5,310	53,600	56,000		2.6	
		Weed	Leaf Vegetable	4/23 12:52	4,480	62,100	63,200		2.2	
		Weed	Leaf Vegetable	4/24 13:12	724	6,570	6,760		2.2	
		Weed	Leaf Vegetable	4/25 16:00	4,750	61,100	63,200		1.5	
		Weed	Leaf Vegetable	4/26 14:15	26,900	233,000	244,000		2.2	
		Weed	Leaf Vegetable	4/27 13:28	561	9,500	9,120		2.1	
		Weed	Leaf Vegetable	4/28 13:25	3,960	57,200	56,400		2.0	
		Weed	Leaf Vegetable	4/29 12:51	2,480	43,500	45,000		2.2	
		Weed	Leaf Vegetable	4/30 13:25	4,890	112,000	118,000		2.0	
		Weed	Leaf Vegetable	5/1 13:13	1,600	15,100	15,800		2.0	
		Weed	Leaf Vegetable	5/2 12:31 (5/3 18:40)	Not Detectable	7,500	7,600		2.4	
		Weed	Leaf Vegetable	5/3 13:02 (5/4 19:11)	1,100	27,000	27,000		2.4	
		Weed	Leaf Vegetable	5/4 13:08 (5/5 15:18)	Not Detectable	6,500	6,900		2.0	
		Weed	Leaf Vegetable	5/5 13:05 (5/6 18:28)	170	2,500	2,900		2.3	
		Weed	Leaf Vegetable	5/6 13:24 (5/8 10:48)	580	18,000	20,000		2.4	
		Weed	Leaf Vegetable	5/7 13:16 (5/8 15:31)	Not Detectable	2,400	2,700	Not Detectable	2.4	
		Weed	Leaf Vegetable	5/8 13:20 (5/9 16:15)	190	3,400	3,700	Not Detectable	2.4	
		Weed	Leaf Vegetable	5/9 13:45 (5/10 16:42)	180	1,400	1,200	Not Detectable	2.6	
		Weed	Leaf Vegetable	5/10 13:29 (5/11 17:03)	Not Detectable	3,700	3,600	Not Detectable	2.9	
		Weed	Leaf Vegetable	5/11 13:15 (5/12 15:38)	180	3,000	3,200	Not Detectable	2.9	
		Weed	Leaf Vegetable	5/12 14:11 (5/14 15:22)	95	2,900	3,100	Not Detectable	2.6	
		Weed	Leaf Vegetable	5/13 13:14 (5/14 15:53)	Not Detectable	2,000	2,100	Not Detectable	2.8	
		Weed	Leaf Vegetable	5/14 14:40 (5/15 14:01)	Not Detectable	1,400	1,500	Not Detectable	2.8	
		Weed	Leaf Vegetable	5/15 13:00 (5/16 17:25)	Not Detectable	1,100	1,300	Not Detectable	2.8	
		Weed	Leaf Vegetable	5/16 13:00 (5/18 15:40)	Not Detectable	1,700	1,500	Not Detectable	2.8	
		Weed	Leaf Vegetable	5/17 13:35 (5/19 13:59)	Not Detectable	6,500	6,300	Not Detectable	2.6	
		Weed	Leaf Vegetable	5/18 14:15 (5/19 18:59)	Not Detectable	900	1,100	Not Detectable	2.9	
		Weed	Leaf Vegetable	5/19 14:13 (5/21 13:35)	Not Detectable	1,100	1,200	Not Detectable	2.6	
		Weed	Leaf Vegetable	5/20 13:53 (5/21 13:50)	Not Detectable	1,100	1,200	Not Detectable	2.5	
		Weed	Leaf Vegetable	5/21 14:01 (5/22 12:19)	Not Detectable	500	540	Not Detectable	2.7	
		Weed	Leaf Vegetable	5/22 13:55	Not Detectable	900	873	Not Detectable	2.7	
		Weed	Leaf Vegetable	5/23 13:47	Not Detectable	1,010	1,120	Not Detectable	2.8	
		Weed	Leaf Vegetable	5/24 13:33	Not Detectable	1,010	1,120	Not Detectable	2.8	
		Weed	Leaf Vegetable	5/25 13:44	Not Detectable	611	643	Not Detectable	2.5	
		Weed	Leaf Vegetable	5/26 12:25	Not Detectable	1,040	1,120	Not Detectable	2.7	
		Weed	Leaf Vegetable	5/27 12:35	Not Detectable	2,660	2,670	Not Detectable	2.7	
		Weed	Leaf Vegetable	5/28 12:08	Not Detectable	436	483	Not Detectable	2.7	
		Weed	Leaf Vegetable	5/29 11:50	Not Detectable	681	657	Not Detectable	2.6	

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (8/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*2	Radioactivity concentration (Bq/kg)				Air dose rate (μSv/h)	Note
					^{131}I	^{134}Cs	^{137}Cs	other detected nuclides		
[2-8] (50km North West)	Date city Tsukidate town	Weed	Leaf Vegetable	3/25 16:18	77,100	39,800	40,700		–	
		Weed	Leaf Vegetable	3/26 15:13	39,400	24,500	24,000		–	
		Weed	Leaf Vegetable	3/27 15:50	43,900	43,200	44,600		–	
		Weed	Leaf Vegetable	3/28 14:37	43,300	52,100	52,000		–	
		Weed	Leaf Vegetable	3/29 15:50	37,100	62,800	62,100		1.6	
		Weed	Leaf Vegetable	3/30 16:05	33,800	43,700	44,300		–	
		Weed	Leaf Vegetable	3/31 14:25	22,500	24,200	24,500		–	
		Weed	Leaf Vegetable	4/1 15:14	72,000	92,000	91,600		–	
		Weed	Leaf Vegetable	4/2 14:29	60,300	71,000	73,400		–	
		Weed	Leaf Vegetable	4/3 14:13	42,700	54,700	56,000		–	
		Weed	Leaf Vegetable	4/4 14:16	22,700	56,700	56,700		–	
		Weed	Leaf Vegetable	4/5 14:25	24,800	46,600	46,800		1.3	
		Weed	Leaf Vegetable	4/6 13:40	11,700	21,700	22,500		1.3	
		Weed	Leaf Vegetable	4/7 13:46	9,570	19,900	19,900		1.4	
		Weed	Leaf Vegetable	4/8 13:54	5,700	11,200	11,700		1.4	
		Weed	Leaf Vegetable	4/9 13:39	2,050	2,410	2,420		0.9	
		Weed	Leaf Vegetable	4/10 13:21	4,120	8,550	8,970		1.3	
		Weed	Leaf Vegetable	4/11 13:04	4,200	11,000	11,400		1.3	
		Weed	Leaf Vegetable	4/12 13:11	2,890	8,770	8,460		1.3	
		Weed	Leaf Vegetable	4/13 13:36	3,340	7,980	8,570		1.2	
		Weed	Leaf Vegetable	4/14 13:42	5,470	18,700	19,300		1.1	
		Weed	Leaf Vegetable	4/15 13:25	4,200	5,290	11,400		1.2	
		Weed	Leaf Vegetable	4/16 13:26	889	2,930	3,160		1.1	
		Weed	Leaf Vegetable	4/17 13:08	863	2,490	2,660		1.2	
		Weed	Leaf Vegetable	4/18 12:57	3,460	13,500	14,400		1.1	
		Weed	Leaf Vegetable	4/19 16:00	816	3,020	3,010		1.2	
		Weed	Leaf Vegetable	4/20 13:30	559	2,060	2,330		1.3	
		Weed	Leaf Vegetable	4/21 14:05	2,120	15,300	16,200		1.1	
		Weed	Leaf Vegetable	4/22 13:38	553	2,370	2,380		1.1	
		Weed	Leaf Vegetable	4/23 13:48	612	4,070	4,270		1.1	
		Weed	Leaf Vegetable	4/24 14:00	829	3,660	4,040		1.1	
		Weed	Leaf Vegetable	4/25 17:10	1,030	12,100	12,200		1.1	
		Weed	Leaf Vegetable	4/26 15:10	2,600	19,100	20,300		1.0	
		Weed	Leaf Vegetable	4/27 14:20	467	4,030	4,000		1.0	
		Weed	Leaf Vegetable	4/28 14:15	273	2,630	2,510		1.0	
		Weed	Leaf Vegetable	4/29 13:38	241	2,220	2,420		1.1	
		Weed	Leaf Vegetable	4/30 14:18	177	4,590	4,650		1.1	
		Weed	Leaf Vegetable	5/1 13:55	78	1,500	1,540		1.0	
		Weed	Leaf Vegetable	5/2 13:13 (5/3 18:49)	160	1,100	1,300		1.1	
		Weed	Leaf Vegetable	5/3 14:06 (5/4 19:03)	190	3,300	3,200		1.1	
		Weed	Leaf Vegetable	5/4 14:09 (5/5 15:15)	150	3,600	3,300		1.0	
		Weed	Leaf Vegetable	5/5 14:03 (5/6 18:15)	Not Detectable	850	870		1.0	
		Weed	Leaf Vegetable	5/6 14:21 (5/8 11:00)	Not Detectable	840	840		1.0	
		Weed	Leaf Vegetable	5/7 14:15 (5/8 15:30)	60	830	900	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/8 14:30 (5/9 16:14)	63	370	490	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/9 15:00 (5/10 16:41)	110	1,300	1,500	Not Detectable	1.0	
		Weed	Leaf Vegetable	5/10 14:27 (5/11 17:01)	Not Detectable	960	1,000	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/11 14:10 (5/12 15:32)	Not Detectable	590	620	Not Detectable	1.0	
		Weed	Leaf Vegetable	5/12 15:04 (5/14 15:19)	Not Detectable	610	730	Not Detectable	0.9	
		Weed	Leaf Vegetable	5/13 14:03 (5/14 15:51)	42	620	750	Not Detectable	1.0	
		Weed	Leaf Vegetable	5/14 10:20 (5/15 13:53)	Not Detectable	360	370	Not Detectable	0.9	
		Weed	Leaf Vegetable	5/15 14:06 (5/16 17:22)	Not Detectable	1,100	1,300	Not Detectable	1.0	
		Weed	Leaf Vegetable	5/16 13:50 (5/18 15:33)	Not Detectable	240	260	Not Detectable	0.9	
		Weed	Leaf Vegetable	5/17 14:25 (5/19 13:54)	Not Detectable	2,800	2,700	Not Detectable	0.9	
		Weed	Leaf Vegetable	5/18 15:20 (5/19 18:47)	Not Detectable	600	640	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/19 15:30 (5/21 13:33)	Not Detectable	270	270	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/20 14:51 (5/21 13:49)	Not Detectable	170	160	Not Detectable	1.0	
		Weed	Leaf Vegetable	5/21 15:05 (5/22 12:17)	Not Detectable	420	470	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/22 15:00	Not Detectable	133	151	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/23 14:48	Not Detectable	123	180	Not Detectable	1.3	
		Weed	Leaf Vegetable	5/24 14:36	Not Detectable	1,390	1,420	Not Detectable	1.2	
		Weed	Leaf Vegetable	5/25 14:42	Not Detectable	720	827	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/26 13:30	Not Detectable	218	241	Not Detectable	1.0	
		Weed	Leaf Vegetable	5/27 13:55	Not Detectable	2,050	2,200	Not Detectable	1.1	
		Weed	Leaf Vegetable	5/28 12:55	Not Detectable	503	402	Not Detectable	1.0	
		Weed	Leaf Vegetable	5/29 12:28	Not Detectable	70.4	97.9	Not Detectable	1.0	

Results of Radionuclide Analysis of Environmental Monitoring Samples (9/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※2	Radioactivity concentration(Bq/kg)				Air dose rate (μSv/h)	Note
					131I	134Cs	137Cs	other detected nuclides		
[2-3] (45kmWest/North-West)	Nihonmatsu city Karairo	Weed	Leaf Vegetable	3/25 11:40	73,400	231,000	235,000		–	
		Weed	Leaf Vegetable	3/26 10:13	24,300	106,000	106,000		–	
		Weed	Leaf Vegetable	3/27 10:30	73,400	224,000	230,000		–	
		Weed	Leaf Vegetable	3/28 10:13	34,800	221,000	223,000		–	
		Weed	Leaf Vegetable	3/29 11:45	34,000	158,000	160,000		–	
		Weed	Leaf Vegetable	3/30 10:35	31,800	150,000	153,000		–	
		Weed	Leaf Vegetable	3/31 10:50	17,700	127,000	131,000		–	
		Weed	Leaf Vegetable	4/1 11:03	23,800	135,000	136,000		–	
		Weed	Leaf Vegetable	4/2 10:03	35,000	206,000	217,000		–	
		Weed	Leaf Vegetable	4/3 10:05	27,500	161,000	161,000		–	
		Weed	Leaf Vegetable	4/4 10:04	21,800	170,000	170,000		–	
		Weed	Leaf Vegetable	4/5 10:35	15,800	203,000	208,000		1.9	
		Weed	Leaf Vegetable	4/6 10:13	7,870	62,900	66,100		2.3	
		Weed	Leaf Vegetable	4/7 10:10	5,230	60,000	60,300		1.7	
		Weed	Leaf Vegetable	4/8 10:24	6,630	77,600	80,600		1.7	
		Weed	Leaf Vegetable	4/9 10:16	3,580	45,200	46,800		1.4	
		Weed	Leaf Vegetable	4/10 10:00	3,010	25,000	26,500		0.7	
		Weed	Leaf Vegetable	4/11 10:05	3,470	65,200	67,000		1.7	
		Weed	Leaf Vegetable	4/12 10:15	1,670	23,300	23,500		1.7	
		Weed	Leaf Vegetable	4/13 10:07	4,180	61,000	63,800		1.1	
		Weed	Leaf Vegetable	4/14 10:11	1,140	24,200	24,800		1.8	
		Weed	Leaf Vegetable	4/15 10:25	3,470	20,600	67,000		2.5	
		Weed	Leaf Vegetable	4/16 10:05	2,400	23,300	24,900		1.5	
		Weed	Leaf Vegetable	4/17 10:05	1,940	28,400	29,600		2.0	
		Weed	Leaf Vegetable	4/18 9:56	8,750	78,800	82,300		1.8	
		Weed	Leaf Vegetable	4/19 11:18	899	13,100	13,700		1.7	
		Weed	Leaf Vegetable	4/20 9:52	380	7,130	7,370		2.1	
		Weed	Leaf Vegetable	4/21 10:26	563	16,600	16,900		1.9	
		Weed	Leaf Vegetable	4/22 10:10	1,600	42,600	44,100		2.0	
		Weed	Leaf Vegetable	4/23 10:15	524	10,500	11,400		2.1	
		Weed	Leaf Vegetable	4/24 9:54	359	9,880	9,790		2.0	
		Weed	Leaf Vegetable	4/25 11:00	732	26,500	27,000		2.1	
		Weed	Leaf Vegetable	4/26 10:25	Not Detectable	14,600	14,200		1.8	
		Weed	Leaf Vegetable	4/27 10:10	292	4,580	4,550		2.4	
		Weed	Leaf Vegetable	4/28 10:05	304	11,400	11,700		1.7	
		Weed	Leaf Vegetable	4/29 9:55	256	8,030	8,220		2.5	
		Weed	Leaf Vegetable	4/30 10:15	220	10,000	10,400		2.0	
		Weed	Leaf Vegetable	5/1 10:00	159	2,830	3,280		2.5	
		Weed	Leaf Vegetable	5/2 9:51 (5/3 18:38)	350	6,800	7,500		1.8	
		Weed	Leaf Vegetable	5/3 9:51 (5/4 18:59)	450	25,000	27,000		1.8	
		Weed	Leaf Vegetable	5/4 9:43 (5/5 15:09)	Not Detectable	3,600	3,800		2.4	
		Weed	Leaf Vegetable	5/5 9:53 (5/6 18:14)	Not Detectable	1,200	1,300		2.2	
		Weed	Leaf Vegetable	5/6 9:59 (5/8 10:46)	Not Detectable	2,200	2,400		2.1	
		Weed	Leaf Vegetable	5/7 9:57 (5/8 15:28)	Not Detectable	920	900	Not Detectable	2.1	
		Weed	Leaf Vegetable	5/8 9:55 (5/9 16:12)	Not Detectable	870	1,000	Not Detectable	1.9	
		Weed	Leaf Vegetable	5/9 10:09 (5/10 16:19)	Not Detectable	690	590	Not Detectable	1.6	
		Weed	Leaf Vegetable	5/10 9:58 (5/11 17:07)	Not Detectable	1,400	1,700	Not Detectable	1.7	
		Weed	Leaf Vegetable	5/11 10:10 (5/12 15:28)	Not Detectable	1,700	2,000	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/12 10:40 (5/14 15:19)	Not Detectable	580	660	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/13 9:57 (5/14 15:50)	Not Detectable	600	510	Not Detectable	1.7	
		Weed	Leaf Vegetable	5/14 9:45 (5/15 13:58)	Not Detectable	420	430	Not Detectable	1.9	
		Weed	Leaf Vegetable	5/15 9:45 (5/16 17:21)	Not Detectable	410	440	Not Detectable	1.9	
		Weed	Leaf Vegetable	5/16 9:50 (5/18 15:28)	Not Detectable	410	510	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/17 10:10 (5/19 13:45)	Not Detectable	580	560	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/18 10:20 (5/19 18:45)	Not Detectable	370	530	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/19 9:56 (5/21 13:32)	Not Detectable	210	170	Not Detectable	1.6	
		Weed	Leaf Vegetable	5/20 9:47 (5/21 13:49)	Not Detectable	470	480	Not Detectable	1.7	
		Weed	Leaf Vegetable	5/21 9:40 (5/22 12:16)	Not Detectable	160	170	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/22 9:46	Not Detectable	929	993	Not Detectable	1.9	
		Weed	Leaf Vegetable	5/23 9:56	Not Detectable	144	175	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/24 9:52	Not Detectable	Not Detectable	Not Detectable	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/25 9:51	Not Detectable	437	438	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/26 9:46	Not Detectable	14,700	16,600	Not Detectable	1.8	
		Weed	Leaf Vegetable	5/27 9:37	Not Detectable	7,210	7,460	Not Detectable	1.7	
		Weed	Leaf Vegetable	5/28 9:32	Not Detectable	150	153	Not Detectable	1.6	
		Weed	Leaf Vegetable	5/29 9:40	Not Detectable	212	218	Not Detectable	1.6	
[2-10] (50kmNorth)	Soma county Shinchi Town	Weed	Leaf Vegetable	3/25 16:20	29,300	12,500	12,500		–	
[4-1] (80kmSouth/West)	Sirakawa city	Weed	Leaf Vegetable	4/7 15:00	4,070	20,700	21,100		0.8	
		Weed	Leaf Vegetable	4/8 14:50	4,180	27,400	28,400		0.8	
		Weed	Leaf Vegetable	4/9 13:50	1,270	14,400	15,300		0.9	
		Weed	Leaf Vegetable	4/10 13:40	1,100	4,550	4,340		0.7	
		Weed	Leaf Vegetable	4/11 14:00	1,260	12,000	12,800		0.7	
		Weed	Leaf Vegetable	4/12 14:00	1,230	12,000	12,800		0.7	
		Weed	Leaf Vegetable	4/13 14:46	604	1,470	1,520		0.7	
		Weed	Leaf Vegetable	4/14 14:18	1,300	4,310	4,210		0.6	
		Weed	Leaf Vegetable	4/15 14:25	1,280	52,100	12,900		0.6	
		Weed	Leaf Vegetable	4/16 13:25	5,400	72,500	78,800		0.6	
		Weed	Leaf Vegetable	4/17 13:25	1,310	17,800	19,800		0.7	
		Weed	Leaf Vegetable	4/18 13:55	1,560	16,500	17,100		0.5	
		Weed	Leaf Vegetable	4/19 14:00	492	6,710	7,600		0.7	
		Weed	Leaf Vegetable	4/20 11:35	1,050	15,700	15,800		0.6	
		Weed	Leaf Vegetable	4/21 14:32	659	7,450	7,910		0.6	
		Weed	Leaf Vegetable	4/22 14:45	897	15,600	15,800		0.6	
		Weed	Leaf Vegetable	4/23 14:25	Not Detectable	4,350	4,720		0.7	
		Weed	Leaf Vegetable	4/24 13:05	Not Detectable	547	593		0.4	
[4-2] (60kmWest)	Sukagawa city Hachiman Town	Weed	Leaf Vegetable	4/7 13:10	7,020	17,200	17,000		0.4	
		Weed	Leaf Vegetable	4/8 11:50	5,520	16,300	16,100		0.4	
		Weed	Leaf Vegetable	4/9 11:40	2,390	7,650	7,930		0.4	
		Weed	Leaf Vegetable	4/10 11:20	3,180	12,600	13,000		0.4	
		Weed	Leaf Vegetable	4/11 11:40	2,830	13,000	13,600		0.3	
		Weed	Leaf Vegetable	4/12 11:50	3,100	16,300	16,800		0.4	
		Weed	Leaf Vegetable	4/13 12:12	1,640	4,350	4,550		0.4	
		Weed	Leaf Vegetable	4/14 11:48	1,800	5,280	5,340		0.3	
		Weed	Leaf Vegetable	4/15 12:00	2,830	11,600	13,600		0.3	
		Weed	Leaf Vegetable	4/16 11:15	1,830	12,700	14,100		0.3	
		Weed	Leaf Vegetable	4/17 11:25	1,500	6,680	6,950		0.3	
		Weed	Leaf Vegetable	4/18 11:45	1,310	14,300	15,000		0.3	
		Weed	Leaf Vegetable	4/19 11:50	1,430	7,700	8,110		0.3	
		Weed	Leaf Vegetable	4/20 11:30	1,050	8,600	8,410		0.3	
		Weed	Leaf Vegetable	4/21 12:30	972	11,200	11,300		0.3	
		Weed	Leaf Vegetable	4/22 12:00	1,570	21,600	21,500		0.2	
		Weed	Leaf Vegetable	4/23 11:54	687	9,100	9,560		0.3	
		Weed	Leaf Vegetable	4/24 11:10	926	10,500	10,500		0.2	

Results of Radionuclide Analysis of Environmental Monitoring Samples (10/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*2	Radioactivity concentration (Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	other detected nuclides	Air dose rate (μSv/h)	Note
【4-3】(60kmWest)	Adachi county ootama Village	Weed	Leaf Vegetable	4/7 11:10	3,090	28,000	27,900		0.7	
		Weed	Leaf Vegetable	4/8 10:35	2,970	16,800	17,900		0.9	
		Weed	Leaf Vegetable	4/9 10:20	1,410	7,870	8,440		0.8	
		Weed	Leaf Vegetable	4/10 10:20	2,700	13,400	13,800		0.8	
		Weed	Leaf Vegetable	4/11 10:20	3,150	26,700	27,900		0.9	
		Weed	Leaf Vegetable	4/12 10:30	1,030	8,860	8,920		0.8	
		Weed	Leaf Vegetable	4/13 10:46	1,660	9,780	10,700		0.7	
		Weed	Leaf Vegetable	4/14 10:22	662	1,910	2,150		0.5	
		Weed	Leaf Vegetable	4/15 10:40	3,150	19,800	27,900		0.7	
		Weed	Leaf Vegetable	4/16 10:00	2,160	6,780	7,010		0.7	
		Weed	Leaf Vegetable	4/17 10:10	623	10,400	10,300		0.7	
		Weed	Leaf Vegetable	4/18 10:10	599	4,250	4,320		0.7	
		Weed	Leaf Vegetable	4/19 10:30	625	2,240	2,410		0.7	
		Weed	Leaf Vegetable	4/20 10:10	804	8,700	9,290		0.7	
		Weed	Leaf Vegetable	4/21 10:40	1,360	19,200	18,900		0.7	
		Weed	Leaf Vegetable	4/22 10:35	1,240	16,300	17,500		0.7	
		Weed	Leaf Vegetable	4/23 10:40	327	2,360	2,580		0.6	
		Weed	Leaf Vegetable	4/24 10:00	851	9,580	9,620		0.5	
		Weed	Leaf Vegetable	4/25 11:50	233	1,040	991		0.9	
		Weed	Leaf Vegetable	4/26 11:00	441	10,000	9,810		0.9	
		Weed	Leaf Vegetable	4/27 10:46	151	950	1,050		0.8	
		Weed	Leaf Vegetable	4/28 10:38	478	8,880	9,530		0.7	
		Weed	Leaf Vegetable	4/29 10:32	291	7,390	7,180		0.7	
		Weed	Leaf Vegetable	4/30 10:55	230	4,740	4,910		0.7	
		Weed	Leaf Vegetable	5/1 10:43	427	10,600	11,400		0.7	
		Weed	Leaf Vegetable	5/2 10:16 (5/3 18:50)	Not Detectable	1,000	980		0.7	
		Weed	Leaf Vegetable	5/3 10:31 (5/4 19:13)	Not Detectable	1,400	1,500		0.7	
		Weed	Leaf Vegetable	5/4 10:24 (5/5 15:21)	150	4,100	4,100		0.7	
		Weed	Leaf Vegetable	5/5 10:32 (5/6 18:29)	Not Detectable	440	500		0.6	
		Weed	Leaf Vegetable	5/6 10:43 (5/8 10:47)	50	460	580		0.6	
		Weed	Leaf Vegetable	5/7 10:14 (5/8 15:42)	Not Detectable	870	790	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/8 10:40 (5/9 16:24)	Not Detectable	350	350	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/9 10:55 (5/10 16:41)	Not Detectable	470	530	Not Detectable	0.8	
		Weed	Leaf Vegetable	5/10 10:39 (5/11 17:04)	Not Detectable	360	410	Not Detectable	0.9	
		Weed	Leaf Vegetable	5/11 10:55 (5/12 15:33)	Not Detectable	900	990	Not Detectable	0.9	
		Weed	Leaf Vegetable	5/12 11:13 (5/14 15:23)	Not Detectable	870	950	Not Detectable	0.8	
		Weed	Leaf Vegetable	5/13 10:40 (5/14 15:54)	Not Detectable	1,600	1,700	Not Detectable	0.8	
		Weed	Leaf Vegetable	5/14 10:27 (5/15 14:02)	Not Detectable	Not Detectable	Not Detectable	Not Detectable	0.8	
		Weed	Leaf Vegetable	5/15 10:10 (5/16 17:26)	Not Detectable	97	79	Not Detectable	0.8	
		Weed	Leaf Vegetable	5/16 10:20 (5/18 15:48)	Not Detectable	Not Detectable	96	Not Detectable	0.8	
		Weed	Leaf Vegetable	5/17 10:45 (5/19 14:02)	Not Detectable	3,000	3,200	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/18 11:03 (5/19 19:00)	Not Detectable	1,800	2,200	Not Detectable	0.6	
		Weed	Leaf Vegetable	5/19 10:36 (5/21 13:45)	Not Detectable	2,500	2,800	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/20 10:30 (5/21 13:52)	Not Detectable	640	760	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/21 10:19 (5/22 12:14)	Not Detectable	2,700	2,900	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/22 10:21	Not Detectable	1,510	1,660	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/23 10:35	Not Detectable	3,420	3,450	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/24 10:35	Not Detectable	4,880	4,950	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/25 10:30	Not Detectable	2,080	2,380	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/26 10:20	Not Detectable	428	454	Not Detectable	1.6	
		Weed	Leaf Vegetable	5/27 10:10	Not Detectable	1,440	1,390	Not Detectable	0.6	
		Weed	Leaf Vegetable	5/28 10:02	Not Detectable	1,310	1,300	Not Detectable	0.7	
		Weed	Leaf Vegetable	5/29 10:06	Not Detectable	260	327	Not Detectable	0.6	
【4-4】(70kmSouth/West)	Sirakawa county Izumizaki Village	Weed	Leaf Vegetable	4/7 14:10	3,710	8,430	8,200		0.7	
		Weed	Leaf Vegetable	4/8 13:40	2,540	13,700	14,000		0.7	
		Weed	Leaf Vegetable	4/9 13:10	1,370	9,470	9,690		0.7	
		Weed	Leaf Vegetable	4/10 13:00	2,430	15,300	15,800		0.7	
		Weed	Leaf Vegetable	4/11 13:10	1,200	7,740	7,950		0.6	
		Weed	Leaf Vegetable	4/12 13:20	1,830	16,400	16,900		0.6	
		Weed	Leaf Vegetable	4/13 13:53	2,190	7,500	7,890		0.6	
		Weed	Leaf Vegetable	4/14 13:36	1,210	4,240	4,490		0.5	
		Weed	Leaf Vegetable	4/15 13:40	1,200	4,810	7,950		0.5	
		Weed	Leaf Vegetable	4/16 12:45	529	7,330	7,630		0.6	
		Weed	Leaf Vegetable	4/17 12:50	923	12,100	12,300		0.6	
		Weed	Leaf Vegetable	4/18 12:35	993	18,700	19,300		0.5	
		Weed	Leaf Vegetable	4/19 13:15	833	9,440	10,200		0.6	
		Weed	Leaf Vegetable	4/20 12:30	476	8,090	8,210		0.5	
		Weed	Leaf Vegetable	4/21 13:59	653	2,110	2,020		0.5	
		Weed	Leaf Vegetable	4/22 13:45	618	11,000	11,500		0.6	
		Weed	Leaf Vegetable	4/23 12:50	240	4,290	4,830		0.5	
		Weed	Leaf Vegetable	4/24 12:30	239	1,870	1,930		0.4	
【4-5】(80kmSouth/West)	Nishishirakawa county Saigou Village	Weed	Leaf Vegetable	4/8 15:30	1,830	13,600	14,300		0.8	
		Weed	Leaf Vegetable	4/9 14:20	422	5,070	5,210		0.8	
		Weed	Leaf Vegetable	4/10 14:10	1,180	11,000	11,300		0.8	
		Weed	Leaf Vegetable	4/11 14:40	454	4,140	4,350		0.9	
		Weed	Leaf Vegetable	4/12 14:40	751	6,920	7,300		0.7	
		Weed	Leaf Vegetable	4/13 15:36	1,210	6,920	7,160		0.7	
		Weed	Leaf Vegetable	4/14 14:54	989	7,550	7,950		0.6	
		Weed	Leaf Vegetable	4/15 15:00	454	18,400	4,350		0.7	
		Weed	Leaf Vegetable	4/16 14:00	1,270	24,100	25,200		0.8	
		Weed	Leaf Vegetable	4/17 14:00	1,290	19,300	19,400		0.9	
		Weed	Leaf Vegetable	4/18 14:30	790	14,600	14,800		0.6	
		Weed	Leaf Vegetable	4/19 14:30	378	4,070	4,180		0.7	
		Weed	Leaf Vegetable	4/20 14:05	489	11,800	12,200		0.8	
		Weed	Leaf Vegetable	4/21 14:58	371	7,050	7,020		0.5	
		Weed	Leaf Vegetable	4/22 15:10	920	13,800	14,400		0.6	
		Weed	Leaf Vegetable	4/23 15:00	1,480	34,300	36,000		0.6	
		Weed	Leaf Vegetable	4/24 13:40	Not Detectable	2,100	2,090		0.4	

The government requests Fukushima Prefecture to gain the readings above.
As a general rule, samples are measured in the state of NOT washed.
Blanks of other detected nuclides are being confirmed.
*1: These are the readings of same sample in two different state, of washed and of not washed.
*2 Radioactive decay is not taken into account from sampling to measurement for the radioactive concentration of the samples with measurement date and time in parentheses.
Air dose rate since April 5 are the readings of Environmental Radiation Level in emergency monitoring by Fukushima Pref.

The measurement published in here is being executed JCAC (Japan chemical Analysis center) and ERMCF (Environmental Radioactivity Monitoring center of Fukushima).

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (11/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*1	Radioactivity Concentration(Bq/kg)				Note
					^{131}I	^{134}Cs	^{137}Cs	Other detected nuclides	
【2-1】(36kmNorth/West)	Soma county Iitate village Yagisawa	Land Water	Pond Water	3/18 12:20	2,090	464	511		
		Land Water	Pond Water	3/19 11:36	2,450	862	940		
		Land Water	Pond Water	3/20 12:40	2,010	449	437		
		Land Water	Pond Water	3/21 12:35	1,720	240	246		
		Land Water	Pond Water	3/22 12:00	1,330	173	172		
		Land Water	Pond Water	3/23 12:25	1,260	145	145		
		Land Water	Pond Water	3/24 13:05	1,330	252	268		
		Land Water	Pond Water	3/25 12:20	1,280	481	507		
		Land Water	Pond Water	3/26 12:00	835	164	162		
		Land Water	Pond Water	3/27 11:40	828	139	145		
		Land Water	Pond Water	3/28 11:50	884	162	183		
		Land Water	Pond Water	3/29 11:50	701	154	158		
		Land Water	Pond Water	3/30 12:25	629	109	113		
		Land Water	Pond Water	3/31 11:30	610	150	192		
		Land Water	Pond Water	4/1 11:30	612	166	192		
		Land Water	Pond Water	4/2 11:23	465	133	139		
		Land Water	Pond Water	4/3 10:55	393	110	106		
		Land Water	Pond Water	4/4 10:50	439	89	75		
		Land Water	Pond Water	4/5 11:31	357	93	86		
		Land Water	Pond Water	4/6 11:23	306	92	91		
		Land Water	Pond Water	4/7 11:07	303	225	268		
		Land Water	Pond Water	4/8 11:30	290	123	123		
		Land Water	Pond Water	4/9 11:15	334	110	118		
		Land Water	Pond Water	4/10 11:20	242	105	94.7		
		Land Water	Pond Water	4/11 12:05	202	75	71.9		
		Land Water	Pond Water	4/12 11:42	218	92	95.2		
		Land Water	Pond Water	4/13 11:04	189	75	84.5		
		Land Water	Pond Water	4/14 11:15	179	110	114		
		Land Water	Pond Water	4/15 11:30	151	64	65		
		Land Water	Pond Water	4/16 10:55	122	58	38		
		Land Water	Pond Water	4/17 11:20	109	53	52		
		Land Water	Pond Water	4/18 11:05	112	40	53		
		Land Water	Pond Water	4/19 11:23	117	91	88.7		
		Land Water	Pond Water	4/20 10:52	109	53.0	43.8		
		Land Water	Pond Water	4/21 11:05	85	39.8	29.0		
		Land Water	Pond Water	4/22 10:51	68.6	41.1	39.9		
		Land Water	Pond Water	4/23 11:15	65.8	42.1	56.5		
		Land Water	Pond Water	4/24 10:55	63.8	27.9	38.0		
		Land Water	Pond Water	4/25 12:00	43.0	40.3	32.1		
		Land Water	Pond Water	4/26 11:20	36.6	64.2	57.2		
		Land Water	Pond Water	4/27 11:05	42.8	32.9	38.3		
		Land Water	Pond Water	4/28 11:00	26.0	26.4	26.7		
		Land Water	Pond Water	4/29 11:05	26.3	29.4	39.7		
		Land Water	Pond Water	4/30 11:52	36.1	118	117		
		Land Water	Pond Water	5/1 11:25	33.7	212	204		
		Land Water	Pond Water	5/2 11:19 (5/3 16:56)	24.0	25	22		
		Land Water	Pond Water	5/3 11:19 (5/4 17:26)	17	44	57		
		Land Water	Pond Water	5/4 11:10 (5/6 11:07)	16	19	29		
		Land Water	Pond Water	5/5 11:06 (5/7 9:52)	15	26	25		
		Land Water	Pond Water	5/6 11:25 (5/8 9:44)	15	19	23		
		Land Water	Pond Water	5/7 11:23	14.9	63.3	56.4	Not Detectable	
		Land Water	Pond Water	5/8 11:20	Not Detectable	86.5	102	Not Detectable	
		Land Water	Pond Water	5/11 11:40	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Water	Pond Water	5/12 11:20	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Water	Pond Water	5/13 11:00	Not Detectable	34.2	42.8	Not Detectable	
		Land Water	Pond Water	5/14 10:58	6.2	21	21	Not Detectable	
		Land Water	Pond Water	5/16 10:50 (5/17 17:34)	6.6	22	26	Not Detectable	
		Land Water	Pond Water	5/17 11:10 (5/18 17:51)	5.2	8.8	11	Not Detectable	
		Land Water	Pond Water	5/18 11:17	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Water	Pond Water	5/19 11:22	Not Detectable	14.3	19.3	Not Detectable	
		Land Water	Pond Water	5/21 10:38	Not Detectable	32.4	38.9	Not Detectable	
		Land Water	Pond Water	5/22 10:55	Not Detectable	Not Detectable	14.7	Not Detectable	
		Land Water	Pond Water	5/23 11:11	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Water	Pond Water	5/24 10:45	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Water	Pond Water	5/25 10:42	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Water	Pond Water	5/26 10:58	Not Detectable	Not Detectable	14.7	Not Detectable	
		Land Water	Pond Water	5/27 10:59	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Water	Pond Water	5/28 10:55	Not Detectable	Not Detectable	18.6	Not Detectable	
		Land Water	Pond Water	5/29 10:47	Not Detectable	19.7	18.5	Not Detectable	
【2-5】(39kmWest/South/West)	Tamura county Ono town Ononiimachi	Land Water	Rain Water	3/22 12:40	7,440	104	107		
		Land Water	Rain Water	3/25 11:38	3,000	−	800		

The government requests Fukushima Prefecture to gain the readings above.

Blanks of other detected nuclides are being confirmed.

*1 Radioactive decay is not taken into account from sampling to measurement for the radioactive concentration of the samples with measurement date and time in parentheses.

The measurement published in here is being executed JCAC(Japan Chemical Analysis Center) and ERMCF(Environmental Radioactivity Monitoring Center of Fukushima).

Results of Radionuclide Analysis of Environmental Monitoring Samples (12/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration(Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
【2-1】(36km north/west)	Soma county Iitate village Yagisawa	Land Soil	Soil	3/18 12:26	406,000	56,300	56,800						
		Land Soil	Soil	3/19 11:40	300,000	27,700	28,100						
		Land Soil	Soil	3/20 12:40	1,170,000	162,000	163,000						
		Land Soil	Soil	3/21 12:32	207,000	39,500	39,900						
		Land Soil	Soil	3/22 12:00	256,000	58,300	57,400						
		Land Soil	Soil	3/23 12:25	135,000	31,400	32,200						
		Land Soil	Soil	3/24 13:05	45,500	1,680	1,870						
		Land Soil	Soil	3/25 12:20	265,000	26,600	27,900						
		Land Soil	Soil	3/26 12:00	564,000	215,000	227,000						
		Land Soil	Soil	3/26 15:20	82,000	28,600	28,000						
		Land Soil	Soil	3/27 11:40	169,000	29,100	29,100						
		Land Soil	Soil	3/27 12:00	69,800	20,100	20,800						
		Land Soil	Soil	3/28 11:50	14,000	1,930	2,040						
		Land Soil	Soil	3/28 12:10	23,100	733	860						
		Land Soil	Soil	3/29 11:50	53,700	5,250	5,650						
		Land Soil	Soil	3/29 12:10	58,400	23,400	25,100						
		Land Soil	Soil	3/30 12:25	89,000	30,500	32,300						
		Land Soil	Soil	3/30 12:45	11,900	398	408						
		Land Soil	Soil	3/31 11:30	149,000	26,900	27,600						
		Land Soil	Soil	3/31 11:45	60,800	24,100	26,500						
		Land Soil	Soil	4/1 11:30	146,000	38,900	43,700						
		Land Soil	Soil	4/1 12:05	21,400	1,290	1,410						
		Land Soil	Soil	4/2 11:24	55,500	7,350	8,140						
		Land Soil	Soil	4/2 11:48	61,900	27,800	30,800						
		Land Soil	Soil	4/3 10:55	103,000	25,900	27,600						
		Land Soil	Soil	4/3 11:15	9,670	814	885						
		Land Soil	Soil	4/4 10:50	70,000	20,400	21,200						
		Land Soil	Soil	4/4 11:10	40,400	20,900	23,100						
		Land Soil	Soil	4/5 11:31	31,600	7,540	8,280						
		Land Soil	Soil	4/5 11:53	59,300	22,300	24,500						
		Land Soil	Soil	4/6 11:23	5,970	2,720	2,930						
		Land Soil	Soil	4/6 11:47	31,100	11,300	12,100						
		Land Soil	Soil	4/7 11:07	52,800	29,700	31,400						
		Land Soil	Soil	4/7 11:30	57,300	3,260	3,500						
		Land Soil	Soil	4/8 11:30	29,000	17,800	19,500						
		Land Soil	Soil	4/8 11:45	64,600	33,600	34,200						
		Land Soil	Soil	4/10 11:45	28,700	32,400	33,800						
		Land Soil	Soil	4/11 12:05	62,600	35,400	35,900						
		Land Soil	Soil	4/11 12:05	26,800	10,100	11,100						
		Land Soil	Soil	4/12 11:42	61,300	33,000	36,800						
		Land Soil	Soil	4/12 12:04	27,800	20,300	23,400						
		Land Soil	Soil	4/13 11:04	20,200	10,900	11,900						
		Land Soil	Soil	4/13 11:20	23,500	25,100	28,100						
		Land Soil	Soil	4/14 11:15	48,900	16,900	18,600						
		Land Soil	Soil	4/14 11:37	9,280	2,560	2,820						
		Land Soil	Soil	4/15 11:30	66,200	27,000	29,600						
		Land Soil	Soil	4/15 11:55	5,740	2,660	3,040						
		Land Soil	Soil	4/16 13:55	14,400	1,820	2,000						
		Land Soil	Soil	4/16 11:18	5,960	1,670	1,720						
		Land Soil	Soil	4/17 11:20	18,200	35,000	38,800						
		Land Soil	Soil	4/17 11:47	12,200	20,400	22,300						
		Land Soil	Soil	4/18 11:05	7,450	8,090	8,850						
		Land Soil	Soil	4/18 11:25	7,400	8,600	9,770						
		Land Soil	Soil	4/19 11:23	5,340	5,730	6,460						
		Land Soil	Soil	4/19 11:43	8,740	5,590	6,220						
		Land Soil	Soil	4/20 10:52	2,120	7,160	8,210						
		Land Soil	Soil	4/20 11:10	9,350	15,800	17,500						
		Land Soil	Soil	4/21 11:05	17,200	26,300	30,200						
		Land Soil	Soil	4/21 11:26	9,100	22,800	25,600						
		Land Soil	Soil	4/22 10:51	13,300	18,600	21,000						
		Land Soil	Soil	4/22 11:15	4,940	11,700	13,400						
		Land Soil	Soil	4/23 11:15	6,260	1,910	2,110						
		Land Soil	Soil	4/23 11:40	4,960	9,540	10,800						
		Land Soil	Soil	4/24 10:55	4,880	1,770	2,000						
		Land Soil	Soil	4/24 11:17	7,410	19,400	21,500						
		Land Soil	Soil	4/25 12:00	3,720	3,620	4,020						
		Land Soil	Soil	4/25 12:30	4,390	9,560	10,800						
		Land Soil	Soil	4/26 11:20	10,300	15,100	17,100						
		Land Soil	Soil	4/26 11:55	2,100	2,850	3,180						
		Land Soil	Soil	4/27 11:05	2,570	10,800	12,100						
		Land Soil	Soil	4/27 11:27	6,680	22,400	24,900						
		Land Soil	Soil	4/28 11:05 (4/29 16:32)	4,900	4,300	5,100						
		Land Soil	Soil	4/28 11:33 (4/29 13:17)	6,200	31,000	35,000						
		Land Soil	Soil	4/29 11:10 (4/30 14:57)	5,000	12,000	13,000						
		Land Soil	Soil	4/29 11:34 (4/30 16:59)	2,100	7,400	8,100						
		Land Soil	Soil	4/30 11:47 (5/1 14:36)	1,800	2,400	2,500						
		Land Soil	Soil	4/30 12:16 (5/1 14:37)	2,000	10,000	12,000						
		Land Soil	Soil	5/1 11:25 (5/2 17:02)	2,300	13,000	13,000						
		Land Soil	Soil	5/1 11:50 (5/2 16:57)	4,200	27,000	30,000						
		Land Soil	Soil	5/2 11:19 (5/3 18:49)	3,600	8,800	8,900						
		Land Soil	Soil	5/2 11:43 (5/3 18:56)	1,100	3,100	3,600						
		Land Soil	Soil	5/3 11:19 (5/4 19:18)	1,000	3,700	3,600						
		Land Soil	Soil	5/3 11:51 (5/4 19:19)	1,500	6,600	6,900						
		Land Soil	Soil	5/4 11:10 (5/5 15:31)	2,000	9,100	10,000						
		Land Soil	Soil	5/4 11:32 (5/5 15:32)	620	2,100	2,200						
		Land Soil	Soil	5/5 11:06 (5/6 18:27)	3,100	23,000	25,000						

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (13/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration(Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
		Land Soil	Soil	5/5 11:38 (5/6 18:18)	1,700	11,000	13,000						
		Land Soil	Soil	5/6 11:25 (5/8 10:51)	3,100	35,000	40,000						
		Land Soil	Soil	5/6 11:52 (5/8 10:50)	2,200	27,000	31,000						
		Land Soil	Soil	5/7 11:15 (5/8 15:06)	720	330	360	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/7 11:59 (5/8 15:16)	2,100	21,000	25,000	9,400	Not Detectable	250	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 11:16 (5/9 15:46)	1,900	20,000	24,000	11,000	Not Detectable	200	Not Detectable	^{110m}Ag : 150	
		Land Soil	Soil	5/8 11:40 (5/9 15:56)	770	4,600	5,400	1,900	Not Detectable	52	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 11:04 (5/10 16:18)	960	9,200	10,000	4,400	Not Detectable	85	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 11:28 (5/10 16:28)	1,300	10,000	13,000	4,500	Not Detectable	110	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 11:12 (5/11 17:02)	1,500	21,000	24,000	9,400	Not Detectable	240	Not Detectable	^{110m}Ag : 150	
		Land Soil	Soil	5/10 11:44 (5/11 16:39)	2,300	35,000	40,000	14,000	Not Detectable	270	Not Detectable	^{110m}Ag : 140	
		Land Soil	Soil	5/11 11:45 (5/12 16:18)	2,700	48,000	53,000	22,000	Not Detectable	410	Not Detectable	^{110m}Ag : 280	
		Land Soil	Soil	5/11 12:15 (5/12 16:17)	1,100	8,300	9,100	3,500	Not Detectable	79	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 11:29 (5/14 15:51)	3,900	89,000	99,000	35,000	Not Detectable	740	Not Detectable	^{110m}Ag : 520	
		Land Soil	Soil	5/12 12:08 (5/14 15:50)	2,100	39,000	42,000	18,000	Not Detectable	290	Not Detectable	^{110m}Ag : 180	
		Land Soil	Soil	5/13 10:56 (5/14 16:16)	1,300	14,000	16,000	8,200	Not Detectable	130	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 11:21 (5/14 16:09)	940	12,000	13,000	4,000	Not Detectable	77	Not Detectable	^{110m}Ag : 81	
		Land Soil	Soil	5/14 11:23 (5/15 14:26)	310	2,300	2,600	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 10:58 (5/15 14:26)	2,000	11,000	12,000	5,800	Not Detectable	100	Not Detectable	^{110m}Ag : 140	
		Land Soil	Soil	5/15 11:25 (5/16 17:40)	710	15,000	16,000	4,300	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 120	
		Land Soil	Soil	5/15 10:55 (5/16 17:41)	950	7,700	8,700	5,700	Not Detectable	88	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 11:10 (5/18 15:43)	490	4,800	5,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 10:50 (5/18 15:46)	1,000	28,000	32,000	10,000	Not Detectable	190	Not Detectable	^{110m}Ag : 160	
		Land Soil	Soil	5/17 11:30 (5/19 13:44)	900	25,000	28,000	11,000	Not Detectable	170	Not Detectable	^{110m}Ag : 130	
		Land Soil	Soil	5/17 11:10 (5/19 13:44)	950	19,000	22,000	11,000	Not Detectable	95	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 11:40 (5/19 18:23)	950	21,000	22,000	7,000	Not Detectable	130	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 11:17 (5/19 18:24)	3,200	61,000	68,000	28,000	Not Detectable	330	Not Detectable	^{110m}Ag 210	
		Land Soil	Soil	5/19 11:22 (5/20 15:55)	660	2,700	3,100	3,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 11:45 (5/20 15:55)	520	9,200	9,400	2,900	Not Detectable	83	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 11:15	495	8,920	10,200	Not Detectable	Not Detectable	74.7	Not Detectable	^{110m}Ag : 60.7	
		Land Soil	Soil	5/20 11:40	498	10,200	12,100	Not Detectable	Not Detectable	64.7	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 10:38	3,370	40,700	43,900	Not Detectable	Not Detectable	238	Not Detectable	^{110m}Ag : 294	
		Land Soil	Soil	5/21 10:58	1,020	23,700	26,800	Not Detectable	Not Detectable	139	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 10:55	349	11,700	12,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 89.1	
		Land Soil	Soil	5/22 11:15	330	5,430	5,990	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 11:11	639	15,000	16,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 102	
		Land Soil	Soil	5/23 11:36	572	22,900	26,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 10:45	297	2,670	2,960	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 11:05	722	18,300	21,000	Not Detectable	Not Detectable	91.1	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 10:42	288	12,100	14,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 90.4	
		Land Soil	Soil	5/25 11:05	683	28,200	30,500	Not Detectable	Not Detectable	115	Not Detectable	^{110m}Ag : 179	
		Land Soil	Soil	5/26 10:58	231	8,770	9,310	Not Detectable	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 74.6	
		Land Soil	Soil	5/26 11:18	723	34,300	37,000	Not Detectable	Not Detectable	154	Not Detectable	^{110m}Ag : 143	
		Land Soil	Soil	5/27 10:59	679	7,920	9,130	Not Detectable	Not Detectable	50.4	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 11:21	436	20,200	21,900	Not Detectable	Not Detectable	91.0	Not Detectable	^{110m}Ag : 110	
		Land Soil	Soil	5/28 10:55	1,300	3,200	3,610	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 11:20	508	20,700	22,800	Not Detectable	Not Detectable	83.3	Not Detectable	Not Detectable	

Results of Radionuclide Analysis of Environmental Monitoring Samples (14/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration(Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
【2-2】(45km north/west)	Date county Kawamata town	Land Soil	Soil	3/18 11:45	84,300	13,800	14,200						
		Land Soil	Soil	3/19 11:00	85,400	8,690	8,690						
		Land Soil	Soil	3/20 12:04	151,000	14,700	15,100						
		Land Soil	Soil	3/21 12:10	157,000	15,900	16,500						
		Land Soil	Soil	3/22 11:00	38,900	4,840	4,720						
		Land Soil	Soil	3/23 11:30	44,600	5,510	6,010						
		Land Soil	Soil	3/24 11:20	21,500	1,110	1,160						
		Land Soil	Soil	3/26 11:20	29,300	3,920	3,760						
		Land Soil	Soil	3/27 10:45	44,900	7,180	7,580						
		Land Soil	Soil	3/28 11:05	31,100	2,240	2,470						
		Land Soil	Soil	3/29 11:00	34,400	5,680	5,900						
		Land Soil	Soil	3/30 11:35	23,800	4,660	5,280						
		Land Soil	Soil	3/31 10:35	32,300	6,450	6,810						
		Land Soil	Soil	4/1 10:35	19,500	4,700	5,130						
		Land Soil	Soil	4/2 10:39	22,000	5,300	5,740						
		Land Soil	Soil	4/3 10:10	18,800	7,580	8,140						
		Land Soil	Soil	4/4 10:05	18,800	7,190	8,020						
		Land Soil	Soil	4/5 10:39	28,300	6,170	6,700						
		Land Soil	Soil	4/6 10:38	16,400	5,080	5,320						
		Land Soil	Soil	4/7 11:27	17,100	5,070	5,320						
		Land Soil	Soil	4/8 10:50	12,000	4,310	4,710						
		Land Soil	Soil	4/10 10:40	10,500	6,150	6,680						
		Land Soil	Soil	4/11 11:10	8,580	4,710	5,130						
		Land Soil	Soil	4/12 10:40	8,040	5,900	6,530						
		Land Soil	Soil	4/13 10:25	8,360	5,950	6,650						
		Land Soil	Soil	4/14 10:31	5,680	3,970	4,430						
		Land Soil	Soil	4/15 10:50	3,760	3,050	3,110						
		Land Soil	Soil	4/16 10:10	2,970	1,900	2,150						
		Land Soil	Soil	4/17 10:40	3,390	2,600	2,930						
		Land Soil	Soil	4/18 10:15	3,060	9,370	1,700						
		Land Soil	Soil	4/19 10:34	3,990	3,330	3,720						
		Land Soil	Soil	4/20 10:07	1,570	511	503						
		Land Soil	Soil	4/21 10:15	4,180	5,210	5,790						
		Land Soil	Soil	4/22 10:08	3,260	5,530	6,080						
		Land Soil	Soil	4/23 10:29	722	245	268						
		Land Soil	Soil	4/24 10:09	2,380	5,040	5,640						
		Land Soil	Soil	4/25 11:02	1,780	3,410	3,720						
		Land Soil	Soil	4/26 10:37	1,610	3,270	3,650						
		Land Soil	Soil	4/27 10:20	1,100	4,030	4,520						
		Land Soil	Soil	4/28 10:22 (4/29 16:35)	1,900	6,100	6,700						
		Land Soil	Soil	4/29 10:29 (4/30 16:57)	1,300	4,800	5,200						
		Land Soil	Soil	4/30 11:15 (5/1 14:35)	1,500	6,100	7,100						
		Land Soil	Soil	5/1 10:35 (5/2 17:01)	1,700	6,100	6,500						
		Land Soil	Soil	5/2 10:32 (5/3 18:54)	1,400	6,100	6,800						
		Land Soil	Soil	5/3 10:43 (5/4 19:00)	590	1,300	1,400						
		Land Soil	Soil	5/4 10:30 (5/5 15:14)	1,000	5,500	6,000						
		Land Soil	Soil	5/5 10:32 (5/6 18:16)	840	3,600	3,900						
		Land Soil	Soil	5/6 10:44 (5/8 10:51)	910	7,400	8,100						
		Land Soil	Soil	5/7 10:32 (5/8 15:03)	610	5,000	5,800	2,900	Not Detectable	55	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 10:32 (5/9 15:42)	190	770	790	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 10:22 (5/10 16:13)	170	440	530	540	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 10:46 (5/11 16:42)	580	3,300	3,800	2,000	Not Detectable	37	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 11:12 (5/12 16:14)	650	6,900	7,300	2,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 10:55 (5/14 15:30)	480	4,900	5,300	2,600	Not Detectable	50	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 10:53 (5/14 16:13)	380	2,700	3,500	1,100	Not Detectable	25	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 10:20 (5/15 14:54)	410	4,100	4,500	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/15 10:20 (5/16 17:24)	290	3,100	3,400	2,300	Not Detectable	52	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 10:10 (5/18 15:32)	180	1,300	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 10:30 (5/19 13:35)	200	3,500	4,100	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 10:35 (5/19 18:06)	190	4,000	4,400	2,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 10:40 (5/20 15:52)	150	2,000	2,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 10:30	140	729	844	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 10:05	139	2,070	2,280	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 10:13	195	3,450	3,590	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 10:31	144	2,950	3,410	Not Detectable	Not Detectable	25.8	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 10:07	219	4,850	5,250	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 10:10	181	5,050	5,320	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/26 10:16	122	4,120	4,470	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 10:18	202	6,540	7,130	Not Detectable	Not Detectable	43.8	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 10:20	56	647	734	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (15/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration (Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
【2-3】(41 km west)	Tamura city Funehiki town Funehiki	Land Soil	Soil	3/17 13:05	8,670	1,210	1,320						
		Land Soil	Soil	3/18 11:50	19,300	3,450	3,510						
		Land Soil	Soil	3/19 11:35	6,970	1,240	1,260						
		Land Soil	Soil	3/20 12:40	5,390	1,160	1,250						
		Land Soil	Soil	3/21 12:30	3,000	398	390						
		Land Soil	Soil	3/22 11:30	7,290	1,230	1,290						
		Land Soil	Soil	3/24 11:35	6,600	1,200	1,310						
		Land Soil	Soil	3/25 13:35	5,480	534	533						
		Land Soil	Soil	3/26 11:51	5,250	911	1,010						
		Land Soil	Soil	3/27 11:45	3,700	739	796						
		Land Soil	Soil	3/28 11:37	4,360	979	1,110						
		Land Soil	Soil	3/29 13:35	5,080	1,470	1,610						
		Land Soil	Soil	3/30 12:30	5,040	307	834						
		Land Soil	Soil	3/31 12:10	3,530	1,090	1,180						
		Land Soil	Soil	4/1 12:19	3,160	929	934						
		Land Soil	Soil	4/2 11:27	2,200	738	803						
		Land Soil	Soil	4/3 11:25	3,130	1,460	1,530						
		Land Soil	Soil	4/4 11:23	3,070	1,500	1,570						
		Land Soil	Soil	4/5 11:42	2,860	1,290	1,410						
		Land Soil	Soil	4/6 11:28	772	129	127						
		Land Soil	Soil	4/7 11:24	1,230	468	464						
		Land Soil	Soil	4/8 11:31	334	142	145						
		Land Soil	Soil	4/10 11:06	903	336	393						
		Land Soil	Soil	4/11 11:00	593	294	323						
		Land Soil	Soil	4/12 11:17	960	381	386						
		Land Soil	Soil	4/13 11:13	588	283	296						
		Land Soil	Soil	4/14 11:27	782	573	642						
		Land Soil	Soil	4/15 11:30	691	645	702						
		Land Soil	Soil	4/16 11:15	639	554	618						
		Land Soil	Soil	4/17 11:10	859	1,070	1,180						
		Land Soil	Soil	4/18 11:04	289	129	153						
		Land Soil	Soil	4/19 13:13	457	346	384						
		Land Soil	Soil	4/20 11:15	618	1,500	1,680						
		Land Soil	Soil	4/21 11:40	543	576	588						
		Land Soil	Soil	4/22 11:23	337	389	414						
		Land Soil	Soil	4/23 11:23	63	149	143						
		Land Soil	Soil	4/24 11:08	149	178	196						
		Land Soil	Soil	4/25 13:40	333	414	484						
		Land Soil	Soil	4/26 12:30	242	1,110	1,220						
		Land Soil	Soil	4/27 11:50	232	558	635						
		Land Soil	Soil	4/28 12:00 (4/29 12:00)	310	950	1,100						
		Land Soil	Soil	4/29 11:25 (4/30 16:55)	300	980	1,100						
		Land Soil	Soil	4/30 11:49 (5/1 14:41)	79	380	410						
		Land Soil	Soil	5/1 12:01 (5/2 17:30)	48	100	110						
		Land Soil	Soil	5/2 11:16 (5/3 19:05)	210	1,400	1,500						
		Land Soil	Soil	5/3 11:38 (5/4 18:58)	180	890	970						
		Land Soil	Soil	5/4 11:23 (5/5 15:12)	110	420	480						
		Land Soil	Soil	5/5 11:35 (5/6 18:06)	62	250	280						
		Land Soil	Soil	5/6 11:46 (5/8 11:03)	94	290	320						
		Land Soil	Soil	5/7 11:45 (5/8 15:01)	140	970	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 11:47 (5/9 15:40)	90	200	250	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 12:10 (5/10 16:11)	48	190	230	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 11:46 (5/11 16:28)	24	240	300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 11:50 (5/12 16:12)	38	130	130	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 12:37 (5/14 15:28)	43	140	160	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 11:42 (5/14 15:55)	68	720	770	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 13:10 (5/15 14:52)	70	310	280	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/15 11:20 (5/16 17:22)	67	960	1,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 11:25 (5/18 15:30)	49	1,300	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 12:05 (5/19 13:25)	55	1,100	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 12:20 (5/19 18:07)	76	1,100	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 11:50 (5/20 16:00)	40	1,400	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 11:40	Not Detectable	104	113	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 11:28	21.4	337	339	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 10:21	14.7	104	96.6	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 11:50	46.4	1,330	1,450	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 11:42	Not Detectable	1,140	1,350	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 11:43	Not Detectable	134	176	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/26 11:22	43.5	635	763	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 11:15	Not Detectable	83	105	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 11:07	Not Detectable	465	499	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	

Results of Radionuclide Analysis of Environmental Monitoring Samples (16/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*1	Radioactivity concentration(Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
[2-4] (24km north)	Minami Soma city Haramachi ward Takami town	Land Soil	Soil	3/18 13:30	22,600	3,200	3,280						
		Land Soil	Soil	3/19 13:00	35,800	3,630	4,040						
		Land Soil	Soil	3/20 14:30	35,800	4,510	4,950						
		Land Soil	Soil	3/21 14:07	83,200	7,890	8,660						
		Land Soil	Soil	3/22 13:35	21,300	4,340	4,230						
		Land Soil	Soil	3/23 14:10	16,600	1,670	1,720						
		Land Soil	Soil	3/24 14:40	14,900	1,830	1,990						
		Land Soil	Soil	3/25 14:20	2,480	176	189						
		Land Soil	Soil	3/26 13:50	15,100	2,370	2,490						
		Land Soil	Soil	3/27 13:25	10,100	1,350	1,520						
		Land Soil	Soil	3/28 13:27	7,730	1,220	1,330						
		Land Soil	Soil	3/29 13:30	9,010	2,020	2,200						
		Land Soil	Soil	3/30 14:45	14,900	3,250	3,300						
		Land Soil	Soil	3/31 13:15	7,980	2,660	2,850						
		Land Soil	Soil	4/1 13:40	10,200	2,740	2,900						
		Land Soil	Soil	4/2 13:17	8,210	2,200	2,410						
		Land Soil	Soil	4/3 12:35	4,730	1,690	1,810						
		Land Soil	Soil	4/4 12:20	14,800	4,600	4,770						
		Land Soil	Soil	4/5 13:05	2,770	591	621						
		Land Soil	Soil	4/6 13:03	1,860	445	425						
		Land Soil	Soil	4/7 12:48	1,430	445	450						
		Land Soil	Soil	4/8 13:00	1,510	1,400	1,630						
		Land Soil	Soil	4/10 13:00	4,610	2,350	2,640						
		Land Soil	Soil	4/11 14:00	1,280	340	346						
		Land Soil	Soil	4/12 13:36	4,130	2,230	2,500						
		Land Soil	Soil	4/13 12:44	1,900	1,100	1,160						
		Land Soil	Soil	4/14 13:00	658	473	567						
		Land Soil	Soil	4/15 13:07	1,720	1,650	1,730						
		Land Soil	Soil	4/16 13:35	568	339	371						
		Land Soil	Soil	4/17 13:05	649	266	274						
		Land Soil	Soil	4/18 12:40	3,540	3,350	3,690						
		Land Soil	Soil	4/19 12:55	510	288	319						
		Land Soil	Soil	4/20 12:24	347	136	170						
		Land Soil	Soil	4/21 12:33	1,020	800	923						
		Land Soil	Soil	4/22 12:20	294	310	336						
		Land Soil	Soil	4/23 13:01	845	1,320	1,500						
		Land Soil	Soil	4/24 12:31	659	951	950						
		Land Soil	Soil	4/25 14:35	698	1,000	1,060						
		Land Soil	Soil	4/26 13:41	1,270	1,590	1,790						
		Land Soil	Soil	4/27 13:06	814	1,640	1,820						
		Land Soil	Soil	4/28 13:20 (4/29 16:49)	340	880	930						
		Land Soil	Soil	4/29 13:05 (4/30 16:59)	740	3,300	3,700						
		Land Soil	Soil	4/30 13:05 (5/1 14:38)	460	1,700	1,800						
		Land Soil	Soil	5/1 13:40 (5/2 17:04)	970	2,100	2,100						
		Land Soil	Soil	5/2 13:39 (5/3 18:57)	920	3,200	3,400						
		Land Soil	Soil	5/3 13:52 (5/4 18:59)	490	1,300	1,500						
		Land Soil	Soil	5/4 13:25 (5/5 15:13)	290	1,000	1,100						
		Land Soil	Soil	5/5 13:54 (5/6 18:13)	380	510	560						
		Land Soil	Soil	5/6 14:08 (5/8 10:58)	360	2,400	2,900						
		Land Soil	Soil	5/7 13:27 (5/8 15:02)	740	6,200	6,900	2,400	Not Detectable	95	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 13:45 (5/9 15:41)	260	1,300	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 12:58 (5/10 16:12)	340	1,700	2,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 13:42 (5/11 16:30)	480	3,200	3,400	1,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 13:36 (5/12 16:13)	250	1,600	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 13:50 (5/14 15:28)	79	480	570	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 12:38 (5/14 15:56)	190	2,200	2,500	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 12:33 (5/15 14:52)	240	2,200	2,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/15 12:40 (5/16 17:22)	450	6,300	6,700	2,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 12:25 (5/18 15:30)	75	310	310	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 12:46 (5/19 13:38)	74	910	890	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 13:10 (5/19 18:08)	370	6,300	6,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 13:33 (5/20 15:51)	270	3,900	4,500	2,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 14:10	215	2,300	2,650	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 12:05	72.6	624	760	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 13:10	215	3,840	3,980	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 13:25	245	4,040	4,760	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 12:18	38.5	661	687	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 12:10	109	3,710	4,230	Not Detectable	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 76.3	
		Land Soil	Soil	5/26 12:33	187	3,890	4,180	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 12:45	45	1,110	1,280	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 12:43	69	992	1,020	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (17/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration (Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
[2-5] (39kmwest/South/west)	Tamura county Ono town Ononiimachi	Land Soil	Soil	3/17 14:05	3,210	597	683						
		Land Soil	Soil	3/18 12:30	8,170	2,130	2,260						
		Land Soil	Soil	3/19 12:15	14,100	4,370	4,630						
		Land Soil	Soil	3/20 13:50	10,300	3,050	3,020						
		Land Soil	Soil	3/21 13:40	4,830	846	910						
		Land Soil	Soil	3/22 11:40	3,220	447	466						
		Land Soil	Soil	3/23 12:50	6,430	1,570	1,590						
		Land Soil	Soil	3/24 13:18	2,830	696	747						
		Land Soil	Soil	3/25 11:39	3,000	722	800						
		Land Soil	Soil	3/26 11:50	1,510	148	159						
		Land Soil	Soil	3/27 11:10	2,140	123	158						
		Land Soil	Soil	3/28 11:25	505	43	59						
		Land Soil	Soil	3/29 11:30	2,290	155	161						
		Land Soil	Soil	3/30 11:02	2,230	811	947						
		Land Soil	Soil	3/31 11:10	1,690	312	342						
		Land Soil	Soil	4/1 10:50	1,450	271	281						
		Land Soil	Soil	4/2 10:40	1,390	541	600						
		Land Soil	Soil	4/3 10:22	1,280	544	671						
		Land Soil	Soil	4/4 10:17	791	106	139						
		Land Soil	Soil	4/5 10:48	1,410	904	1,040						
		Land Soil	Soil	4/6 10:35	650	240	240						
		Land Soil	Soil	4/7 10:49	984	572	593						
		Land Soil	Soil	4/8 10:40	1,720	1,670	1,900						
		Land Soil	Soil	4/10 10:40	926	959	1,040						
		Land Soil	Soil	4/11 10:44	316	235	238						
		Land Soil	Soil	4/12 10:51	546	359	396						
		Land Soil	Soil	4/13 10:30	416	403	429						
		Land Soil	Soil	4/14 10:56	637	839	939						
		Land Soil	Soil	4/15 10:57	695	1,030	1,050						
		Land Soil	Soil	4/16 10:30	230	2,550	268						
		Land Soil	Soil	4/17 10:32	225	215	223						
		Land Soil	Soil	4/18 10:21	271	257	300						
		Land Soil	Soil	4/19 10:54	340	480	516						
		Land Soil	Soil	4/20 10:33	143	274	279						
		Land Soil	Soil	4/21 10:45	307	614	679						
		Land Soil	Soil	4/22 10:26	98.3	67.7	70.2						
		Land Soil	Soil	4/23 10:42	289	909	1,020						
		Land Soil	Soil	4/24 10:13	275	778	892						
		Land Soil	Soil	4/25 11:13	189	698	744						
		Land Soil	Soil	4/26 10:51	217	728	835						
		Land Soil	Soil	4/27 10:55	136	399	451						
		Land Soil	Soil	4/28 10:39 (4/29 16:50)	120	580	620						
		Land Soil	Soil	4/29 10:28 (4/30 17:00)	110	660	750						
		Land Soil	Soil	4/30 11:09 (5/1 14:37)	120	560	590						
		Land Soil	Soil	5/1 10:55 (5/2 17:05)	130	760	910						
		Land Soil	Soil	5/2 11:01 (5/3 18:58)	46	300	320						
		Land Soil	Soil	5/3 11:04 (5/4 19:18)	49	450	520						
		Land Soil	Soil	5/4 10:33 (5/5 15:31)	42	280	250						
		Land Soil	Soil	5/5 10:59 (5/6 18:23)	52	480	570						
		Land Soil	Soil	5/6 10:42 (5/8 10:59)	120	1,000	1,100						
		Land Soil	Soil	5/7 10:42 (5/8 15:05)	77	610	690	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 10:35 (5/9 15:45)	68	870	970	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 10:50 (5/10 16:17)	71	1,200	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 10:55 (5/11 16:38)	79	1,100	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 11:00 (5/12 16:16)	77	1,300	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 10:45 (5/14 15:32)	30	200	310	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 10:44 (5/14 16:15)	30	510	590	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 11:20 (5/15 14:25)	60	460	530	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/15 10:20 (5/16 17:25)	42	620	740	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 10:31 (5/18 15:33)	28	510	610	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 10:34 (5/19 13:47)	34	760	930	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 10:43 (5/19 18:07)	Not Detectable	220	280	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 10:30 (5/20 15:47)	39	1,000	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 11:08	Not Detectable	19.5	27.7	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 10:26	26.5	780	860	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 10:30	26.5	489	549	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 11:13	Not Detectable	1,160	1,280	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 10:33	Not Detectable	915	1,040	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 10:31	Not Detectable	826	949	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/26 10:28	Not Detectable	1,250	1,530	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 10:20	20	298	342	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 10:37	Not Detectable	1,410	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	

Results of Radionuclide Analysis of Environmental Monitoring Samples (18/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration (Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
【2-6】 (43kmSouth/South/west)	Iwaki city Taira Aza Umemoto	Land Soil	Soil	3/18 13:46	3,000	36.3	61.2						
		Land Soil	Soil	3/19 13:15	12,600	279	288						
		Land Soil	Soil	3/20 15:17	14,600	412	460						
		Land Soil	Soil	3/21 15:10	30,700	1,160	1,220						
		Land Soil	Soil	3/22 13:50	1,960	36	23						
		Land Soil	Soil	3/23 14:20	32,600	817	840						
		Land Soil	Soil	3/24 15:00	27,100	893	951						
		Land Soil	Soil	3/25 13:45	23,900	497	519						
		Land Soil	Soil	3/26 13:50	41,100	842	875						
		Land Soil	Soil	3/27 12:30	25,100	789	849						
		Land Soil	Soil	3/28 12:50	11,500	431	465						
		Land Soil	Soil	3/29 13:05	15,700	555	617						
		Land Soil	Soil	3/30 12:30	1,420	Not Detectable	Not Detectable						
		Land Soil	Soil	3/31 12:51	8,370	130	150						
		Land Soil	Soil	4/1 12:17	1,540	45	50						
		Land Soil	Soil	4/2 12:04	12,600	460	540						
		Land Soil	Soil	4/3 11:45	1,400	51	56						
		Land Soil	Soil	4/4 11:46	2,070	17	24						
		Land Soil	Soil	4/5 12:10	1,280	24	21						
		Land Soil	Soil	4/6 12:04	993	35	37						
		Land Soil	Soil	4/7 12:11	4,210	323	329						
		Land Soil	Soil	4/8 12:03	14,700	1,500	1,700						
		Land Soil	Soil	4/10 12:09	8,240	994	1,230						
		Land Soil	Soil	4/11 12:18	1,670	170	174						
		Land Soil	Soil	4/12 12:14	5,950	899	945						
		Land Soil	Soil	4/13 12:00	5,430	658	699						
		Land Soil	Soil	4/14 12:28	6,130	683	684						
		Land Soil	Soil	4/15 12:35	614	94	114						
		Land Soil	Soil	4/16 11:56	1,530	256	305						
		Land Soil	Soil	4/17 12:00	5,110	1,670	1,810						
		Land Soil	Soil	4/18 11:48	7,280	1,620	1,700						
		Land Soil	Soil	4/19 12:20	5,490	1,780	1,960						
		Land Soil	Soil	4/20 12:02	4,660	1,430	1,570						
		Land Soil	Soil	4/21 12:12	2,540	593	621						
		Land Soil	Soil	4/22 11:50	2,780	1,330	1,460						
		Land Soil	Soil	4/23 12:40	1,510	519	540						
		Land Soil	Soil	4/25 12:35	2,080	944	1,010						
		Land Soil	Soil	4/26 12:31	1,470	897	1,040						
		Land Soil	Soil	4/27 12:30	1,370	652	752						
		Land Soil	Soil	4/29 12:00 (4/30 17:01)	1,200	930	1,000						
		Land Soil	Soil	4/30 12:43 (5/1 14:39)	1,400	1,400	1,600						
		Land Soil	Soil	5/1 12:26 (5/2 17:06)	1,200	1,200	1,500						
		Land Soil	Soil	5/2 12:36 (5/3 18:59)	1,000	1,000	1,100						
		Land Soil	Soil	5/3 12:44 (5/4 18:57)	1,200	1,300	1,400						
		Land Soil	Soil	5/4 12:05 (5/5 15:11)	1,000	1,200	1,400						
		Land Soil	Soil	5/5 12:40 (5/6 18:10)	680	980	1,100						
		Land Soil	Soil	5/6 12:12 (5/8 10:59)	690	1,100	1,200						
		Land Soil	Soil	5/7 12:22 (5/8 15:00)	980	1,500	1,700	3,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 12:10 (5/9 15:39)	600	780	960	1,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 12:18 (5/10 16:09)	390	810	890	1,800	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 12:30 (5/11 16:28)	760	1,900	2,200	2,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 12:50 (5/12 16:10)	660	2,100	2,200	2,900	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 12:22 (5/14 15:26)	530	1,600	1,800	3,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 12:27 (5/14 15:54)	77	200	240	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 12:00 (5/15 14:27)	170	650	700	2,000	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 41	
		Land Soil	Soil	5/15 11:55 (5/16 17:21)	18	46	55	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 12:07 (5/18 15:28)	130	370	390	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 12:30 (5/19 13:00)	250	1,200	1,400	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 12:08 (5/19 18:06)	400	1,600	2,000	2,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 12:00 (5/20 15:36)	340	1,600	1,800	3,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 13:05	339	1,420	1,590	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 12:06	198	978	1,060	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 12:10	75.5	156	167	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 13:22	241	959	1,140	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 12:10	190	1,160	1,350	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 12:23	225	1,610	1,850	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/26 12:11	231	1,600	1,840	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 12:06	230	2,160	2,380	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 12:08	77	702	786	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	

Results of Radionuclide Analysis of Environmental Monitoring Samples (19/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration(Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	Note
【2-7】 (34kmwest/north/west)	Date county Kawamata town Yamakiya	Land Soil	Soil	3/25 15:05	112,000	20,000	21,600						
		Land Soil	Soil	3/26 13:59	100,000	20,400	21,900						
		Land Soil	Soil	3/27 13:47	50,800	7,310	7,350						
		Land Soil	Soil	3/28 13:39	39,800	3,990	4,330						
		Land Soil	Soil	3/29 14:50	61,800	22,300	23,400						
		Land Soil	Soil	3/30 14:00	42,600	7,060	7,750						
		Land Soil	Soil	3/31 13:40	14,700	920	949						
		Land Soil	Soil	4/1 14:22	26,400	3,810	3,900						
		Land Soil	Soil	4/2 13:28	19,400	5,030	5,340						
		Land Soil	Soil	4/3 13:20	43,000	21,600	22,000						
		Land Soil	Soil	4/4 13:23	65,900	37,000	38,500						
		Land Soil	Soil	4/5 13:40	39,300	14,700	16,300						
		Land Soil	Soil	4/6 12:57	30,600	18,600	19,800						
		Land Soil	Soil	4/7 13:02	38,300	22,200	22,300						
		Land Soil	Soil	4/8 13:08	37,300	21,100	23,300						
		Land Soil	Soil	4/10 12:37	9,550	6,880	7,200						
		Land Soil	Soil	4/11 12:22	11,400	3,220	3,720						
		Land Soil	Soil	4/12 12:28	11,000	6,870	7,600						
		Land Soil	Soil	4/13 12:46	6,990	1,380	1,510						
		Land Soil	Soil	4/14 12:55	14,400	19,500	22,200						
		Land Soil	Soil	4/15 12:42	7,110	4,500	4,770						
		Land Soil	Soil	4/16 12:35	7,320	14,400	14,500						
		Land Soil	Soil	4/17 12:23	18,500	27,300	30,400						
		Land Soil	Soil	4/18 12:16	7,160	9,370	10,300						
		Land Soil	Soil	4/19 14:56	5,120	11,200	11,800						
		Land Soil	Soil	4/20 12:45	7,380	9,450	10,600						
		Land Soil	Soil	4/21 13:15	3,710	17,700	20,200						
		Land Soil	Soil	4/22 12:55	8,680	20,100	21,800						
		Land Soil	Soil	4/23 12:52	9,260	19,800	22,200						
		Land Soil	Soil	4/24 13:12	3,140	3,930	4,590						
		Land Soil	Soil	4/25 16:00	8,690	20,100	22,400						
		Land Soil	Soil	4/26 14:15	4,810	11,800	12,800						
		Land Soil	Soil	4/27 13:28	4,730	21,600	22,700						
		Land Soil	Soil	4/28 13:28 (4/29 13:28)	960	1,400	1,400						
		Land Soil	Soil	4/29 12:51 (4/30 16:55)	3,800	23,000	24,000						
		Land Soil	Soil	4/30 12:51 (5/1 14:42)	2,000	4,700	5,300						
		Land Soil	Soil	5/1 13:16 (5/2 17:31)	2,700	8,000	8,600						
		Land Soil	Soil	5/2 12:31 (5/3 19:07)	950	3,200	3,400						
		Land Soil	Soil	5/3 13:02 (5/4 19:17)	4,000	29,000	31,000						
		Land Soil	Soil	5/4 13:08 (5/5 15:30)	1,900	13,000	15,000						
		Land Soil	Soil	5/5 13:05 (5/6 18:17)	1,100	7,500	8,500						
		Land Soil	Soil	5/6 13:24 (5/8 11:04)	2,000	19,000	21,000						
		Land Soil	Soil	5/7 13:16 (5/8 15:04)	1,900	20,000	24,000	9,200	Not Detectable	180	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 13:20 (5/9 15:43)	1,900	18,000	21,000	7,000	Not Detectable	200	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 13:45 (5/10 16:14)	2,100	22,000	25,000	7,900	Not Detectable	210	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 13:29 (5/11 16:34)	830	1,600	1,800	1,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 13:15 (5/12 16:15)	470	3,000	3,200	1,900	Not Detectable	36	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 14:11 (5/14 15:30)	190	1,000	1,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 13:14 (5/14 16:14)	970	13,000	14,000	5,600	Not Detectable	110	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 14:40 (5/15 14:55)	800	5,400	6,100	2,600	Not Detectable	50	Not Detectable	Not Detectable	
		Land Soil	Soil	5/15 13:00 (5/16 17:24)	1,600	24,000	28,000	11,000	Not Detectable	260	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 13:00 (5/18 15:32)	730	20,000	22,000	7,700	Not Detectable	140	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 13:35 (5/19 13:36)	440	9,700	11,000	3,900	Not Detectable	80	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 14:15 (5/19 18:06)	320	7,500	8,100	3,600	Not Detectable	49	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 14:13 (5/20 15:53)	1,200	27,000	30,000	12,000	Not Detectable	150	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 13:53	455	5,520	5,780	Not Detectable	Not Detectable	36.6	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 14:01	985	18,000	19,600	Not Detectable	Not Detectable	112	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 13:55	264	7,150	7,720	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 13:47	245	5,320	5,630	Not Detectable	Not Detectable	32.8	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 13:33	429	20,500	23,300	Not Detectable	Not Detectable	114	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 13:43	244	8,120	9,500	Not Detectable	Not Detectable	39.4	Not Detectable	Not Detectable	
		Land Soil	Soil	5/26 12:25	443	15,200	17,200	Not Detectable	Not Detectable	71.7	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 12:35	395	9,820	11,200	Not Detectable	Not Detectable	52.3	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 12:08	557	16,900	19,800	Not Detectable	Not Detectable	75.4	Not Detectable	Not Detectable	

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (20/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration(Bq/kg) ^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	Note
【2-8】(50kmNorth/west)	Date city Tsukidate town	Land Soil	Soil	3/24 12:10	41,200	6,180	6,850						
		Land Soil	Soil	3/25 16:15	20,800	3,570	3,790						
		Land Soil	Soil	3/26 15:13	16,000	3,820	3,740						
		Land Soil	Soil	3/27 14:54	16,900	2,820	3,070						
		Land Soil	Soil	3/28 14:34	22,300	4,910	5,320						
		Land Soil	Soil	3/29 15:50	25,700	5,340	5,800						
		Land Soil	Soil	3/30 16:05	20,500	3,240	3,360						
		Land Soil	Soil	3/31 14:25	27,200	6,040	6,740						
		Land Soil	Soil	4/1 15:12	27,000	5,970	6,030						
		Land Soil	Soil	4/2 14:27	21,100	5,750	6,100						
		Land Soil	Soil	4/3 14:11	25,800	8,250	8,510						
		Land Soil	Soil	4/4 14:15	8,270	2,580	2,640						
		Land Soil	Soil	4/5 14:25	18,900	6,570	7,180						
		Land Soil	Soil	4/6 13:40	3,870	464	494						
		Land Soil	Soil	4/7 13:46	2,730	377	400						
		Land Soil	Soil	4/8 13:56	9,980	3,850	4,360						
		Land Soil	Soil	4/10 13:21	2,510	406	452						
		Land Soil	Soil	4/11 13:04	2,290	486	560						
		Land Soil	Soil	4/12 13:11	8,940	4,370	4,840						
		Land Soil	Soil	4/13 13:36	8,250	6,290	7,160						
		Land Soil	Soil	4/14 13:35	8,800	8,000	7,160						
		Land Soil	Soil	4/15 13:25	4,110	1,500	8,900						
		Land Soil	Soil	4/16 13:26	8,750	8,000	1,600						
		Land Soil	Soil	4/17 13:08	4,430	3,710	8,920						
		Land Soil	Soil	4/18 12:57	2,170	1,770	4,020						
		Land Soil	Soil	4/19 16:00	3,520	4,850	2,010						
		Land Soil	Soil	4/20 13:30	1,310	1,000	1,180						
		Land Soil	Soil	4/21 14:05	2,430	3,620	4,170						
		Land Soil	Soil	4/22 13:38	2,580	4,500	5,080						
		Land Soil	Soil	4/23 13:48	2,530	4,510	5,110						
		Land Soil	Soil	4/24 14:00	2,090	4,120	4,740						
		Land Soil	Soil	4/25 17:10	1,870	1,640	1,850						
		Land Soil	Soil	4/26 15:10	1,910	3,420	3,840						
		Land Soil	Soil	4/27 14:20	2,350	6,210	7,040						
		Land Soil	Soil	4/28 14:20 (4/29 14:20)	1,100	2,300	2,500						
		Land Soil	Soil	4/29 13:38 (4/30 13:38)	1,500	2,600	3,000						
		Land Soil	Soil	4/30 14:15 (5/1 14:53)	1,100	2,100	2,400						
		Land Soil	Soil	5/1 14:01 (5/2 17:26)	640	1,700	2,000						
		Land Soil	Soil	5/2 13:13 (5/3 19:06)	1,200	3,000	3,500						
		Land Soil	Soil	5/3 14:06 (5/4 18:58)	870	1,900	2,100						
		Land Soil	Soil	5/4 14:09 (5/5 15:12)	1,200	2,400	2,800						
		Land Soil	Soil	5/5 14:03 (5/6 18:15)	630	1,700	1,700						
		Land Soil	Soil	5/6 14:21 (5/8 11:05)	940	3,200	3,900						
		Land Soil	Soil	5/7 14:15 (5/8 15:01)	780	3,700	4,000	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 14:30 (5/9 15:40)	460	810	880	820	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 15:00 (5/10 16:11)	440	1,900	2,000	1,100	Not Detectable	30	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 14:27 (5/11 16:30)	470	3,600	4,400	1,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 14:10 (5/12 16:12)	450	1,700	2,000	950	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 15:04 (5/14 15:22)	150	500	600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 14:03 (5/14 16:21)	570	5,000	5,600	2,900	Not Detectable	42	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 10:20 (5/15 14:53)	100	490	540	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/15 14:06 (5/16 17:17)	410	4,500	4,900	2,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 13:50 (5/18 15:30)	320	4,500	5,100	1,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 14:25 (5/19 13:33)	440	4,000	4,900	2,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 15:20 (5/19 18:03)	74	420	490	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 15:30 (5/20 15:52)	95	1,800	2,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 14:51	303	4,020	4,410	Not Detectable	Not Detectable	29.5	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 15:05	71.3	785	770	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 15:00	206	3,670	4,240	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 14:48	39.8	394	425	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 14:36	295	6,800	7,630	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 14:42	167	4,020	4,820	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/26 13:30	202	6,060	6,700	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 13:55	182	5,430	6,180	Not Detectable	Not Detectable	32.8	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 12:55	179	6,520	7,420	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (21/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*1	Radioactivity concentration(Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
[2-9] (45km west/north/west)	Nihonmatsu city Kanairo	Land Soil	Soil	3/26 10:14	39,000	16,700	16,900						
		Land Soil	Soil	3/27 10:26	49,300	21,700	22,700						
		Land Soil	Soil	3/28 10:13	34,100	14,200	15,700						
		Land Soil	Soil	3/29 11:45	36,400	20,000	21,100						
		Land Soil	Soil	3/30 10:35	24,000	13,600	14,800						
		Land Soil	Soil	3/31 10:50	24,400	12,900	14,200						
		Land Soil	Soil	4/1 11:05	17,800	10,300	10,500						
		Land Soil	Soil	4/2 10:05	12,700	4,610	5,010						
		Land Soil	Soil	4/3 10:04	21,100	14,500	15,500						
		Land Soil	Soil	4/4 10:02	20,300	18,100	19,200						
		Land Soil	Soil	4/5 10:35	17,800	14,600	15,800						
		Land Soil	Soil	4/6 10:13	12,000	7,750	8,000						
		Land Soil	Soil	4/7 10:10	3,990	1,150	1,190						
		Land Soil	Soil	4/8 10:20	15,900	14,700	16,300						
		Land Soil	Soil	4/10 10:00	13,400	15,400	16,900						
		Land Soil	Soil	4/11 10:05	4,230	2,900	3,200						
		Land Soil	Soil	4/12 10:15	8,530	9,760	10,500						
		Land Soil	Soil	4/13 10:07	6,580	8,320	8,860						
		Land Soil	Soil	4/14 10:08	7,800	13,200	14,700						
		Land Soil	Soil	4/15 10:25	10,100	20,900	22,700						
		Land Soil	Soil	4/16 10:05	5,560	7,200	7,860						
		Land Soil	Soil	4/17 10:05	12,000	26,700	29,800						
		Land Soil	Soil	4/18 9:56	1,790	1,890	2,020						
		Land Soil	Soil	4/19 11:18	3,190	5,820	6,430						
		Land Soil	Soil	4/20 9:52	2,630	5,040	5,860						
		Land Soil	Soil	4/21 10:30	1,860	5,460	6,040						
		Land Soil	Soil	4/22 10:10	2,820	8,170	9,050						
		Land Soil	Soil	4/23 10:15	2,700	7,500	8,290						
		Land Soil	Soil	4/24 9:54	1,540	3,040	3,280						
		Land Soil	Soil	4/25 11:00	3,010	11,000	12,400						
		Land Soil	Soil	4/26 10:25	1,400	4,560	5,200						
		Land Soil	Soil	4/27 10:10	3,930	21,100	22,300						
		Land Soil	Soil	4/28 10:00 (4/29 10:00)	560	1,500	1,500						
		Land Soil	Soil	4/29 9:47 (4/30 17:12)	1,600	9,300	11,000						
		Land Soil	Soil	4/30 10:06 (5/1 14:40)	820	3,300	3,800						
		Land Soil	Soil	5/1 10:16 (5/2 17:07)	610	1,500	1,700						
		Land Soil	Soil	5/2 9:51 (5/3 19:04)	720	3,000	3,300						
		Land Soil	Soil	5/3 9:51 (5/4 18:58)	2,000	20,000	22,000						
		Land Soil	Soil	5/4 9:43 (5/5 15:11)	980	12,000	13,000						
		Land Soil	Soil	5/5 9:53 (5/6 18:11)	920	8,200	9,000						
		Land Soil	Soil	5/6 9:59 (5/8 11:00)	1,300	16,000	18,000						
		Land Soil	Soil	5/7 9:57 (5/8 15:01)	610	5,800	6,500	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 9:55 (5/9 15:39)	1,200	16,000	18,000	6,400	Not Detectable	220	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 10:09 (5/10 16:10)	930	17,000	19,000	5,200	Not Detectable	160	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 9:58 (5/11 16:28)	490	5,700	6,800	2,700	Not Detectable	45	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 10:10 (5/12 16:11)	940	22,000	25,000	7,300	Not Detectable	200	Not Detectable	^{110m}Ag : 130	
		Land Soil	Soil	5/12 10:40 (5/14 15:26)	640	13,000	14,000	3,700	Not Detectable	78	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 9:57 (5/14 15:55)	390	9,300	11,000	2,900	Not Detectable	74	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 9:45 (5/15 14:51)	460	12,000	14,000	4,600	Not Detectable	160	Not Detectable	Not Detectable	
		Land Soil	Soil	5/15 9:45 (5/16 17:20)	270	6,500	7,000	2,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 9:50 (5/18 15:29)	500	16,000	18,000	5,800	Not Detectable	160	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 10:10 (5/19 13:13)	240	9,200	10,000	3,900	Not Detectable	57	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 10:20 (5/19 18:07)	510	16,000	17,000	5,400	Not Detectable	110	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 9:55 (5/20 15:36)	200	6,900	7,700	2,100	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 9:47	305	6,200	7,190	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 9:40	236	5,500	5,890	Not Detectable	Not Detectable	39.3	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 9:45	314	6,940	7,480	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 9:55	196	8,100	8,790	Not Detectable	Not Detectable	57.0	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 9:52	264	15,100	16,800	Not Detectable	Not Detectable	97.3	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 9:51	478	28,700	31,500	Not Detectable	Not Detectable	158	Not Detectable	Not Detectable	
		Land Soil	Soil	5/26 9:46	255	16,400	19,300	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 9:37	38	663	816	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 9:32	90	4,590	5,320	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
[2-10] (50km north)	Soma county Shinchi town	Land Soil	Soil	3/25 16:20	2,690	203	213						
[4-1] (80km South/west)	Sirakawa city	Land Soil	Soil	4/7 15:00	1,850	1,580	1,660						
		Land Soil	Soil	4/8 14:50	1,630	1,440	1,520						
		Land Soil	Soil	4/10 13:40	2,050	2,520	2,630						
		Land Soil	Soil	4/11 14:00	1,220	1,300	1,320						
		Land Soil	Soil	4/12 14:00	1,670	2,100	2,420						
		Land Soil	Soil	4/13 14:46	2,650	5,350	5,580						
		Land Soil	Soil	4/14 14:18	647	1,130	1,090						
		Land Soil	Soil	4/15 14:25	636	687	820						
		Land Soil	Soil	4/16 13:25	1,500	3,430	3,550						
		Land Soil	Soil	4/17 13:25	3,010	6,150	6,630						
		Land Soil	Soil	4/18 13:55	1,570	3,500	3,840						
		Land Soil	Soil	4/19 14:00	829	2,110	2,210						
		Land Soil	Soil	4/20 13:35	933	3,150	3,450						
		Land Soil	Soil	4/21 14:32	694	2,400	2,550						
		Land Soil	Soil	4/22 14:45	825	2,170	2,320						
		Land Soil	Soil	4/23 14:25	698	2,330	2,560						
		Land Soil	Soil	4/24 13:05	607	2,680	2,930						

Attachment V-13-4-(3)

Results of Radionuclide Analysis of Environmental Monitoring Samples (22/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)※1	Radioactivity concentration(Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
【4-2】(60kmwest)	Sukagawa city Hachiman town	Land Soil	Soil	4/7 13:10	1,450	1,630	1,600						
		Land Soil	Soil	4/8 11:50	1,090	869	925						
		Land Soil	Soil	4/10 11:20	989	1,120	1,280						
		Land Soil	Soil	4/11 11:40	1,280	1,720	1,820						
		Land Soil	Soil	4/12 11:50	1,020	1,590	1,760						
		Land Soil	Soil	4/13 12:12	329	268	321						
		Land Soil	Soil	4/14 11:47	1,080	1,790	1,830						
		Land Soil	Soil	4/15 12:00	1,120	1,850	1,950						
		Land Soil	Soil	4/16 11:15	736	1,280	1,370						
		Land Soil	Soil	4/17 11:25	702	1,580	1,730						
		Land Soil	Soil	4/18 11:45	487	1,110	1,190						
		Land Soil	Soil	4/19 11:50	353	624	675						
		Land Soil	Soil	4/20 11:30	298	650	736						
		Land Soil	Soil	4/21 12:30	314	845	911						
		Land Soil	Soil	4/22 12:00	411	1,270	1,410						
		Land Soil	Soil	4/23 11:55	312	896	1,050						
		Land Soil	Soil	4/24 11:10	249	1,030	1,160						
【4-3】(60kmwest)	Adachi county Ootama Village	Land Soil	Soil	4/7 11:10	3,770	3,200	3,310						
		Land Soil	Soil	4/8 10:35	4,460	4,780	5,070						
		Land Soil	Soil	4/10 10:20	5,100	5,670	6,220						
		Land Soil	Soil	4/11 10:20	3,250	4,240	4,700						
		Land Soil	Soil	4/12 10:30	2,220	3,050	3,430						
		Land Soil	Soil	4/13 10:46	2,020	2,980	3,210						
		Land Soil	Soil	4/14 10:22	6,050	5,100	5,640						
		Land Soil	Soil	4/15 10:40	545	363	466						
		Land Soil	Soil	4/16 10:00	2,630	1,250	1,330						
		Land Soil	Soil	4/17 10:10	1,160	647	717						
		Land Soil	Soil	4/18 10:10	1,800	1,770	1,960						
		Land Soil	Soil	4/19 10:30	309	402	480						
		Land Soil	Soil	4/20 10:10	3,140	4,270	4,740						
		Land Soil	Soil	4/21 10:40	3,640	6,210	7,080						
		Land Soil	Soil	4/22 10:33	4,970	9,270	9,910						
		Land Soil	Soil	4/23 10:40	2,900	5,670	6,210						
		Land Soil	Soil	4/24 10:00	3,060	6,680	7,360						
		Land Soil	Soil	4/25 11:50	1,760	4,090	4,560						
		Land Soil	Soil	4/26 11:00	1,630	3,140	3,580						
		Land Soil	Soil	4/27 10:46	1,770	4,050	4,470						
		Land Soil	Soil	4/28 10:37 (4/29 13:29)	460	1,200	1,400						
		Land Soil	Soil	4/29 10:25 (4/30 16:56)	870	2,500	2,600						
		Land Soil	Soil	4/30 10:50 (5/1 14:44)	230	660	700						
		Land Soil	Soil	5/1 10:52 (5/2 17:33)	410	1,400	1,600						
		Land Soil	Soil	5/2 10:16 (5/3 19:13)	31	200	280						
		Land Soil	Soil	5/3 10:31 (5/4 19:18)	260	670	770						
		Land Soil	Soil	5/4 10:24 (5/5 15:30)	180	650	730						
		Land Soil	Soil	5/5 10:32 (5/6 18:21)	130	480	560						
		Land Soil	Soil	5/6 10:43 (5/8 10:59)	130	630	710						
		Land Soil	Soil	5/7 10:14 (5/8 15:04)	48	580	540	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/8 10:40 (5/9 15:43)	170	420	540	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/9 10:55 (5/10 16:14)	57	560	610	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/10 10:39 (5/11 16:28)	60	510	520	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/11 10:55 (5/12 16:15)	340	2,700	3,200	2,600	Not Detectable	38	Not Detectable	Not Detectable	
		Land Soil	Soil	5/12 11:13 (5/14 15:31)	31	300	310	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/13 10:40 (5/14 16:14)	51	370	450	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/14 10:27 (5/15 14:24)	34	610	730	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/15 10:10 (5/16 17:25)	55	450	460	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/16 10:20 (5/18 15:42)	36	490	520	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/17 10:45 (5/19 13:40)	100	1,100	1,300	820	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/18 11:03 (5/19 18:23)	Not Detectable	510	540	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/19 10:36 (5/20 15:54)	120	2,800	3,000	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/20 10:30	174	1,560	1,760	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/21 10:19	23.0	193	207	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/22 10:21	69.8	461	499	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/23 10:35	Not Detectable	405	474	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/24 10:35	36.7	733	774	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/25 10:30	294	6,890	7,670	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/26 10:20	81.1	2,250	2,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/27 10:10	66.2	1,200	1,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
		Land Soil	Soil	5/28 10:02	174	6,320	7,400	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	
【4-4】(70kmSouth/west)	Sirakawa county Izumizaki Village	Land Soil	Soil	4/7 14:15	3,670	2,730	2,990						
		Land Soil	Soil	4/7 14:10	1,830	1,340	1,390						
		Land Soil	Soil	4/8 13:40	2,790	2,230	2,410						
		Land Soil	Soil	4/10 13:00	1,280	1,700	1,890						
		Land Soil	Soil	4/11 13:10	1,630	1,700	1,810						
		Land Soil	Soil	4/12 13:20	534	653	702						
		Land Soil	Soil	4/13 13:53	2,020	2,300	2,520						
		Land Soil	Soil	4/14 13:36	1,440	1,550	1,760						
		Land Soil	Soil	4/15 13:40	811	1,370	1,350						
		Land Soil	Soil	4/16 12:45	1,560	3,790	4,140						
		Land Soil	Soil	4/17 12:50	591	1,440	1,490						
		Land Soil	Soil	4/18 12:35	1,760	4,800	5,220						
		Land Soil	Soil	4/19 13:15	585	1,210	1,430						
		Land Soil	Soil	4/20 12:30	256	553	583						
		Land Soil	Soil	4/21 13:59	547	1,640	1,690						
		Land Soil	Soil	4/23 12:50	500	1,260	1,390						
		Land Soil	Soil	4/24 12:30	109	433	454						

Results of Radionuclide Analysis of Environmental Monitoring Samples (23/23)

Sampling Point		Sample	Sort or Region	Sampling Time and Date (Monitoring Time)*1	Radioactivity concentration(Bq/kg)								Note
					^{131}I	^{134}Cs	^{137}Cs	^{129m}Te	^{132}Te	^{136}Cs	^{140}La	Other detected nuclides	
[4-5] (80kmSouth/west)	Nishishirakawa county Saigou Village	Land Soil	Soil	4/8 15:30	1,330	956	923						
		Land Soil	Soil	4/10 14:10	1,480	1,240	1,460						
		Land Soil	Soil	4/11 14:40	4,580	6,060	6,740						
		Land Soil	Soil	4/12 14:40	3,860	4,640	5,250						
		Land Soil	Soil	4/13 15:36	2,710	4,540	4,760						
		Land Soil	Soil	4/14 14:54	2,900	4,220	4,550						
		Land Soil	Soil	4/15 15:00	1,940	3,020	3,390						
		Land Soil	Soil	4/16 14:00	1,220	1,600	1,680						
		Land Soil	Soil	4/17 14:00	1,860	3,300	3,730						
		Land Soil	Soil	4/18 14:30	438	2,690	3,070						
		Land Soil	Soil	4/19 14:30	1,350	2,830	3,180						
		Land Soil	Soil	4/20 14:05	784	1,890	2,010						
		Land Soil	Soil	4/21 14:58	904	2,580	2,800						
		Land Soil	Soil	4/22 15:10	1,210	3,120	3,580						
		Land Soil	Soil	4/23 15:00	278	1,760	2,010						
		Land Soil	Soil	4/24 13:40	804	3,010	3,410						
[ms-1] (33kmNorth/North/west)	Minami Soma city Haramachi ward Ohara	Land Soil	Soil	5/24 10:17	211	6,000	6,440	Not Detectable	Not Detectable	37.6	Not Detectable	^{110m}Ag : 88.5	[ms-1]
[ms-3] (36kmNorth/North/west)	Minami Soma city Kashima ward Kamitochikubo	Land Soil	Soil	5/24 11:36	77.2	10,400	12,100	Not Detectable	Not Detectable	39.3	Not Detectable	Not Detectable	[ms-3]
[ms-4] (27kmNorth/west)	Minami Soma city Haramachi ward Takanokura	Land Soil	Soil	5/24 14:49	53.5	1,730	1,830	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[ms-4]
[ms-5] (25kmNorth/North/west)	Minami Soma city Haramachi ward Takanokura	Land Soil	Soil	5/24 15:07	268	11,100	11,900	Not Detectable	Not Detectable	68.4	Not Detectable	^{110m}Ag : 127	[ms-5]
[ms-6] (21kmNorth/west)	Minami Soma city Haramachi ward Baba	Land Soil	Soil	5/24 13:58	736	45,500	50,300	Not Detectable	Not Detectable	231	Not Detectable	^{110m}Ag : 394	[ms-6]
[ms-7] (22kmNorth/North/west)	Minami Soma city Haramachi ward Baba	Land Soil	Soil	5/24 14:21	183	10,100	11,200	Not Detectable	Not Detectable	46.1	Not Detectable	^{110m}Ag : 54.5	[ms-7]
[ms-8] (20kmNorth)	Minami Soma city Haramachi ward Kanezawa	Land Soil	Soil	5/24 12:36	37.4	1,460	1,600	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[ms-8]
[ms-9] (24kmNorth)	Minami Soma city Haramachi ward Takami town	Land Soil	Soil	5/24 12:55	134	4,150	4,560	Not Detectable	Not Detectable	Not Detectable	Not Detectable	^{110m}Ag : 44.1	[ms-9]
[ms-10] (21kmNorth/North/west)	Minami Soma city Haramachi ward Taka	Land Soil	Soil	5/24 13:18	130	2,640	2,980	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[ms-10]
[ms-11] (29kmNorth/North/west)	Minami Soma city Haramachi ward Ohara	Land Soil	Soil	5/24 10:39	137	8,890	9,880	Not Detectable	Not Detectable	48.2	Not Detectable	^{110m}Ag : 65.9	[ms-11]
[ms-12] (32kmNorth/North/west)	Minami Soma city Kashima ward Jisabara Maeta	Land Soil	Soil	5/24 11:04	63.7	1,260	1,480	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[ms-12]
[kw-1] (42kmNorth/west)	Date county Kawamata town Kotsunagi Aza Ushirozawa	Land Soil	Soil	5/25 10:46	191	3,730	3,970	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[kw-1]
[kw-2] (42kmNorth/west)	Date county Kawamata town Kotsunagi Aza Kamihagane	Land Soil	Soil	5/25 10:59	187	2,920	2,950	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[kw-2]
[kw-3] (40kmwest/North/west)	Date county Kawamata town Yamakiya Aza Shimonagahashi	Land Soil	Soil	5/25 11:16	149	6,810	7,270	Not Detectable	Not Detectable	40.6	Not Detectable	Not Detectable	[kw-3]
[kw-4] (37kmwest/North/west)	Date county Kawamata town Yamakiya Aza Boyoshi	Land Soil	Soil	5/25 11:35	Not Detectable	7,070	7,440	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[kw-4]
[kw-5] (34kmwest/North/west)	Date county Kawamata town Yamakiya Aza Ishotatsuyama	Land Soil	Soil	5/25 11:52	370	12,400	12,900	Not Detectable	Not Detectable	49.2	Not Detectable	Not Detectable	[kw-5]
[kw-6] (33kmwest/North/west)	Date county Kawamata town Yamakiya Aza Hirokuboyama	Land Soil	Soil	5/25 12:08	1,060	35,700	40,500	Not Detectable	Not Detectable	162	Not Detectable	Not Detectable	[kw-6]
[kw-7] (45kmNorth/west)	Date county Kawamata townKotsunagi Aza Nakada	Land Soil	Soil	5/25 9:53	138	4,010	4,160	Not Detectable	Not Detectable	32.7	Not Detectable	Not Detectable	[kw-7]
[kw-8] (43kmNorth/west)	Date county Kawamata town Kotsunagi Aza Awahukuji	Land Soil	Soil	5/25 10:08	239	5,200	5,730	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[kw-8]
[kw-9] (43kmNorth/west)	Date county Kawamata town Kotsunagi Aza wakamatsu	Land Soil	Soil	5/25 10:22	140	6,240	6,920	Not Detectable	Not Detectable	34.7	Not Detectable	Not Detectable	[kw-9]
[kw-10] (42kmNorth/west)	Date county Kawamata town Kotsunagi Aza Sawa	Land Soil	Soil	5/25 10:36	195	6,540	7,200	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[kw-10]
[ni-2] (36kmwest/North/west)	Nihonmatsu city Tazawa Aza shimomagariyama	Land Soil	Soil	5/25 12:25	64.0	3,180	3,320	Not Detectable	Not Detectable	Not Detectable	Not Detectable	Not Detectable	[ni-2]
(Reference)	(Reference)												
[2-11] (5kmSouth/west)	Futaba county Okuma Town	Land Soil	Soil	3/31 13:00	423,000	90,000	98,100						

The government requests Fukushima Prefecture to gain the readings above.

*Blanks of ^{129m}Te, ^{132}Te, ^{136}Cs, ^{140}La and other detected nuclides are being confirmed.

*1 Radioactive decay is not taken into account from sampling to measurement for the radioactive concentration of the samples with measurement date and time in parentheses.

The measurement published in here is being executed, JCAC (Japan Chemical Analysis Center) and ERMCF (Environmental Radioactivity Monitoring Center of Fukushima).

Results of Pu&U Analysis in Land Soil out of 20&30 Km Zone of Fukushima Dai-ichi NPP

Sampling Point	Sampling Date and Time	radiation dose rate [μ Sv/h]	Pu-238	Pu-239+240	U-235/U-238
Around Kodeya in Kuzuo Village	3/23 About 10:20	43.5	Not Detectable (Below 0.1 Bq/kg)	Not Detectable (Below 0.1 Bq/kg)	0.00731
East Side of Hirusone Tunnel ,Namie Town	3/23 About 10:40	46.5	Not Detectable (Below 0.1 Bq/kg)	Not Detectable (Below 0.1 Bq/kg)	0.00726
Akougi Namie Town	3/22 About 11:30	50.1	Not Detectable (Below 0.1 Bq/kg)	Not Detectable (Below 0.1 Bq/kg)	0.00723

* Isotope abundance ratio of U-235/U-238 in a state of nature : 0.00725

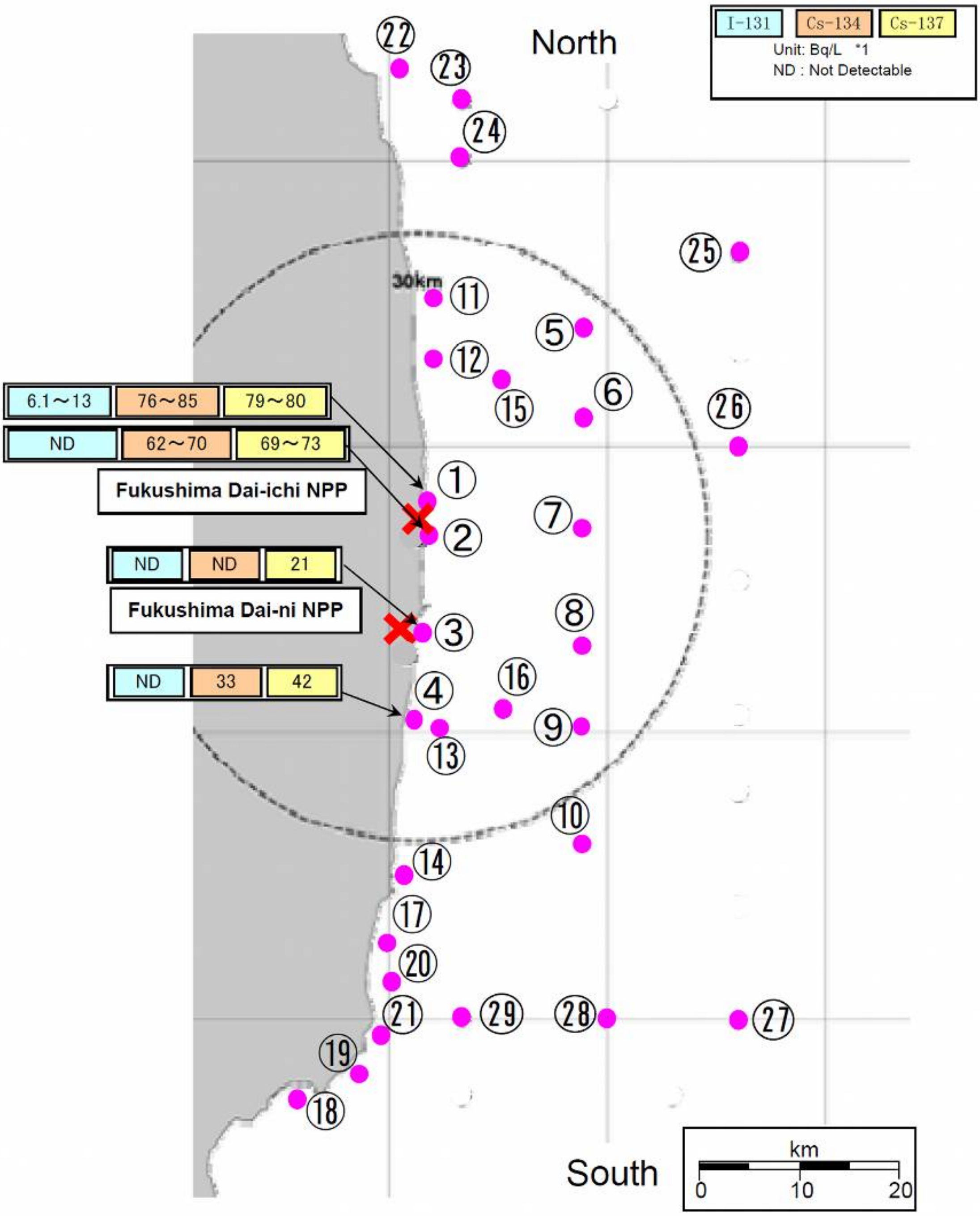
Results of Radioactive Strontium Analysis in Land Soil and Plant regarding the Accident of Fukushima Dai-ichi NPP

Sample	Sampling Point (Number or Name)	Sampling Date	^{131}I	^{134}Cs	^{137}Cs	^{89}Sr	^{90}Sr	Unit
Land Soil	31*2	3/17	30,000	2,300	2,300	13	3.3	Bq/kg WetSoil
Land Soil	32*2	3/16	100,000	20,000	19,000	81	9.4	Bq/kg WetSoil
Land Soil	33*3	3/16	160,000	52,000	51,000	260	32	Bq/kg WetSoil
Plant	Ootama Village	3/19	43,000	89,000	90,000	61	5.9	Bq/kg raw
Plant	Motomiya City	3/19	21,000	57,000	57,000	28	3.7	Bq/kg raw
Plant	Ono Town	3/19	22,000	12,000	12,000	12	1.8	Bq/kg raw
Plant	Nishigou Village	3/19	12,000	25,000	25,000	15	3.8	Bq/kg raw

＊1 Plants are provided by Fukushima Pref.
＊2 Namie Town
＊3 Iitate Village

Distribution map of radioactivity concentration in the seawater around Fukushima Dai-ichi NPP

(Sampling Date: 2011/5/29)

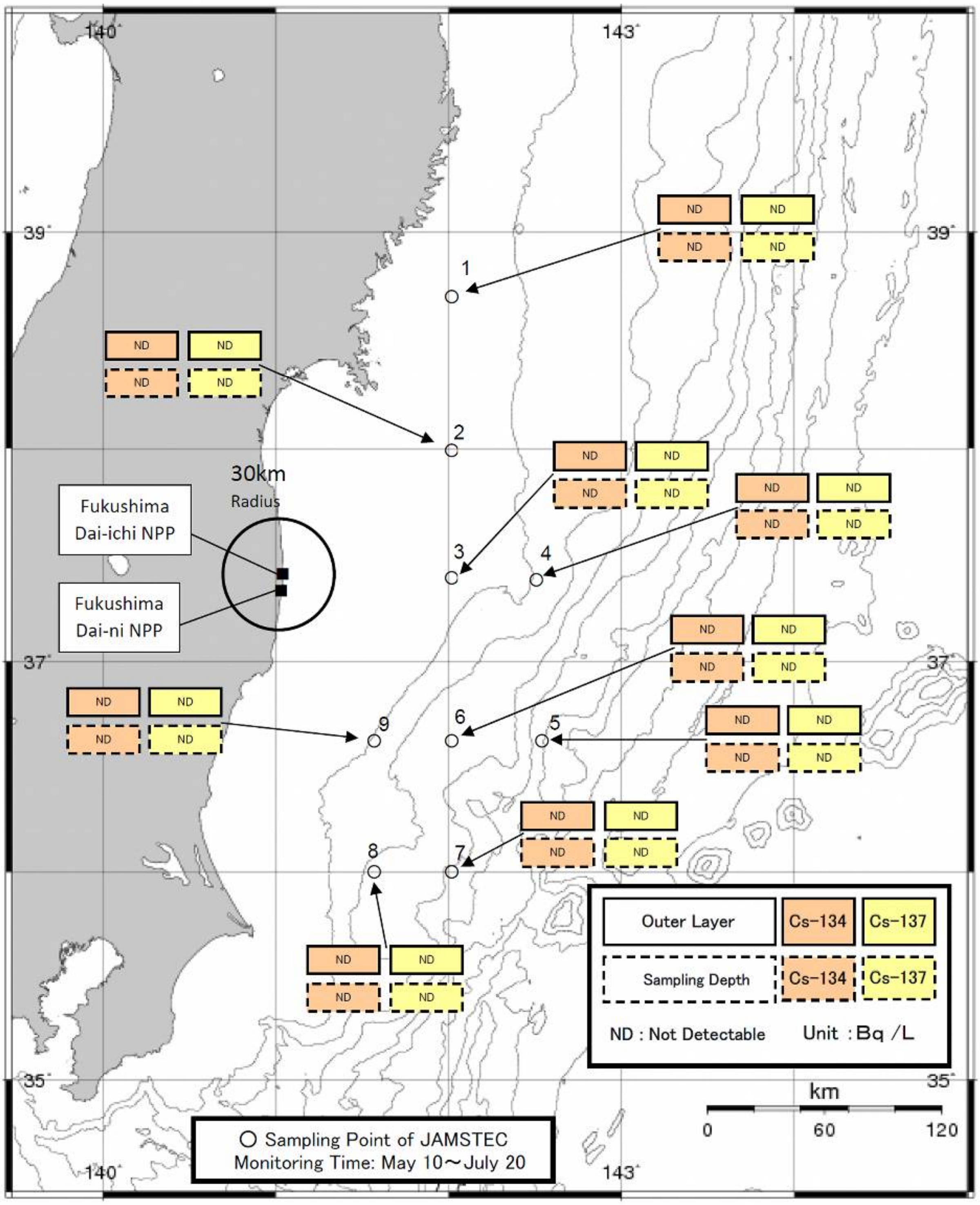


*All sampling depth of all data: Outer Layer

*(Based on the press release of TEPCO (http://www.tepco.co.jp/cc/press/index11-j.html)

*1 The detection limits for radioactivity concentration in sea water are approximately 6Bq/L for I-131 and approximately 14 Bq/L for Cs-134.

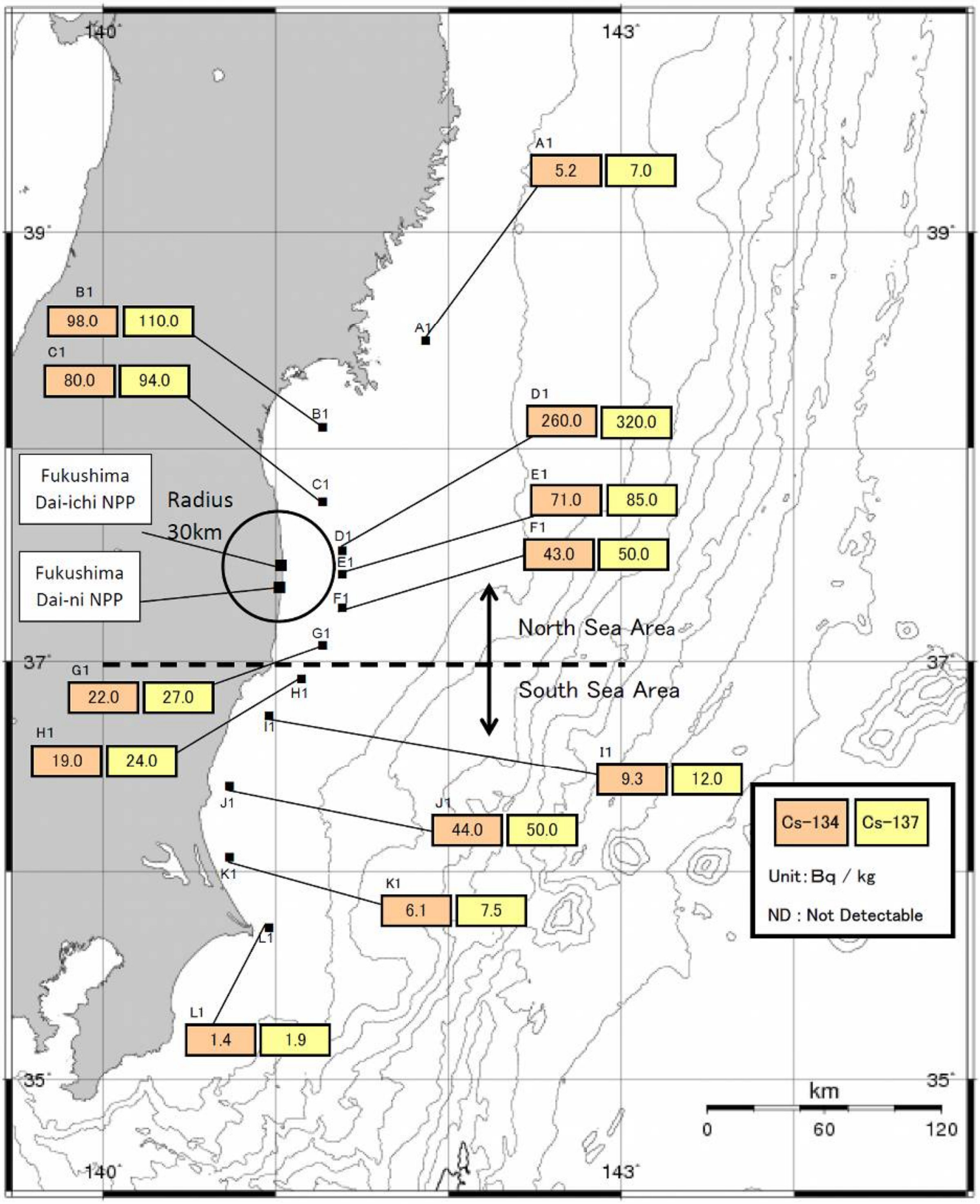
Readings of Sea Area Monitoring (May 10－12, 2011)



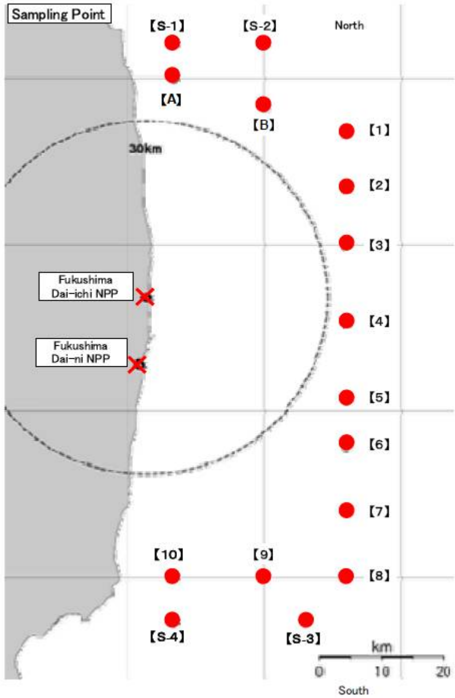
The readings of temperatures and salinity levels of seawater at the measurement points are put on the websites of JAMSTEC bellow.
http://www.godac.jamstec.go.jp/monitoringdata/

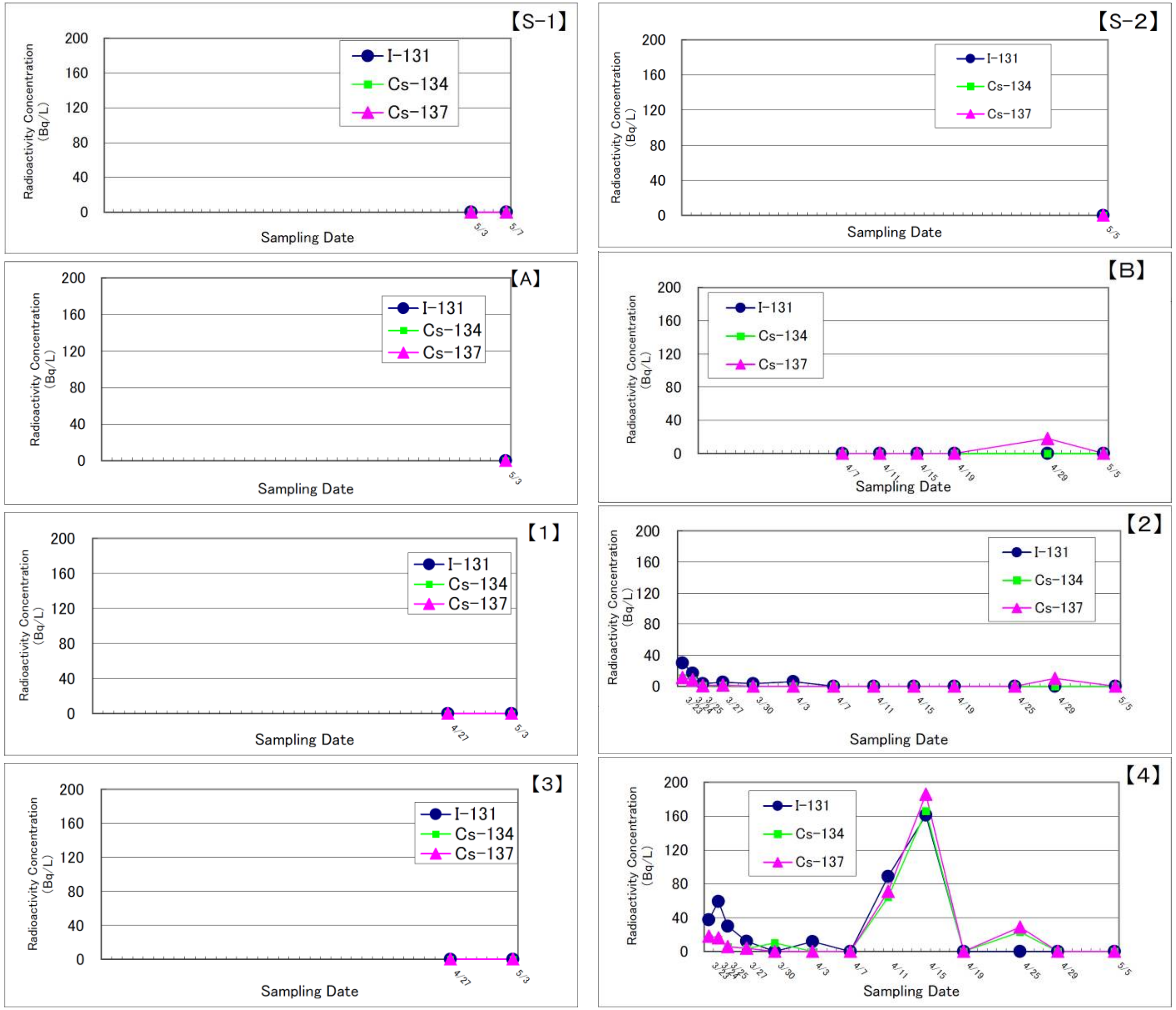
Readings of Sea Area Monitoring (May 9-14, 2011)

Radioactivity Concentration in marine soil



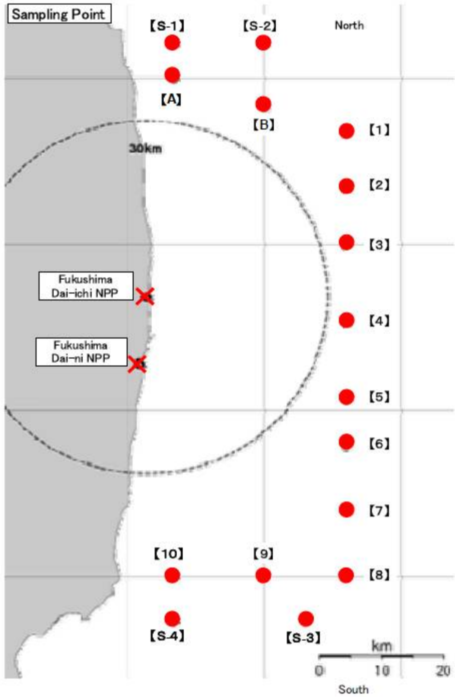
Results of radionuclide quantitative analyses
(Sea water; out of 30 km zone of Fukushima Dai-ichi NPP; 1/2)

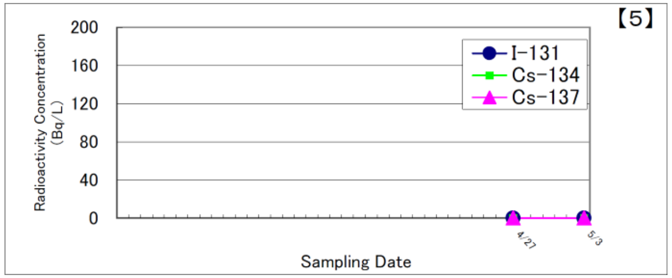


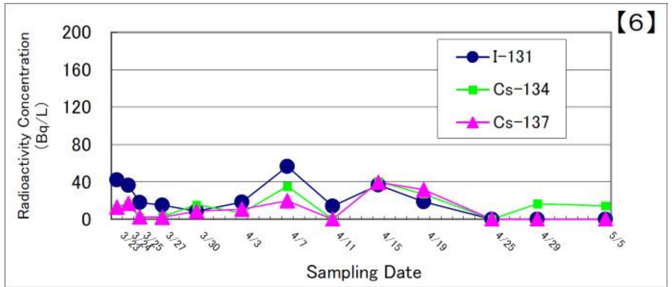


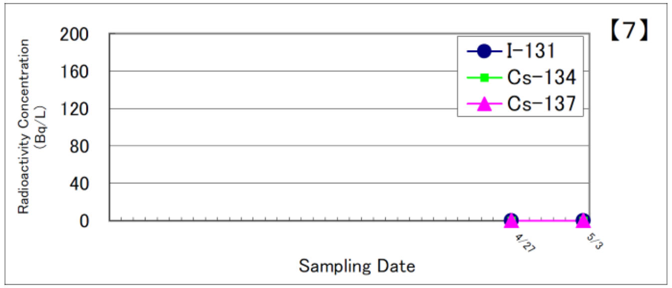
Attachment V-16-1

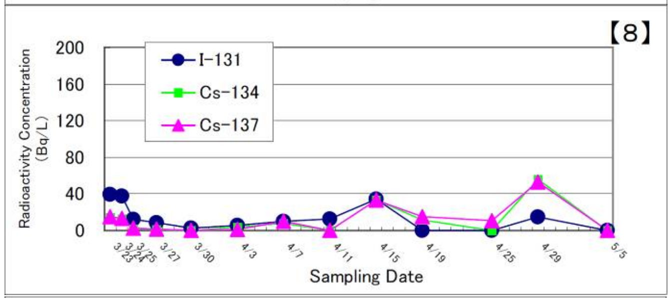
Results of radionuclide quantitative analyses
(Sea water; out of 30 km zone of Fukushima Dai-ichi NPP; 2/2)

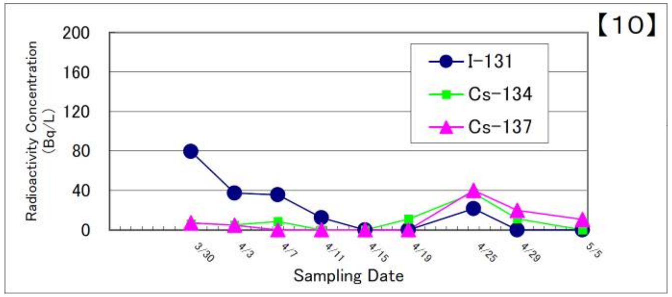


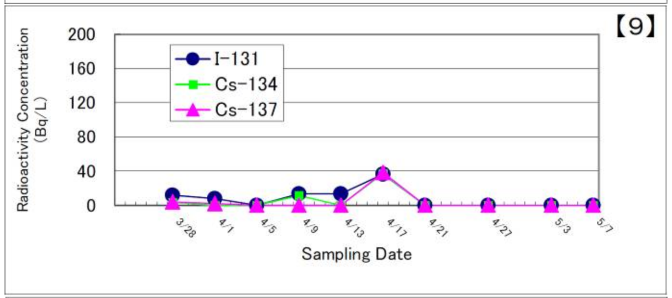


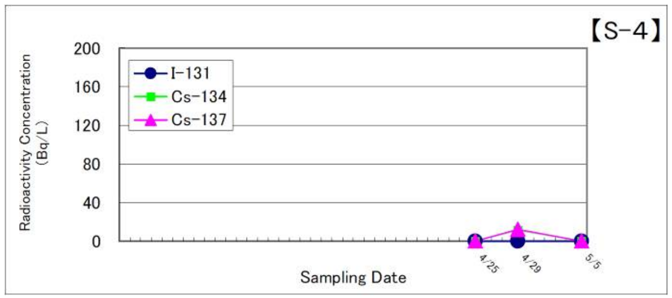


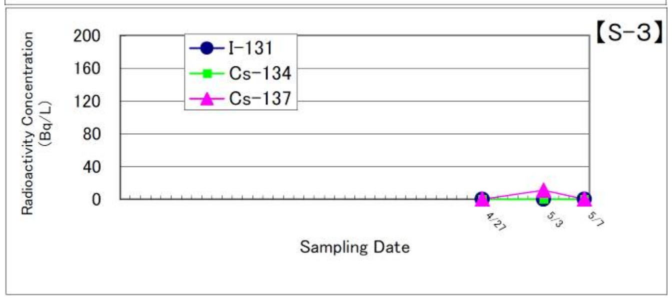






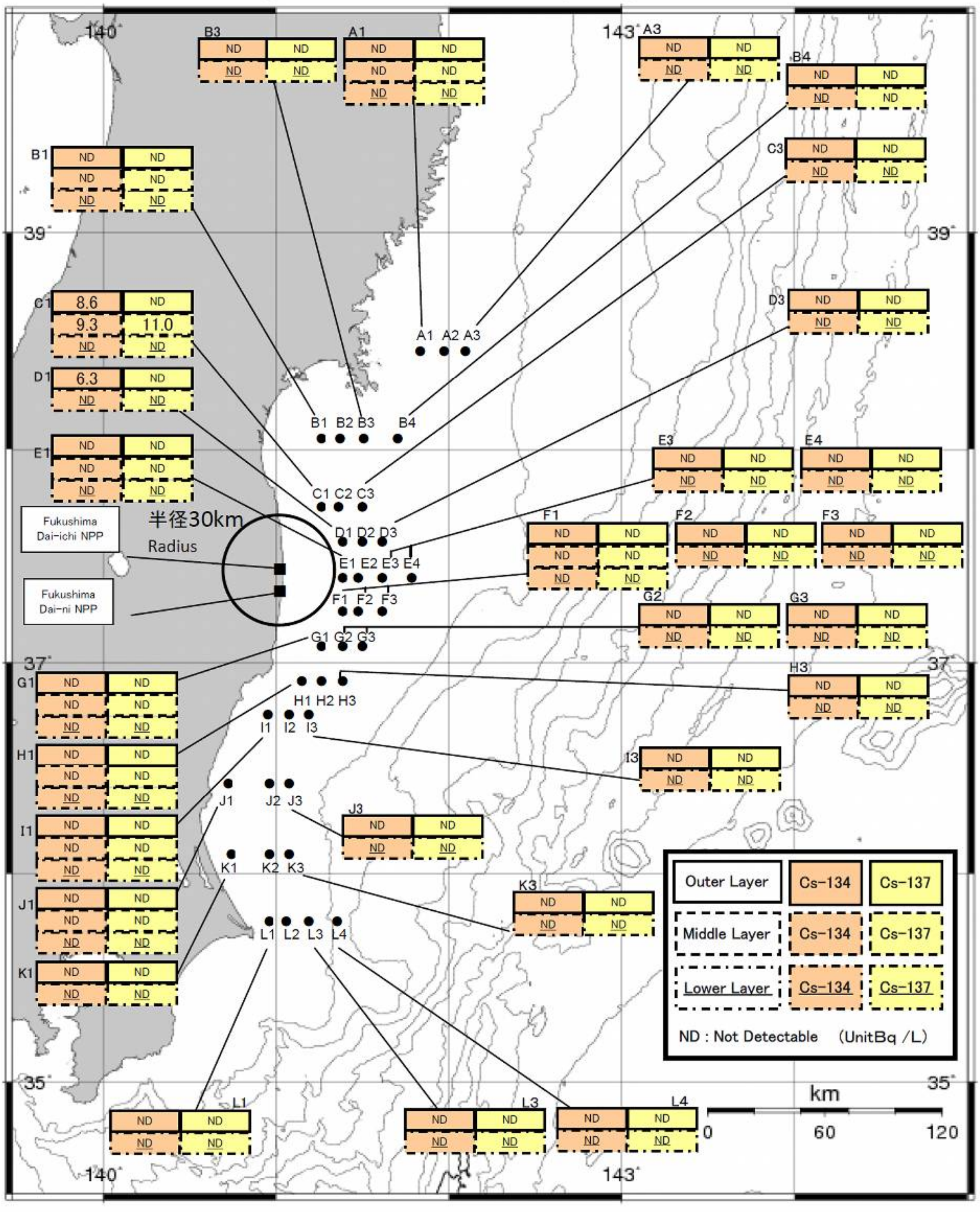






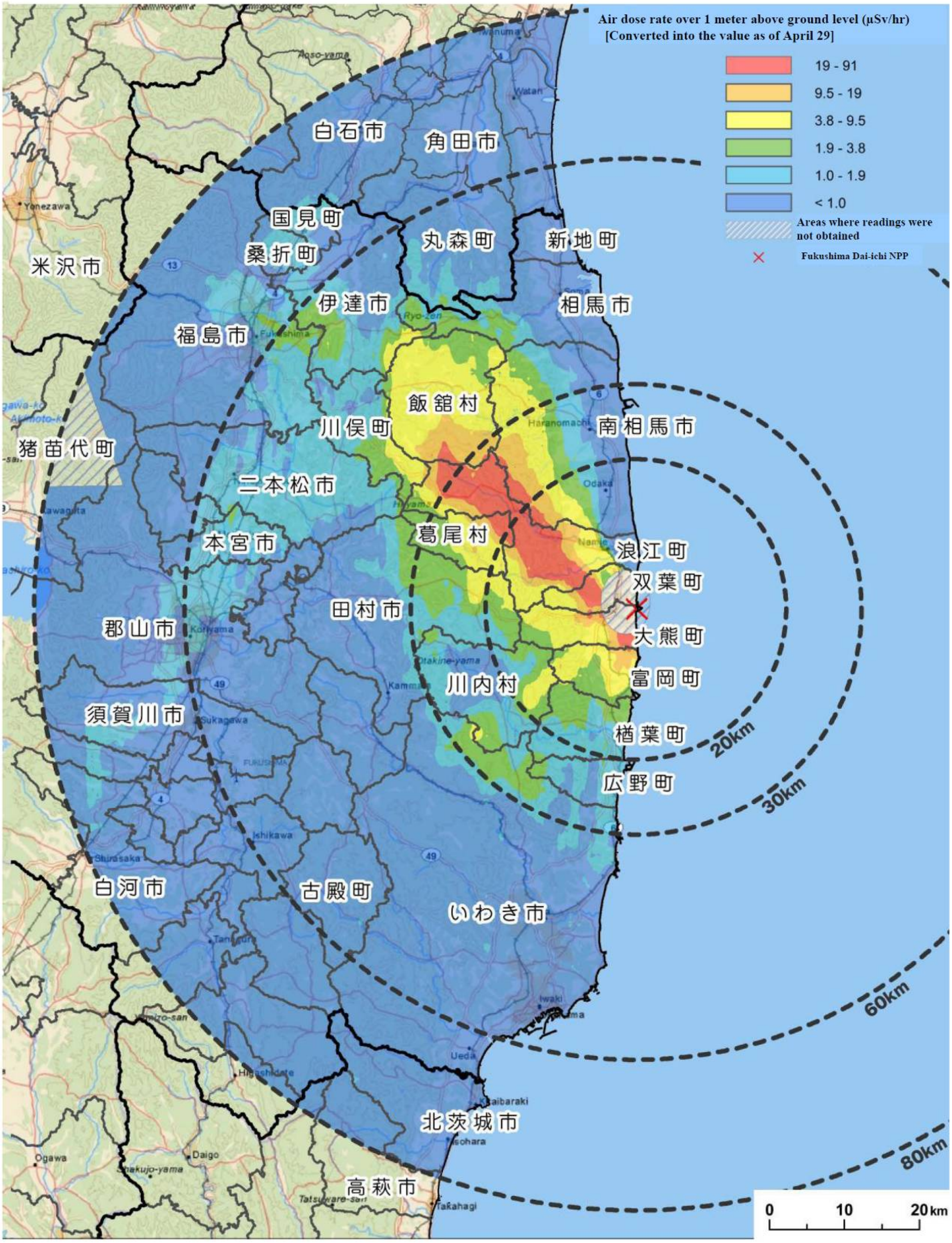
Attachment V-16-1

Readings of Sea Area Monitoring (May 9-14, 2011)

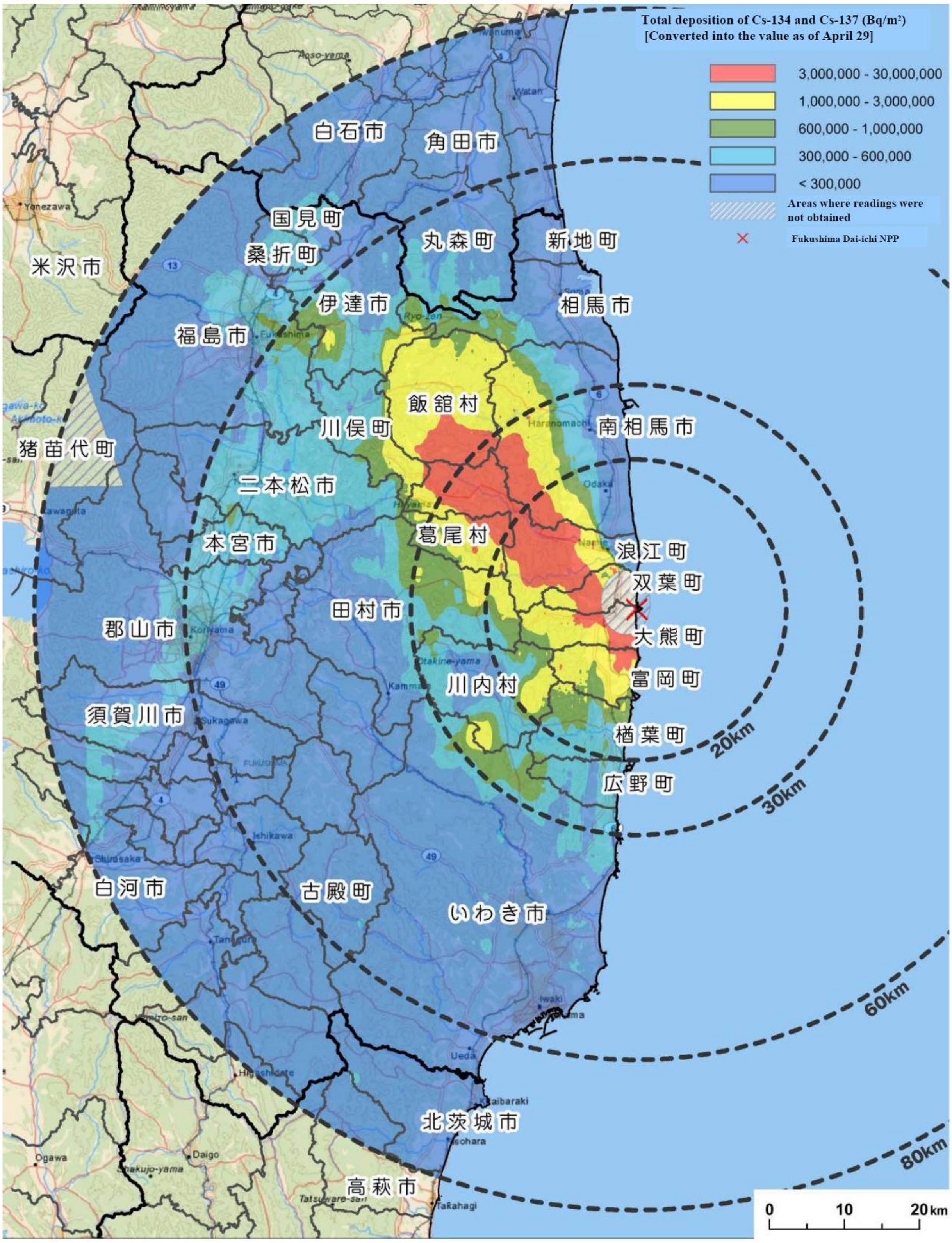


Attachment V-17

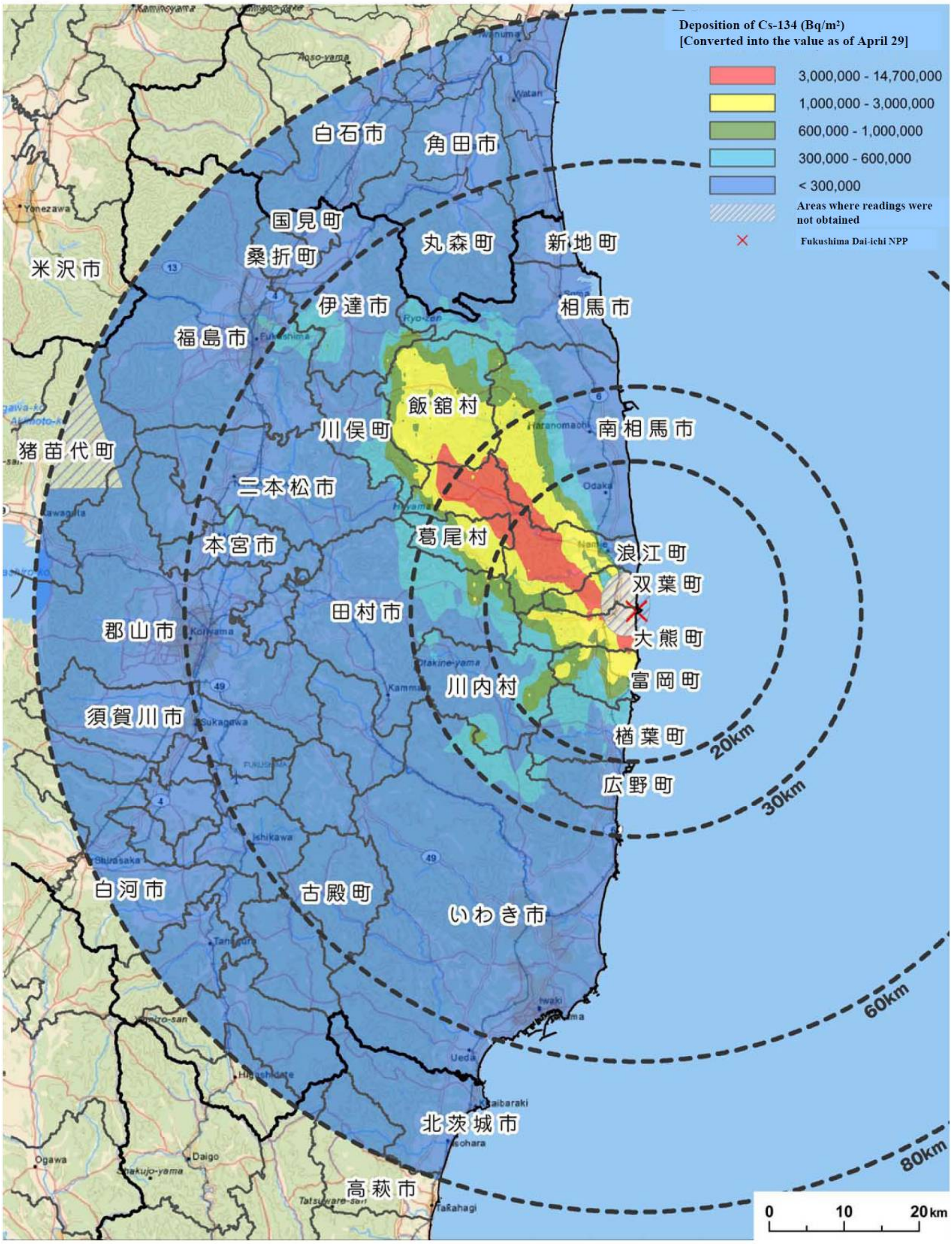
Results of airborne monitoring by MEXT and DOE
（Readings of air dose monitoring inside 80km zone of Fukushima Dai-ichi NPP)



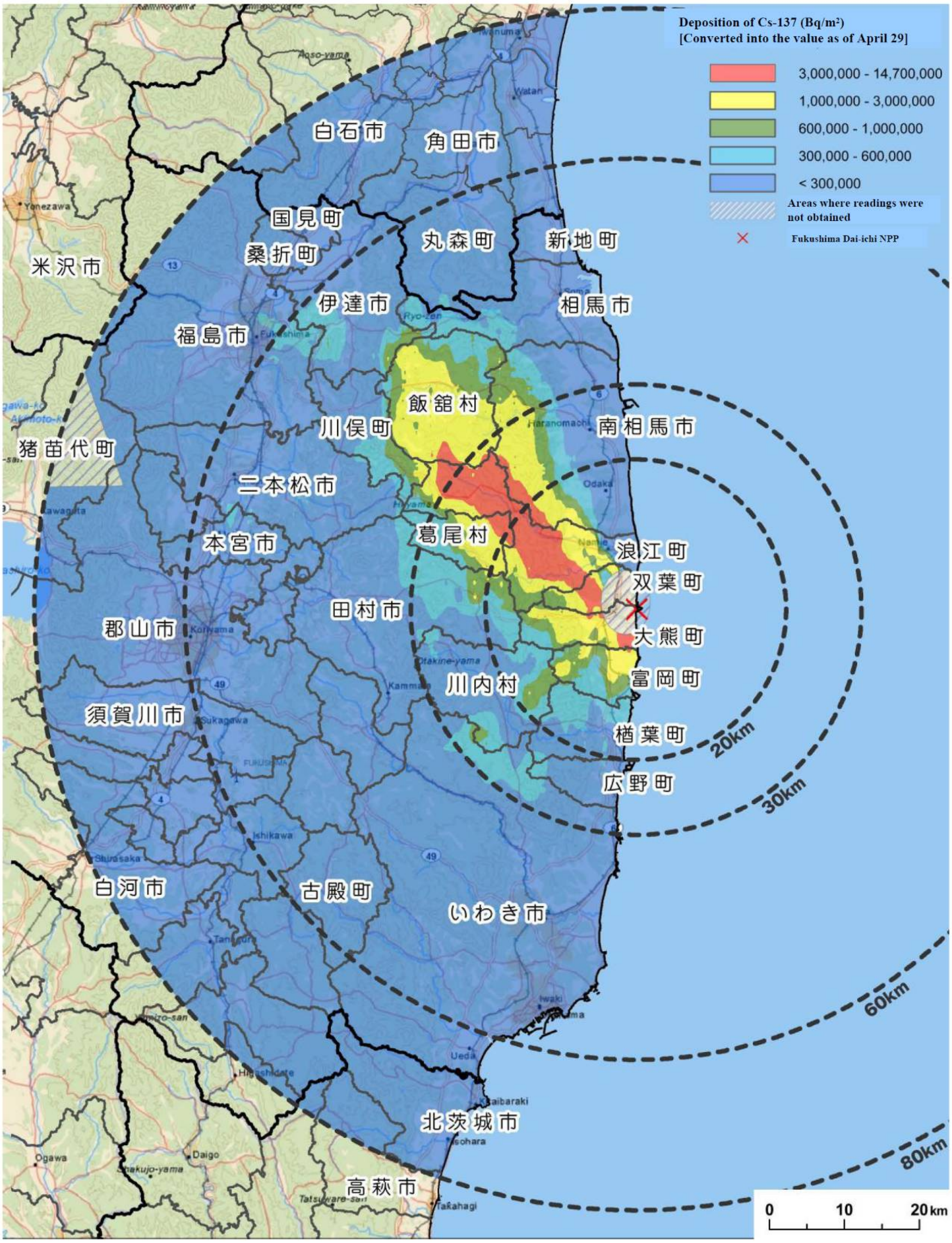
Results of airborne monitoring by MEXT and DOE
(Total surface deposition of Cs-134 and Cs-137 inside 80 km zone of Fukushima Dai-ichi NPP)

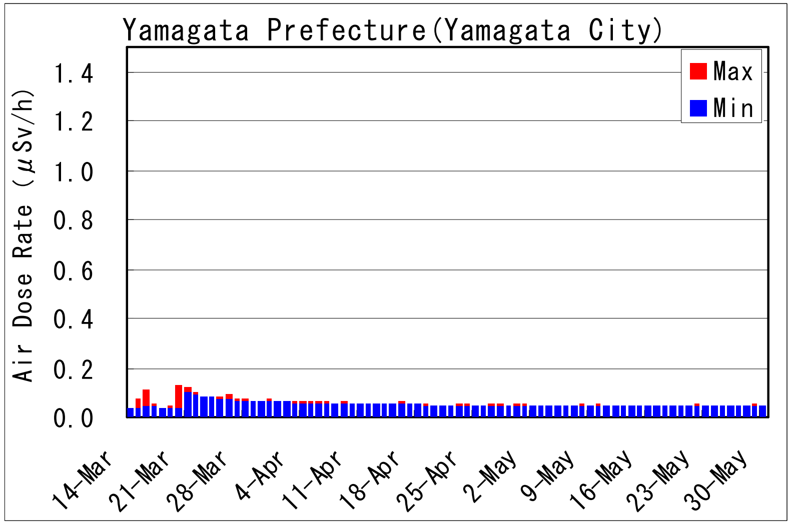


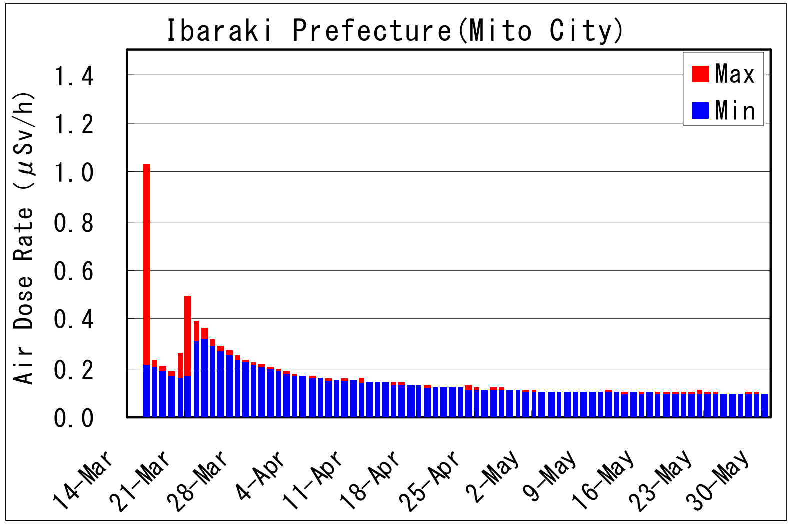
Results of airborne monitoring by MEXT and DOE
(Surface deposition of Cs-134 inside 80 km zone of Fukushima Dai-ichi NPP)

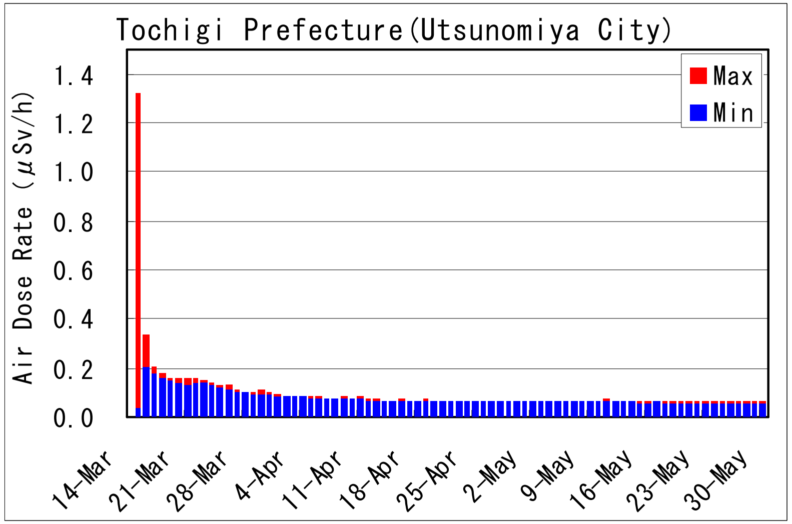


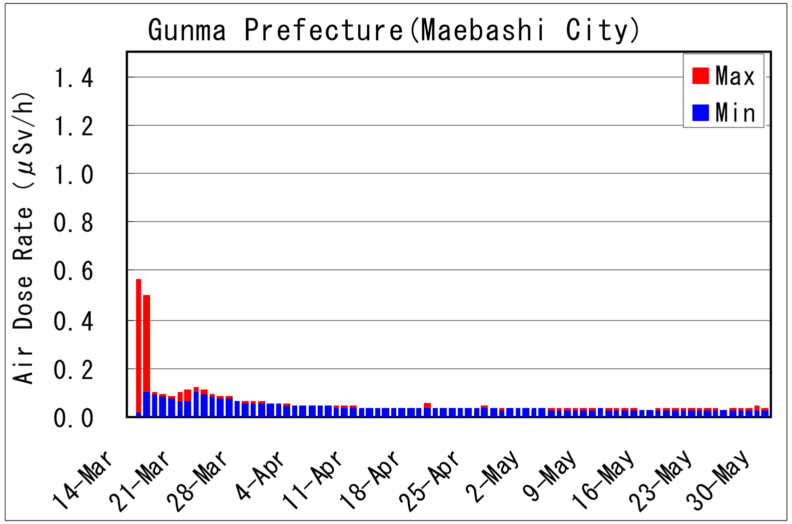
Results of airborne monitoring by MEXT and DOE
(Surface deposition of Cs-137 inside 80 km zone of Fukushima Dai-ichi NPP)





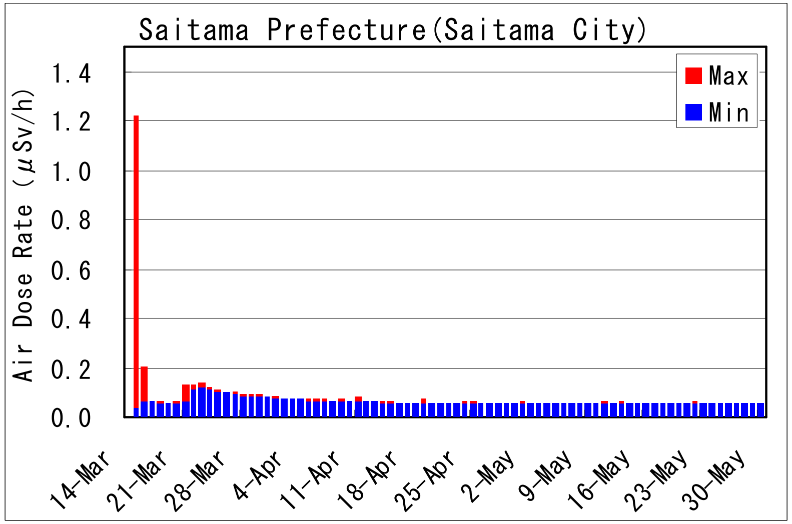


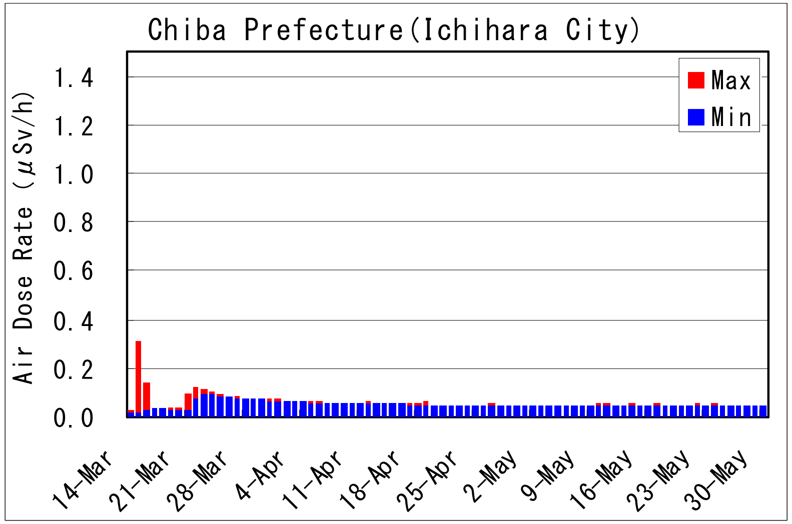


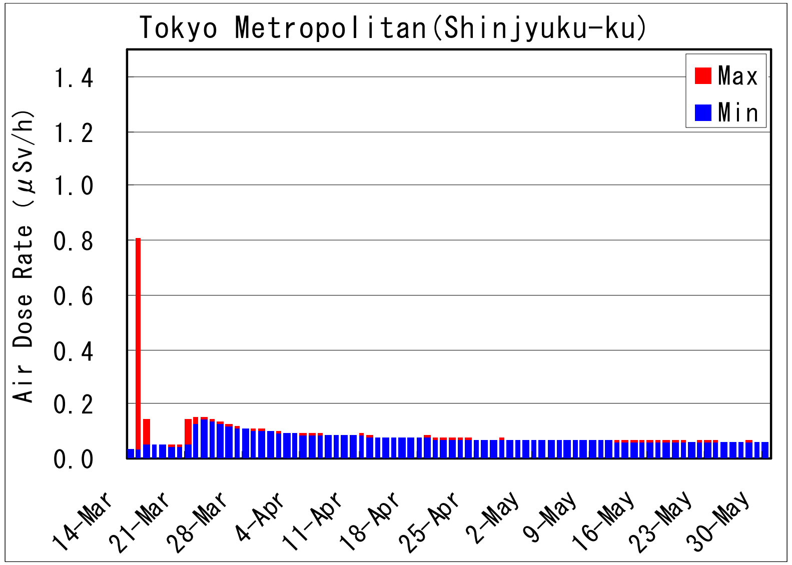


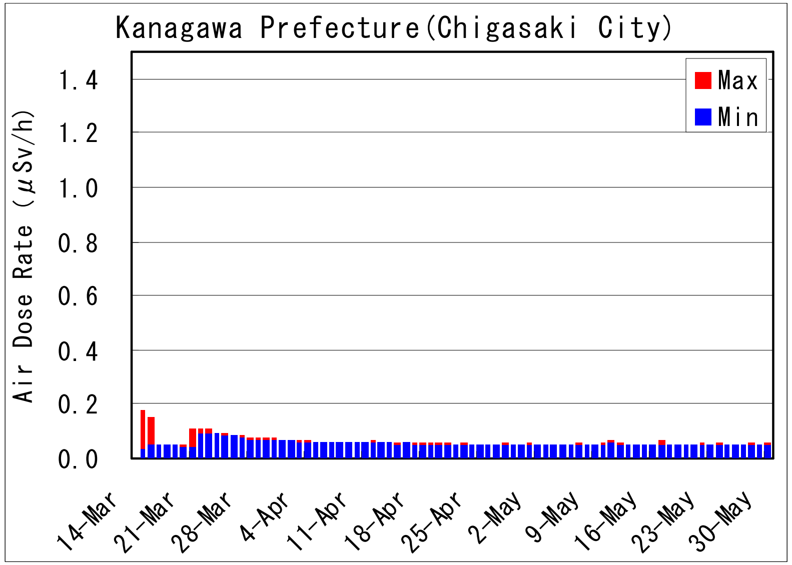
Chronological Change of Air Dose Rate for each Prefecture (1/2)

Attachment V-18-1





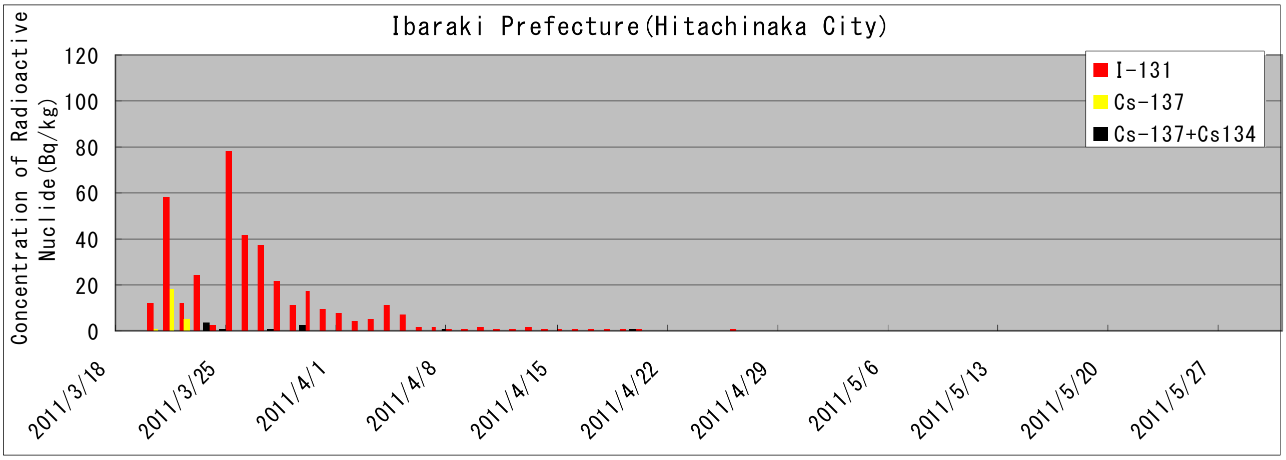


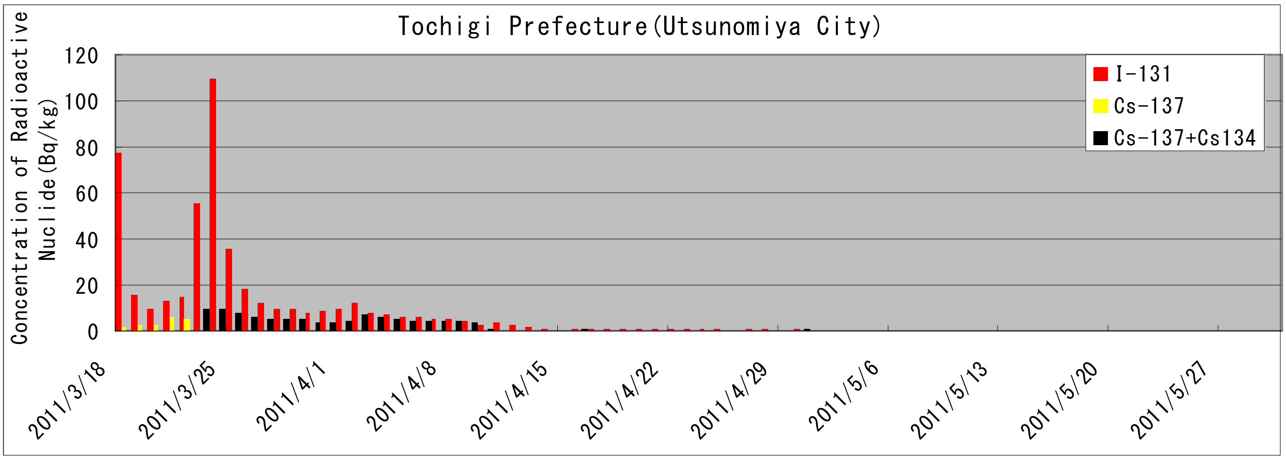


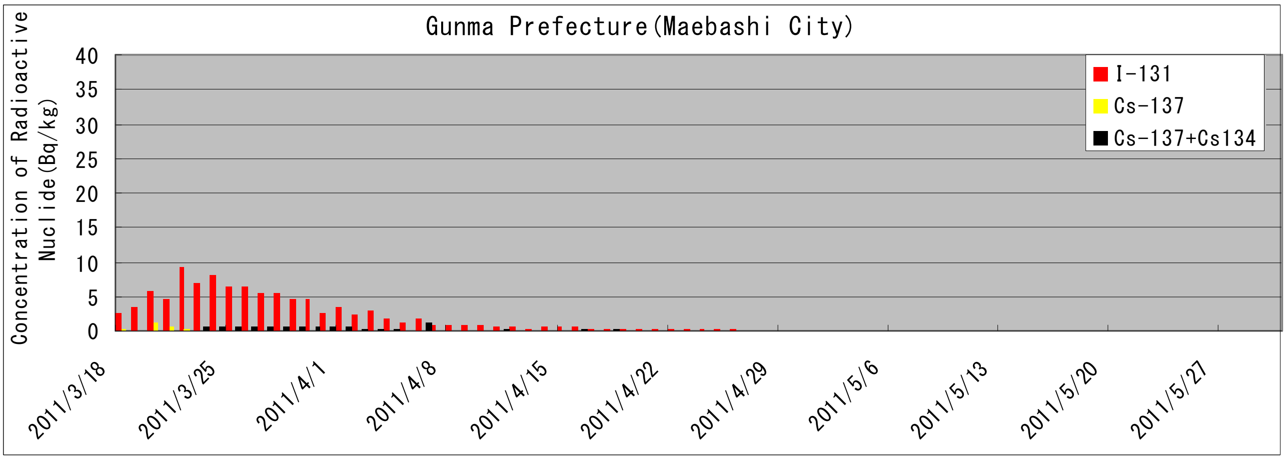
Chronological Change of Air Dose Rate for each Prefecture(2/2)

Attachment V-18-1

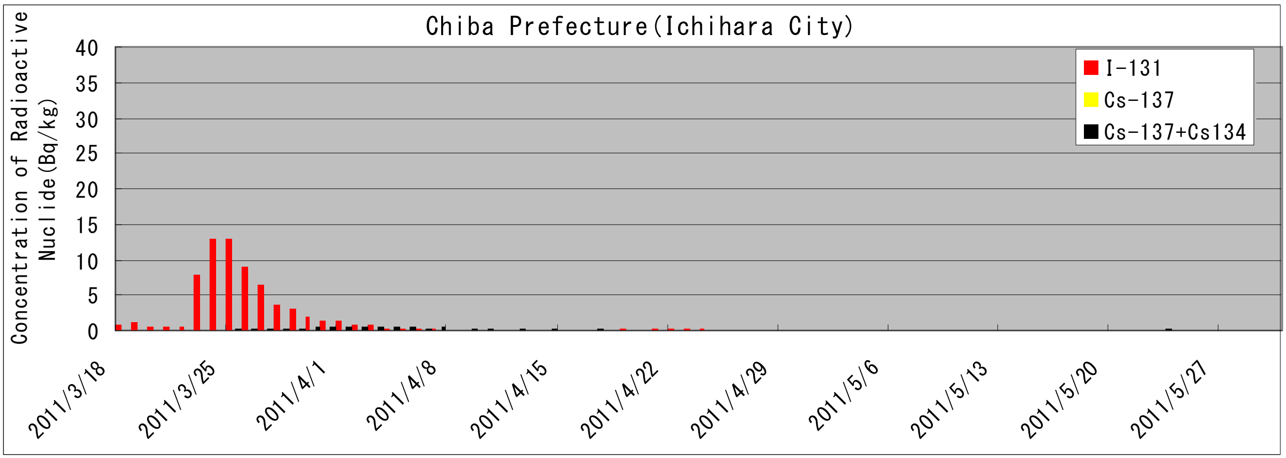
Attachment V-18-2

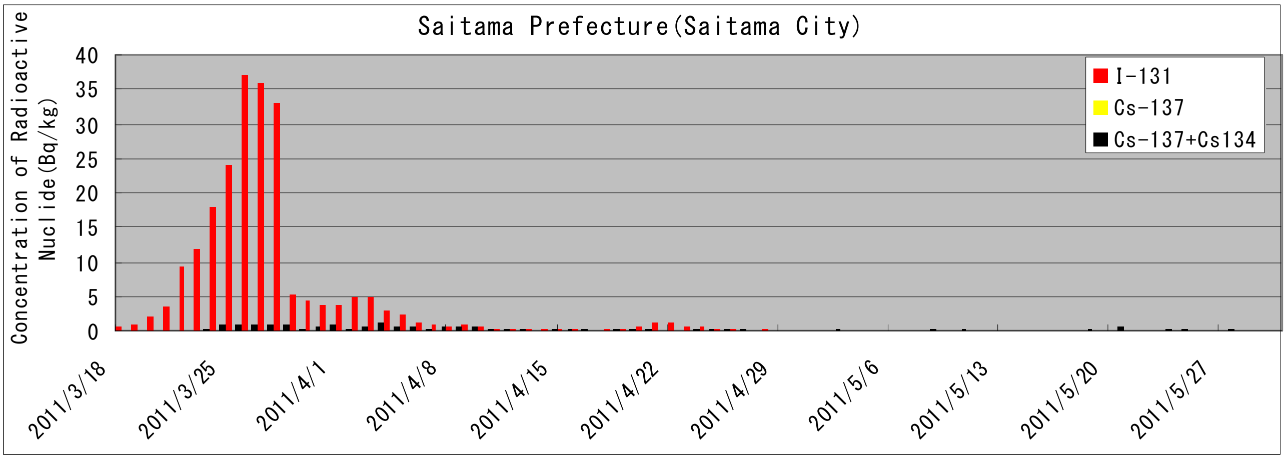


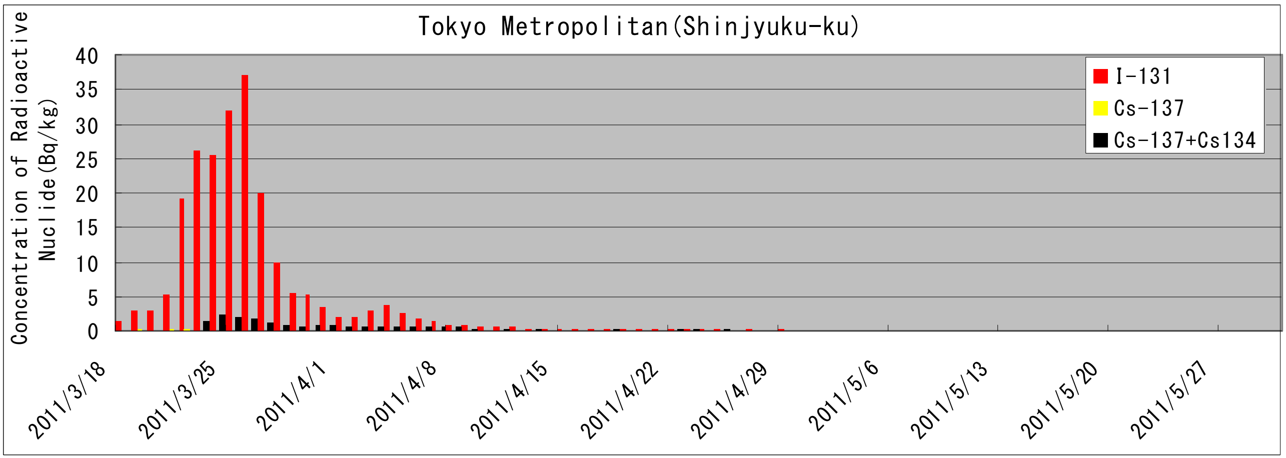




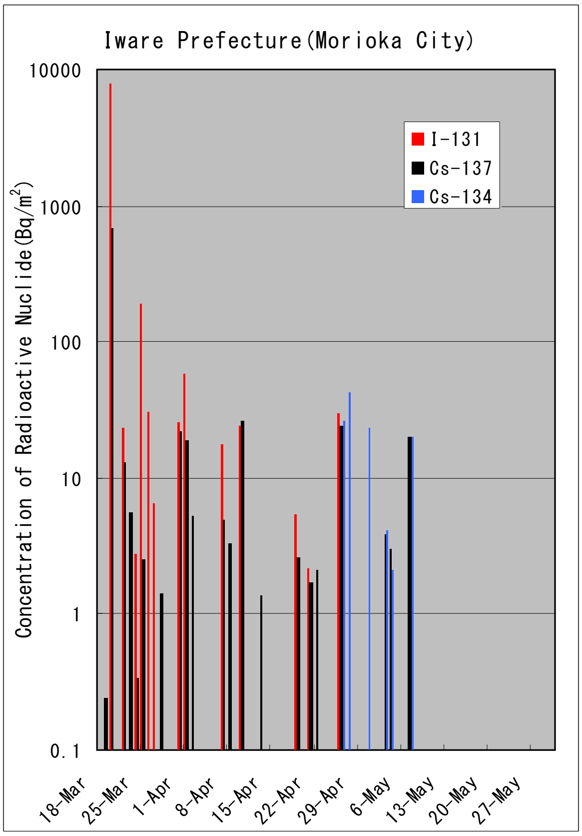
Chronological Change of Concentration of Radioactive Nuclide in Drinking Water for each Prefecture (1/2)

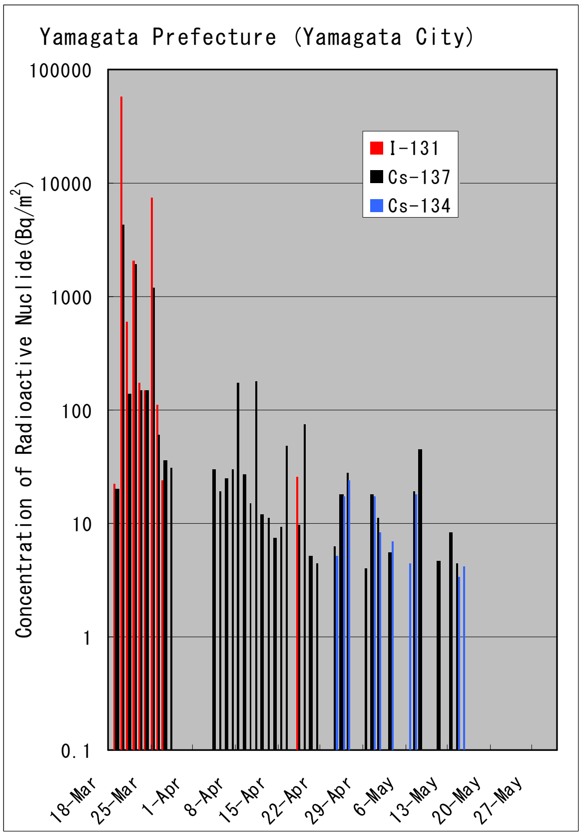


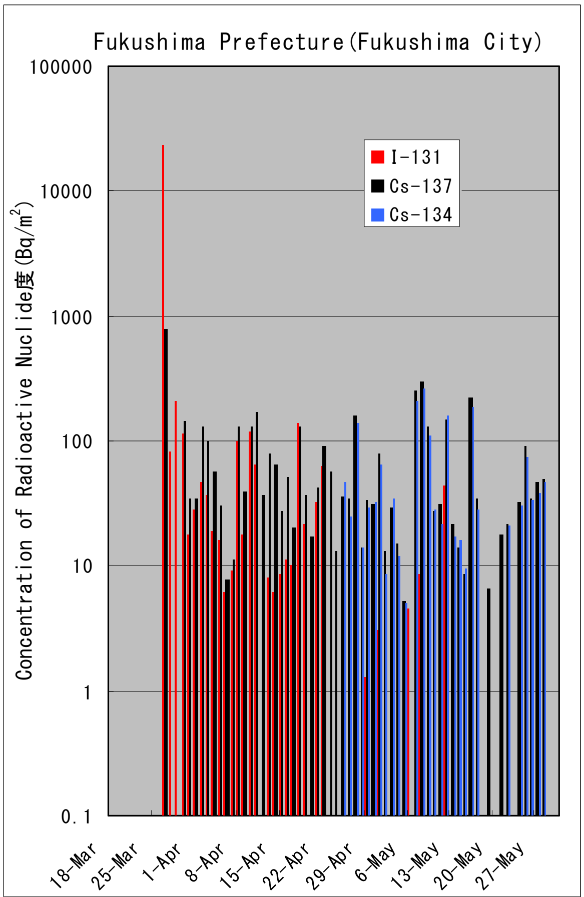


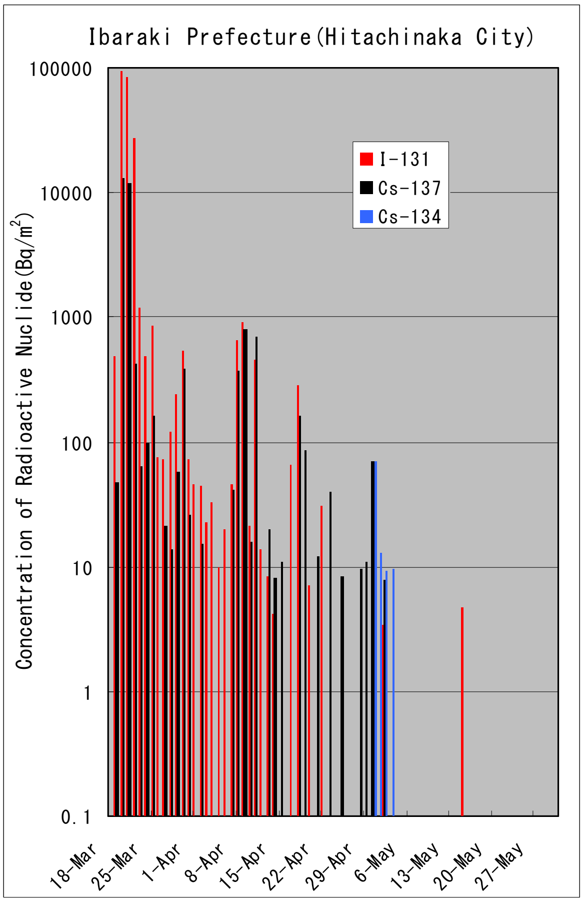


Chronological Change of Concentration of Radioactive Nuclide in Drinking Water for each Prefecture (1/2)

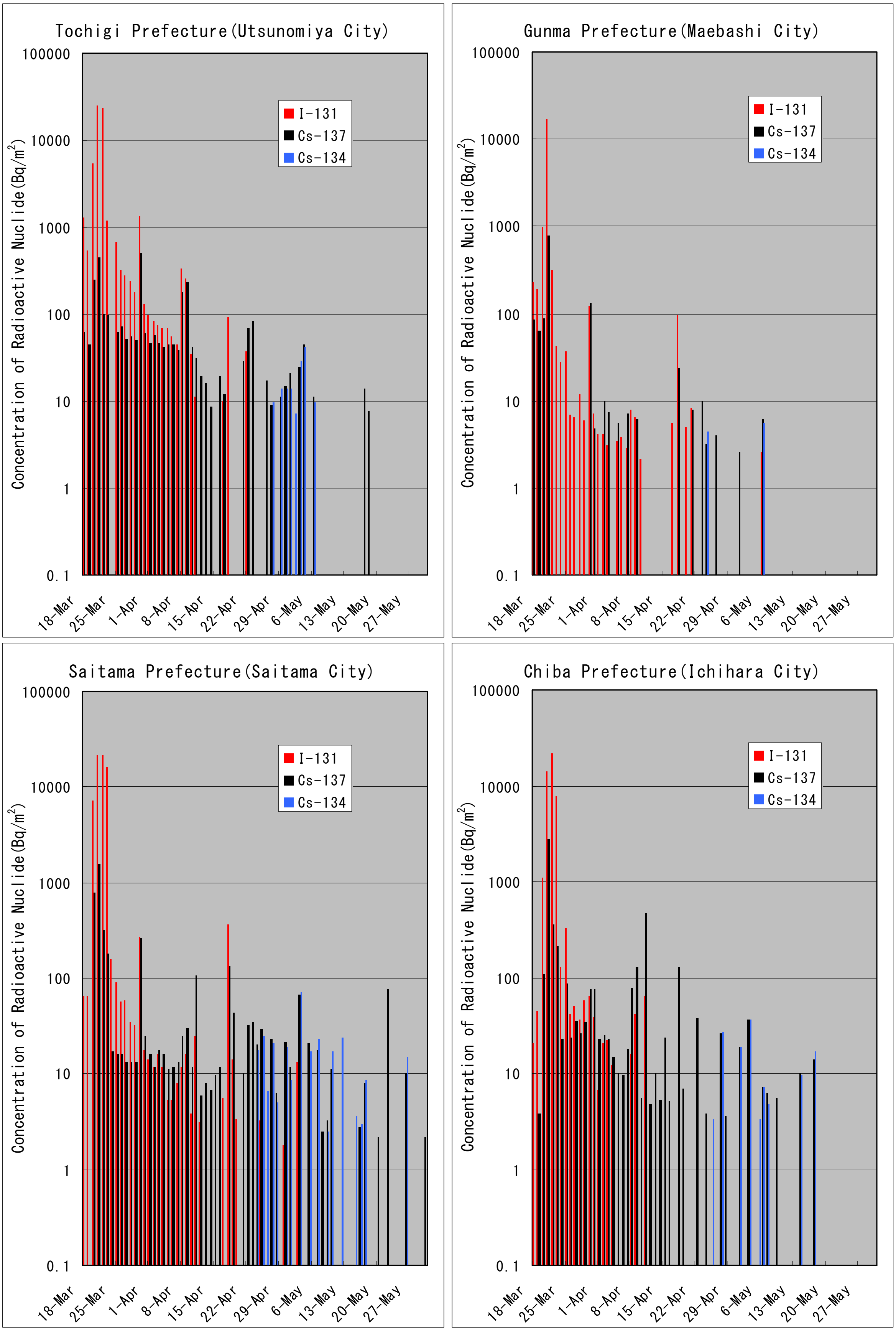




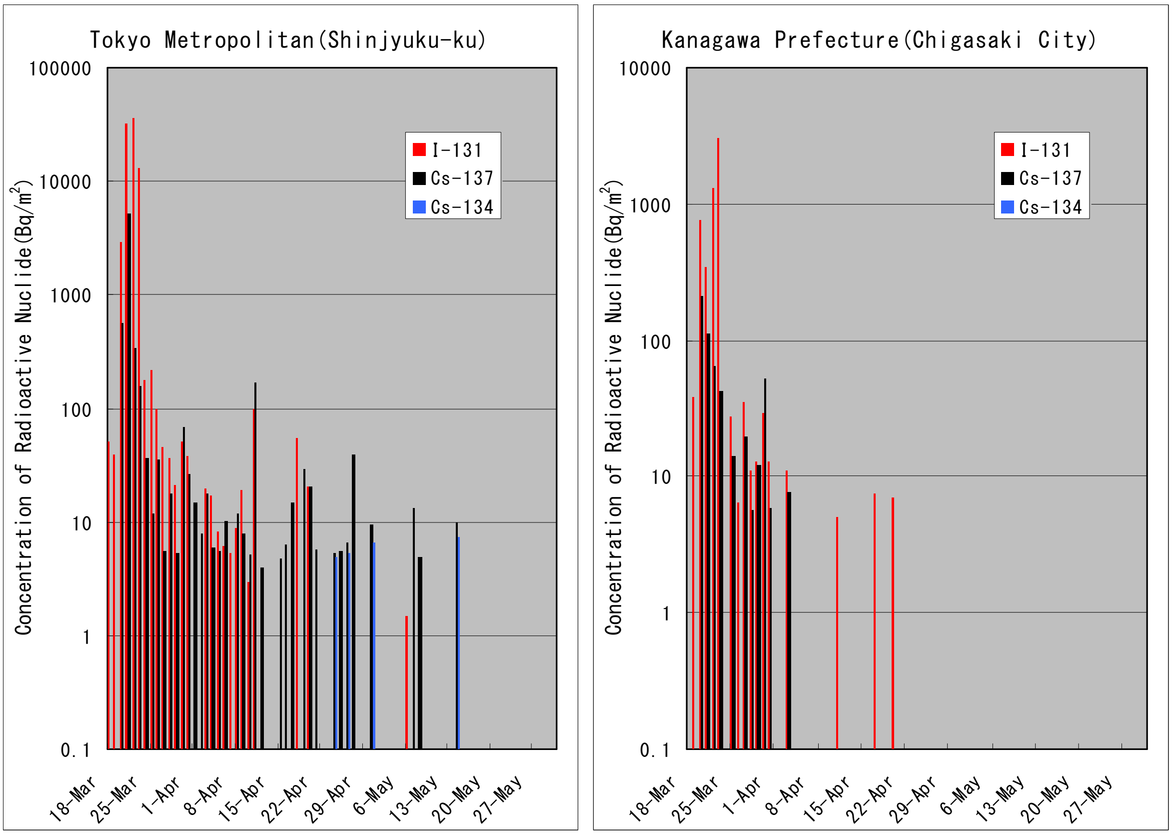




Chronological Change of Concentration of Radioactive Nuclide in Fallout for each Prefecture (1/3)



Chronological Change of Concentration of Radioactive Nuclide in Fallout for each Prefecture (2/3)



Chronological Change of Concentration of Radioactive Nuclide in Fallout for each Prefecture (3/3)

V-19(1)　The instructions associated with food by Director-General of the Nuclear Emergency Response Headquarters (Restriction of distribution in Fukushima Prefecture)

As of 2 June 2011

			Restriction of distribution — Fukushima prefecture — whole area	Individual areas	
raw milk			*3/21～ (excluding areas listed on the right cells)*	3/21～4/ 8	Kitakata-shi, Bandai-machi, Inawashiro-machi, Mishima-machi, Aizumisato-machi, Shimogo-machi, Minamiaizu-machi
				3/21～4/16	Fukushima-shi, Nihonmatsu-shi, Date-shi, Motomiya-shi, Kunimi-machi, Otama-mura, Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding miyakoji area), Miharu-machi, Ono-machi, Kagamiishi-machi, Ishikawa-machi, Asakawa-machi, Hirata-mura, Furudono-machi, Shirakawa-shi, Yabuki-machi, Izumizaki-mura, Nakajima-mura, Nishigo-mura, Samegawa-mura, Hanawa-machi, Yamatsuri-machi, Iwaki-shi
				3/21～4/21	Soma-shi, Shinchi-machi
				3/21～5/ 1	Minamisoma-shi (limited to Kashima-ku excluding Karasuzaki, Ouchi, Kawago and Shionosaki area), Kawamata-machi (excluding Yamakiya area)
Vegetable	non-head type leafy vegetables, e.g. spinach, komatsuna	spinach, kakina	*3/21～ (excluding areas listed on the right cells)*	3/21～5/ 4	Shirakawa-shi, Iwaki-shi, Yabuki-machi, Tanagura-machi, Yamatsuri-machi, Hanawa-machi, Nishigo-mura, Izumizaki-mura, Nakajima-mura, Samegawa-mura
				3/21～5/11	Aizuwakamatsu-shi, Bandai-machi, Inawashiro-machi, Kitakata-shi, Kitashiobara-mura, Nishiaizu-machi, Aizumisato-machi, Aizubange-machi, Yugawa-mura, Yanaizu-machi, Mishima-machi, Kaneyama-machi, Showa-mura, Minamiaizu-machi, Shimogo-machi, Hinoemata-mura, Tadami-machi
				3/21～5/25	Shinchi-machi, Soma-shi, Minamisoma-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant and Planned Evacuation Zones)
				3/21～6/ 1	Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Kagamiishi-machi, Ishikawa-machi, Asakawa-machi, Furudono-machi, Miharu-machi, Ono-machi, Tenei-mura, Tamakawa-mura, Hirata-mura
		all the other	*3/23～ (excluding areas listed on the right cells)*	3/23～5/ 4	Shirakawa-shi, Iwaki-shi, Yabuki-machi, Tanagura-machi, Yamatsuri-machi, Hanawa-machi, Nishigo-mura, Izumizaki-mura, Nakajima-mura, Samegawa-mura
				3/23～5/11	Aizuwakamatsu-shi, Bandai-machi, Inawashiro-machi, Kitakata-shi, Kitashiobara-mura, Nishiaizu-machi, Aizumisato-machi, Aizubange-machi, Yugawa-mura, Yanaizu-machi, Mishima-machi, Kaneyama-machi, Showa-mura, Minamiaizu-machi, Shimogo-machi, Hinoemata-mura, Tadami-machi
				3/23～5/25	Shinchi-machi, Soma-shi, Minamisoma-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant and Planned Evacuation Zones)
				3/23～6/ 1	Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Kagamiishi-machi, Ishikawa-machi, Asakawa-machi, Furudono-machi, Miharu-machi, Ono-machi, Tenei-mura, Tamakawa-mura, Hirata-mura
	head type leafy vegetables, e.g. cabbage		*3/23～ (excluding areas listed on the right cells)*	3/23～4/27	Aizuwakamatsu-shi, Bandai-machi, Inawashiro-machi, Kitakata-shi, Kitashiobara-mura, Nishiaizu-machi, Aizumisato-machi, Aizubange-machi, Yugawa-mura, Yanaizu-machi, Mishima-machi, Kaneyama-machi, Syouwa-mura, Minamiaizu-machi, Shimogou-machi, Hinoemata-mura, Tadami-machi
				3/23～5/ 4	Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Iwaki-shi, Kagamiishi-machi, Ishikawa-machi, Asakawa-machi, Furudono-machi, Miharu-machi, Ono-machi, Tenei-mura, Tamagawa-mura, Hirata-mura
				3/23～5/11	Fukushima-shi, Nihonmatsu-shi, Date-shi, Motomiya-shi, Kori-machi, Kunimi-machi, Kawamata-machi (excluding Yamakiya area) , Otama-mura, Shirakawa-shi, Yabuki-machi, Tanagura-machi, Yamatsuri-machi, Hanawa-machi, Nishigo-mura, Izumizaki-mura, Nakajima-mura, Samegawa-mura
				3/23～5/25	Shinchi-machi, Soma-shi, Minamisoma-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant and Planned Evacuation Zones)
	flowerhead brassicas, e.g. broccoli, cauliflower		*3/23～ (excluding areas listed on the right cells)*	3/23～4/27	Shirakawa-shi, Yabuki-machi, Nishigou-mura, Izumizaki-mura, Nakajima-mura, Tanagura-machi, Yamatsuri-machi, Hanawa-machi, Samegawa-mura
				3/23～5/ 4	Iwaki-shi
				3/23～5/11	Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Kagamiishi-machi, Tenei-mura, Ishikawa-machi, Tamagawa-mura, Hirata-mura, Asakawa-machil, Furudono-machi, Miharu-machi, Ono-machi
	turnip		*3/23～ (excluding areas listed on the right cells)*	3/23～5/ 4	Fukushima-shi, Nihonmatsu-shi, Date-shi, Motomiya-shi, Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Iwaki-shi, Kori-machi, Kunimi-machi, Kawamata-machi (excluding Yamakiya area), Kagamiishi-machi, Ishikawa-machi, Asakawa-machi, Furudono-machi, Miharu-machi, Ono-machi, Otama-mura, Tenei-mura, Tamakawa-mura, Hirata-mura
				3/23～5/18	Shirakawa-shi, Yabuki-machi, Tanagura-machi, Yamatsuri-machi, Hanawa-machi, Nishigo-machi, Izumizaki-mura, Nakajima-mura, Samekawa-mura, Aizuwakamatsu-shi, Bandai-machi, Inawashiro-machi, Kitakata-shi, Kitashiobara-mura, Nishiaizu-machi, Aizumisato-machi, Aizubange-machi, Yugawa-mura, Yanaizu-machi, Mishima-machi, Kaneyama-machi, Syouwa-mura, Minamiaizu-machi, Shimogou-machi, Hinoemata-mura, Tadami-machi
	log-grown shiitake (grown outdoor)		—	*4/13～ :*	*Date-shi, Iitate-mura, Soma-shi, Minamisoma-shi, Namie-machi, Futaba-machi, Okuma-machi, Tomioka-machi, Naraha-machi, Hirono-machi, Kawamata-machi, Katsurao-mura, Tamura-shi (limiting area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Kawauchi-mura (limiting area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant)*
				4/18～ :	*Fukushima-shi*
				4/13～4/25	Iwaki-shi
				4/25～ :	*Motomiya-shi*
				4/13～5/16	Shinchi-machi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant)
				4/13～5/23	Kawauchi-mura (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant)
	bamboo shoot		—	*5/9～ :*	*Date-shi, Soma-shi, Iwaki-shi, Miharu-machi, Tenei-mura*
				5/13～ :	*Minamisoma-shi, Motomiya-shi, Kori-machi, Kunimi-machi, Kawamata-machi, Nishigo-mura*
				5/9～5/30	Hirata-mura
	ostrich fern		—	*5/9～ :*	*Fukushima-shi, Kori-machi*
	Ume		—	*6/2～ :*	*Fukushima-shi, Date-shi, Kori-machi*
Fishery product	sand lance (juvenile)		*4/20～*		

*** Instructions still imposed are expressed in Italic type.**

V-19(2) The instructions associated with food by Director-General of the Nuclear Emergency Response Headquarters
(Restriction of distribution in prefectures other than Fukushima Prefecture)

As of 2 June 2011

			Restriction of distribution								
			Ibaraki prefecture		Tochigi prefecture		Gunma prefecture	Chiba prefecture		Chiba prefecture	
			whole area	individual areas	whole area	individual areas	whole area	whole area	individual areas	whole area	individual areas
raw milk			3/23～4/10		—	–	—	—	–	—	–
vegetable	non-head type leafy vegetables, e.g. spinach, komatsuna	spinach	3/21～4/17 excluding areas listed on the right cells)	3/21～6/1 Kitaibaraki-shi, Takahagi-shi	3/21～4/27	3/21～4/21 Nasushiobara-shi, Shioya-machi	3/21～4/8	—	4/4～4/22 Asahi-shi, Katori-shi, Tako-machi	—	–
		kakina	3/21～4/17	–	3/21～4/14	–	3/21～4/8	—	–	—	–
		garland chrysanthemum, qing-geng-cai, sanchu asian lettuce	—	–	—	–	—	—	4/4～4/22 Asahi-shi	—	–
	parsley		3/23～4/17	–	—	–	—	—	4/4～4/22 Asahi-shi	—	–
	celery		—	–	—	–	—	—	4/4～4/22 Asahi-shi	—	–
others	tea leaf		*6/2～*	–	—	*6/2～* *Kanuma-shi, Ootawara-shi*	—	—	*6/2～* *Noda-shi, Narita-shi, Yachimata-shi, Sammu-shi, Ooamishirasato-machi*	—	*6/2～* *Minamiashigara-shi, Odawara-shi, Aikawa-machi, Manazuru-machi, Yugawara-machi, Kiyokawa-mura*

＊ Instructions still imposed are expressed in Italic type.

V-19(3)　The instructions associated with food by Director-General of the Nuclear Emergency Response Headquarters
(Restriction of consumption in Fukushima Prefecture)

As of 2 June 2011

		Restriction of consumption		
		Fukushima prefecture		
		whole area	individual areas	
	non-head type leafy vegetables, e.g. spinach, komatsuna	*3/23～ (excluding areas listed on the right cell)*	3/23～5/ 4	Shirakawa-shi, Iwaki-shi, Yabuki-machi, Tanagura-machi, Yamatsuri-machi, Hanawa-machi, Nishigo-mura, Izumizaki-mura, Nakajima-mura, Samegawa-mura
			3/23～5/11	Aizuwakamatsu-shi, Bandai-machi, Inawashiro-machi, Kitakata-shi, Kitashiobara-mura, Nishiaizu-machi, Aizumisato-machi, Aizubange-machi, Yugawa-mura, Yanaizu-machi, Mishima-machi, Kaneyama-machi, Showa-mura, Minamiaizu-machi, Shimogo-machi, Hinoemata-mura, Tadami-machi
			3/23～5/25	Shinchi-machi, Soma-shi, Minamisoma-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant and Planned Evacuation Zones)
			3/23～6/ 1	Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Kagamiishi-machi, Ishikawa-machi, Asakawa-machi, Furudono-machi, Miharu-machi, Ono-machi, Tenei-mura, Tamakawa-mura, Hirata-mura
	head type leafy vegetables, e.g. cabbage	*3/23～ (excluding areas listed on the right cell)*	3/23～4/27	Aizuwakamatsu-shi, Bandai-machi, Inawashiro-machi, Kitakata-shi, Kitashiobara-mura, Nishiaizu-machi, Aizumisato-machi, Aizubange-machi, Yugawa-mura, Yanaizu-machi, Mishima-machi, Kaneyama-machi, Syouwa-mura, Minamiaizu-machi, Shimogou-machi, Hinoemata-mura, Tadami-machi
			3/23～5/ 4	Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Iwaki-shi, Kagamiishi-machi, Ishikawa-machi, Asakawa-machi, Furudono-machi, Miharu-machi, Ono-machi, Tenei-mura, Tamagawa-mura, Hirata-mura
			3/23～5/11	Fukushima-shi, Nihonmatsu-shi, Date-shi, Motomiya-shi, Kori-machi, Kunimi-machi, Kawamata-machi (excluding Yamakiya area), Otama-mura, Shirakawa-shi, Yabuki-machi, Tanagura-machi, Yamatsuri-machi, Hanawa-machi, Nishigo-mura, Izumizaki-mura, Nakajima-mura, Samegawa-mura
			3/23～5/25	Shinchi-machi, Soma-shi, Minamisoma-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant and Planned Evacuation Zones)
	flowerhead brassicas, e.g. broccoli, cauliflower	*3/23～ (excluding areas listed on the right cell)*	3/23～4/27	Shirakawa-shi, Yabuki-machi, Nishigou-mura, Izumizaki-mura, Nakajima-mura, Tanagura-machi, Yamatsuri-machi, Hanawa-machi, Samegawa-mura
			3/23～5/ 4	Iwaki-shi
			3/23～5/11	Koriyama-shi, Sukagawa-shi, Tamura-shi (excluding area within 20 km radius from the Fukushima Daiichi Nuclear Power Plant), Kagamiishi-machi, Tenei-mura, Ishikawa-machi, Tamagawa-mura, Hirata-mura, Asakawa-machil, Furudono-machi, Miharu-machi, Ono-machi
			3/23～5/18	Aizuwakamatsu-shi, Bandai-machi, Inawashiro-machi, Kitakata-shi, Kitashiobara-mura, Nishiaizu-machi, Aizumisato-machi, Aizubange-machi, Yugawa-mura, Yanaizu-machi, Mishima-machi, Kaneyama-machi, Syouwa-mura, Minamiaizu-machi, Shimogou-machi, Hinoemata-mura, Tadami-machi
	log-grown shiitake (grown outdoor)	—	*4/13～*	*Iidate-mura*
fishery product	sand lance (juvenile)	*4/20～*		

＊Instructions still imposed are expressed in Italic type.

Nuclear Safety Commission

[Information in confidential category 2] May 13, 2011

Attachment V-20

The policies for dose criteria for radiation protection

The International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA) recommend the criteria of the integrated dose for members of public under normal situation and accidents. Japan applies these international criteria.

(1) Integrated dose in the normal situation

As for the procedure of the radiation protection for public in the normal situation, from the idea to hold the exposure as low as possible from nuclear power plants in usual operation, the dose limit has been stipulated as 1 mSv/year in "Public notices which provide the dose limit based on the provisions of the rule about establishment operation etc. of the practical use nuclear reactors for electricity generation". This dose limit was adopted from the recommendation 1990 by ICRP.

(2) Integrated dose in accident

The radiation protection criteria for public in accident are as follows ;
(a) Criteria to prevent large exposure in the early stage of the accidents
(b) Criteria in the emergency situation (accident continuation.)
(c) Criteria in the situation where contamination from past accidents should be taken into the consideration.

Figure A illustrates the outline of the concept of these dose criteria.

(a) Criteria to prevent large exposure in the early stage of the accident

As for the criteria to be used for protection measures in the early stage of accidents (indoor sheltering / evacuation), the regulatory guide by the Nuclear Safety Commission, "Emergency Preparedness for Nuclear Facilities", provide criteria for projected dose as effective dose from external exposure "10-50 mSv (indoor sheltering)" and "over 50 mSv (evacuation)". These criteria were determined by reference to the IAEA safety requirements GS-R-2 "Preparedness and Response for a Nuclear or Radiological Emergency" (2002)

(b) Criteria in the emergency situation (accident continuation)

In this accident, if people would continue to live the area with high level dose by locally accumulation of radioactive materials released from the plant, integrated dose to the people might become high level. Therefore, the Prime Minister, who is the chief of the nuclear emergency response headquarters, considering the opinion of the Nuclear Safety Commission into account, established "scheduled controlled evacuation area". The scheduled controlled evacuation area was set by reference to the recommendation 2007 of ICRP in which 20-100 mSv is suggested as a reference level to protect public in the emergency exposure situation and IAEA safety guidance GSG2 "Preparedness and Response for a Nuclear or Radiological Emergency" (2011) in which the countermeasures for protection in the emergency situation are described to be optimized under 100 mSv/year, and in consideration of basic principle

“ Radiation exposure should be kept as low as reasonably achievable”. Predicted integrated dose of 20 mSv in one year from the accident outbreak is adopted as the criteria for the scheduled controlled evacuation area.

(c) Radiation protection criteria in the situation where contamination from past accidents should be taken into the consideration

In the 2007 recommendation of ICRP, a standard of “1-20 mSv/year” is provided as a reference level for protecting the public from contamination after accidents (existing exposure situation). And also, the principle of optimization of protection, “ALARA (As Low As Reasonably Achievable)” is to be applicable to the existing exposure situation.

Table A shows the authority of the above-mentioned radiation dose standards in order.

Table A Authority of the radiation dose standard

Standard for the radiation dose	Authority
(1) Integrated radiation dose in the normal situation • Public radiation exposure dose limit 1 mSv/ year	• Notice of Ministry of Economy, Trade and Industry “Public notices which provide the dose limit based on the provisions of the rule about establishment operation etc. of the practical use nuclear reactors for electricity generation” Article 3: radiation dose out of the peripheral surveillance area • ICRP recommendation Publication 60 (1990): Dose limit of the public radiation exposure
(2) Integrated dose at the time of the accident	
Standard for avoiding large radiation exposure in the early stage of the accident outbreak 10 mSv (indoor sheltering) 50 mSv (evacuation)	• The guidance of the Nuclear Safety Commission “About the disaster prevention measures such as nuclear energy facilities” • IAEA safety requirements GS-R-2 “Preparedness and Response for a Nuclear or Radiological Emergency” (2002)
(b) Standard of the radiation protection in the emergency situation (accident continuation) 20-100 mSv	• ICRP recommendation Publication 103 (2007) • IAEA safety requirements GSG2 “Preparedness and Response for a Nuclear or Radiological Emergency” (2011)
(c) The radiation protection standard in the situation where the pollution after the accident has come to a settlement should be taken into the consideration 1-20 mSv/year	• ICRP recommendation Publication 103 (2007) Reference level for protecting the public in the situation where the pollution after the accident has come to a settlement should be taken into the consideration (existing situation)

ICRP: International Commission on Radiological Protection
IAEA: The International Atomic Energy Agency

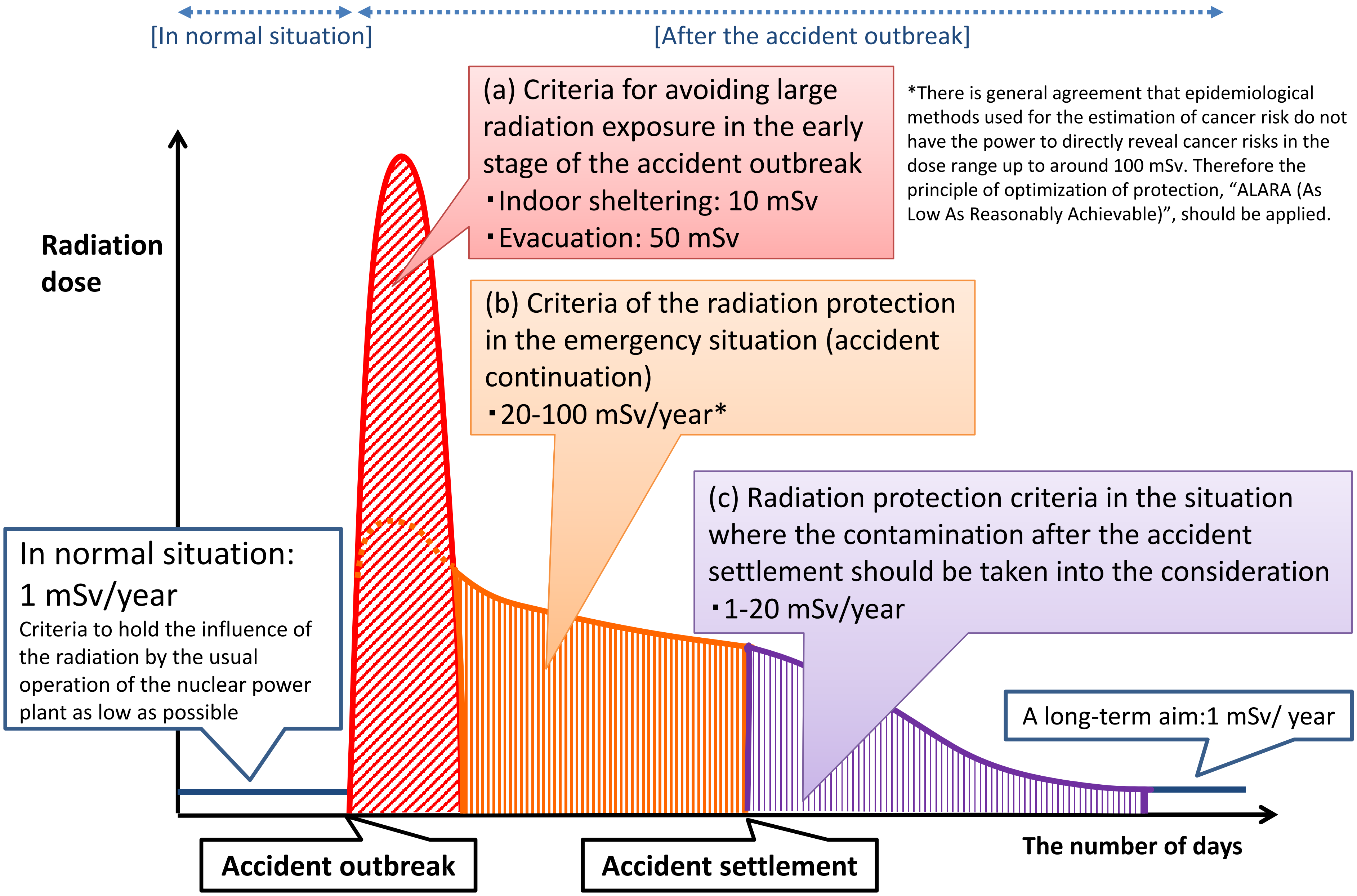


Figure A The idea of the Criteria of the radiation dose for the radiation protection

1. Estimates of Integrated Dose at Each Monitoring Location based on Actual Measurement

Location Number	Location (Monitoring Area)	Distance	Direction	Starting Date of Monitoring	Estimates of Integrated Dose (mSv) 【※1】	Note for Integrated Dose	Latest Readings (mSv/h) 【※3】	Estimates of Integrated Dose as of March 11, 2012 (mSv) 【※4】
○83	Futaba county Namie town Akougi Kunugidaira	24km	North/West	2011/3/24	34.0	【※2】	0.0570	313.9
○81	Futaba county Namie town Akougi Ishikoya	31km	North/West	2011/3/24	20.3	【※2】	0.0274	154.8
○32	Futaba county Namie town Akougi Teshichiro	31km	North/West	2011/3/16	20.8		0.0260	148.4
○79	Futaba county Namie town shimotsushima kayabuka	29km	West/North/West	2011/3/16	8.5		0.0153	83.6
○31	Futaba county Namie town Tsushima Nakaoki	30km	West/North/West	2011/3/17	8.0		0.0106	60.1
○34	Futaba county Namie town Tsushima Taikougi	30km	West/North/West	2011/3/19	3.7	【※2】	0.0065	35.6
21	Futaba county Namie town Tsushima Higashidate (Futaba County Katsurao Village Kaminogawa)	30km	West/North/West	2011/3/17	1.7		0.0023	13.0
○33	Soma county Iitate Village Nagadoro	33km	North/West	2011/3/16	11.1		0.0163	91.1
○62	Soma county Iitate Village Kusano Taishido	39km	North/West	2011/3/17	4.0		0.0071	38.8
○61	Soma county Iitate Village Yagisawa	36km	North/West	2011/3/17	3.2		0.0061	33.2
63	Soma county Iitate Village Nimaibashi	44km	North/West	2011/3/17	1.5		0.0028	15.3
○46	Date county Kawamata town Yamakiya Mukaideyama	34km	West/North/West	2011/3/17	4.5		0.0057	32.4
○36	Date county Kawamata town Yamakiya Nagahashi (Date county Kawamata town Yamakiya Oonukari)	41km	West/North/West	2011/3/20	2.8	【※2】	0.0046	25.4
4	Date county Kawamata town oaza Tsurusawa aza Kawabat	47km	North/West	2011/3/17	0.8		0.0017	9.1
78	Date county kawamata town Tsurusawa	48km	North/West	2011/3/20	0.9	【※2】	0.0017	9.3
○37	Date city Ryozen town Ishida Hojizawa	48km	North/West	2011/3/31	2.6	【※2】	0.0039	21.8
3	Date city Ryozen town Ishida Hikohei	46km	North/West	2011/3/17	1.8		0.0028	15.5
2	Fukushima city Onami Takinoiri	56km	North/West	2011/3/17	2.1		0.0030	16.8
1	Fukushima city Sugitsuma town	62km	North/West	2011/3/16	1.4		0.0011	6.8
85	Fukushima city Arai Harajiku	66km	West/North/West	2011/3/27	0.4	【※2】	0.0004	2.4
77	Iwaki city Ogawa town Kamiogawa	26km	South/West	2011/3/20	1.0	【※2】	0.0015	8.4
74	Iwaki city Ogawa town Takahagi	36km	South/South/West	2011/3/20	0.4	【※2】	0.0006	3.3
75	Iwaki city Uchigoumiyamaya town	43km	South/South/West	2011/3/20	0.2	【※2】	0.0002	1.2
44	Iwaki city Ohisa town Ohisa Yanomezawa	28km	South/South/West	2011/3/17	0.9		0.0010	5.8
38	Iwaki City Yotsukura town Shiraiwa Hokita	34km	South/South/West	2011/3/31	0.5	【※2】	0.0010	5.5
73	Iwaki City Yotsukura town	35km	South	2011/3/20	0.5	【※2】	0.0006	3.4
72	Iwaki city Hisanohama town Hisanohama aza Kitaaramaki	31km	South	2011/3/20	0.6	【※2】	0.0012	6.5
84	Iwaki city Miwa-town Saiso	39km	South/West	2011/3/26	0.3	【※2】	0.0005	2.7
45	Futaba county Naraha town Yamadaoka Utsukushimori	20km	South	2011/3/17	0.9		0.0017	9.3
71	Futaba county Hirono town Shimokitaba Nawashirogae	23km	South	2011/3/20	1.1	【※2】	0.0012	7.0
11	Nihonmatsu city Ota aza Shimoda	43km	West/North/West	2011/3/17	0.8		0.0015	8.2
10	Nihonmatsu city Harimichi Nakajima	44km	West/North/West	2011/3/17	0.7		0.0016	8.5
35	Nihonmatsu city Tazawa Hagidaira	37km	West/North/West	2011/3/19	0.6	【※2】	0.0015	8.0
86	Koriyama city Ootsuki town Choemonbayashi	63km	West	2011/3/27	1.0	【※2】	0.0014	7.8
87	Futaba county Kawauchi village Kamikawauchi Hananouchi	29km	West/South/West	2011/3/27	0.6	【※2】	0.0011	6.0
76	Futaba county Kawauchi village Kamikawauchi Hayawata	22km	West/South/West	2011/3/20	0.5	【※2】	0.0008	4.4
43	Futaba county Kawauchi village Shimokawauchi Miyawata	22km	West/South/West	2011/3/16	0.4		0.0004	2.3
42	Tamura city Tokiwa town Yamane Tomioka	33km	West	2011/3/17	0.6		0.0011	6.0
15	Tamura city Tokiwa town Yamane Kashima	32km	West	2011/3/17	0.6		0.0017	8.9
14	Tamura city Tokiwa town Tokiwa Uchimachi	34km	West	2011/3/17	0.2		0.0006	3.1
13	Tamura city Tokiwa town Nishimuki Yakata	37km	West	2011/3/17	0.3		0.0008	4.2
41	Tamura City Miyakoji town Furumichi Teranomae	21km	West	2011/3/17	0.5		0.0009	5.0
20	Tamura city Funehiki town Niitate Shimo	41km	West	2011/3/17	0.4		0.0008	4.3
23	Tamura city Funehiki town Niitatemagariyama (Tamura city Funehiki town Minamiutsushi Suichu-uchi)	41km	West/North/West	2011/3/17	0.4		0.0006	3.4
22	Tamura city Funehiki town Kamiutsushi aza Ushirota	35km	West/North/West	2011/3/17	0.3		0.0006	3.3
12	Tamura city Funehiki town Funehiki aza Ozawakawashiro	39km	West	2011/3/17	0.2		0.0005	2.7
52	Tamura city Funehiki town funehiki Babakawara	41km	West	2011/3/17	0.2		0.0003	1.6
39	Soma city Yamakami Kaminamiki	41km	North/North/West	2011/4/1	0.7	【※2】	0.0010	5.6
5	Soma city Nakano Teramae	42km	North/North/West	2011/3/17	0.4		0.0008	4.4
6	Minami Soma city Kashima ward Nishimachi	32km	North	2011/3/17	0.6		0.0013	7.0
7	Minami Soma city Kashima ward Terauchi Motoyashiki	32km	North/North/West	2011/3/17	0.6		0.0008	4.5
80	Minami Soma city Haramachi ward Takami town	24km	North	2011/3/20	0.7	【※2】	0.0006	3.6
51	Tamura county Ono town Ononiimachi Tatemawari	39km	West/South/West	2011/3/17	0.2		0.0002	1.2

○ indicates the locations where estimated integrated radiation dose exceeds 20mSv at March 11,2012.

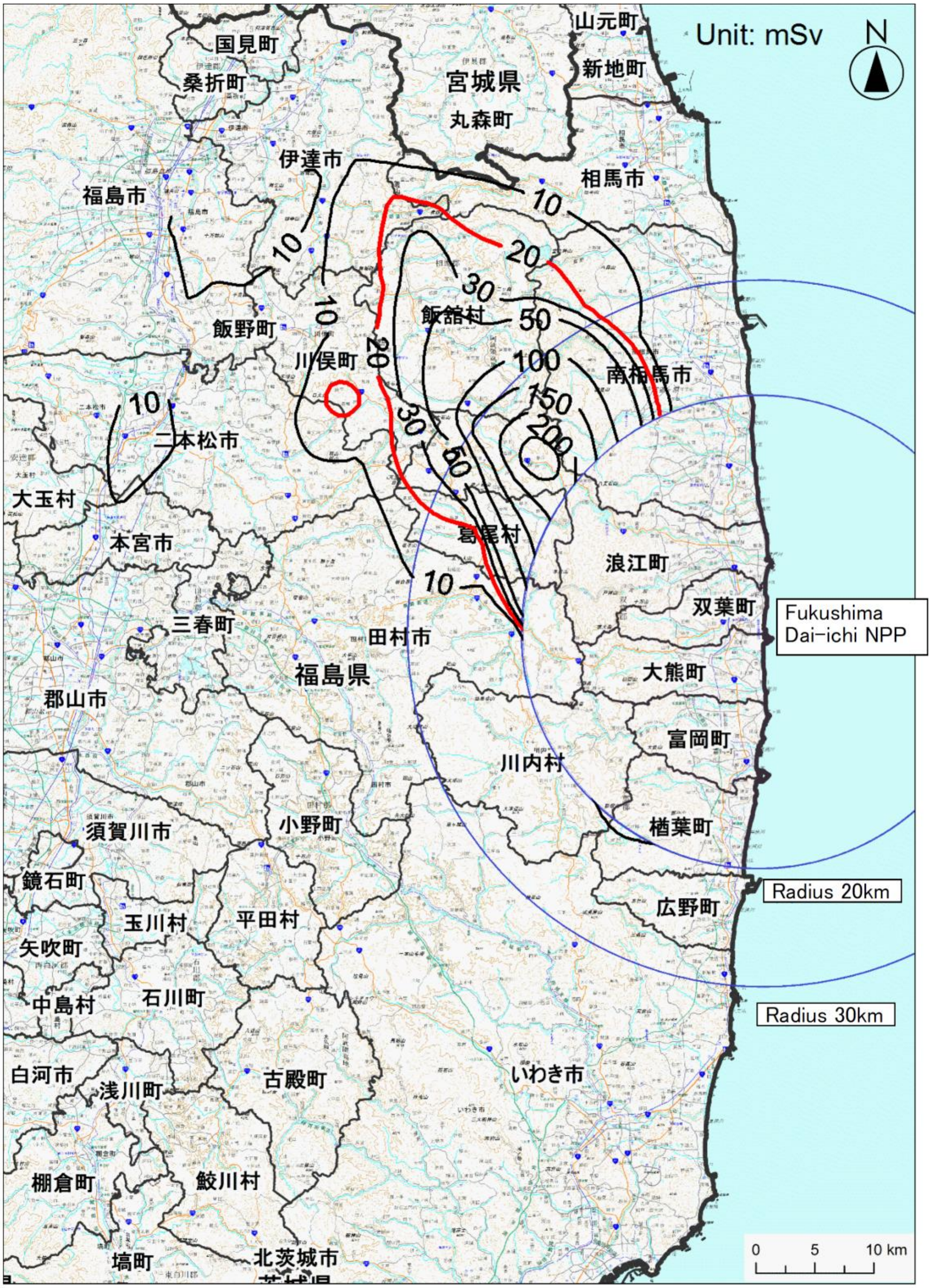
※1: Shown values are integrated values monitored from 6:00, March 12 through 24:00, April 5 whereby the values are estimated in consideration of the reduction effect of wooden buildings.

※2: For locations where the monitoring was started on or after March 19, the dose data for the period from March 16 to the day before the start of monitoring has been derived by assuming that the dose has changed in proportion to changes at Location No. 32, where the steepest dose change has been observed.

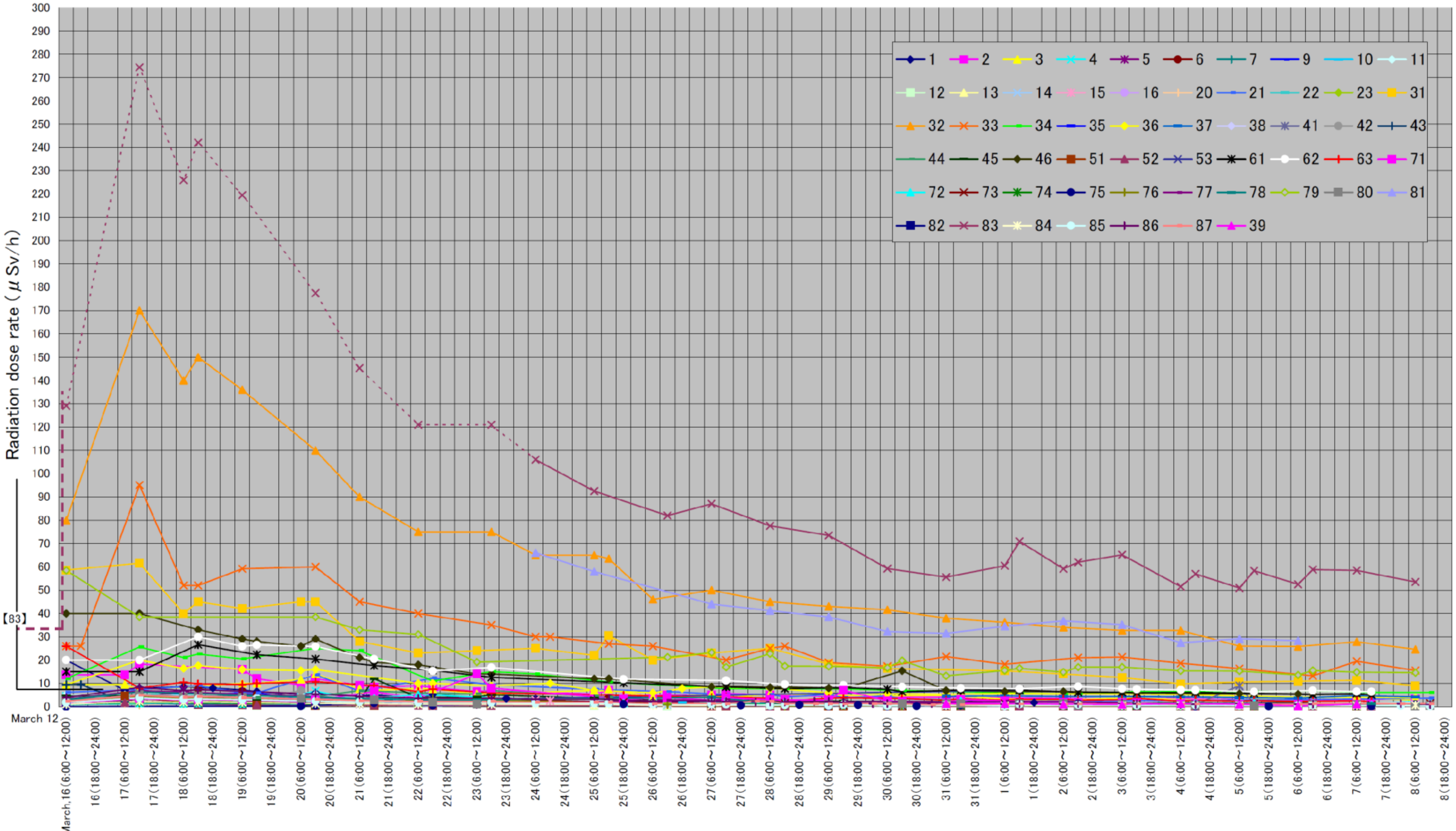
※3: Dose rate until news release at 13:00 April 3.

※4: Evaluated assuming that the latest measurement results【※3】continue, after April 6.

Integrated Dose Estimation Map
(Integrated dose up until May 11, 2012)



3. Change of radiation dose



Remarks: Maximum values are plotted if several data exist in each 6 hour-sector.
Dotted line is not measured but estimated value assuming that it is in proportion to the measurement value at point number 32.

Attachment VI-1

SPEEDI trial estimation of total discharge of radioactive nuclides

Although accurately estimating the amount of radioactive materials discharged by the accident that occurred at Fukushima Dai-ichi NPS was still difficult, the NSC announced the estimated amounts of iodine-131 and cesium-137 discharged to the air from Fukushima Dai-ichi NPS on April 12 with assistance from the JAEA in an effort to grasp the overall picture of the accident. As the total amount of some radioactive nuclides discharged to the air from Mar 11 to April 5, estimated values of 1.5×1017Bq of iodine-131 and 1.2×1016Bq of cesium-137 (which was corrected as 1.3×1016 on May 12) was obtained.

These values were obtained by an inverse estimation method that estimates discharge rates by comparing them with values obtained by an air diffusion calculation, assuming environmental monitoring data and a unit discharge rate of 1Bq/h. Data used were measured by MEXT, JAEA, and the Japan Chemical Analysis Center. Most of the estimated values were obtained by a comparison between the concentrations of iodine-131 and cesium-137 in the air by dust sampling, and calculated values. However, regarding the discharge of nuclides during the day of March 15 when a large amount of radioactive nuclides were deposited on the earth's surface in the northwest of the NPS while it rained, the discharge rates of iodine-131 and cesium-137 during this period of time were obtained by comparing the air dose rate distributions of surface-deposited nuclides after the radioactive plume disappeared due to unavailability of dust sampling. As a result, the estimated discharge rate of iodine-131 was about 106Bq/h and the estimated discharge period was around 12:00 till 15:00 based on values such as environmental monitoring readings obtained by Fukushima prefecture. However, the conservative 6-hour discharge from 9:00 to 15:00 was assumed for estimating a total discharge because a dose increase was observed at the front gate of the plant after around 09:00 on the day. The amount of iodine-131 discharge remained in the order of magnitude of 1,014Bq/h until March 24 from March 15 when a large amount was discharged. From March 24 to early April, it reduced from the order of magnitude as 1,012Bq/h to 1,011Bq/h. The amount of cesium-137 discharged was estimated from a comparison between dust sampling data on iodine-131 and cesium-137, and it fluctuated in a similar way to the discharge rate of iodine-131 in a comparative range of 1-100.

The amounts of iodine-131 and cesium-137 discharged to the air, which were used for a presumptive calculation, are important when peripheral exposure doses are evaluated from the occurrence to the end of the accident. These results are just of an exploratory analysis and they require further evaluation with higher accuracy through gathering knowledge from specialists of inside-facility analysis and environmental analysis.

Radioactive materials discharged into the environment after the accident include noble gases, radioactive materials discharged to the sea, and those deposited on the surfaces in the site and the soil.

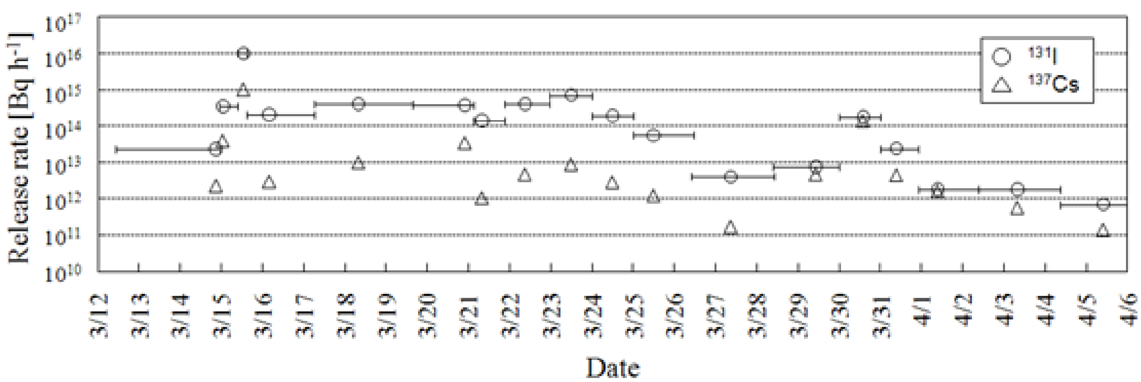


Fig. Provisional discharge rates of Iodine-131 and Cesium-137
The horizontal bar represents estimated continuing discharge time.
(Source: Material 4-2 for NSC the 31th held on May 12, 2011)

Attachment VI-2

Outflow of radioactive water off the site near water intake of Unit 2 at Fukushima Daiichi Nuclear Power Station

1. Evaluation of the fact

At around 9:30 am April 2nd, 2011, outflow was found. It had stopped at around 5:38 pm April 6th, after appropriate counter measure had being taken.

At around noon April 1st, one day before when outflow was found, it was confirmed that atmospheric dose rate near inlet canal screen was 1.5mSv/h and increase of dose rate was not observed, and also it was confirmed that no sound of outflow into sea face had been observed from the pit near the crack. Considering these two facts, it is impractical to estimate, as at the time of April 1st, the outflow had already started in a similar manner which was observed during April 2nd to 6th. However, we have no reasonable evidence to estimate when outflow has started, we have conducted our calculation based on the assumption that outflow was started on April 1st.

After outflow was found, we have been monitoring the situation by remote camera and it is detailed in this report

Stoppage work has been implemented from 3 pm April 5th, injecting “water glass” underneath of trench, and decrease of outflow was observed, however, we have conducted our calculation based on the assumption that outflow has continued as if there were no decrease of outflow due to stoppage work.

Based on above, we estimate the outflow as follows;

- Fall length (height) : 75 cm
- Flying distance : 65 cm
- Diameter of outflow : 30 mm(*)

In addition to above assumptions, we estimate about 4.3 m3/h of water have continuously flown out for 5days, from April 1st to 6th (120 hours), we calculated accumulated volume of outflow will be approximately 520 m3.

(*) By interpreting the photographs and hearing from the workers, we judged the diameter of outflow approximately 30 mm.

2. Concentration of radioactive water

Concentration of radioactive water was analyzed by using sample which was collected at 4:30 pm, April 2nd, inlet water to screen of Unit 2 are as follows;

Concentration of radioactive substance;

Iodine 131	—	5.4×10^6	Beq/cm^3
Cesium 134	—	1.8×10^6	Beq/cm^3
Cesium 137	—	1.8×10^6	Beq/cm^3

3. Estimated total outflow volume

Total volume of outflow;

Iodine 131	—	2.8×10^{15}	Beq
Cesium 134	—	9.4×10^{14}	Beq
Cesium 137	—	9.4×10^{14}	Beq
(Total sum		4.7×10^{15}	Beq)

4. Estimated source of outflow

According to the result of nuclide analysis of outflow water and retained water in the pit, it has turned out the radiation are both in the same level, therefore, we estimate outflow water is same as the retained water in the pit. And as it is confirmed the pit and trench of Unit 2 is structurally connected, we consider the water has flown out from turbine building of Unit 2 through trench into the sea.

5. Countermeasure to prevent diffusion and outflow of radioactive water

(1) Countermeasure to prevent diffusion of radioactive water

In order to prevent diffusion of radioactive water, we put steel plate on the screen for inlet canal of Unit 2, where radioactive water has flown out into the sea, put silt fence across the harbor, and put large size 62 sandbags around breakwater south to the screen of Unit 4. In addition to above countermeasure, we put 10 sandbags filled with absorbent of radioactive material, zeolite, in front of each screen room of Unit 1 to 4 for the purpose of absorption of radioactive material and minimize diffusion of radioactive material to offshore. In addition, we plan to consider other countermeasure such as putting steel sheet pile or installing facility which absorb radioactive material around the breakwater south to the screen of Unit 4.

(2) Countermeasure to prevent outflow of radio active water

For the purpose of preventing outflow of radioactive water outside with absolute certainty, we transfer high radiation water into the Centralized Radiation Waste Treatment Facility and is under strict control and storage. And we also implement segregation between trench and turbine buildings. Furthermore, in order to gain steady progress of storage and treatment of retained water, we implement plans such as installing storage tank to meet each radiation level and water treatment facilities for decontamination and salinity treatment of radioactive water.

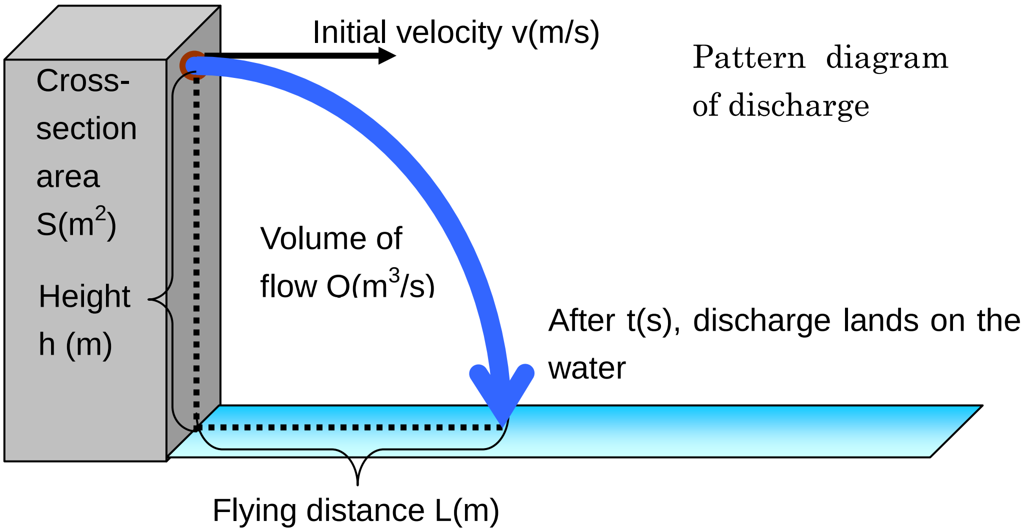
(3) Assessment of environmental impact

We will continue to monitor sea water across on and off shore with additional monitoring point and fish and shellfish to follow up the radiation level.

END

Reference 1

Evaluation method of volume of discharge



Based on the flying distance and height, assuming discharged liquid in falling motion, volume of flow is calculated as follows:

Vertical direction is free-fall motion $h = \frac{1}{2} g t^2 \Leftrightarrow t = \sqrt{\frac{2h}{g}}$

Horizontal direction is uniform motion $v = \frac{L}{t} = \frac{L}{\sqrt{\frac{2h}{g}}}$

Volume of flow $Q = Sv = \frac{SL}{\sqrt{\frac{2h}{g}}} \cdots ①$

<Premise>

Cross-section area : S=Diameter 3cm = 7.07×10^{-4} (m^2)

Flying distance : L = 0.65 (m)

Height : h = 0.75 (m)

Gravity acceleration : g=9.8 (m/s^2)

By substituting premise into equation ①, volume of flow is evaluated as fallows:

$$Q = \frac{SL}{\sqrt{\frac{2h}{g}}} = \frac{7.07 \times 10^{-4} \times 0.65}{\sqrt{\frac{2 \times 0.75}{9.8}}} = 1.17 \times 10^{-3} (m^3/s) \neq 4300(\ell/h)$$

Reference 2

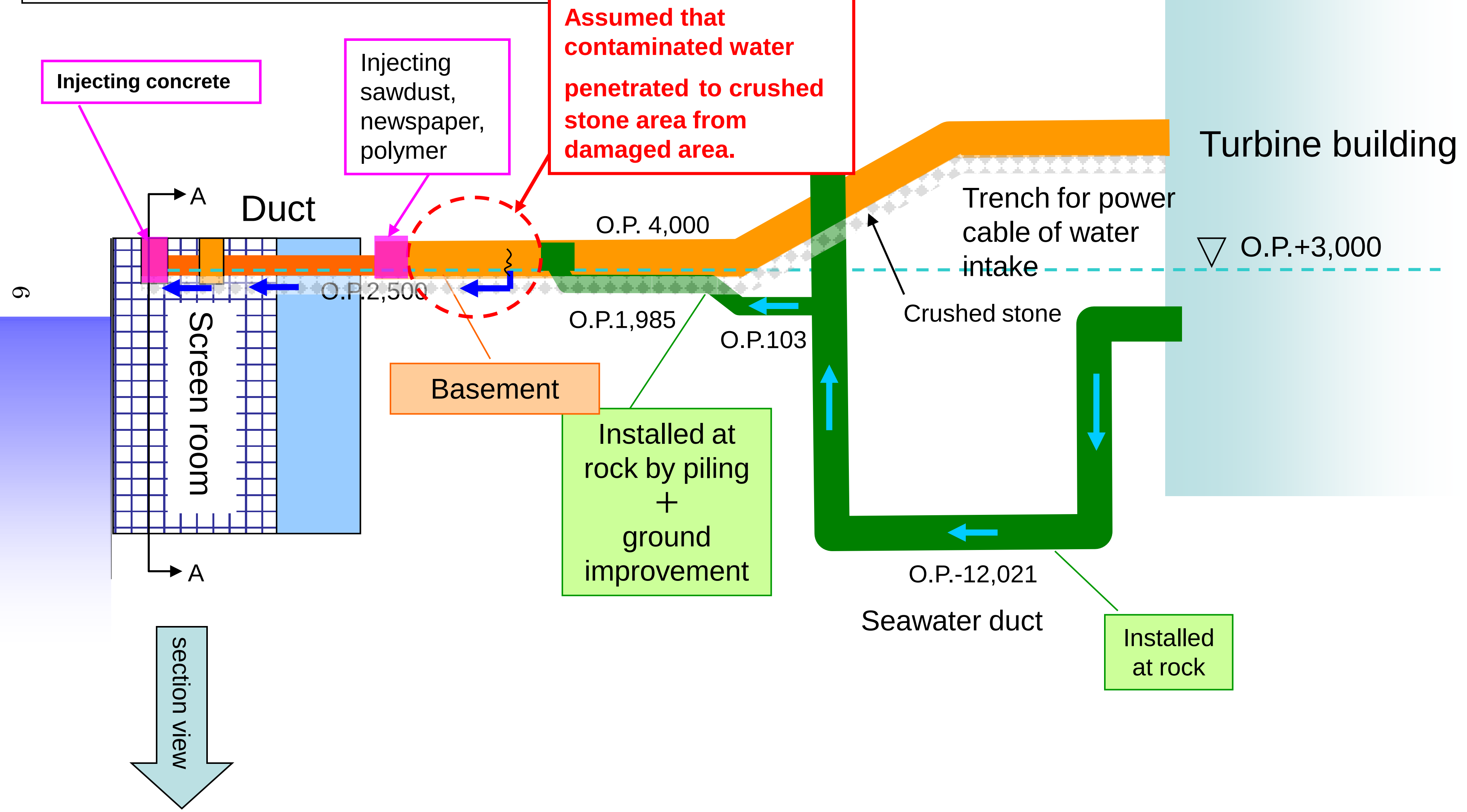
Photo (taken at approx. 2:20 pm on April 5th, 2011)

Estimated Cause

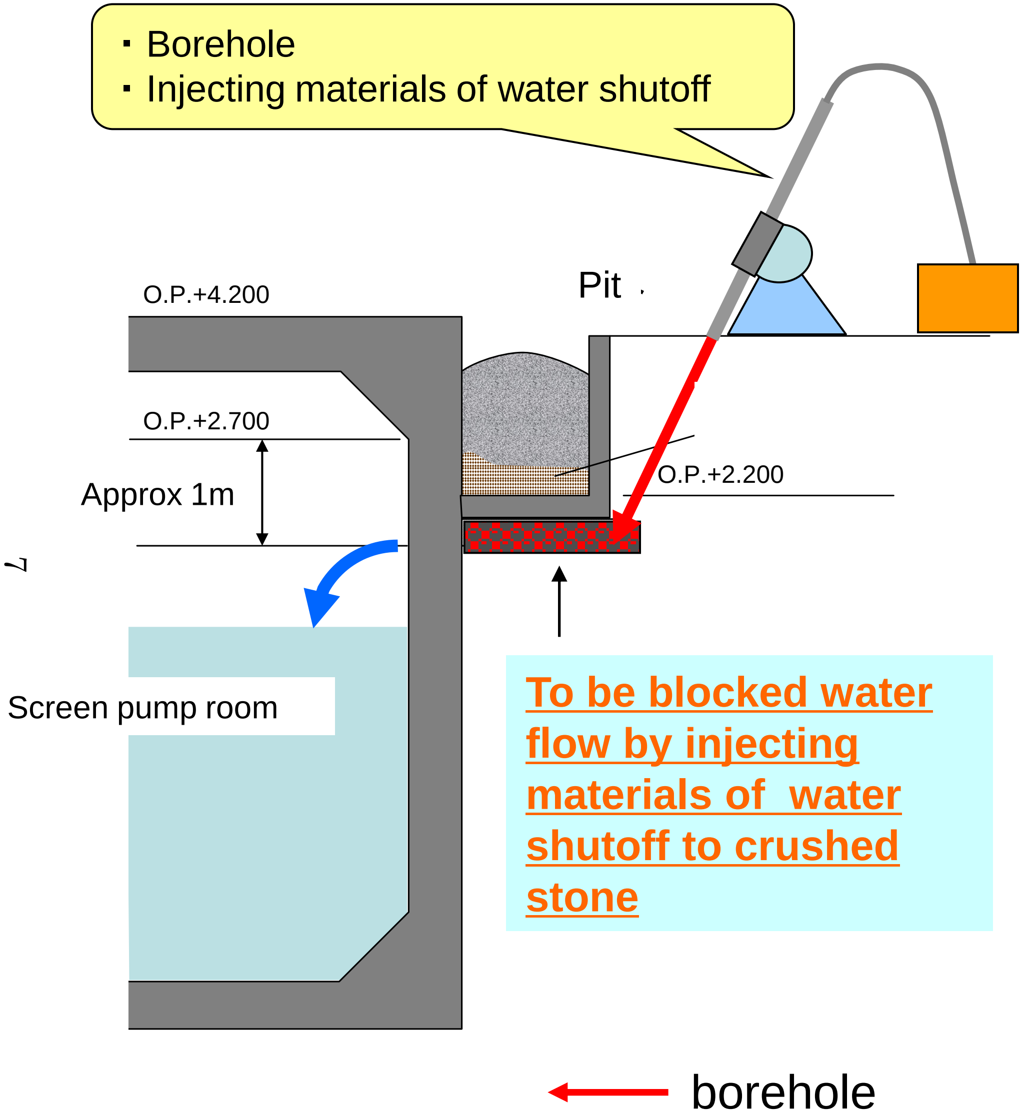
Reference 3

<Estimated cause>

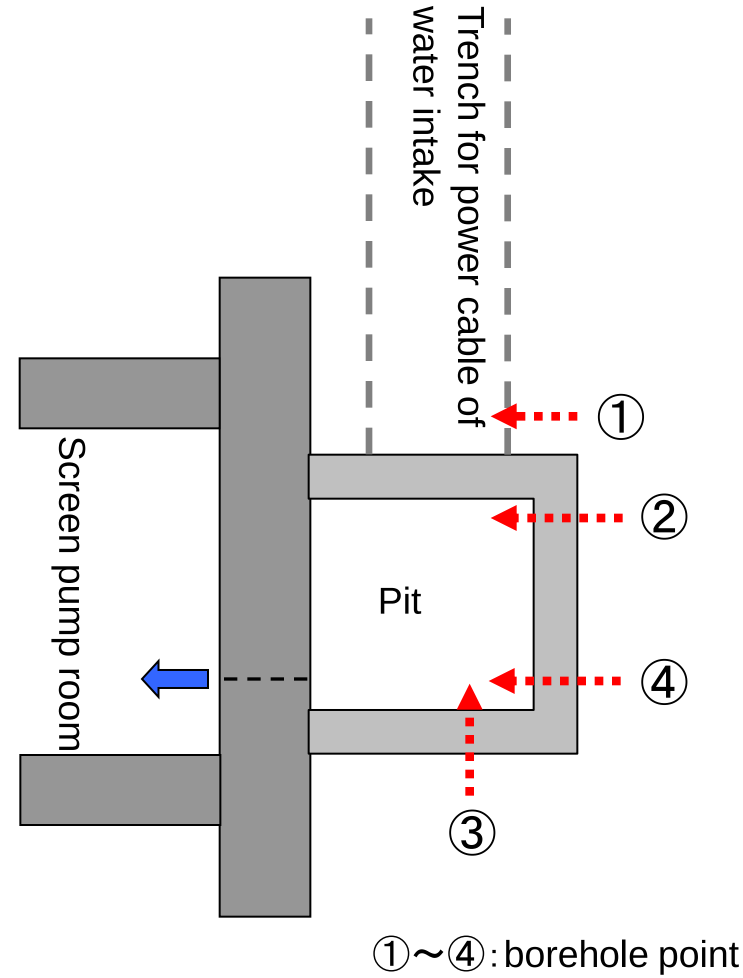
・High probability that water flowed because crushed stone area installed at the bottom of trench became water path.



Tentative planned countermeasure construction



A-A Section view



Plain view

Attachment VI-3

Outflow of radioactive water off the site near water intake of Unit 3 at Fukushima Daiichi Nuclear Power Station

1. Overview of the event

At around 12:30 pm on May 11, 2011, a worker, who was working to block the vertical shaft near the intake canal, heard the water flowing into the pit and understood the situation by opening the lid of the pit. However, at that time we were not aware of the outflow to the screen area.

Later, when we checked the site again we opened the cover hatch to the screen room and observed the inside by CCD camera. We confirmed that the water in the pit was flowing into the screen area at around 4:05pm on the same day.

Seeing that the inflow water contains highly radioactive materials, we assume that drainage water in the turbine building of Unit 3 flowed out into the power cable pit on the ocean side of the turbine building through the trench for sea water pipes, the connection point to the trench for power cables, and the duct, the connection points to the power cable pit, and ducts for electric wires, and it further flowed out into the screen area of the intake canal of Unit 3 through the penetration created on the concrete wall between the power cable pit to the north of such pit and the screen pump room.

After we confirmed the outflow from such pit into the screen area, we immediately cut the duct for the electric wires in the pit and stuffed fabrics, and blocked the pit by concrete. As a result, we confirmed by CCD camera that the outflow was stopped at 6:45pm on May 11, 2011.

2. Estimation of amount of flow

(1) Estimation of amount of flow

We estimated the amount of flow based on the observation of the status of flow into the power cable pit from ducts and into the screen area through the wall of the pit.

a. Status of flow into power cable pit

The water flew into the pit through the void part in ducts where electric wires were laid out. Based on the data (diameter of a duct: 10cm, number of ducts: 4, and the photo of void part (taken at around 10:30am on May 11), we assumed the details of the outflow as follows – width of the flow: 6cm, drop: 1.27m, flying distance: 0.5m. As a result, the estimated amount of flow is approx. 6m^3/h (approx. 100 litters/min).

b. Status of flow into screen area from power cable pit
We observed the water flowed cylindrically into the screen area from the pit. Based on the photo taken (at around 6:30pm on May 11) after fabrics were stuffed into the duct, we assumed as follows – diameter: 5cm, drop: 1.4m, flying distance: 0.3m. The estimated amount of flow is approx. 4.3 m ^{3}/h (approx. 72 litters/min)

However, in an interview on the status of the flow into the screen area from the pit, a worker answered that the amount of flow before fabrics were stuffed into the duct was larger than that after the stuff, thus we assumed approx. 6m ^{3}/h.

(2)Duration of flow

The record of the water level in the vertical shaft at Unit 3, which is the upstream of the power cable pit where the outflow was found, shows;
from 7:00am on May 4 (o.p. +3,140mm) to 7:00am on May 10 (o.p. +3,240mm): the water level was increased by 10 to 30 mm per day, whereas
from 7:00am on May 10 to 5:00pm on May 11: the water level was decreased by 20 mm per day.
By calculating correlations using the least square method to each increase period and decrease period, we estimated that the increase turned to the decrease at 2:00am on May 10.
Based on the above, we assumed the water started to flow out at 2:00am on May 10 when the water level turned to decrease.

Separately, we conduct surveys of radioactive doses of sea water at the south of the intakes of Units 1 to 4 and near the bar screen of Unit 2 at Fukushima Daiichi Nuclear Power Station to monitor periodically the radioactive materials contained in the sea water near the intake of Unit 3. The study of the monitoring results showed that generally the doses were decreasing until 7:00am on May 10, whereas it turned to increase after 7:00am on May 11. In addition, the record of radioactive doses at the north of intakes for Units 1 to 4 which is a little to the north from the screen area of Unit 3 showed the same trend. Judging from the above, we estimate that the outflow started at 7:00am on May 10 and we consider that the estimation of starting time based on the change of the water level in the vertical shaft is conservative.

We confirmed the outflow was stopped at 6:45pm on May 11. Therefore, we estimated that the duration of the outflow is approx 41 hours from 2:00am on May 10 to 7:00pm on May 11.

In conclusion, based on (1) and (2) above, the estimated amount of outflow is approx. $250m^3$ (6 m^3/h, and lasted for 41 hours).

(3) Amount of radioactive materials flowed out

a. Radioactive dose of inflow water

The radioactive doses of the water into the power cable pit sampled at 1:30 pm on May 11 are as follows;

Cesium 137	: $3.9 \times 10^4 Bq/cm^3$
Cesium 134	: $3.7 \times 10^4 Bq/cm^3$
Iodine131	: $3.4 \times 10^3 Bq/cm^3$

We calculated the amount of radioactive materials flowed into the screen area using the amount of outflow water in (2) and radioactive doses above as follows;

Cesium 137	: $3.9 \times 10^4 Bq/cm^3 \times 250m^3 = 9.8 \times 10^{12} Bq$
Cesium 134	: $3.7 \times 10^4 Bq/cm^3 \times 250m^3 = 9.3 \times 10^{12} Bq$
Iodine 131	: $3.4 \times 10^3 Bq/cm^3 \times 250m^3 = 8.5 \times 10^{11} Bq$
Total	: $2.0 \times 10^{13} Bq$

3. Preventive measures and plans to prevent scattering to the outside of harbor

(1) Blocking pits the water might flow out from

Before May 15 we completed all the work to block the pits the radioactive water might flow out from. Furthermore, as an additional measure, we will block 27 pits which are connected to the trenches for sea water pipes by concrete etc.

(2) Isolation of screen pump rooms at Units 1 to 4
We will install waterstop etc. in front of each screen pump room until the end of June.

(3) Installation of sandbags which contains zeolite
As a first step countermeasure, we will install sandbags which contains zeolie inside the intake.

(4) Installation of circulating water purification equipment
We will install circulating water purification equipment in the screen area. By circulating the sea water in the intake, we will remove radioactive cesium (installment: by the end of May, commencement of operation: early June).

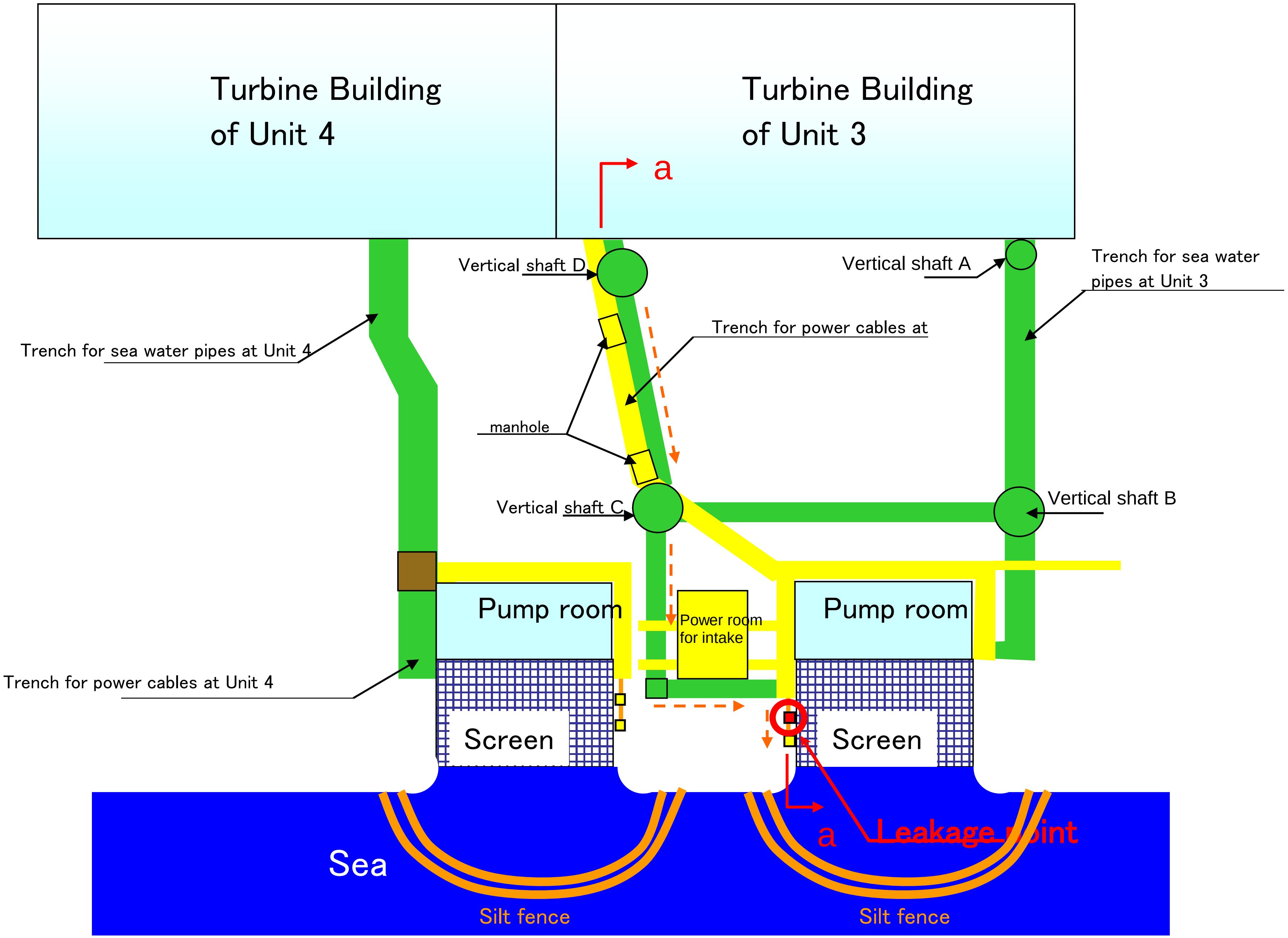
(5) Continuance and reinforcement of monitoring
We will continue monitoring of sea water inside and outside of the harbor to check whether there is any significant difference in radioactive doses.

As for Units 1, 3 and 4, we will analyze sea water inside the silt fence as we do for Unit 2, to reinforce the monitoring system.

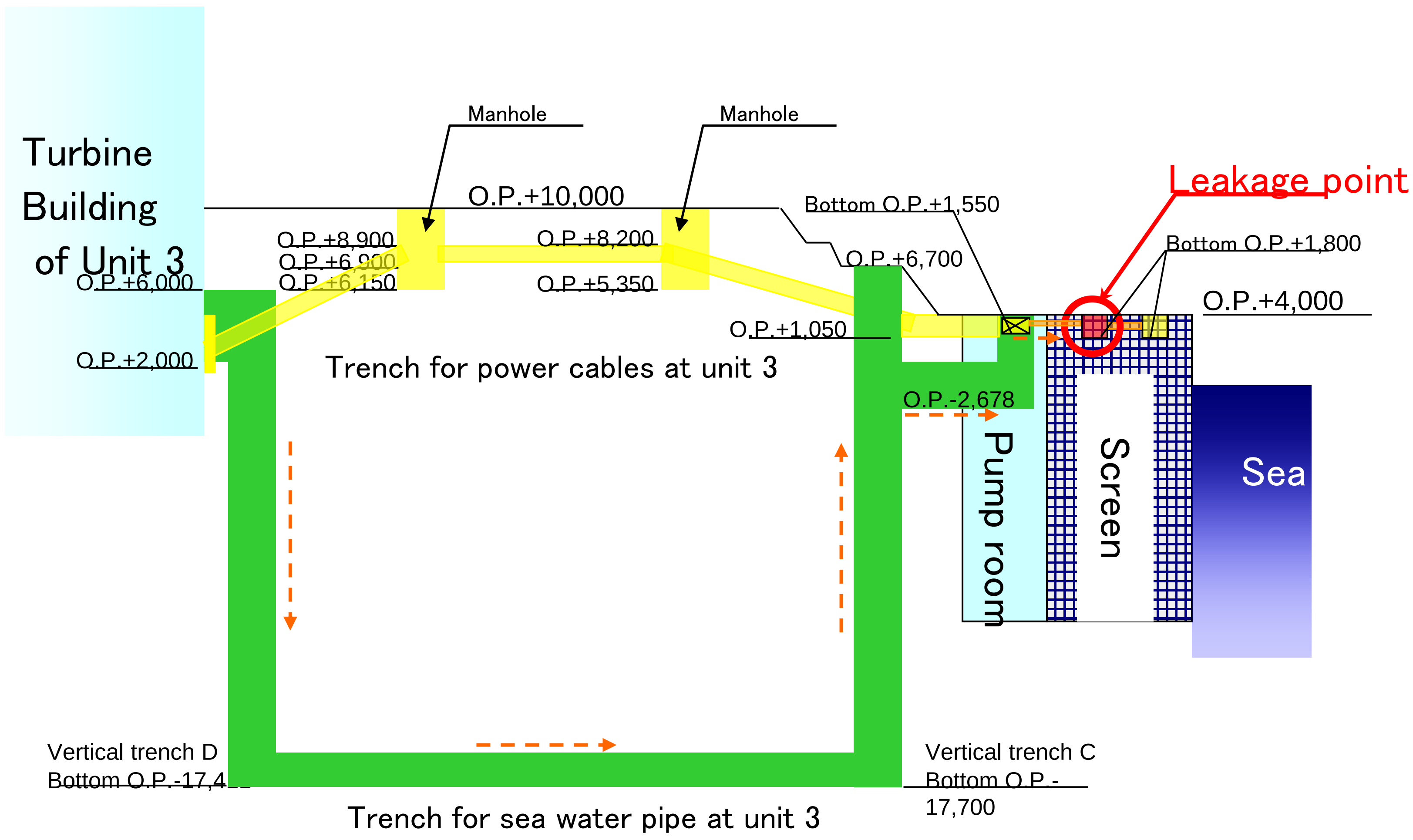
END

Trench for sea water pipes at Unit 3 (plain view)

Reference 1



Trench for sea water pipes at Unit 3 (a – a vertical cross sectional view)

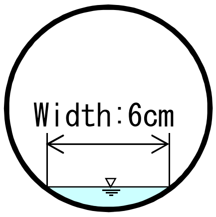


Status of outflow to near intake of Unit 3

Reference 2

【Status of flow into power cable pit】

(Enlarged view of the left photo)



Cross-sectional view of a

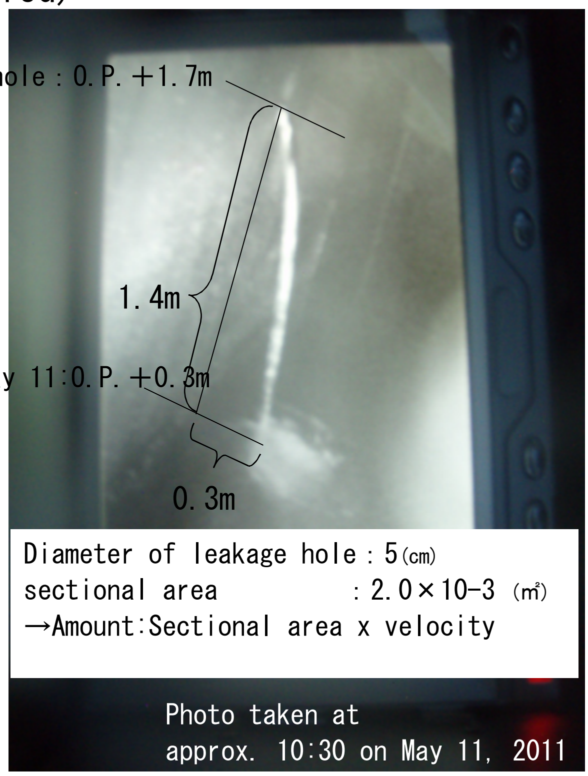
Time required to drop 1.27m:
√ {(2×1.27)/9.8} =0.51(s)
Horizontal velocity:
0.5(m)÷0.51(s)=

Diameter of a duct: 10(cm)
Width of flow: 6(cm)
Sectional area: 4.1×10-4 (m²)
→Amount: sectional area×4 ducts×velocity
=approx. 100(litters/min.)

【Status of flow into screen area from power cable pit】
(after fabrics were stuffed)

Height of leakage hole: O.P.+1.7m

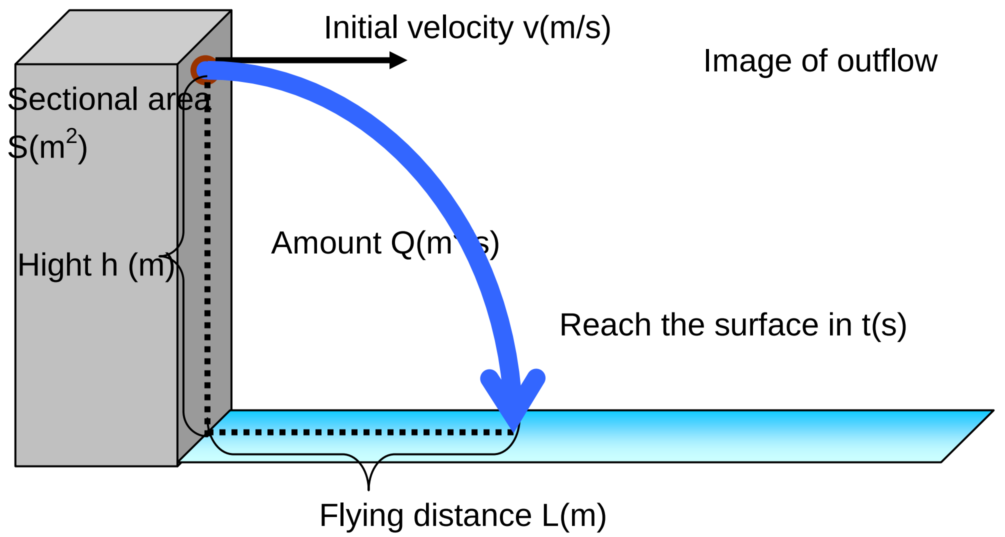
Height of tide at 6:30pm on May 11:O.P.+0.3m



Time required to drop to the sea level:
√ {(2×1.4)/9.8} =0.55(s)
Horizontal velocity:
0.3(m)÷0.55(s)=0.6(m/s)

Reference 3

Method taken to estimate amount of flow



Assuming the flowed liquid free-falls, calculate the amount by applying the formulas below based on the flying distances and heights.

Free-fall vertically
$$h = \frac{1}{2}gt^2 \Leftrightarrow t = \sqrt{\frac{2h}{g}}$$

Uniform motion horizontally
$$v = \frac{L}{t} = \frac{L}{\sqrt{\frac{2h}{g}}}$$

Amount
$$Q = Sv = \frac{SL}{\sqrt{\frac{2h}{g}}} \quad \cdots ①$$

＜Assumptions＞

Diameter of a duct :10 (cm)

Width of water flow : 6 (cm)

Sectional area of water flow in a duct : $S = 4.1\times10^{-4}$ (m^2)

Flying distance : L = 0.50 (m)

Height : h = 1.27 (m)

Gravity acceleration : g=9.8 (m/s^2)

Calculate the amount by inputting the assumptions above into formula① as follows;

$$Q = \frac{SL}{\sqrt{\frac{2h}{g}}} \times 4 = \frac{4.1\times10^{-4}\times0.5}{\sqrt{\frac{2\times1.27}{9.8}}} \times 4 = 1.6\times10^{-3}(m^3/s) \neq 6(m^3/h)$$

Attachment VI-4

Result of discharge of low level radioactive accumulated water from Fukushima Daiichi Nuclear Power Station to the sea

There is currently great amount of radioactive wastewater in the turbine buildings of the Fukushima Daiichi Nuclear Power Station. Especially, the wastewater in Unit 2 is extremely highly radioactive.
We think it is necessary to transfer the radioactive wastewater to the Central Radioactive Waste Disposal Facility in order to store it in a stable condition. However, ten thousand ton of low level radioactive wastewater is already stored and we have to discharge the existing low level radioactive wastewater in order to receive new liquids.
In addition, as low radioactive subsurface water is piling up in sub-drain pits of Unit 5 and 6 and a part of subsurface water is running into buildings, we are concerned that important equipment to secure the safety of reactors will be submerged.
Therefore, based on the Section 1 of the Article 64 of the Nuclear Reactor Regulation Law, we have decided to discharge to the sea approximately ten thousand tons of the accumulated low level radioactive water and a total of 1,500 tons of the low level radioactive subsurface water stored in the sub drain pits of Unit 5 and 6 as soon as we got ready.

Afterwards, we were preparing to discharge the low radioactive waste water to the sea. As preparation was completed, we decided to start discharging the low radioactive waste water stored in the Central Radioactive Waste Disposal Facility to the sea at 7:00 pm on April 4th. In addition, at 9:00 pm on April 4th, we decided to start discharging the low level radioactive subsurface water stored in the sub drain pits of Unit 5 and 6 to the sea.

As to the low level radioactive wastewater stored at the Central Radioactive Waste Disposal Facility, we began discharging at 7:03PM, April 4th to the south of the water discharge channel and finished at 5:40PM, April 10th. After that, at 9:55AM, April 11th, we confirmed that the wastewater in the building had been discharged sufficiently so that the preparation work to accept high level radioactive wastewater (such as water sealing) in the building could be done.
In relation to the low level radioactive subsurface water in sub-drain pits of Units 5 and 6, we began discharging from 9 PM, April 4th via the water

discharge channel of Units 5 and 6 and finished by 6:52PM, April 9th.

In terms of the discharge of low level radioactive accumulated water to the sea, as instructed by NISA, we have been conducting ocean monitoring in a steadfast manner. We have been increasing the number of monitoring points and the frequency to investigate and confirm the influence of the dispersion of radioactive substances and have been notifying the result.
The radioactive density monitored at the measurement points including near the power station did not indicate significant fluctuation in comparison with the trend one week before the discharge.

The amount of low level radioactive wastewater discharged to the sea this time was approx 9,070 tons from the Central Radioactive Waste Disposal Facility and approx 1,323 tons from the sub-drain pits of Units 5 and 6 (Unit 5: approx 950 tons, Unit 6: approx 373 tons). The total radiation discharged was approx 1.5 x 10^{11} Bq.

With the completion of discharge, as soon as the preparation work to accept high level radioactive wastewater at the Central Radioactive Waste Disposal Facility such as water sealing is over, we will transfer the extremely highly radioactive wastewater in the turbine building of Unit 2 to the Central Radioactive Waste Disposal Facility and store under stable conditions.
Also, from now on, as to the low level radioactive subsurface water in sub-drain pits of Units 5 and 6, we will transfer to a temporary outdoor tank and consider an appropriate radiation mitigation plan.
Furthermore, we will closely monitor the evaluation result of the seawater sampling and conduct the environmental assessment.

END

Reference 1

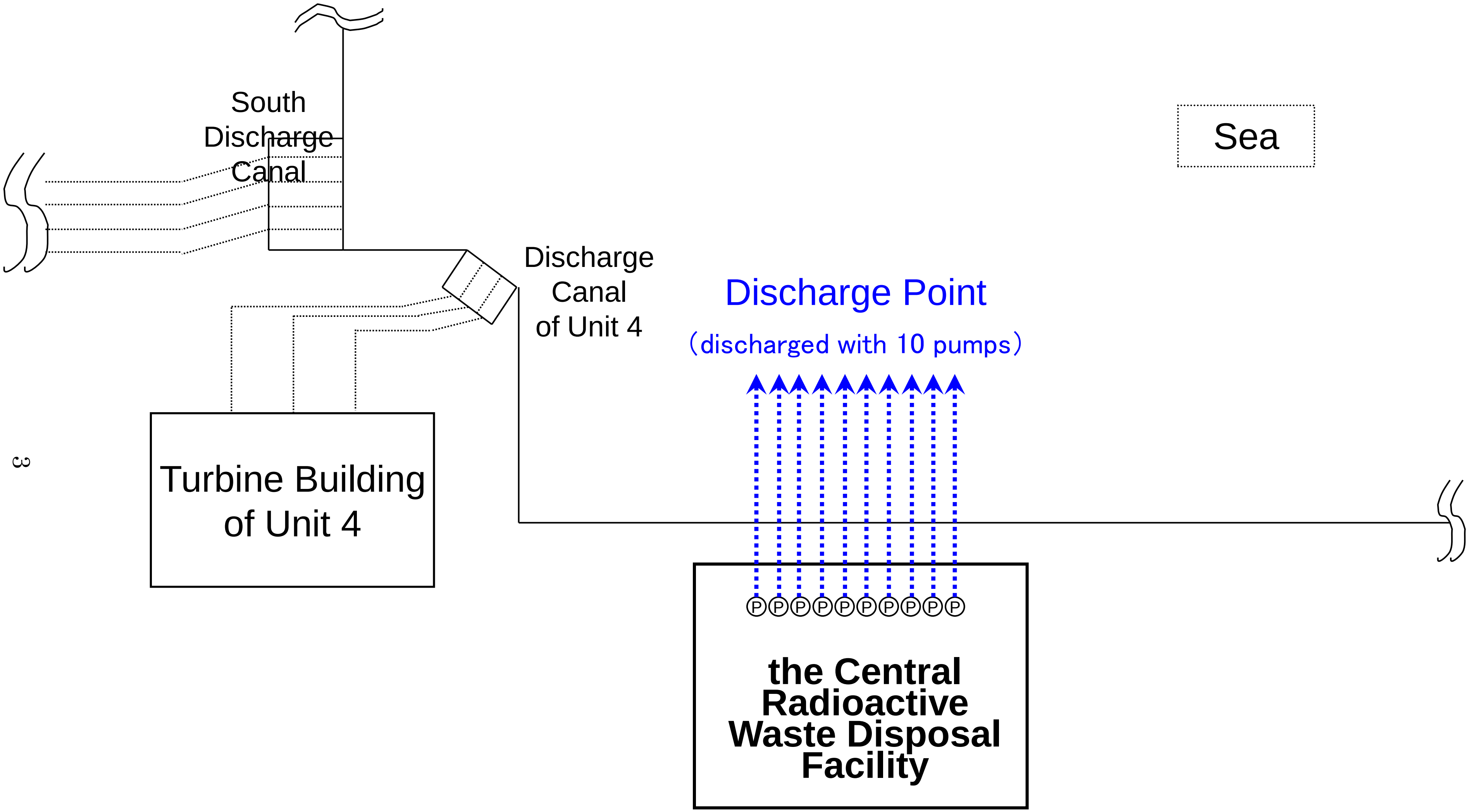
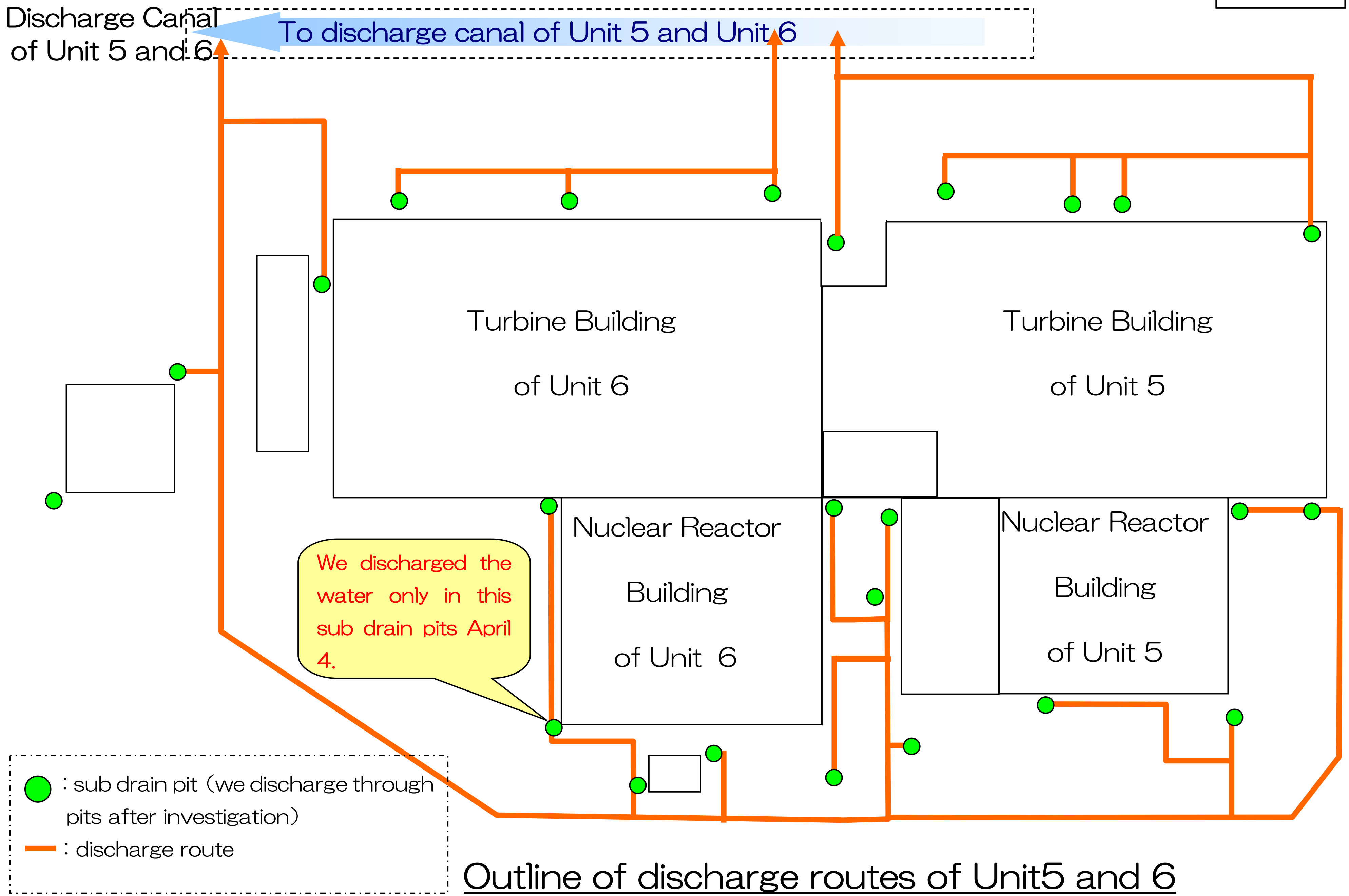


Image of discharge of the low radioactive waste water to the sea

at Fukushima Daiichi Power Station

Reference 2



Outline of discharge routes of Unit5 and 6

Reference 3

Nuclide analysis of accumulated water and sub-drain water, 1F

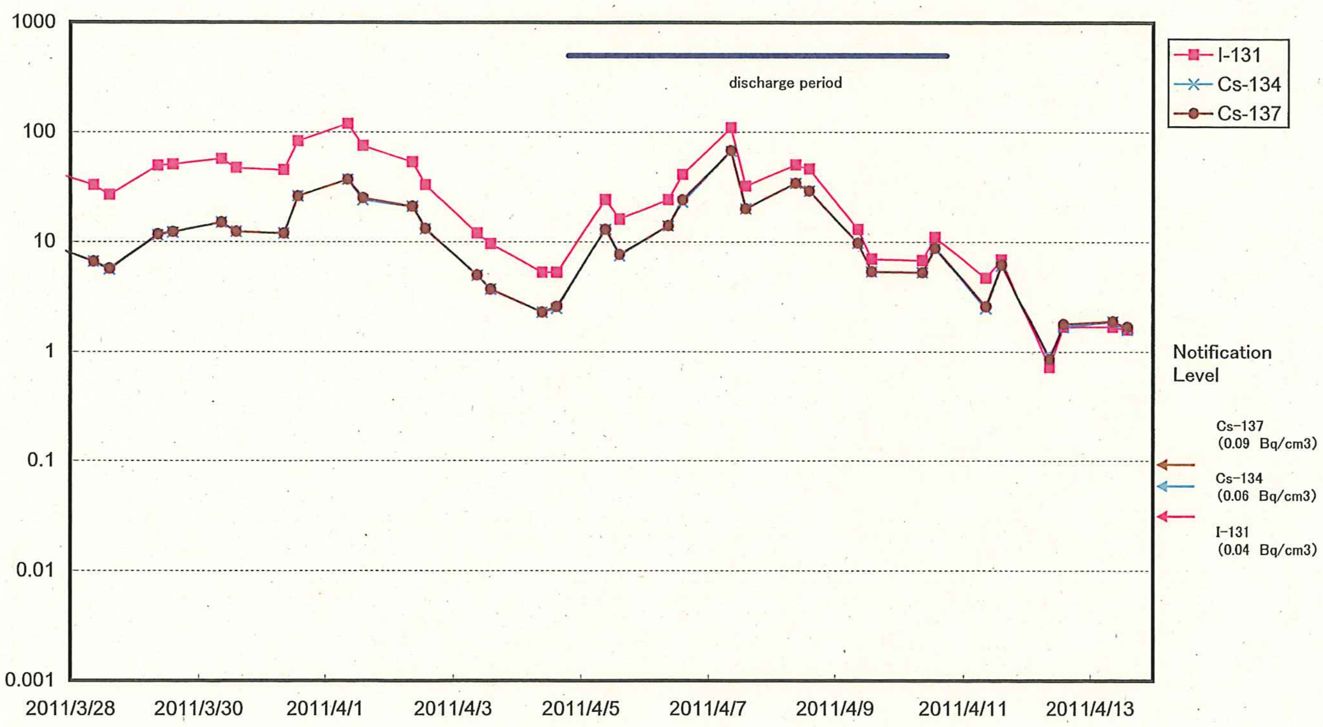
Time and Date of sample collection	15:30, Mar 28th, 2011	16:00, March 28th, 2011	10:30, March 30th, 2011	10:40, March 30th, 2011
Place of sampling	Accumulated water, Centralized Radiation Waste Treatment Facility (out of controlled area)	Accumulated water, Centralized Radiation Waste Treatment Facility (controlled area)	Sub-drain pit water, Unit 5	Sub-drain pit water, Unit 6
Detected Nuclides (Half-life)	Density of Sample (Bq/cm3)			
I-131 (approx 8 days)	6. 3E+00	8. 7E-01	1. 6E+00	2. 0E+01
Cs-134 (approx 2 years)	2. 7E+00	4. 4E+00	2. 5E-01	4. 7E+00
Cs-137 (approx 30 years)	2. 8E+00	4. 4E+00	2. 7E-01	4. 9E+00

※ ○. ○E−○ means ○. ○×10−○.

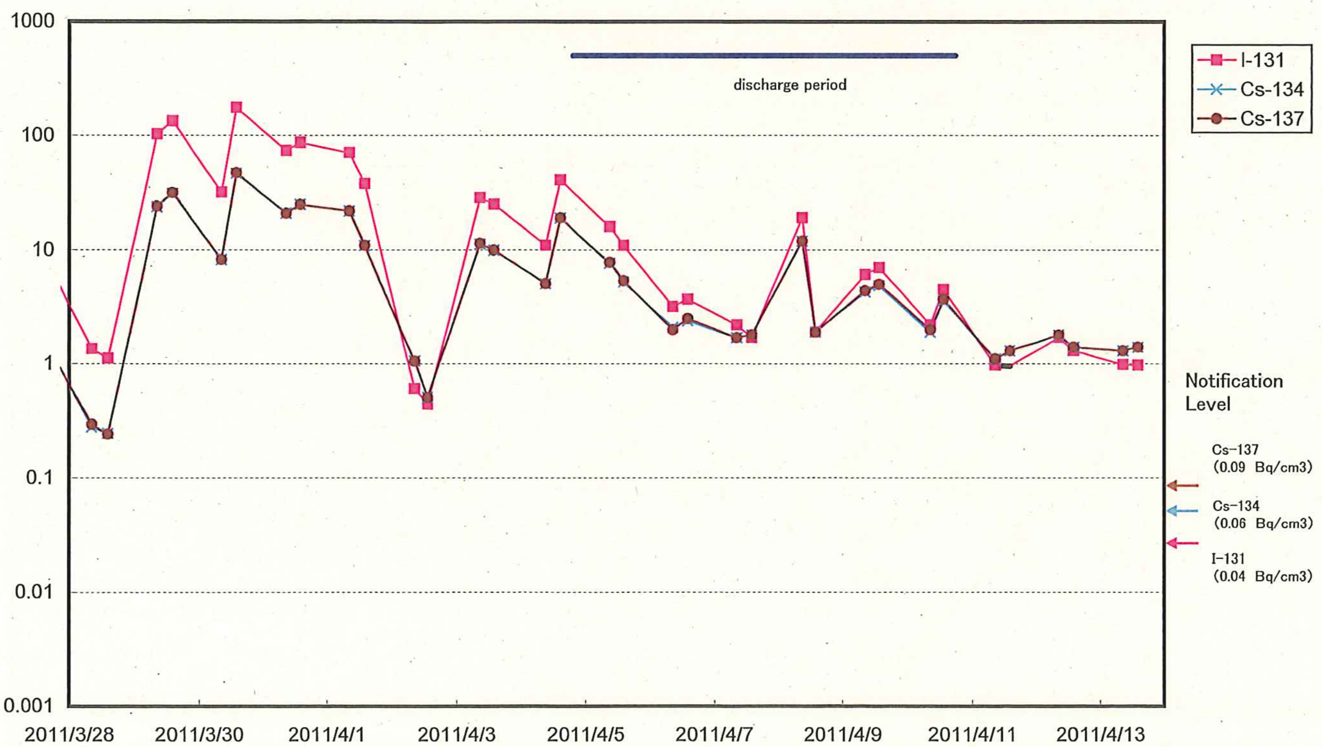
※I-131, Cs-134, Cs-137 are fixed figures. Data of other nuclides are under evaluation.

Reference 4

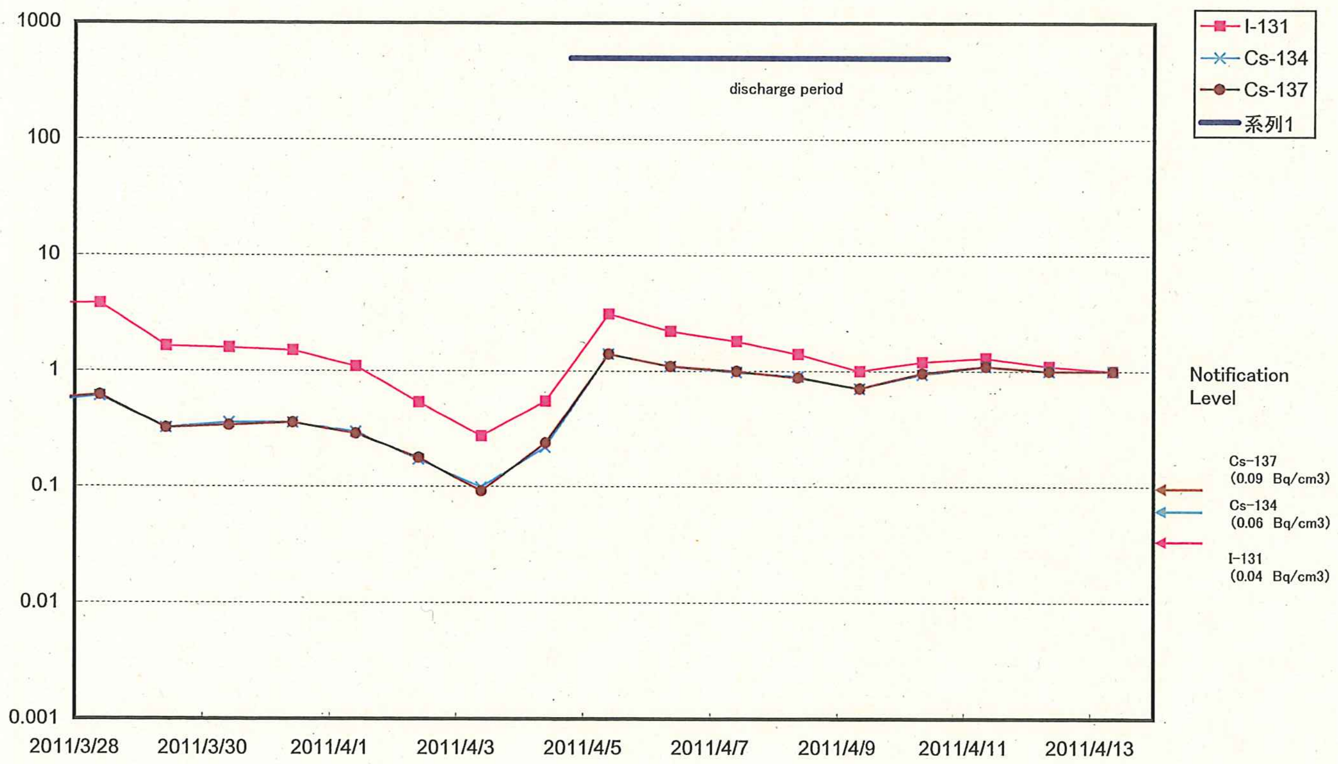
Radioactivity Concentration of Seawater at North of 1F 5 – 6 Discharge Channel (approx. 30 m north of 5–6u discharge channel) (Bq/cm3)



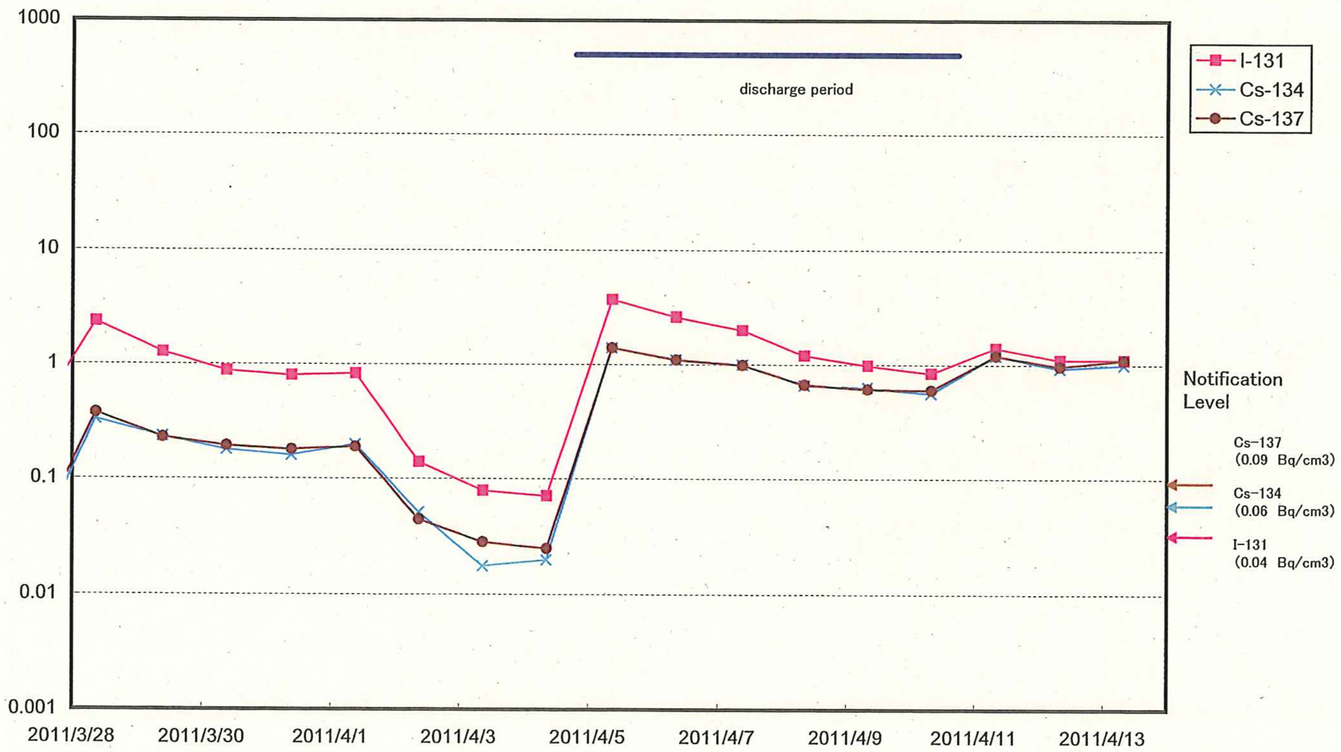
Radioactivity Concentration of Seawater at South Discharge Channel of 1F (Bq/cm3)



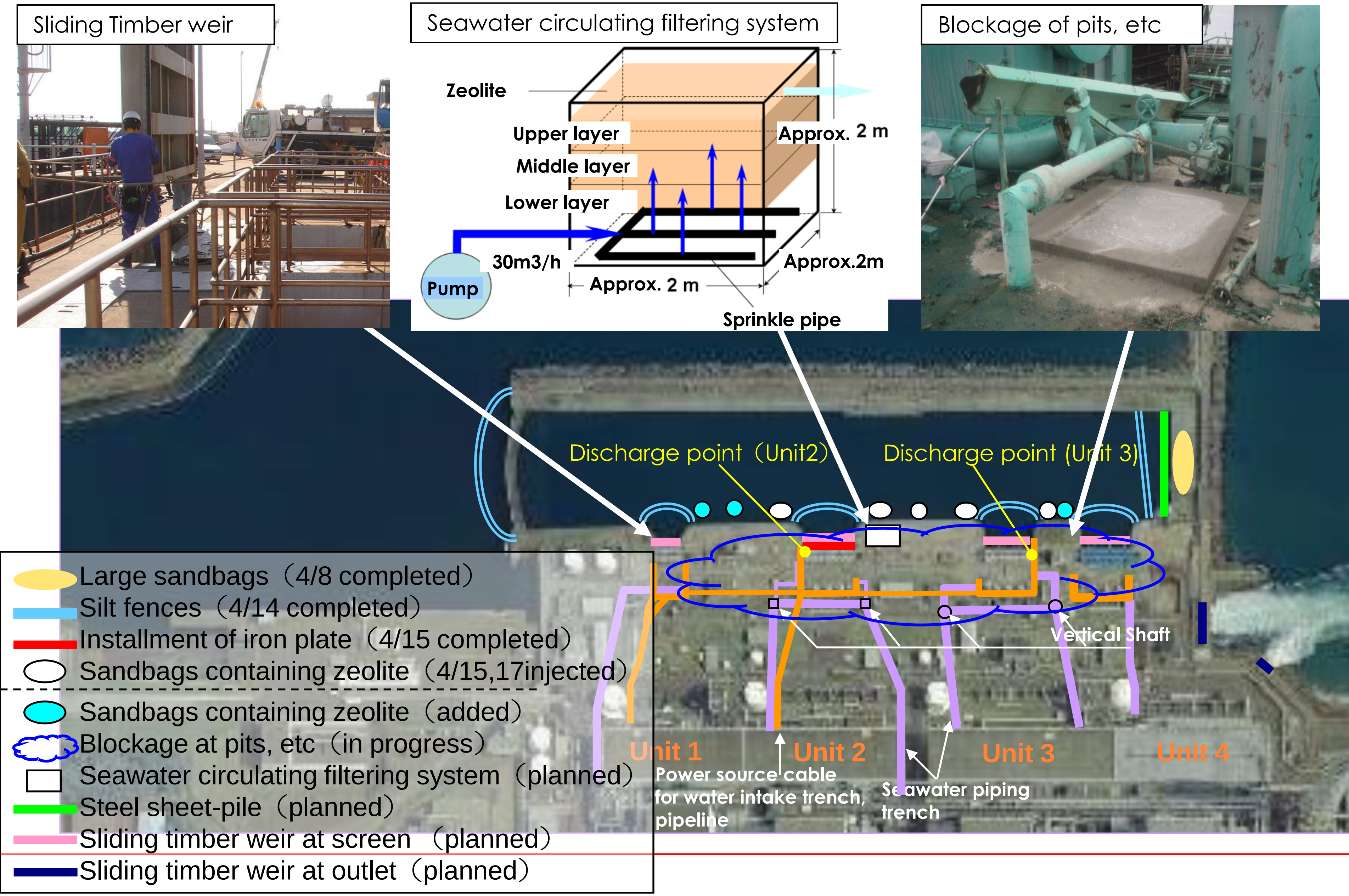
Radioactivity Concentration of Seawater at North Discharge Channel of 2F (Bq/cm3)



Radioactivity Concentration of Seawater at Iwasawa Shore at 2F (Bq/cm3)



Attachment VI-5
Countermeasures for preventing diffusion of liquid containing radioactive material



Appendix VII-1

Doc.Ref. Ki-Hatsu 0428 No.1
April 28, 2011

To: Directors of Prefectural Labor Bureau

From: Director-General, Labour Standards Bureau
Ministry of Health, Labour and Welfare

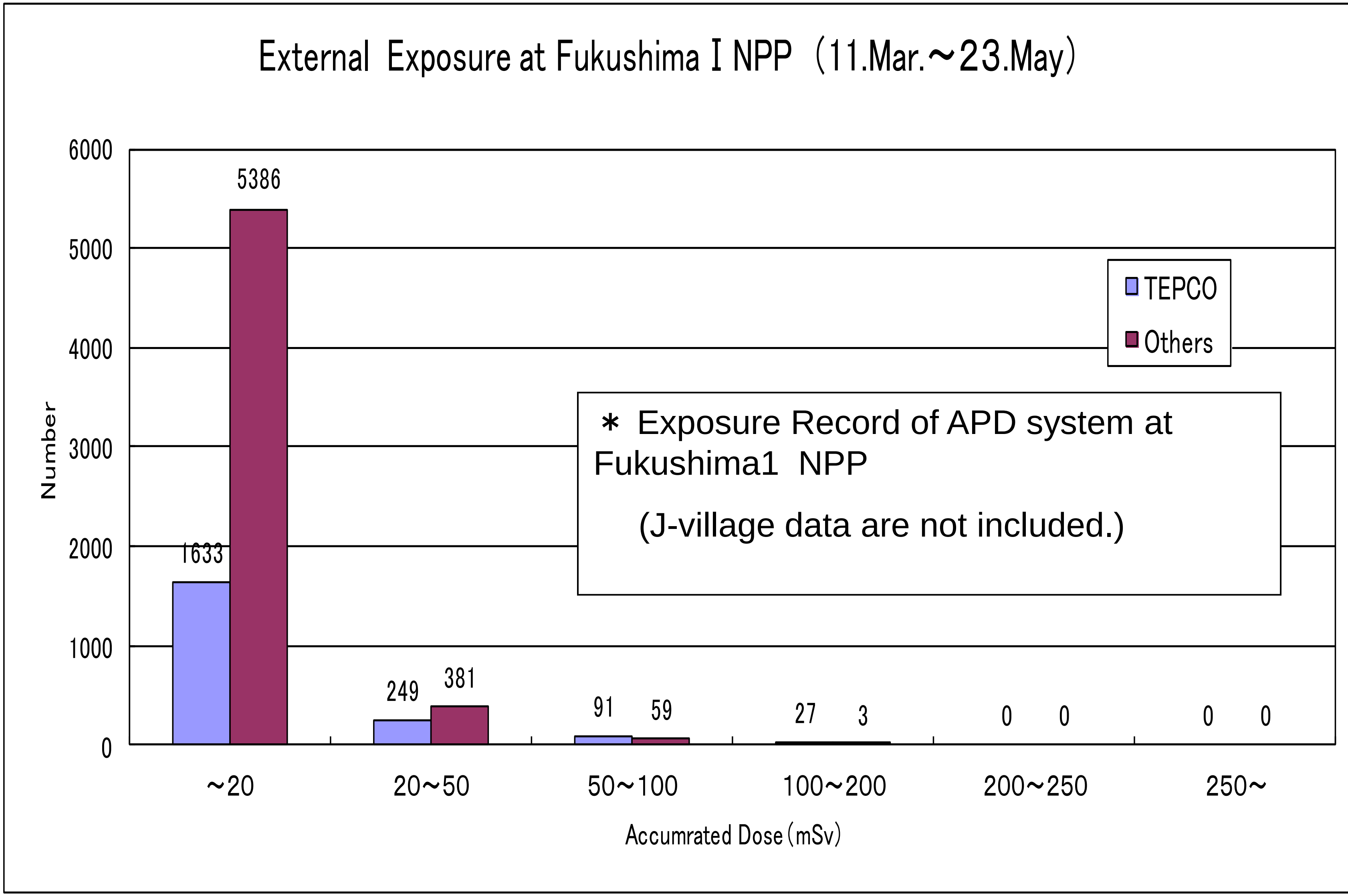
Subject: Instruction concerning the exposure dose resulted from radiation work other than the emergency activities incurred by the workers earlier engaged in the emergency activities

According to the basic rules of the Article 1 of "Ordinance on Prevention of Ionizing Radiation Hazards", we have indicated in the second point of the note in the document Ki-Hatsu 0315 No. 7 dated March 15, 2011 the detailed regulations that the limit exposure dose in the emergency activities be raised from 100 mSv to 250 mSv exclusively for the unavoidable urgent activities at Fukushima Dai-ichi Nuclear Power Station, as per the minister order on the special rules of "Ordinance on Prevention of Ionizing Radiation Hazards" to respond to the events resulted from the 2011 Tohoku District –off the Coast of Pacific Ocean Earthquake. Please note the points listed in the below note on the instruction concerning the exposure dose resulted from radiation work other than the emergency activities incurred by the workers earlier engaged in the unavoidable emergency activities at Fukushima Dai-ichi NPS.

Note

1. It is requested to give guidance to limit the exposure dose under 100 mSv and reduce it as much as possible, for five years including the period engaged in the emergency activities, when it comes to engaging in other radiation work than emergency activities, for the radiation workers who incurred less than 100 mSv by the unavoidable emergency activities at Fukushima Dai-ichi NPS.
   It should be noted that the above is the special treatment for the total exposure dose which includes the absolutely unavoidable emergency activities at Fukuishima Dai-ichi NPS and that any excess of the legal exposure dose of 50 mSv per year violates law when the worker was not involved in the emergency activities.

2. It is requested to give guidance to avoid any additional exposure, for five years including the period engaged in the emergency activities, when it comes to engaging in other radiation work than emergency activities, for the radiation workers who incurred more than 100 mSv by the unavoidable emergency activities at Fukushima Dai-ichi NPS.


External Exposure at Fukushima I NPP (11.Mar.～23.May)
6000
5000
4000
3000
2000
1000
0
Number
5386
1633
249
381
91
59
27
3
0
0
0
0
TEPCO
Others
＊ Exposure Record of APD system at Fukushima1 NPP
(J-village data are not included.)
～20
20～50
50～100
100～200
200～250
250～
Accumrated Dose (mSv)

Appendix 2

Ministry of Economy, Trade and Industry

05.25.2011 Nuclear Number 1
May 25, 2011

Tokyo Electric Power Co. Inc.
President Masataka Shimizu

Director-General, Nuclear and Industrial Safety Agency
Nobuaki Terasaka
NISA-168d-11-5
NISA-326d-11-2

Evaluation Results of Radiation Management at Fukushima Dai-ichi and Fukushima Dai-ni Nuclear Power Stations (Direction)

Responding to the April 27th report of radiation worker who received radiation exceeding the dose limit specified in the Notification that specifies the dose limit (notification of dose) etc. pursuant to the Rules for Commercial Power Reactors concerning the Installation, Operation, etc. (MITI Ministerial Ordinance No. 77, 1978), Nuclear and Industrial Safety Agency (NISA) issued "On the Investigation of the Cause and Establishment of Recurrence Prevention Measures, etc., Regarding the Exposure Exceeding the Dose Limit of A Radiation Worker in Fukushima Dai-ichi NPS" (04.27.2011 Nuclear Number 4). With respect to the direction, TEPCO submitted "On the Investigation of the Cause and Establishment of Recurrence Prevention Measures, etc., Regarding the Exposure Exceeding the Dose Limit of A Radiation Worker in Fukushima Dai-ichi NPS" on 2 and 11 of May and NISA evaluated the report.

As a result of evaluation, it is regrettable that violations of the Rules for Commercial Power Reactors concerning the Installation, Operation, etc. (MITI Ministerial Ordinance No.77, 1978, hereinafter referred to as "Reactor Rule") and notification of dose limit occurred and NISA strictly warnedto TEPCO.

① Regardless of the fact that concentration of radioactive materials in the air radiation workers breathe exceeded the limit (0.001Bq/cm^3 of I^{131}) specified in the Rector Rule and notification of dose limit at the Seismic Isolated Building of Fukushima Dai-ichi NPS, wearing of appropriate protective equipment was not enforced.

② In addition to the fact that exposure doses of 2 female employees exceeded the dose limit specified in the notification of dose limit (5mSv/3 months), 5 female non-radiation workers worked in the area where controlled area was supposed to be established violate the Reactor Rule. Furthermore, exposure dose of 2 of the workers exceeded the public dose limit (1mSv/year).

③ Despite radiation dose of the outside of buildings at Fukushima Dai-ni NPS exceeded the establishing standard for controlled area specified in the notification of dose limit (1.3mSv/3 months), exposure dose was not controlled.

Furthermore, NISA directs your company to further strive to improve worker's living, health management and work safety from the viewpoint of appropriate radiation management of radiation workers, and to take the following measures in order to comply with the Operational Safety Programs at Fukushima Dai-ichi and Dai-ni NPSs.

Required Items

1. In order to measure radiation dose of the operational site in advance and properly supervise operation, reinforce the system by increasing the number of staff to measure radiation, etc.

2. Secure sufficient numbers of personal dosimeters so that every employee can carry one. Until sufficient number of personal dosimeter is secured, if a representative person carries a dosimeter in areas where radiation dose should be controlled, operational sites should be limited to areas that are confirmed to have homogenous radiation dose inside the controlled area in advance.

3. Conduct promptly radiation exposure assessment of employees who have not completed, and conduct quarterly internal radiation assessment as soon as possible pursuant to the operational safety programs of Fukushima Dai-ichi and Dai-ni NPSs.

4. Implement quickly health examination necessary to register for radiation workers which is specified in your company regulations.

5. In order to implement dose management of radiation workers without fail, recover the system related to dose management promptly and perform registration to the Central Registration Center of Radiation Workers of Radiation Effects Association without fail.

6. Re-survey of the number of female radiation workers reported to NISA on May 11 was not conducted in an appropriate manner. Execute measures to conduct proper examination in order to prevent recurrence.

7. If an event related to radiation work violates the law, report to NISA as soon as possible.

Activities of IAEA Experts

1. Radiation Monitoring

(1) Teams of experts for radiation monitoring on land
A total of four Teams from the IAEA visited Japan from March 18 to April 20 to conduct radiation measurements. The schedule of their visit to Japan is as follows:

a. First Team
March 18-31 (Tokyo, Kanagawa, Chiba, Saitama, Gunma, Tochigi, Ibaraki, and Fukushima)

b. Second Team
March 24 - April 1 (Fukushima)

c. Third Team
April 1-11 (Fukushima)

d. Fourth Team
April 11-18 (Fukushima)

(2) Marine expert
A marine expert from the IAEA Environment Laboratories Monaco visited Japan from April 1 to 6. From April 2 to 4, the expert boarded the Research Vessel MIRAI of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) to observe ocean monitoring activities and to provide technical advice.

2. Food Monitoring

A joint food safety assessment team comprised of three experts from the IAEA and the FAO visited Japan from March 26 to April 1. For a period of four days, they visited four prefectures: Fukushima on March 27, Ibaraki on March 28, Tochigi on March 29, and Gunma on March 30. The team exchanged views with the local governments concerned and provided technical advice on food monitoring.

3. Boiling-Water Reactor (BWR)

A total of three IAEA experts in BWR technology visited Japan from April 3 to 12 (of which two arrived in Japan on April 3, with one joining the two on April 7). The experts visited the Fukushima Dai-ichi Nuclear Power Plant on April 6 and the Fukushima Dai-ni Nuclear Power Plant on April 7. They also exchanged views with officials of the Government of Japan – including the Nuclear and Industrial Safety Agency (NISA), the Ministry of Foreign Affairs (MOFA), the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and the Cabinet Office (CAO) – as well as the Tokyo Electric Power Co., Inc. (TEPCO).

4. Others

From March 24 to April 12, an IAEA international assistance coordinator visited Japan and took charge of the overall coordination of the activities by the experts described in sections 1-3 above.

Briefings by Japanese Officials at Major International Meetings

Date	Meeting	Outline of the briefing
March 20	Technical briefing by the International Atomic Energy Agency (IAEA) Secretariat in Vienna	Japan’s efforts to provide information, the state of the radiation monitoring, the status of Units 5 and 6 at the Fukushima Dai-ichi Nuclear Power Station
March 21	Technical briefing by the IAEA Secretariat in Vienna	Overview of the earthquake, causes and effects, the status of Units 1-6 at the Fukushima Dai-ichi Nuclear Power Station, measures taken by the Nuclear and Industrial Safety Agency, and environmental radiation readings in Fukushima Prefecture
March 21	Special meeting of the IAEA Board of Governors in Vienna	IAEA Director General Amano’s visit to Japan, the state of the accident and the countermeasures taken, Japan's efforts to provide information, cooperation with international organizations, the state of the environmental monitoring, indoor sheltering and evacuation, and press releases by ICAO and WHO
March 22	Joint session between the Standing Group on Emergency Questions (SEQ) and the Standing Group on the Oil Market (SOM) of the International Energy Agency (IEA) in Paris	The state of the accident, power demand, oil and gas markets and related measures
March 29	Informal meeting of the Trade Negotiations Committee (TNC) of the World Trade Organization (WTO) in Geneva	Import restrictions on Japanese products
March 30-31	Formal meeting of the WTO Committee on Sanitary and Phytosanitary (SPS) Measures in Geneva	Safety of Japanese foods and member countries’ import restrictions
April 4	Side event co-sponsored by Japan and the IAEA at the Fifth Review Meeting of the Convention on Nuclear Safety in Vienna	The status of the units at the Fukushima Dai-ichi Nuclear Power Station and the countermeasures taken, the state of the radiation monitoring, cooperation between the government and the Tokyo Electric Power Company (TEPCO)
April 6	Informal meeting of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) in Vienna	Japan’s efforts to provide information

April 6	Clean Energy Ministerial Meeting	An overview of the accident and the countermeasures taken, radiation monitoring, the effects on foods, drinking water and workers at the plant, impact on the Japanese economy, and the efforts to provide information
April 19	Summit on safe and innovative use of nuclear energy to commemorate the 25 anniversary of the Chernobyl Accident in Kyiv	The importance of nuclear safety, the cause of the accident, the state of the accident and the countermeasures taken, international information dissemination, and the sharing of the findings of an investigation to be made into the accident and the experiences gained with the international community
April 19	Meeting of the Infrastructure Development Working Group of the International Framework for Nuclear Energy Cooperation (IFNEC)	An overview of the accident and the countermeasures taken, radiation monitoring, the effects on foods, drinking water and workers at the plant, and the efforts to provide information
April 27-29	Meeting of the Organisation for Economic Co-operation and Development - the Multinational Design Evaluation Programme (OECD/MDEP) in Paris	The state of the accident and the countermeasures taken, the roadmap announced by TEPCO, the emergency response measures for nuclear power plants across Japan, the effects on the residents and the environment, radiation monitoring, and information sharing with the international community
April 28-29	Meeting of the Steering Committee and the regulators meeting of the Organisation for Economic Co-operation and Development - the Nuclear Energy Agency (OECD/NEA) in Paris	The state of the accident and the countermeasures taken, the roadmap announced by TEPCO, the emergency response measures for nuclear power plants across Japan, the effects on the residents and the environment, radiation monitoring, and information sharing with the international community
May 16-24	64th World Health Assembly of the WHO in Geneva	An overview of the accident and the countermeasures taken, the relief efforts for the disaster victims, radiation risks, the safety of food and water, and information provision to the international community
May 17-19	69th Meeting of the Committee on Radiation Protection and Public Health (CRPPH) of OECD/NEA in Paris	An overview of the accident and the countermeasures taken, the distribution of the released radioactive substances (including the readings in soil), the environmental impacts (the state of the monitoring, the case of three workers exposed to radiation), and information provision to the international community
May 23	58th meeting of UNSCEAR in Vienna	An overview of the accident, the effects of radiation, monitoring, and information sharing with the international community

Briefings Given to Diplomatic Corps in Tokyo

	Date	Nos. of diplomatic corps in Tokyo and intl. organizations attended*	Approx. no. of attendees	Theme(s)	Briefer(s)**
1	Mar. 13	Some 50 nations and organizations	80	The status of the nuclear stations	MOFA, NISA
2	Mar. 14	Some 60 nations and organizations	110	The status of the nuclear stations, evacuation information	MOFA, NISA
3	Mar. 15	60 nations, 2 organizations	120	The status of the nuclear stations, evacuation information	MOFA, MEXT, NISA
4	Mar. 16	46 nations, 2 organizations	110	The status of the nuclear stations, environmental monitoring, briefing on radiation	MOFA, MEXT, NISA, NIRS
5	Mar. 17	42 nations, 1 organization	90	The status of the nuclear stations, environmental monitoring, briefing on radiation	MOFA, MEXT, NISA
6	Mar. 18	n/a	80	The status of the nuclear stations, environmental monitoring, consular information	MOFA, MEXT
7	Mar. 19	n/a	60	The status of the nuclear stations, food safety, environmental monitoring, the International Civil Aviation Organization (ICAO)'s press release	MOFA, MEXT, NISA
8	Mar. 20	n/a	60	The status of the nuclear reactors, radiation levels near the nuclear power stations, the World Health Organization (WHO)'s press release, food and water safety, consular information	MOFA, MEXT, MHLW, NIPH
9	Mar. 21	51 nations, 1 organization	70	The status of the nuclear stations, food and water safety, port and aviation safety, environmental monitoring, consular information	MOFA, MEXT, MHLW, NISA, MLIT
10	Mar. 22	52 nations, 1 organization	80	The status of the nuclear stations, the International Maritime Organization (IMO)'s press release, food safety, environmental monitoring, briefing on radiation, consular information	NPA, MOFA, MEXT, MHLW, JFA, NISA, MLIT
11	Mar. 23	46 nations, 2 organizations	70	The status of the nuclear stations, food and water safety, transport and logistics information, briefing on radiation, consular information	MOFA, MEXT, MHLW, METI, NISA
12	Mar. 24	55 nations, 2 organizations	70	The status of the nuclear stations, port safety, food and water safety, simulations of radioactive material dispersion (using SPEEDI), environmental monitoring, consular information	NSC, NPA, MOFA, MEXT, MHLW, MAFF, JFA, NISA, MLIT
13	Mar. 25	52 nations, 1 organization	70	The status of the nuclear stations, food and water safety, environmental monitoring, IMO's press release	NSC, MOFA, MEXT, MHLW, JFA, NISA, MLIT, JCG
14	Mar. 26	Some 40 countries and organizations	60	The status of the nuclear stations, food and water safety, environmental monitoring, consular information	MOFA, MEXT, MHLW, JFA, NISA
15	Mar. 27	37 nations, 2 organizations	50	The status of the nuclear stations, food and water safety, environmental monitoring, consular information	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
16	Mar. 28	59 nations, 4 organizations	80	The status of the nuclear stations, food and water safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, NISA
17	Mar. 29	62 nations, 2 organizations	80	The status of the nuclear stations, food safety, port safety, environmental monitoring, consular information	NSC, MOJ, MOFA, MEXT, MHLW, MAFF, NISA, MLIT
18	Mar. 30	56 nations, 3 organizations	80	The status of the nuclear stations, food and water safety, environmental monitoring, the aviation status	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA, MLIT
19	Mar. 31	52 nations, 2 organizations	70	The status of the nuclear stations, food and water safety, environmental monitoring, seismic information, consular information	MOFA, MEXT, MHLW, MAFF, JFA, NISA
20	Apr. 1	51 nations, 1 organization	60	The status of the nuclear stations, food and water safety, environmental monitoring, consular information	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA

Briefings Given to Diplomatic Corps in Tokyo

	Date	Nos. of diplomatic corps in Tokyo and intl. organizations attended*	Approx. no. of attendees	Theme(s)	Briefer(s)**
21	Apr. 2	45 nations	50	The status of the nuclear stations (including the leakage of highly radioactive wastewater from the Unit 2 pit into the ocean), environmental monitoring, food and water safety	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
22	Apr. 4	51 nations, 1 organization	60	The status of the nuclear stations (including the leakage of highly radioactive wastewater from the Unit 2 pit into the ocean, and the discharge of low level radioactive accumulated water), press releases by IMO, ICAO, and the International Air Transport Association (IATA), environmental monitoring, the NSC regular meeting, food and water safety, consular information	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA, MLIT
23	Apr. 5	48 nations, 1 organization	60	The status of the nuclear stations (including the discharge of low level radioactive accumulated water), food and water safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
24	Apr. 6	48 nations	50	The status of the nuclear stations (including the discharge of low level radioactive accumulated water), food and water safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, JFA, NISA
25	Apr. 7	55 nations	60	The status of the nuclear stations (including the discharge of low level radioactive accumulated water), food safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
26	Apr. 8	49 nations, 1 organization	50	The status of the nuclear stations (including the discharge of low level radioactive accumulated water), simulation of radioactive material dispersion, port safety, food safety, environmental monitoring, the effects of aftershocks	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA, MLIT, JMA
27	Apr. 9	31 nations	30	The status of the nuclear stations (including the discharge of low level radioactive accumulated water), food and water safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
28	Apr. 11	43 nations, 1 organization	50	The status of the nuclear stations (including the discharge of low level radioactive accumulated water), food and water safety, environmental monitoring, evacuation information, the status of aftershock	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA, JMA
29	Apr. 12	63 nations, 2 organizations	80	The status of the nuclear stations (including the change in the International Nuclear and Radiological Event Scale (INES) rating), food and water safety, simulations of radioactive material dispersion (including those using SPEEDI)	NSC, MOFA, MEXT, MHLW, JFA, NISA
30	Apr. 13	48 nations, 1 organization	50	The status of the nuclear stations, food and water safety, environmental monitoring, the INES rating, seismic information	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
31	Apr. 14	48 nations, 1 organization	50	The status of the nuclear stations, food and water safety, environmental monitoring, seismic information	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
32	Apr. 15	37 nations, 1 organization	40	The status of the nuclear stations (including the discharge of low level radioactive accumulated water), food and water safety, ICAO's press release, environmental monitoring, consular information	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA, MLIT
33	Apr. 18	51 nations	60	The status of the nuclear stations (including the Roadmap), environmental monitoring, food safety, IMO's press release	NSC, MOFA, MEXT, MHLW, JFA, NISA, MLIT, TEPCO
34	Apr. 19	45 nations, 1 organization	50	The status of the nuclear stations, food safety, the NSC regular meeting, consular information	NSC, MOFA, MHLW, MAFF, JFA, NISA
35	Apr. 20	42 nations	50	The status of the nuclear stations, food safety, environmental monitoring, the NSC regular meeting	NSC, NPA, MOFA, MEXT, MHLW, MAFF, JFA, NISA
36	Apr. 21	32 nations	30	The status of the nuclear stations, food safety, environmental monitoring, evacuation information	NSC, Nuclear Sufferers Life Support Team, MOFA, MEXT, MHLW, JFA, NISA

Briefings Given to Diplomatic Corps in Tokyo

	Date	Nos. of diplomatic corps in Tokyo and intl. organizations attended*	Approx. no. of attendees	Theme(s)	Briefer(s)**
37	Apr. 22	23 nations	30	The status of the nuclear stations, food safety, port safety, environmental monitoring, evacuation information, relief efforts for the disaster victims	NSC, MIC, MOFA, MEXT, MHLW, MAFF, JFA, NISA, MLIT
38	Apr. 25	30 nations	30	The status of the nuclear stations (including the discharge of low level radioactive accumulated water), food safety, the status of the livestock, environmental monitoring, the NSC regular meeting	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
39	Apr. 26	28 nations, 1 organization	30	The status of the nuclear stations, food safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, JFA, NISA
40	Apr. 27	28 nations	30	The status of the nuclear stations, food safety, environmental monitoring, port safety	NSC, MOFA, MEXT, MHLW, MAFF, NISA, MLIT
41	Apr. 28	23 nations	30	The status of the nuclear stations (including the upper limit of exposure for workers), food safety, environmental monitoring, the NSC special meeting	NSC, MOFA, MEXT, MHLW, JFA, NISA
42	May 2	25 nations	30	The status of the nuclear stations, the introduction of the op-ed to the New York Times by Foreign Minister Matsumoto, food safety, the status of the livestock, the health effects of radiation, environmental monitoring, the NSC regular meeting	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
43	May 6	24 nations	20	The status of the nuclear stations (including a better working environment in the reactor building of Unit 1), food safety, the health effects of radiation, environmental monitoring	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA, TEPCO
44	May 9	28 nations	30	The status of the nuclear stations (including a better working environment in the reactor building of Unit 1), food safety, environmental monitoring, the NSC regular meeting, the request to shut down the Hamaoka Nuclear Power stations	NSC, MOFA, MEXT, MHLW, JFA, NISA
45	May 10	23 nations	20	The status of the nuclear stations, food safety, environmental monitoring, simulations of radioactive material dispersion using SPEEDI, the request to shut down the Hamaoka Nuclear Power stations	NSC, MOFA, MEXT, MHLW, NISA
46	May 11	22 nations	30	The status of the nuclear stations (including the leakage of wastewater from the Unit 3 pit into the ocean), food safety, the NSC special meeting, environmental monitoring, consular information	NSC, NPA, MOFA, MEXT, MHLW, NISA
47	May 12	20 nations	20	The status of the nuclear stations (including the leakage of wastewater from the Unit 3 pit into the ocean), the NSC special meeting, food safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, NISA
48	May 13	22 nations	20	The status of the nuclear stations (including the leakage of wastewater from the Unit 3 pit into the ocean), food safety, environmental monitoring, the status of the livestock, relief efforts for the disaster victims	NSC, MOFA, MEXT, MHLW, MAFF, JFA, NISA
49	May 16	26 nations	30	The status of the nuclear stations (including the results of TEPCO's analysis of the status of Unit 1's reactor core), food safety, environmental monitoring, the NSC regular meeting	NSC, MOFA, MEXT, MHLW, NISA
50	May 17	14 nations	20	The status of the nuclear stations (including progress in the implementation of TEPCO's roadmap, the Japanese Government's Roadmap, and the acceptance of the IAEA International Fact-Finding Expert Mission), food and water safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, NISA
51	May 18	23 nations	30	The status of the nuclear stations (including TEPCO's and the Japanese Government's Roadmap), food safety, environmental monitoring	NSC, MOFA, MEXT, MHLW, NISA
52	May 20	15 nations	20	The status of the nuclear stations, food safety, environmental monitoring, the NSC special meeting, port safety	NSC, MOFA, MEXT, MHLW, MAFF, NISA, MLIT

Briefings Given to Diplomatic Corps in Tokyo

	Date	Nos. of diplomatic corps in Tokyo and intl. organizations attended*	Approx. no. of attendees	Theme(s)	Briefer(s)**
53	May 24	20 nations	20	The status of the nuclear stations, food safety, environmental monitoring, the NSC regular meeting, information on the visit to Japan by the IAEA International Fact-Finding Expert Mission, and the convening of the Nuclear Incident Investigation and Verification Committee	NSC, MOFA, MEXT, MHLW, MAFF, NISA
54	May 25	15 nations	20	The status of the nuclear stations, food safety, environmental monitoring, the outcomes of the Japan-China-ROK Trilateral Summit	NSC, MOFA, MEXT, MHLW, MAFF, NISA
55	May 27	24 nations	20	The status of the nuclear stations, food safety, the NSC regular meeting, environmental monitoring	NSC, MOFA, MEXT, MHLW, NISA
56	May 30	15 nations	20	The status of the nuclear stations, food safety, the NSC regular meeting, environmental monitoring	NSC, MOFA, MEXT, MHLW, NISA

* The numbers of embassies and international organizations have been calculated based on the registration forms submitted.
** Abbreviations:

JCG	Japan Coast Guard
JFA	Japan Fisheries Agency
JMA	Japan Meteorological Agency
MAFF	Ministry of Agriculture, Forestry and Fisheries
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MHLW	Ministry of Health, Labour and Welfare Ministry
MIC	Ministry of Internal Affairs and Communications
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MOFA	Ministry of Foreign Affairs
MOJ	Ministry of Justice
NIPH	National Institute of Public Health
NIRS	National Institute of Radiological Sciences
NISA	Nuclear and Industrial Safety Agency
NPA	National Police Agency
NSC	Nuclear Safety Commission
TEPCO	Tokyo Electric Power Company

Information Provided by MOFA to Diplomatic Corps in Tokyo

March 11	Sent a list of points of inquiry regarding the damage to foreign diplomatic missions and their staffs.
	Introduced the website of Miyagi Prefecture.
	Introduced the website of the Prime Minister's Office (Kantei).
March 12	Sent the latest list of points of inquiry regarding the damage to foreign diplomatic missions and their staffs.
	Introduced the website of the International Committee of the Red Cross (ICRC)
	Provided information on the evacuation advisory for people within the 20 km radius of the Fukushima Dai-ichi Nuclear Power Station and those within the 10 km radius of the Fukushima Dai-ni Nuclear Power Station, both operated by the Tokyo Electric Power Company (TEPCO).
March 13	Sent excerpts from the record of press conferences given by the Chief Cabinet Secretary on the Fukushima Dai-ichi and Dai-ni Nuclear Power Stations
	Requested for information for confirming the safety of foreign nationals in Japan
	Provided information on possible rolling blackouts
March 14	Requested for information for confirming the safety of foreign nationals in Japan
	Provided information on the possible continuation of the ongoing rolling blackouts
	Introduced the website of the Nuclear and Industrial Safety Agency (NISA), especially the webpages on data related to nuclear power stations
	Introduced the website of Kantei
March 15	Provided information on the advisory to shelter indoors for people within the 20-30 km radius of the Fukushima Dai-ichi Nuclear Power Station.
	Introduced a map showing the evacuation advisory zone.
	Introduced the websites related to the March 11 disaster.
	Introduced the website of the Japan Meteorological Agency (JMA)
March 16	Introduced the website of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), especially the webpages on the results of radiation surveys.
March 17	Introduced the website of the Ministry of Foreign Affairs (MOFA), especially the webpages on radiation readings.
	Introduced the website of MEXT, especially the webpages on the results of radiation surveys.
	Sent a list of points of contact for foreign nationals in Japan.
March 18	Introduced the website of the National Institute of Radiological Sciences (NIRS)
	Provided information for foreign nationals in Japan from the Ministry of Justice (MOJ)
March 19	Provided information regarding the export of Japanese products
March 21	Provided information on the detection of radioactive iodine in drinking water in Iitate Village.
March 22	Provided information on the detection of radioactive substances in the seawater near the outlets at the Fukushima Dai-ichi Nuclear Power Station.
March 29	Provided information on the detection of plutonium in the soil of the Fukushima Dai-ichi Nuclear Power Station.
April 4	Provided information on the plan to discharge low level radioactive water accumulated in the Central Radioactive Waste Disposal Facility into the ocean
April 6	Provided information on the stopped leakage of water from the Unit 2 pit at the Fukushima Dai-ichi Nuclear Power Station.
	Provided information on the injection of nitrogen into the containment vessel of

	Unit 1 of the Fukushima Dai-ichi Nuclear Power Station.
April 8	Provided information on the effects of the earthquake that had occurred at 23:50 on April 7 on the Fukushima Dai-ichi Nuclear Power Station.
April 10	Provided information on the completion of the discharge of low level radioactive water accumulated in the Central Radioactive Waste Disposal Facility into the ocean.
	Provided information on the plan to transport highly radioactive water accumulated in the Unit 2 pit to the condenser at the Fukushima Dai-ichi Nuclear Power Station.
April 11	Provided information on the completion of the discharge of low level radioactive water accumulated in the Central Radioactive Waste Disposal Facility into the ocean.
	Provided information on the policy of designating planned evacuation zones, which had been announced at a press conference given by the Chief Cabinet Secretary.
	Provided information on the effects of the earthquake that had occurred at 17:00 on April 11 on the Fukushima Dai-ichi Nuclear Power Station.
April 12	Communicated an outline of the NISA press release "INES (the International Nuclear and Radiological Event Scale) Rating on the Events in Fukushima Dai-ichi Nuclear Power Station by the Tohoku District - off the Pacific Ocean Earthquake" as well as the forthcoming issuance.
April 15	Communicated the forthcoming issuance of the NISA press release "Regarding the discharge of the waste water, of which the concentration of radioactive materials exceeds the concentration limit by the notification, to the sea" and sent the material.
April 17	Communicated the forthcoming issuance of the TEPCO press release "Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station" and sent the material.
April 19	Communicated the forthcoming issuance of the NISA press release "Regarding the Transfer of Waste Water Measured High Radiation Dose to the Radioactive Waste Treatment Facilities" and sent the material.
April 21	Sent the press release material by the Nuclear Emergency Response Headquarters titled "Establishment of a Restricted Area and Basic Viewpoint of a Temporary Access."
	Sent the material regarding the TEPCO press release "Fukushima Daiichi Nuclear Power Station Unit 2: Countermeasures to stop the outflow of contaminated water and the water amount flowed out into the sea."
April 25	Sent the material regarding the NISA press release "Regarding the contaminated water including radioactive materials with high concentration that flowed out from Unit 2 of Fukushima Dai-ichi Nuclear Power Station."
May 1	Sent the material regarding the TEPCO press release "Improvement of the working environment inside the reactor building of Unit 1, Fukushima Daiichi Nuclear Power Station."
May 3	Sent the material regarding the TEPCO press release "The results of nuclide analyses of radioactive materials in the ocean soil off the coast of Fukushima Daiichi Nuclear Power Station."
May 5	Provided information regarding the entry by workers into the reactor building of Unit 1 of the Fukushima Dai-ichi Nuclear Power Station.

	Sent the attachment to a TEPCO press release titled "Report regarding the implementation of a measure to flood primary containment vessel to the upper area of fuel range in Unit 1 of Fukushima Daiichi Nuclear Power Station (summary)."
May 6	Sent the document titled "Statement regarding the confirmation of the implementation of the emergency safety measures and Hamaoka Nuclear Power Station" by the Minister of Economy, Trade, and Industry Banri Kaieda.
May 8	Sent the material regarding two press releases: (i) the TEPCO press release "Improvement of Working Environment inside the Reactor Building and Opening the Airlock of Unit 1 of Fukushima Daiichi Nuclear Power Station"; and (ii) the NISA press release document "Regarding the Evaluation of the Collection of Reports on the Implementation of the Measures for Reducing the Concentration of Radioactive Materials in Unit 1 Reactor Building of Fukushima Dai-ichi Nuclear Power Station (NPS), Tokyo Electric Power Co. Inc. (TEPCO)."
May 11	Sent the material regarding the TEPCO press release "Possible leakage of water including radioactive materials to the outside from around the intake canal of Unit 3 of Fukushima Daiichi Nuclear Power Station."
May 15	Sent the material regarding the TEPCO press release "The Reactor Core Status of Fukushima Daiichi Nuclear Power Station Unit 1."
	Communicated the forthcoming issuance of the NISA press release "Regarding the Transfer of Waste Water Measured High Radiation Dose to Radioactive Waste Treatment Facilities" and sent the material.
May 17	Sent three documents issued by the Nuclear Emergency Response Headquarters: (i) "Roadmap for Immediate Actions for the Verification of and Restoration from the Accident at Fukushima Dai-ichi Nuclear Power Station," (ii) "Immediate Actions for the Assistance of Nuclear Sufferers," and (iii) "Roadmap for Immediate Actions for the Assistance of Nuclear Sufferers," as well as two attachments to a TEPCO press release: (i) "Progress status of the 'Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station'"; and "Current Status of Roadmap (issues/targets/major countermeasures) as of May 17."
May 21	Sent the material regarding two TEPCO press releases: (i) "Countermeasures to outflow of radioactive water off the site near water intake of Unit 3 at Fukushima Daiichi Nuclear Power Station"; and (ii) "Submission of report to Nuclear and Industrial Safety Agency regarding the impact due to the discharge of drained water with concentrations of radioactive materials exceeding discharge standard to the ocean"
May 24	Sent the attachment to a TEPCO press release titled "The status of reactors of Units 2 and 3, Fukushima Daiichi Nuclear Power Station, TEPCO."
	Sent NISA press release documents: "Regarding the Outflow of Contaminated Water with High Concentration of Radioactive Materials from Unit 3 of Fukushima Dai-ichi Nuclear Power Station, Tokyo Electric Power Co. Inc., and Actions Taken" and "Regarding the Impacts of the Outflow of Waste Water with Concentration of Radioactive Materials above the Discharge Limit on the Sea."
May 31	Sent the material regarding the TEPCO press release "Oil leakage to the sea confirmed around the curtain wall of the water intake canal of Unit 5 and 6, Fukushima Daiichi Nuclear Power Station."
	Sent the material regarding the TEPCO press release "Oil leakage to the sea confirmed around the curtain wall of the water intake canal of Unit 5 and 6, Fukushima Daiichi Nuclear Power Station (Further Report)."

Press Conferences in English to the Foreign Press

[FPC: Foreign Press Center/Japan FCCJ: The Foreign Correspondents' Club of Japan PMO: Prime Minister's Office]

Date	Venue	Briefer(s)	Content (movies, etc.)
Apr. 1	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=320&storytopic=3&ml_lang=en
Apr. 2	FPC	Deputy Cabinet Secretary for Public Relations, MOFA, MEXT, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=322&storytopic=3&ml_lang=en
Apr. 3	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, MEXT, MHLW, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=325&storytopic=3&ml_lang=en
Apr. 4	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, MEXT, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=327&storytopic=3&ml_lang=en
Apr. 5	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, MEXT, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=329&storytopic=3&ml_lang=en
Apr. 6	PMO	Deputy Cabinet Secretary for Public Relations, CAO, JAMSTEC, MOFA, MAFF, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=331&storytopic=3&ml_lang=en
Apr. 7	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, MAFF, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=333&storytopic=3&ml_lang=en
Apr. 8	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, MAFF, NISA, MLIT	http://fpcj.jp/modules/news3/index.php?page=article&storyid=335&storytopic=3&ml_lang=en
Apr. 9	FPC	Deputy Cabinet Secretary for Public Relations, MOFA, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=337&storytopic=3&ml_lang=en
Apr. 10	FPC	Deputy Cabinet Secretary for Public Relations, MOFA, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=339&storytopic=3&ml_lang=en
Apr. 11	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, MAFF, NISA	http://nettv.gov-online.go.jp/eng/prg/prg2082.html
Apr. 12	PMO	Chief Cabinet Secretary, Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, MAFF, NISA	http://nettv.gov-online.go.jp/eng/prg/prg2085.html
Apr. 13	PMO	Director of Global Communications Strategy, Prime Minister's Office, CAO, MOFA, JAMSTEC, MHLW, NISA	http://nettv.gov-online.go.jp/eng/prg/prg2088.html
Apr. 14	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA	http://nettv.gov-online.go.jp/eng/prg/prg2092.html
Apr. 15	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, MAFF, NISA	http://nettv.gov-online.go.jp/eng/prg/prg2094.html
Apr. 17	FPC	Special Advisor to the Prime Minister, Deputy Cabinet Secretary for Public Relations, MOFA, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=343&storytopic=3&ml_lang=en
Apr. 18	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA	http://nettv.gov-online.go.jp/eng/prg/prg2097.html

Press Conferences in English to the Foreign Press
[FPC: Foreign Press Center/Japan FCCJ: The Foreign Correspondents' Club of Japan PMO: Prime Minister's Office]

Apr. 19	FCCJ	Deputy Cabinet Secretary for Public Relations, MOFA, NISA, MAFF	http://fpcj.jp/modules/news3/index.php?page=article&storyid=346&storytopic=3&ml_lang=en
Apr. 20	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA, MHLW	http://nettv.gov-online.go.jp/eng/prg/prg2104.html
Apr. 21	FPC	MOFA, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=347&storytopic=3&ml_lang=en
Apr. 22	PMO	Director of Global Communications Strategy, Prime Minister's Office, CAO, MOFA, JAMSTEC, MHLW, NISA, MLIT	http://nettv.gov-online.go.jp/eng/prg/prg2107.html
Apr. 25	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA	http://nettv.gov-online.go.jp/eng/prg/prg2111.html
Apr. 27	FCCJ	Special Advisor to the Prime Minister, Deputy Cabinet Secretary for Public Relations, MOFA, METI, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=349&storytopic=3&ml_lang=en
Apr. 28	FPC	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, NISA, MAFF	http://fpcj.jp/modules/news3/index.php?page=article&storyid=352&storytopic=3&ml_lang=en
May. 2	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA	http://nettv.gov-online.go.jp/eng/prg/prg2126.html
May. 6	FPC	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=355&storytopic=3&ml_lang=en
May. 9	FCCJ	Special Advisor to the Prime Minister, NISA	http://fpcj.jp/modules/news3/index.php?page=article&storyid=358&storytopic=3&ml_lang=en
May. 11	FPC	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA, MAFF	http://fpcj.jp/modules/news3/index.php?page=article&storyid=360&storytopic=3&ml_lang=en
May. 13	PMO	Deputy Cabinet Secretary for Public Relations, CAO, MOFA, JAMSTEC, MHLW, NISA, MAFF	http://nettv.gov-online.go.jp/eng/prg/prg2142.html
May. 17	FPC	Special Advisor to the Prime Minister, Deputy Cabinet Secretary for Public Relations, CAO, NISA, TEPCO	http://fpcj.jp/modules/news3/index.php?page=article&storyid=364&storytopic=3

CAO Cabinet Office
JAMSTEC Japan Agency for Marine-Earth Science and Technology
MAFF Ministry of Agriculture, Forestry and Fisheries
MOFA Ministry of Foreign Affairs
METI Ministry of Economy, Trade and Industry
MEXT Ministry of Education, Culture, Sports, Science and Technology
MHLW Ministry of Health, Labour and Welfare
MLIT Ministry of Land, Infrastructure and Transport and Tourism
NISA Nuclear and Industrial Safety Agency
TEPCO Tokyo Electric Power Co., Inc.

Interviews with Cabinets Ministers and Other Officials by the Foreign Press

Date	Interviewee	Interviewing media
Mar. 18 (In writing)	Foreign Minister Takeaki Matsumoto	Xinhua News Agency (China)
Mar. 20	Chief Cabinet Secretary Yukio Edano	CNN (US)
Mar. 24	Chief Cabinet Secretary Yukio Edano	Thomson Reuters (UK)
Mar. 29	Deputy Chief Cabinet Secretary Tetsuro Fukuyama	RTL (Germany)
Mar. 30	Chief Cabinet Secretary Yukio Edano	Wall Street Journal (US)
Mar. 31	Chief Cabinet Secretary Yukio Edano	Financial Times (UK)
Apr. 10	Chief Cabinet Secretary Yukio Edano	The Economist (UK), The New York Times (US), Bloomberg (US), BBC (UK), CBS (US)
Apr. 19	Chief Cabinet Secretary Yukio Edano	Phoenix TV (Hong Kong)
Apr. 19	Chief Cabinet Secretary Yukio Edano	CCTV (China)
Apr. 19 (Phone)	Special Advisor to the Prime Minister Goshi Hosono	FOCUS (Germany)
Apr. 22	Chief Cabinet Secretary Yukio Edano	Wall Street Journal (US)
Apr. 23	Special Advisor to the Prime Minister Goshi Hosono	Wall Street Journal (US)
Apr. 23	Special Advisor to the Prime Minister Goshi Hosono	Financial Times (UK)
Apr. 26	Special Advisor to the Prime Minister Goshi Hosono	Ukrainian TV (Ukraine)
Apr. 29	Foreign Minister Takeaki Matsumoto	Washington Post (US)
May. 1	Foreign Minister Takeaki Matsumoto (in Dakar)	RTS (Radiodiffusion Télévision Sénégalaise) (Senegal)
May. 9 (In writing)	Foreign Minister Takeaki Matsumoto	Global Times (China)
May. 16	Special Advisor to the Prime Minister Kiyomi Tsujimoto	Mr. Wang Jiangang (China) * The interview will be reported by Xinhua and other Chinese news agencies.
May. 16	Special Advisor to the Prime Minister Kiyomi Tsujimoto	Monocle (UK)
May. 19	Foreign Minister Takeaki Matsumoto	Phoenix TV (Hong Kong)
May. 24	Prime Minister Naoto Kan	Financial Times (UK)

Japan's road to recovery and rebirth

BY NAOTO KAN

On March 11, Japan was hit by one of the most powerful earthquakes in recorded history. We are making all-out efforts to restore livelihoods and recover from the series of tragedies that followed the Great East Japan Earthquake. The disaster left more than 28,000 people, including foreign citizens, dead or missing.

Since March 11, Japan has been strongly supported by our friends around the world. On behalf of the Japanese people, I would like to express my sincerest gratitude for the outpouring of support and solidarity we have received from more than 130 countries, nearly 40 international organizations, numerous nongovernmental organizations and countless individuals from all parts of the world. The Japanese people deeply appreciate the *kizuna* ("bonds of friendship") shown to us. Through this hardship, we have come to truly understand that a friend in need is a friend indeed.

Immediately after the earthquake, the United States, our most important friend and ally, provided swift cooperation. President Obama kindly called me to convey his strong commitment that the United States stood ready to provide all-out support to the Japanese people during this time of great difficulty. He reaffirmed that the relationship between our nations is unshakable. So many Japanese citizens, including myself, were enormously encouraged by these remarks. From an early stage in the response efforts, U.S. forces have diligently performed relief activities on multiple fronts as part of Operation Tomodachi (Japanese for "friendship"). The attitude that Americans have demonstrated during this operation has deeply touched the hearts and minds of the Japanese. Support has come from not only the government but also NGOs and countless individuals, in various forms of humanitarian assistance, search-and-rescue missions, charity events and fundraising. We have also received full U.S. support in responding to the accidents at the Fukushima Daiichi nuclear power plant, from providing equipment and other material assistance such as fire trucks and special protective suits, to dispatching nuclear experts and radiation-control teams.

I take very seriously, and deeply regret, the nuclear accidents we have had at the Fukushima Daiichi plant. Bringing the situation under control at the earliest possible date is my top priority. Leading a unified effort by the government, I have mobilized all available resources to combat the risks posed by the plant, based on three principles: First, give the highest priority to the safety and health of all citizens, in particular those residents living close to the plant; second, conduct thorough risk management; and, third, plan for all possible scenarios so that we are fully prepared to respond to any future situations. For example, we continue to make the utmost efforts to address the issue of outflow of radioactive water from the plant into the ocean. In addition, the government has taken every possible measure to ensure the safety of all food and other products, based on strict scientific criteria. We have taken great precautions to ensure the safety of all Japanese food and products that have reached and will continue to reach markets. To ensure domestic and foreign consumer confidence in the safety of Japanese food and products, my administration will redouble its efforts to maintain transparency and keep everyone informed of our progress in the complex and evolving circumstances at the Fukushima Daiichi plant.

I pledge that the Japanese government will promptly and thoroughly verify the cause of this incident as well as share information and the lessons learned with the rest of the world to help prevent such accidents in the future. Through such a process, we will proactively contribute to global debate to enhance the safety of nuclear power generation. Meanwhile, regarding a comprehensive energy policy, we must squarely tackle a two-pronged challenge: responding to rising global energy demand and striving to reduce greenhouse gas emissions to combat global warming. Going forward, I would like to present a clear vision to the world — which includes the aggressive promotion of clean energy — that may contribute to solving global energy issues.

The Great East Japan Earthquake and the resulting tsunami are the worst natural disasters that Japan has faced since the end of the Second World War. Reconstruction of the devastated Tohoku region will not be easy. I believe, however, that this difficult period will provide us with a precious window of opportunity to secure the "Rebirth of Japan." The government will dedicate itself to demonstrating to the world its ability to establish the most sophisticated reconstruction plans for East Japan, based on three principles: first, create a regional society that is highly resistant to natural disasters; second, establish a social system that allows people to live in harmony with the global environment; and third, build a compassionate society that cares about people, in particular, the vulnerable.

The Japanese people rose from the ashes of the Second World War using our fundamental strength to secure a remarkable recovery and the country's present prosperity. I have not a single doubt that Japan will overcome this crisis, recover from the aftermath of the disaster, emerge stronger than ever, and establish a more vibrant and better Japan for future generations.

I believe that the best way for Japan to reciprocate the strong kizuna and cordial friendship extended to us is to continue our contribution to the development of the international community. To that end, I will work to the best of my ability to realize a forward-looking reconstruction that gives people bright hopes for the future. I would wholeheartedly appreciate your continued support and cooperation. Arigatou.

The writer is prime minister of Japan.

Japan's road to recovery and rebirth

A pledge from the Japanese prime minister to bolster nuclear safety and international trust.

Naoto Kan

On March 11, Japan was hit by one of the most powerful earthquakes in recorded history. We are making all-out efforts to restore livelihoods and recover from the series of tragedies that followed the Great East Japan Earthquake. The disaster left more than 28,000 people, including foreign citizens, dead or missing.

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I take very seriously, and deeply regret, the nuclear accidents we have had at the Fukushima Daiichi plant. Bringing the situation at the plant under control at the earliest possible date is my top priority. Leading a unified effort by the government, I have mobilized all available resources to combat the risks posed by the plant, based on three principles: first, give the highest priority to the safety and health of all citizens, in particular those residents living close to the plant; second, conduct thorough risk management; and, third, plan for all possible scenarios so that we are fully prepared to respond to any future situations. For example, we continue to make the utmost efforts to address the issue of outflow of radioactive water from the plant into the ocean. In addition, the government has taken every possible measure to ensure the safety of all food and other products, based on strict scientific criteria. We have taken great precautions to ensure the safety of all Japanese food and products that reach the market and will continue to do so. To assure domestic and foreign consumer confidence in the safety of Japanese food and products, my administration will redouble its efforts to maintain transparency and keep everyone informed of our progress in the complex and evolving circumstances at the Fukushima Daiichi plant.

I pledge that the Japanese government will promptly and thoroughly verify the cause of this incident, as well as share information and the lessons learned with the rest of the world to help prevent such accidents in the future. Through such a process, we will proactively contribute to the global debate to enhance the safety of nuclear power generation. Meanwhile, regarding a comprehensive energy policy, we must squarely tackle a two-pronged challenge: responding to rising global energy demand and striving to reduce greenhouse gas emissions to combat global warming. Going forward, I would like to present a clear vision to the world — that includes the aggressive promotion of clean energy — that may contribute to solving global energy issues.

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The Great East Japan Earthquake and the resulting tsunami are the worst natural disasters that Japan has faced since the end of World War II. Reconstruction of the devastated Tohoku region will not be easy. I believe, however, that this difficult period will provide us with a precious window of opportunity to secure the "Rebirth of Japan."

The government will dedicate itself to demonstrating to the world its ability to establish the most sophisticated reconstruction plans for East Japan, based on three principles: first, create a regional society that is highly resistant to natural disasters; second, establish a social system that allows people to live in harmony with the global environment; and third, build a compassionate society that cares about people, in particular, the vulnerable.

The Japanese people rose from the ashes of the Second World War using our fundamental strength to secure a remarkable recovery and the country's present prosperity. I have not a single doubt that Japan will overcome this crisis, recover from the aftermath of the disaster, emerge stronger than ever, and establish a more vibrant and better Japan for future generations.

I believe that the best way for Japan to reciprocate the strong kizuna and cordial friendship extended to us is to continue our contribution to the development of the international community. To that end, I will work to the best of my ability to realize a forward-looking reconstruction that gives people bright hopes for the future. I would wholeheartedly appreciate your continued support and cooperation.

NAOTO KAN *is prime minister of Japan.*

Japan is open for business

We promise you that Japan will reshape itself into a more dynamic country.

Takeaki Matsumoto

TOKYO After the earthquake and tsunami disaster, many foreign dignitaries, including French President Nicolas Sarkozy and U.S. Secretary of State Hillary Clinton, have expressed their solidarity with Japan. "The Japanese are indomitable and courageous," Australian Prime Minister Julia Gillard said when she visited an evacuation shelter in the afflicted region.

The Great East Japan Earthquake and Tsunami are the worst natural disasters Japan has encountered since the end of the Second World War. However, Japan will not simply rebuild what used to be, but aim for an innovative reconstruction that focuses on the future by fully mobilizing its signature strength: a society with high levels of technology, safety and security.

We promise all of you that Japan will reshape itself into a more dynamic country, harnessing the support and solidarity offered to us from all over the world.

Japan is and will remain open for business and travel. International organizations such as the International Civil Aviation Organization, the International Maritime Organization and the World Health Organization have been making objective assessments, and state that excessive travel restriction measures are unnecessary.

I would call on all readers to trust such information, rather than being misguided by sensational media reports, and come to Japan with peace of mind for sightseeing, study, business or any other purposes.

Regarding the Fukushima Daiichi Nuclear Power Station, a Roadmap was released by the Tokyo Electric Power Company (TEPCO). We expect to move from the "emergency response phase" to the "planned and stabilizing action phase."

The government will regularly follow up, monitoring the progress of the work and making necessary safety checks in order to ensure the implementation of the roadmap in a steady and safe manner.

The government has been constantly monitoring air, water and food. Most of the radioactive materials were released in the first several days of the accident, and radiation levels in the air have been gradually declining since.

In Tokyo, for instance, the level of radiation has never reached a point at which it would affect human health. It is declining steadily, and has reached the level at which it was measured before the accident.

As for food products, measures have been taken to prevent domestic distribution of those products that have a higher radiation level than the standard set in accordance with the recommendations of the International Commission on Radiological Protection.

Naturally, such products will not be exported. Radiation levels that exceed the authorized threshold have thus far been found only in limited kinds of agricultural and fishery products in limited areas. When necessary, certification is issued to declare that a product does not originate in the affected region.

Most of Japan remains unharmed by the disaster, and the streets have leapt back to life.

Industrial products are manufactured in factories outside of the no-entry zone, and remain under strict quality control. It is therefore unlikely that those products will be affected by radioactive materials, and their safety is ensured. Data on the radiation levels in ports and airports are published regularly. In addition, a guideline on radiation measurements for export containers and ships was published by the Ministry of Land, Infrastructure, Transport and Tourism. Attestation of measurement results started at the Yokohama port on April 28.

If you imagine that the whole of Japan is covered by debris, that is completely wrong. Most of Japan remains unharmed by the disaster, and the streets have leapt back to life. The major highway that runs through the most affected Tohoku region was reopened only two weeks after the earthquake. The Shinkansen, the bullet train that connects Tokyo and Tohoku region, became fully operational again on April 29.

Many affected companies and factories are recovering at surprising speed, helped by innovative approaches to tackling the crisis. Domestic and international supply chains are being reconnected. Japan's strength for manufacturing remains on full display.

Allow me to quote Dr. Donald Keene, professor emeritus at Colombia University, expressing his will to obtain Japanese nationality after the disaster: Japan was hit hard for the moment, but it "will surely resurrect to become an even more splendid country."

If you are thinking of supporting us in our path towards recovery, the most effective way would be to visit Japan and buy our excellent products, just as before. I call on all of you to be more engaged in the exchange with Japan.

TAKEAKI MATSUMOTO *is Japan's minister for foreign affairs.*

福島第一原子力発電所事故等に関する日本政府機関ＨＰにおける
外国語での情報提供

平成２３年５月２７日現在

１　英語

主な内容	掲載場所	初回掲載日	最終更新日	更新回数
【情報提供待ち】	首相官邸ホームページ			
地震による原子力施設への影響、原子力発電所の状況等	原子力安全・保安院ホームページ	３月１２日	５月２４日	５００回
渡航関連情報、国際機関が発出した情報等	外務省ホームページ	３月１３日	５月１８日	３３回
被災後の原子力施設の状況のサマリー	経済産業省ホームページ	３月１５日	５月２６日	４５回
環境モニタリング結果（空間線量率、積算線量、海域、航空）等	文部科学省ホームページ	３月１６日	５月２３日	１０００回
食品・飲料水の放射線検査、出荷制限／摂取制限等	厚生労働省ホームページ	３月２３日	５月２７日	１９８回
放射線拡散予測、環境モニタリング結果評価等	原子力安全委員会ホームページ	３月２３日	５月２２日	１２８回
農産品・水産物の放射線検査等	農林水産省ホームページ	３月２５日	５月２７日	１１５回

２　中国語

主な内容	掲載場所	初回掲載日	最終更新日	更新回数
渡航関連情報、国際機関が発出した情報等	外務省ホームページ	３月１５日	５月１８日	３２回
環境モニタリング結果（空間線量率、積算線量、海域、航空）等	文部科学省ホームページ	３月１６日	５月２３日	７２５回

３　韓国語

主な内容	掲載場所	初回掲載日	最終更新日	更新回数
渡航関連情報、国際機関が発出した情報等	外務省ホームページ	３月１５日	５月１７日	２９回
環境モニタリング結果（空間線量率、積算線量、海域、航空）等	文部科学省ホームページ	３月１６日	５月２３日	７１４回

４　その他の言語（ポルトガル語、スペイン語及びロシア語）

主な内容	掲載場所	初回掲載日	最終更新日	更新回数
渡航関連情報	外務省ホームページ	３月３０日	４月４日	３回

（了）

在外公館ウェブサイトにおける事故関連情報の提供

・<u>掲載公館数</u>：<u>９９公館</u>

※アジア・大洋州地域（１９）、北・中南米地域（１８）、欧州地域（３３）、中東・アフリカ地域（２５）、国際機関代表部（４）

・<u>掲載言語</u>　：<u>２９言語</u>

※日本語、英語、スペイン語、仏語、中国語、ロシア語、韓国語、ドイツ語、イタリア語、ポルトガル語、インドネシア語、トルコ語、ポーランド語、チェコ語、アゼルバイジャン語、スロバキア語、ルーマニア語、エストニア語、タイ語、アラビア語、グルジア語、ハンガリー語、クロアチア語、ノルウェー語、リトアニア語、ボスニア語、ラトビア語、ブルガリア語、ベトナム語

・掲載日　　：大多数の公館においては、地震直後（３月１１日）から３月中旬頃までに関連情報のウェブサイトへの掲載を開始している。各公館とも適宜情報の更新を行っている他、関連省庁等（総理官邸、外務省、経産省、文科省、国交省、厚労省等）のウェブサイトへのリンクを設置することにより、最新情報の提供に努めている。

Attachment IX-9

Rationales for Provisional Rating of Event Severity Based on INES

The International Atomic Energy Agency (IAEA) and the OECD Nuclear Energy Agency (OECD/NEA) developed and proposed the International Nuclear and Radiological Event Scale (INES) to the member states in March 1992 as a tool to simply represent the safety significance of nuclear and radiological events at nuclear installations and others. Japan has adopted it since August 1, 1992. In the wake of an event, the Nuclear and Industrial Safety Agency (NISA) temporarily assesses its significance. After the event cause is identified and preventive actions are determined, the INES Evaluation Subcommittee established in the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy reviews the event from the technical view point based on expertise, and issues the final rating.

The provisional rating for the Fukushima Daiichi accident was updated from the first to the fourth report, taking into account the progress of the accident. This paper describes the approaches to each provisional rating.

(1) The First Report

NISA provisionally rated the events at Fukushima Daiichi and Daini Nuclear Power Stations caused by the Tohoku District-Off the Pacific Ocean Earthquake at Level 3 on the INES, because station blackout disabled motor operated pumps of Fukushima Daiichi Units 1 to 4 at 15:42 on March 11, and because the water levels of the reactors of Fukushima Daiichi Units 1 and 2 could not be monitored to identify the water injection conditions and the water might not be injected, leading to a decision at 16:36 that the emergency core cooling system was unavailable to inject water. NISA tentatively posted the provisional rating of Level 3 on the Nuclear Events Web-based System (NEWS), the website of IAEA. In this statement, Fukushima Daini Unit 1, as well as Fukushima Daiichi Units 1 and 2, was placed at Level 3. Subsequent review of the events indicates that Fukushima Daiichi Units 3 and 4 should be also rated Level 3 when the motor operated pumps were inoperable. In addition, Fukushima Daini Units 2 and 4, as well as Fukushima Daini Unit 1, should be at Level 3, as flooding caused by the tsunami failed the pumps of the RHR sea water system and heat sink for decay heat was lost.

(2) The Second Report

The events further developed. At Fukushima Daiichi Unit 1, the venting operations at the reactor containment were conducted and there was an outbreak of explosion in the reactor building, resulting in release of radioactive materials into the environment. The emissions of iodine, cesium and other elements were estimated that radioactive materials exceeding approx. 0.1 % of the core inventory would be released from the fuel assemblies. NISA raised the events to Level 4 as a provisional rating and issued it on NEWS. It should be noted that the data of the emission of radioactivity were not obtained from stack monitors due to loss of power for the reactor facilities. Moreover, the west wind around the plant site was blowing to the sea so that an increase in the radiation level was shown relatively small. Therefore, the emissions of radioactivity were not recognized as significant as those currently assumed. As the accident had not been controlled yet, it was determined that the status of the accident in relation to “People and the Environment” provided in the INES User’s Manual 2008 Edition would be assessed later. The provisional rating was not intended to conclude that the fuel damage did not exceed an equivalent level defined in the Manual, but the severity of the accident may be at Level 4 or more.

(3) The Third Report

Subsequently, Fukushima Daiichi Units 2 and 3 also underwent the fuel damage events. The Tokyo Electric Power Co. Inc. reported*[1] the measurements by the containment atmosphere monitoring systems (CAMS) of each unit and the assumed ratios of fuel damage based on the measurements. The assumed ratios were obtained from the relationship diagram of the elapsed time after a scram considering the loss of coolant accident and the readings of CAMS. The assumptions for this diagram are not always consistent with the case of the Fukushima accident. These estimates include uncertainties. However, the subsequent shifts in the plant data were reviewed and it was determined that the fuel damage of several percent certainly occurred. NISA temporarily placed the events at Fukushima Daiichi Units 1 to 3 on Level 5 on March 18, released to the press and posted the rating separately for each unit on the NEWS. At the same time, provisional ratings of Level 3 for Fukushima Daiichi Unit 4 and Fukushima Daini Units 1, 2 and 4 were released to the press and posted separately for each unit on the NEWS. Radioactive materials still continued to be released into the environment and the events were not under control. It was determined that the status of the accident in relation to "People and the Environment" based on the assumption of released radioactivity would be assessed later.

*1: The values were reported approx. 70 % for Unit 1, approx. 33 % for Unit 2 and approx. 30 % for Unit 3 on March 15; they were corrected to approx. 55 %, 35 % and 30 %, respectively, on April 27.

(4) The Fourth Report

Given these backgrounds, determination of the INES rating on the events at Fukushima Daiichi Nuclear Power Station requires estimates of the atmospheric emission of radioactivity. The estimates led to assignment of the provisional Level 7 on April 12. This was publicized and posted on the NEWS as the rating of Fukushima Daiichi as a whole. In this evaluation, NISA estimated the values using analytical results of the reactor conditions and others provided by the Japan Nuclear Energy Safety Organization (JNES) to organize the total emissions of radioactive materials from Fukushima Daiichi into the atmosphere. As shown in the table below, they are equivalent with those of Level 7 on the INES scale.

Nuclear Safety Commission (NSC) assessed the estimates of the total atmospheric emissions of the radioactive materials at the time. Based on the inverse calculation of the monitoring results, the total releases of iodine 131 and cesium 137 from Fukushima Daiichi as a whole were obtained, which are equivalent of Level 7 releases.

	Estimated Release from Fukushima Daiichi		(Reference) Released from Chernobyl
	Estimated by NISA	Issued by NSC	
Iodine 131 (a)	130,000 TBq (1.3×10^17Bq)	150,000 TBq (1.5×10^17Bq)	1,800,000 TBq (1.8×10^18Bq)
Cesium 137	6,000 TBq (6.1×10^15Bq)	12,000 TBq (1.2×10^16Bq)	85,000 TBq (8.5×10^16Bq)
(Radiological Equivalence to I-131) (b)	240,000 TBq (2.4×10^17Bq)	480,000 TBq (4.8×10^17Bq)	3,400,000 TBq (3.4×10^18Bq)
(a) + (b)	370,000 TBq (3.7×10^17Bq)	630,000 TBq (6.3×10^17Bq)	5,200,000 TBq (5.2×10^18Bq)

(Note) Radiological equivalences to I-131 of the both values estimated by NISA and issued by NSC were calculated by NISA in accordance with INES User's Manual. The values in this table are based on the preliminary one of the event progress analysis described in "IV. 5. Situation of Each Unit etc. at Fukushima NPS" of this report in which the final results were summarized following the subsequent review of the analytical conditions. Therefore, the estimated total releases are different.

The value equivalent to a Level 7 release exceeds several tens of thousands of terabecquerels (an order of 10^{16} becquerels) corresponding to a quantity of radioactivity equivalence to I-131.

In determining this provisional rating, NISA took into account the following:

1) Explanation at the Time of Declaration of Level 7 Rating

Level 7 is the highest rating in INES in terms of safety significance. When a provisional Level 7 rating was declared, NISA mentioned that the environmental release of radioactive materials from Fukushima Nuclear Power Station was currently about 10 % of that from Chernobyl whose INES rating is the same as Fukushima, and added the following statements:

- Twenty-eight persons died by acute exposure to significant doses of radiation in the Chernobyl accident, but such a situation have not occurred in Fukushima. While twenty-one persons received doses exceeding 100 mSv, the dose of workers received is under control.

- After explosion of the reactor at Chernobyl a large scale fire broke out. This spread significant quantities of radioactive materials over extended areas. Hydrogen explosions occurred at Fukushima Nuclear Power Station, but no large and persistent fire was observed.

- Contamination due to radiological materials hampered access to the Chernobyl site after the accident. The site was abandoned and uncontrolled without any action undertaken. However, at Fukushima, the situations allow the actions to be taken to control the accident.

The radioactivity emissions used in the evaluation are the estimates at that time. The environmental releases of radioactive materials were still ongoing at that time. Therefore, NISA had been collecting the information for further evaluation. The results of the revised evaluation are described in " IV. 5. Situation of Each Unit etc. at Fukushima NPS " and " VI. 1. Evaluation of the amount of radioactive materials discharged to the air " in this report.

2) Timing of Evaluation and Public Relations

It has been pointed out that determination and public release of the provisional rating of Level 7 took a long time. In fact, NISA was seeking for gathering the plant data for fair evaluation based on the scientific data. NISA needed enough time to review the items described in " IV. 5. Situation of Each Unit etc. at Fukushima NPS " and " VI. 1. Evaluation of the amount of radioactive materials discharged to the air " using the collected data. On April 12, NISA concluded that the values were equivalent to the Level 7 release, though they were still estimates.

In determination of the provisional rating of Fukushima, NISA faced a difficulty of using the INES scale in a major accident in terms of public relations when uncertainties exist. The intension of INES rating is to easily understand the scale of nuclear accident. However, the rating of an event should be decided in a careful manner referring to the INES manual. There may be a gap between the public image and the INES rating, as seen in consideration of effects of emission of radioactive materials into the sea. This could cause a possibility of misunderstanding. Thus a continuous effort should be made to fill the gap all the time.

Roadmap for Immediate Actions for the Assistance of Nuclear Sufferers

Document 2

May 17, 2011
Nuclear Emergency Response Headquarters

Actions	<Step 1 (Target: Mid-July)> (Currently: May 17)	<Step 2 (around 3 to 6 months*)> *After achieving Step 1	Mid-Term Issues

1. Actions for the restoration from the accident at TEPCO's Fukushima Dai-ichi Nuclear Power Station

- Radiation dose is in steady decline. → Release of radioactive materials is under control and radiation dose is being significantly held down. →

2. Actions related to the evacuation area

3. Actions related to the deliberate evacuation area

4. Actions related to the evacuation prepared area in case of emergency

- Obtain emergency temporary housing, etc., as soon as possible.
  * Provide the housing starting from those living in evacuation shelters for long periods. Presently, the municipal governments have specifically requested about 15,200 units. These are estimated to be completed by the first half of August. Any additional units requested as measures for early completion by the municipal governments will be supported.
- Give temporary access to evacuation areas. (1st round) *To be carried out sequentially from May 10 → Take out vehicles., etc. *To be started from the end of May → 2nd round
- Prepare for the deliberate evaluation (Find evacuation shelters, transfer farm animals, etc.) → Carry out the deliberate evacuation *Complete by end of May → Assist business activities at the evacuation shelters, etc.
- Mid-Term: Monitoring and evaluation → Specifically consider and implement the dismantling of evacuation areas

5. Ensure the safety and reassurance of sufferers

- Screening and decontamination of residents → Estimate the exposure dose as a basis for health surveys of residents *To start from May → Long-term health management of local residents * Specific methods to be considered based on the examination results
- Consider disposal policies for rubble, sewage and sludge → On-site investigation, consider processing methods, conduct the disposal
- Investigate the radiation dose, etc., in school and kindergarten yards, etc. → Carry out measures for the soil in school and kindergarten yards
- Enhanced environmental monitoring Create and announce estimated radiation dose maps, etc. → Continuous implementation of environmental monitoring (atmosphere, soil, seawater, sea-bottom soil) and evaluation * Cancel the evacuation areas and provide continuous assistance for the return of residents

6. Secure employment, and provide support for farms and industries

7. Support the local municipalities in the affected areas

- Grant employment adjustment subsidies and exceptions for unemployment benefits
  Create jobs and assist employment using public works such as rubble removal and projects based on job-creation funds
- Provide substantial guarantees for JA (Japan Agricultural Co-operatives) and JF (Japan Fisheries Cooperatives) Groups' bridge loans
- Expand loans and guarantees for small and medium-sized businesses Support the restoration and business continuity of factories and retail shops → Special assistance that offers long-term interest-free business funds, partnering with Fukushima Prefecture *To be implemented from the end of May
- Implement measures against harmful rumors and assist exports (PR activities in Japan and overseas, offer support for inspections, approach foreign governments, etc.)
- Provide continuous support to affected municipalities and municipalities that are receiving sufferers.

8. Compensation to sufferers and affected businesses, etc.

- Hold the Dispute Reconciliation Committee and announce the preliminary guidelines → Create and announce the guidelines in sequential order Summarize the interim guideline in July (covering the entire nuclear damage) → Additional guidelines to be announced as necessary
- Provisional lump-sump payment by TEPCO to the evacuees → Provisional payment to businesses, etc. → Receive applications and payout the compensations

9. Actions to assist homecoming

- Investigate the situation of the accumulation of radioactive materials in soil, etc. *To be conducted after May
- Experimental study of decontamination and improvement methods of soil, etc. *Carry out in phases after May
- Decontaminate and improve the soil, etc. *Carry out after cancellation of evacuation areas
- Examine measures to reconstruct and revitalize local communities → Implement measures to reconstruct and revitalize the local communities

Policy for Immediate Actions for the Assistance of Nuclear Sufferers

May 17, 2011
Nuclear Emergency Response Headquarters

Policy for Immediate Actions for the Assistance of Nuclear Sufferers

May 17, 2011
Nuclear Emergency Response Headquarters

More than two months have passed since March 11 when the Great East Japan Earthquake brought about an extraordinary disaster followed by the nuclear accident at the Fukushima Daiichi Nuclear Power Station (NPS) operated by the Tokyo Electric Power Co., Inc. (TEPCO).

Those affected by the nuclear accident must have spent many unimaginably long, painful, and difficult days since the accident occurred. Those who had to evacuate with only the barest necessities leaving their damaged homes after the evacuation area was established must have grave concerns, and those who were forced to live in inconvenience or who have voluntarily evacuated due to the establishment of the in-house sheltering area must be suffering indescribably.

We recognize the grave physical and psychological stress that these nuclear sufferers have had to deal with by being transferred from one evacuation site to another, the inconvenience in their lives, the long stays at evacuation sites with little privacy, groundless criticism, and sharp changes in their work and educational environment.

Those affected by the accident that are engaged in agricultural and fishing industries and small businesses are also vulnerable to harmful rumors regarding their products, or have sustained great damage from being unable to stay in business due to the evacuation.

A number of people are currently forced to live at evacuation sites. We have asked those who reside in areas with high radiation dosage to prepare for the imminent deliberate evacuation, and those in other neighboring areas to be prepared for a possible emergency evacuation. We know the accident is inflicting a serious inconvenience on a great number of people.

The situation at Fukushima Daiichi NPS, TEPCO is still far from being fully predictable. Workers are now desperately struggling at the site in order to bring the situation under full control as soon as possible. It is a heart-breaking fact that many of those nuclear plant workers and their families are suffering from this nuclear accident.

The most important thing that is urgently demanded is to properly implement the “Roadmap towards Restoration after the Accident” presented by TEPCO on April 17. This roadmap will bring the reactors to cold shutdown in six to nine months, and the emission of radioactive materials will be under control with significantly reduced radiation dosage.

Everything should not be left to TEPCO, and the government will also make every effort to achieve this goal.

To date, we have been focusing on actions to secure the safety of those afflicted from the nuclear accident such as establishing the evacuation areas. In addition to that, we will also make an utmost effort to help improve the lives of those afflicted by the accident by securing secondary evacuation sites in cooperation with those municipalities inside and outside Fukushima Prefecture who have accepted sufferers.

The supplementary budget for fiscal 2011 passed recently. Further measures will be implemented to build temporary housing and create jobs. Temporary re-entry to the restricted area has begun, which residents in the area have strongly desired.

Including these measures, the government has developed a policy of immediate actions for the assistance of sufferers and affected municipalities from the nuclear accident.

We present the policy here to ask the sufferers and affected municipalities from the nuclear accident, and related municipalities, as well as all people in the nation, to understand the overview of immediate actions to be implemented by all the government forces and the prospect for the near future. We are now moving steadily ahead with these measures.

However, these are just immediate actions. Needles to say, the government will squarely address all problems that nuclear sufferers will face in the future.

Nearly forty years have passed since Unit 1 of Fukushima Daiichi NPS operated by TEPCO started commercial service. This year marks the fortieth anniversary.

The nation has to squarely face the disappointment and feeling of betrayal of people in the affected areas who have long been the best supporters for the nation’s nuclear and power supply policies and lived side-by-side with nuclear power plants believing in their safety.

Nuclear power is the national policy of Japan with its lack of natural resources. The sufferers from the nuclear accident are, in a way, victims of this national policy. The government will take head-on the responsibilities for the restoration, however long it may take, until the very end.

We are confident that the sufferers will be able to return to their homes in their own homeland, and recover their communities to their prior cheerful environment rich in natural beauty. The government is prepared to make every effort to achieve this goal.

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1. Actions to Restore TEPCO's Fukushima Daiichi Nuclear Power Station

(Summary)

Based on the "Roadmap towards Restoration after the Accident at the Fukushima Daiichi Nuclear Power Station" (Roadmap) released by TEPCO on April 17, we will make our utmost effort to bring the situation under control as soon as possible, taking into account the possible impact on the environment, safety and the work environment. At the same time, based on what we have learned from the accident, we will promptly implement further safety measures at other nuclear power stations in the country.

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(1) Actions Towards Restoration

> ➢ Based on the roadmap, we will make our utmost effort to achieve restoration after the accident as soon as possible, taking into account the possible impact on the environment, safety, and the work environment.

<Immediate actions>

- We request TEPCO to properly implement the measures in the roadmap as soon as possible, as well as to conduct regular follow-up assessments of the progress and safety inspections.
- We request TEPCO to report on important measures to be implemented by TEPCO including the following measures in accordance with Article 67 of the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material, and Reactors, and will assess and confirm their necessity and impact on the environment and safety.

i) Support and confirmation of safety by the national government
(Cooling of the reactors)

- Injection of nitrogen gas, safety checks of the cooling conditions, and analysis of reactor core conditions
  Confirm the implementation method for the nitrogen injection to be carried out to reduce the risk of hydrogen explosion in the process of cooling the reactors. For the injection of water to cool the reactors steadily, the effectiveness and impact on the input and outflow of water will be evaluated based on the analyses of the reactor core conditions.

- Confirmation of the cooling method safety and impact on the environment
  For the cooling method to achieve the earliest cold shutdown, the safety and impact on the environment will be confirmed.

- Support for introducing robots to monitor conditions of the buildings
  Remote-controlled robots are being introduced to monitor conditions of the buildings by measuring radiation in the buildings and detecting water leakage in order to keep the workers' exposure doses low enough and improve their work efficiency. The

government supports the introduction of robots by gathering information both within Japan and abroad, and by coordinating or promoting offers of robots from related organizations.

- Assessment of the environmental impact of opening the openings of reactor buildings
  The environmental impact of opening the openings was confirmed prior to workers entering the reactor building of Unit 1 for work related to the procedure of cooling the reactor, because the air coming out of the building may cause the dispersion of radioactive materials. The same will be confirmed before opening other reactor buildings for the first time.

(Cooling of the spent fuel pools)

- Using unmanned helicopters; taking samples from the pools
  To grasp the situation inside the spent fuel pools, video shots of the pools will be taken with unmanned helicopters, and sampling analyses of the pool water will be carried out.

- Planning of removing and transporting spent fuel
  After evaluation of the damage to spent fuel in the pools, a secure method of taking spent fuel out of the pools and transporting them with dedicated casks will be studied.

- Safety check of the alternative cooling system
  The soundness, leakage prevention, and measures to reduce exposure to radiation will be confirmed regarding the alternative cooling system to be installed using existing piping for securely cooling the spent fuel.

(Containing, storing, processing, and recycling of the water (accumulated water) contaminated with radioactive materials)

- Safety checks of the transfer of high-level contaminated water to the Central Radioactive Waste Treatment Building
  In transferring high-level contaminated water from the basement of turbine buildings to the Central Radioactive Waste Treatment Building, measures to prevent or reduce environmental impacts due to water leakage will be confirmed, and monitoring of leaks will be continued.

- Safety checks of the high-level contaminated water treatment facility and storage tanks; and confirmation of the input and outgo of water
  Safety checks will be made on each component of the high-level contaminated water treatment system that consists of a high-level contaminated water treatment device, storage tanks, and a seawater desalination unit. It will be confirmed that the water balance is well considered so that high-, medium- and low-level contaminated water may not exceed the storage tank capacities. Furthermore, for temporary facilities, it will be confirmed that their use period is clearly defined and their usage is planned to be finished as soon as possible.
  Information on decontamination equipment was collected from all over the world including the United States and France that have abundant experience in radioactivity removal, and coordination was made to promptly introduce the high-level contaminated water treatment systems from AREVA in France and KURION Inc. in the US. Safety checks shall also be carried out for those systems.

- Support for the smooth transportation and introduction of the Mega-Float

Coordination with Shimizu City in Shizuoka Prefecture was made to provide the Mega-Float to secure the storage capacity of medium- and high-level contaminated water. It was quickly confirmed with related ministries and agencies that mooring the Mega-Float at the site of Fukushima Daiichi Nuclear Power Station of TEPCO has no legal problems. In addition, in-situ confirmation was conducted for the improvement of waterproof capability of the Mega-Float. Appropriate support and safety checks for its use will follow.

(Prevention of further subsurface water contamination)

- Safety checks will be conducted of the facilities that prevent subsurface water from being further contaminated with radioactive materials and spreading outside of the site. The appropriate implementation of such preventive measures will be evaluated and confirmed.

(Suppression of radioactive materials in the air and soil)

- Support for the design, introduction, and safety check of coverings over the reactor buildings
  Effectiveness and safety will be evaluated and confirmed of reactor building coverings with ventilators and filters for suppressing the emission of radioactive materials and their dispersion to the environment.

- Support for consideration and introduction of an anti-scattering agent
  Introduction of an anti-scattering agent for radioactive materials will be promoted, as well as ensuring it be sprayed appropriately and effectively over the buildings and outdoor areas.
- Support for the introduction of robots to remove rubbles
  For introducing remote-controlled robots in order to keep the exposure of workers low enough and improve their work efficiency, the government supports the activity by gathering domestic and overseas information, and by coordinating or promoting offers of robots from related organizations.

(Measures against aftershocks)

- Confirmation of measures against tsunami
  Implementation of appropriate measures such as installing multiple power sources will be evaluated and confirmed. It will also be confirmed that radiation shielding measures such as use of slurry are appropriately implemented assuming various risks.

- Confirmation of integrity and reinforcement of the spent fuel pool of Unit 4
  Integrity of the spent fuel pool and appropriateness of the reinforcement method using supporting structures will be confirmed for the severely damaged Unit 4 building,. In addition, the seismic safety and necessary seismic reinforcements of other buildings of Units 1 through 4 will also be confirmed.

(Securing safety of the work environment, and improvement of workers' living environment and healthcare)

- Collecting information on dosimeters and protective clothing, and support for their introduction
  The government will collect domestic and overseas information on dosimeters and protective clothing that fit the needs on the site and promote their smooth introduction.

- Monitoring of the management of work safety and workers' exposure
  TEPCO's management systems will be monitored to confirm that the systems for work safety and mitigation of workers' exposure are properly working.
- Promoting the improvement of workers' living environment
  The government will promote planning and actions for the improvement of workers' living environment: such as improving meals, bathing facilities and their sleep environment at Fukushima Daiichi NPS, Fukushima Daini NPS, and J-Village; and building of temporary dormitories.

- Improvement of healthcare and confirmation of management system
  - Management of exposure doses and implementation of extra health checkups
    The government instructed TEPCO to implement management of workers' exposure doses, including internal exposure, and to carry out extra health checkups. Reports on regular implementation of these policies are required.
  - Submission of work notification
    Work notifications for some emergency work will be submitted to the Labor Standards Inspection Office for confirmation of the management of workers' exposure doses.
  - Long-term healthcare management
    A database of exposure doses of all workers who have been engaged in emergency work will be developed so that the exposure of workers can be traced for long periods including after leaving jobs to provide long-term healthcare.

[Reference: Establishment of an exposure management system by TEPCO]

- TEPCO is preparing for building rest houses equipped with clean areas where protective equipment can be taken off to improve the workers' work environment. An exposed doses management system is being created that can read each portable dosimeter carried by an individual worker, along with recovering and improving facilities including repairing the failed computer for management. It is also establishing an internal exposure management system by sharing the whole body counters (WBC) owned by Fukushima Daiichi NPS and Fukushima Daini NPS or by procuring the same types from other organizations to carry out regular checkups of workers' internal exposure. After that, it will introduce new WBCs to improve the capability of the system. The middle-term plan is to introduce a fully-automatic exposure management system.

ii) International cooperation

(Accepting experts from overseas; promoting cooperation related to offers of equipment and materials)

- Experts from overseas including the United States came to Japan and are providing us with technologies for stabilizing reactors and spent fuel pools, for preventing the dispersion of radioactive materials, for dealing with radiation contaminated water, and for radiation monitoring. We are accepting aid supplies (equipment and materials for stabilizing reactors and spent fuel pools, and for helping sufferers from the nuclear accident) from overseas through the Ministry of Foreign Affairs and in coordination among the Cabinet Secretariat, the Nuclear and Industrial Safety Agency (NISA), the Nuclear Emergency Response Headquarters, and TEPCO.

[Reference 1: Examples of supplies for stabilizing reactors and spent fuel pools]

- From US: a fire engine; a large water-discharge pump; protective clothing; a barge carrier; boron compound; personal dosimeters; and robots
- From France: protective clothing; protective masks; pumps; power generators; and compressors
- From UK: radiation measuring instruments; and protective masks
- From Republic of China: a concrete pump truck

[Reference 2: Examples of supplies for helping sufferers]

- From US, France, UK, Canada, Russia, Korea, and some other countries: personal dosimeters; survey meters; and protective clothing

(Improvement of international notification on management and discharge of radioactive materials)

- The government is continuously informing the IAEA of the most recent situation of the nuclear accident at the TEPCO Fukushima Daiichi NPS, and the IAEA is providing member countries with the information. It is also providing foreign embassies in Tokyo with information on the management and discharge of radioactive materials via facsimiles and e-mail. In addition, it is conducting briefings to foreign press every day in principle, as well as briefing to diplomatic corps continuously.

[Reference 3: Current conditions at the TEPCO Fukushima Daiichi NPS]

- Water injection to the reactors of Units 1 to 3 is being continuously carried out to steadily cool the reactors. Nitrogen gas is being injected to the primary containment vessel of Unit 1 in order to prevent another hydrogen explosion (the same is planned for Units 2 and 3).
- Water injection to spent fuel pools of Units 1 through 4 is being continued to steadily cool the pool by spraying or through piping.
- Regarding containing radiation contaminated water, the outflow of contaminated water to the sea from a point near the intake channel of Unit 2 has been halted, and the accumulated contaminated water in the Unit 2 turbine building and the trench (vertical shaft) is now being transferred to Radioactive Waste Treatment Facilities. Preparations for transferring other contaminated water to tanks and storing in the Mega-Float is now under way.
- To suppress the contamination of soil and the atmosphere, an anti-scattering agent is being sprayed around each unit building and rubble is being removed.

iii) Investigation and verification of the causes of the accident

- Preparation for an investigation and verification of the causes of the nuclear accident will be made. It will be based on these three principles: independence, openness, and comprehensiveness. Findings will be released to the public throughout the world, as well as maintaining cooperation with international organizations such as the IAEA.

(2) Implementation of Safety Measures

> ➢ Based on what we have learned from the accident, we will promptly implement further safety measures at other nuclear power stations in the country.

<Immediate actions>

- On March 30, the Nuclear and Industrial Safety Agency (NISA) issued directions to each electric power company and relevant organization about the implementation of emergency safety measures in the light of the accident at the TEPCO Fukushima Daiichi NPS, so that damages to reactor cores can be prevented even if all of the three major functions (AC power sources, cooling with seawater, and cooling spent fuel pools) were lost due to a tsunami, and instructed them to report on the progress of implementation as soon as possible.

- Following these directions, each electric power company and relevant organization reported on the implementation of emergency safety measures, and NISA's nuclear safety inspectors carried out strict on-site inspections to confirm the deployment of equipment such as electric power source trucks and pump trucks, preparation of emergency action manuals, and conducting emergency action drills. As a result, on May 6, NISA judged that the emergency safety measures reported from each electric power company and relevant organization had been appropriately implemented.

- Due to the earthquake off the coast of Miyagi Prefecture that occurred on April 7, the external power supply was temporarily lost at the Higashidori NPS of Tohoku Electric Power Company. After that, although the external power source was recovered, all the emergency diesel generators were not online. Considering this event, on April 9, NISA issued "Regarding the Treatment of Emergency Power Generating Facilities in Terms of Safety Regulations (Directions)." In response, licensees of the reactor operation applied for the approval application of change in the operational safety program, and NISA approved the applications after strictly reviewing the operational safety program based on the reports on implementation of emergency safety measures and the on-site inspections.

- Due to the earthquake off the coast of Miyagi Prefecture on April 7, a wide-area power blackout occurred causing some nuclear facilities to temporarily lose external power supplies. Considering this event, instructions were issued to secure the connections of each reactor unit to multiple (all) external power sources for ensuring the reliability of external power supplies, and enhance power source facilities in each NPS. NISA shall strictly evaluate and confirm reports to be submitted by relevant companies.

- The implementation of measures against water immersion of buildings, which had been instructed after the Operational Safety Inspections and are supposed to be finished by each electric power company and relevant organization toward the end of May, shall be strictly confirmed. Also, regarding securing backup equipment such as seawater pumps, installing large-capacity air-cooling emergency power generators, and preventive measures against tsunami, which are included in the mid- or long-term plan, their implementations shall be strictly confirmed.

- Additionally, the government shall make continuous efforts to improve the reliability of emergency safety measures by continuously promoting each electric power company and relevant organization take measures necessary for improving safety.

[Reference: Directions of safety measures to electric power companies and relevant organizations]

- Each electric power company and relevant organization submitted reports on the implementation of safety measures, and NISA carried out on-site inspections to confirm the implementation and verify their effectiveness.

(March 30: Directions of emergency safety measures)

Because losing all the power sources due to the tsunami was considered to be one of the major causes that brought about the current situation at the TEPCO Fukushima Daiichi NPS, NISA issued directions to each electric power company and relevant organization about the implementation of emergency safety measures including conducting action drills so that the cooling functions can be maintained even if all the power supplies were lost due to a tsunami.

(April 9: Directions of safety measures)

Due to the earthquake off the coast of Miyagi Prefecture on April 7, all the Emergency Diesel Generators for Unit 1 of the Higashidori NPS of Tohoku Electric Power Company were not workable. Considering this event, NISA issued instructions to keep two or more Emergency Diesel Generators ready for operation for each reactor unit even if the unit is in the state of cold shutdown.

(April 15: Directions of securing the reliability of external power supply)

Due to the earthquake off the coast of Miyagi Prefecture on April 7, a wide-area power blackout occurred causing some nuclear facilities to temporarily lose external power supplies. Considering this event, instructions were issued to secure connections of all reactor units to multiple (all) external power sources for ensuring the reliability of the external power supply, and enhance power source facilities in each NPS.

2. Actions Concerning the Evacuation Areas

(Summary)

Since the nuclear accident occurred at the TEPCO Fukushima Daiichi and Daini NPS, the Nuclear Emergency Response Headquarters have been taking action and giving the highest priority to ensuring the safety and health of the residents to brace for the worst possible situation at the NPS.

Considering the development of the accident at the NPS, on March 11, the Prime Minister issued instructions to evacuate residents within a 3-km radius from the TEPCO Fukushima Daiichi NPS, and on March 12, instructed residents within a 10-km radius from the NPS to evacuate, and later in the day instructed residents within a 20-km radius from the NPS to ensure further safety. After that, evacuation of residents in the area was carried out in cooperation among the Fukushima prefectural government and related local governments.

As of mid-May, nearly seven thousand people are still forced to live at primary evacuation sites in Fukushima Prefecture. Utmost efforts shall be made to improve the living environment of those affected by the accident by support for securing public housings and leasing private housings, as well as building temporary housing as early as possible.

In response to the request from the Fukushima prefectural government, people in need of nursing care or with disabilities, who are likely to have special difficulties at primary evacuation sites, have been transferred to facilities outside Fukushima Prefecture that will continuously accept them. Considering their desire to return to Fukushima Prefecture, the government will continue to take necessary actions in cooperation with related local governments.

The Prime Minister issued instructions to Fukushima Prefecture and relevant cities, towns, and villages pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness to establish a restricted area within a 20-km radius around the TEPCO Fukushima Daiichi NPS from the viewpoint of ensuring the safety of residents, and prohibited access to the area in principle starting at midnight on April 22.

Along with establishing the restricted area, the government has decided to allow temporary re-entry on condition that the absolute safety is ensured, so that those who left the zone with only the clothes on their backs can take out their valuables, and for cases where it would cause a great disservice to the public good not to allow members of corporations into the zone, including officers of local governments. These re-entry procedures have been carried out since May 10 while ensuring the absolute safety of those who enter the area temporarily.

The government will continuously take actions to ensure the safety and stable

lives of those affected by the accident, and support affected local governments until restoration from the accident is achieved and the designation of the restricted area is lifted.

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(1) Establishment of the Evacuation Area

- An instruction from the head of the Nuclear Emergency Response Headquarters (Prime Minister) was issued regarding the evacuation and in-house evacuation in order to ensure the health and safety of residents around the Fukushima Daiichi Nuclear Power Station, and the Fukushima Daini Nuclear Power Station of TEPCO in consideration of the situation of the Nuclear Power Stations under the Act on Special Measures Concerning Nuclear Emergency Preparedness.
- Evacuation areas were established to take all possible measures to fully ensure the health and safety of residents based on the results of radiation dosage measurements, the situation of the Nuclear Power Stations, and advice from the Nuclear Safety Commission.

[Reference 1: Instruction on the evacuation issued by the head of the Nuclear Emergency Response Headquarters with regard to the Fukushima Daiichi Nuclear Power Station of TEPCO]

- March 11, 2011, 9:23 pm: Instructions to evacuate residents within three kilometers from the Nuclear Power Station; instructions of in-house evacuation to stay indoors for residents three kilometers away from and within ten kilometers from the Nuclear Power Station
- March 12, 2011, 5:44 am: Instructions to evacuate for residents within 10 km from the Nuclear Power Station

  March 12, 2011, 6:25 pm: Instructions to evacuate for residents within 20 km from the Nuclear Power Station
- March 15, 2011, 11:00 am: Instructions of in-house evacuation for residents 20 km away from and within 30 km from the Nuclear Power Station
- April 21, 2011, 11:00 am: Instructions to evacuation areas as a Restricted Area under the Basic Act on Disaster Control Measures
- April 22, 2011, 9:44 am: The previous instructions of in-house evacuation were cancelled, and a Deliberate Evacuation Area and an Evacuation-Prepared Area were established.

[Reference 2: Instructions on the evacuation issued by the head of the Nuclear Emergency Response Headquarters with regard to the Fukushima Daini Nuclear Power Station of TEPCO]

- March 12, 2011, 7:45 am: Instructions to evacuate for residents within 3 km from the Nuclear Power Station; Instructions of in-house evacuation to evacuate for residents 3 km away from and within 10 km from the Nuclear Power Station.

  March 12, 2011, 5:39 pm: Instructions to evacuate for residents within 10 km from the Nuclear Power Station
- April 21, 2011, 11:00 am: The evacuation area within 10 km from the Nuclear Power Station was changed to the area within 8 km from the Nuclear Power Station.

[Reference 3: Applicable population in the Evacuation Areas]

- The area within 20 km from the Fukushima-Daiichi Nuclear Power Station of TEPCO, and the area within 8 km from the Fukushima-Daini Nuclear Power Station of TEPCO were designated as an evacuation area, and the population in the areas amounted to about 78,000 (according to 2010's preliminary national population census).

(2) Status of the First Evacuation

- The municipalities of Fukushima Prefecture cooperated in implementing the evacuation of residents in their evacuation areas according to instructions issued by the head of the Nuclear Emergency Response Headquarters.
- As of early May 2011, there are still about 7,000 sufferers in about 130 primary evacuation sites in Fukushima Prefecture, and about 35,000 sufferers outside Fukushima Prefecture. Full support will be given to secure secondary evacuation sites and to relocate sufferers to temporary housing units and other places promptly.

[Reference 1: Changes in the number of primary evacuation sites and sufferers in Fukushima Prefecture *]

Fukushima Pref.	As of March 20, 2011		As of May 16, 2011	
Primary evacuation area	**No. of evacuation sites**	**No. of sufferers**	**No. of evacuation sites**	**No. of sufferers**
Kenpoku	104	10,032	22	1,634
Kenchu	139	14,753	26	1,995
Kennan	30	1,771	7	304
Aizu	44	4,171	20	511
Minamiaizu	27	372	1	9
Soso	22	4,499	17	1,582
Iwaki	156	5,044	35	1,204
Total	**522**	**40,642**	**128**	**7,239**

(Source: Fukushima prefectural government's website)* The number of sufferers includes those who evacuated for reasons other than the disaster of the Nuclear Power Stations.

[Reference 2: Evacuation to outside Fukushima Prefecture (as of May 16, 2011)*]

Item	Name of prefecture	No. of sufferers	Remarks
Evacuation to outside Fukushima Prefecture	Yamagata Prefecture	1,861	105 places
	Ibaraki Prefecture	329	24 places
	Tochigi Prefecture	2,284	82 places
	Gunma Prefecture	2,739	104 places
	Saitama Prefecture	4,101	37 places
	Chiba Prefecture	409	90 places
	Niigata Prefecture	7,877	189 places
	Tokyo	4,156	102 places
	Kanagawa Prefecture	1,424	150 places
	Other (35 prefectures)	10,346	839 places
Total		**35,526**	**1,722 places**

(Source: Fukushima Emergency Response Headquarters, "Preliminary Report on Damage Caused by the Great Tohoku Earthquake of 2011") * The number of sufferers includes those who evacuated for reasons other than the disaster of the Nuclear Power Stations.

(3) Securement of Secondary Evacuation Sites

- ➢ In order to prevent sufferers from spending a long period of time in evacuation sites, and improve their living environment, speedy action will be taken to secure land to construct temporary housing units, and use public housing units including those provided by the Urban Renaissance Agency.
- ➢ In addition, considering problems in acquiring land for temporary housing units, private housing units will also be leased to be used for sufferers.

<Immediate actions>

i) Securement of temporary housing units

- As of May 17, 2011, there are specific requests from the municipalities of Fukushima Prefecture to construct about 15,200 housing units (including those for people stricken by the earthquake and tsunami), and it is expected to complete the construction of the housing unites by early August 2011. Additional requests from the municipalities will be met with immediate action to construct temporary housing units.
- The national government will continuously support prefectural efforts to supply temporary housing units promptly.

ii) Use of housing units for national puplic officers and other public housing units

- The national government secured more than 50,000 public housing units, including those for national puplic officers, those provided by the Employment and Human Resources Development Organization of Japan, and those provided by local governments, provided relevant information for each prefecture, and has been coordinating to relocate sufferers. As of May 16, 2011, the number of sufferers who already moved to temporary housing units, and who are in the process of moving to temporary housing units has reached 9,632 through cooperation with prefectures and municipalities. The national government will continuously undertake the use of housing units for national public offcers and other public housing units. (Of 1,209 housing units available in Fukushima Prefecture, 776 housing units have been already occupied.)

- In order to secure evacuation sites for sufferers in the midterm, the national government also requested, through about 700 industry organizations, voluntary provision of their members' corporate housing units on March 20, 2011. In response to the request, 142 companies volunteered to offer 230 facilities and this has enabled the relocation of about 7,500 sufferers to the facilities. The national government has been continuously making efforts to increase the number of housing units available for sufferers.

iii) Use of leased private housing units

- Because it is difficult to secure land to construct temporary housing units, there are many sufferers who moved to private rented housing units before the competition of temporary housing units.
- Under these circumstances, the national government decided to bear rent for the private rented housing units that have been rented by sufferers themselves after the earthquake, and will be re-leased under the name of prefectural governments. (The national government already issued an order dated April 30, 2011 to the Governors of Iwate, Miyagi and Fukushima Prefectures with regard to the leasing of private housing units as temporary housing for the sufferers of the Great East Japan Earthquake.)

[Reference 1: Outline of leasing of private housing units to be used as temporary housing units related to the Great East Japan Earthquake]

- When the disaster-stricken prefectures lease private housing units to be used by sufferers in need of help as temporary housing units, the national government bears rent for the private housing units under the Disaster Relief Act.
- The above also applies to the cases where sufferers leased private housing units under their names.
- Rent may vary according to local conditions and the family of sufferers, however, a monthly rent of ¥60,000 per housing unit was set as reference (based on a similar case applied to the sufferers of the Iwate and Miyagi Earthquake).
- The above should also apply to sufferers outside the prefecture.

[Reference 2: Outline of leasing of private housing units in Fukushima Prefecture (briefed by the Fukushima Emergency Response Headquarters on May 14, 2011)]

- In principle, the monthly rent should be up to ¥60,000, but will be raised to ¥90,000 for a household of five or more (excluding infants).
- Looser requirements were provided for applicable households under this special measure and no requirements were posed on the households which local governments find difficult to stay in evacuation sites because of elderly persons, physically challenged persons or infants in need of care, or schoolchildren with difficulty in commuting to school.

(4) Response to Care Receivers and Physically Challenged People

- People receiving care in facilities for physically challenged people in the evacuation areas were completely evacuated to facilities in other prefectures where they will be able to receive care continuously based on a request from Fukushima Prefecture.
- After finding out information on the situation of care facilities capable of receiving people in need of care outside Fukushima Prefecture, the national government provided the information for Fukushima Prefecture, established a system to receive people in need of care, and completed the evacuation of care receivers from care facilities in the evacuation areas to outside Fukushima Prefecture.
- The national government will cooperate continuously with relevant local governments to provide support for the care receivers who evacuated to other prefectures based on their need to return to Fukushima Prefecture or stay outside Fukushima Prefecture.
- The national government will support the provision of temporary housing units that are equipped with facilities and structured for the ease of care receivers and physically challenged persons.

<Immediate actions>

i) Transportation of care receivers and physically challenged people outside Fukushima Prefecture

- Upon a request from Fukushima Prefecture, the national government coordinated with facilities for physically challenged people in other prefectures so that the people who were evacuated temporarily from the evacuation areas to other facilities outside Fukushima Prefecture could receive continuous care in facilities outside Fukushima Prefecture. Their evacuation has already been completed.
- The care receivers who evacuated temporarily from care facilities in the evacuation areas to other facilities were evacuated completely to outside Fukushima Prefecture with the use of the system established to receive people in need of care.
- The national government will provide support in cooperation with relevant local governments for the people who were evacuated to facilities outside Fukushima Prefecture but want to return to outside the evacuation areas in Fukushima Prefecture.

ii) Support for the provision of temporary housing for elderly people and physically challenged people

- The national government will provide financial support for the provision of temporary housing units that are equipped with facilities and structured for the ease of care receivers and physically challenged persons in need of special care for daily life, including ramps and rooms for persons providing support for them.

(5) Establishment of a Restricted Area, and Implementation of Temporary Access

- To ensure the safety of residents in the area within 20 km from the Fukushima Daiichi Nuclear Power Station of TEPCO, the area was designated as a Restricted Area, and entry to the area was generally banned at 12:00 am on April 22, 2011.
- After the designation of the Restricted Area, the residents who used to live in the area within 20 km have been given temporary access to their homes in rotation since May 10, 2011.

<Immediate actions>

i) Establishment of the Restricted Area

- In order to fully ensure the safety of residents in the area within 20 km from the Fukushima Daiichi Nuclear Power Station of TEPCO, the head of the Nuclear Emergency Response Headquarters issued instructions on April 21, 2011 to the Governor of Fukushima Prefecture, and heads of municipalities in the prefecture to designate the area as a Restricted Area under the Act on Special Measures Concerning Nuclear Emergency Preparedness.
- Since 12:00 am, April 22, 2011, it has been prohibited for anybody except those responding to emergencies including firefighters, the police, and the Self-Defense Forces to enter the Restricted Area without permission from the head of municipalities.
- After establishing the Restricted Area, 10 checkpoints were provided along major roads 20 km from the Fukushima Daiichi Nuclear Power Station of TEPCO to check vehicles entering the Restricted Area.

ii) Implementation of temporary access

- Sufferers from the evacuation areas left home in a hurry, and most of them could take almost nothing with them when the accident occurred. Therefore, they are eager to go home temporarily. For this reason, temporary access has been allowed in cooperation with the local governments after the establishment of the Restricted Area.
- Taking into consideration the estimated number of applicable residents in the applicable cities, towns and villages (see a note below), and preparatory arrangements to be made, temporary access has been allowed since May 10, 2011 in the following areas: Kawauchi Village (May 10 and 12), Katsurao Village (May 12) and Tamura City.
- Temporary access to the remaining city and 6ix towns will be allowed in the middle of May and afterwards. An information center (call center) for temporary access to the Restricted Area in Fukushima Prefecture opened on May 13, 2011, and applications for temporary access have been received.

  Note: Okuma Town, Katsurao Village, Kawauchi Village, Tamura City, Tomioka Town, Namie Town, Naraha Town, Futaba Town and Minamisoma City (listed in the order of the Japanese syllabary)

[Reference: Concept of temporary access to the Restricted Area]

(Restricted Area)

- The area within 20 km from the Fukushima-Daiichi Nuclear Power Station of TEPCO should be a Restricted Area. However, the following areas should be excluded for safety reasons: the area within three kilometers from the Nuclear Power Station, areas with possible high risk due to high air dose rates and for other reasons, and the tsunami-stricken area where temporary access would be dangerous.

(Safety measures)

- In order to fully ensure safety, in principle, one person per household is allowed to return home temporarily except for special reasons, to use buses and to act in groups.
- To enter the Restricted Area, residents should wear Tyvek suits, and carry a dosimeter and a transceiver. On returning from home, they should be screened for radiation without fail. If necessary, as a result of the screening, they should be decontaminated. They are allowed to carry out minimal essential items like wallets and bankbooks, and stay home for up to about two hours.
- In addition to residents' temporary access, arrangements are being made to pick up their private vehicles. As soon as arrangements are made for radiation screening, private vehicles will also be picked up at the end of May or afterwards.
- In conjunction with residents' temporary access, the national government and Fukushima Prefecture jointly started to evacuate the pets of residents.
- Corporations that may be damaged severely if not given temporary access will also be given temporary access after being judged respectively.

(6) Handling Agricultural Products and Livestock in the Areas

<Immediate actions>

i) Compensation for those engaging in agriculture, forestry and fisheries

- On April 28, 2011, the Third Dispute Reconciliation Committee for Nuclear Damage Compensation formulated primary guidelines on compensation for those engaging in agriculture, forestry and fisheries, and discussed the concept of compensation for damage caused by shipments restricted by the national government, and shipments restrained by the prefectural governments.
- On May 12, 2011, emergency aid measures for people affected by the disaster of the Nuclear Power Stations were decided in a cabinet meeting relating to the team responding to economic damage caused by the accidents of the Nuclear Power Stations. The measures include provisional payments to be made by TEPCO to those engaging in agriculture, forestry and fisheries based on the primary guidelines.

ii) Agricultural products and livestock in the areas

- On April 22, 2011, based on the Act on Special Measures Concerning Nuclear Emergency, the head of the Nuclear Emergency Response Headquarters issued instructions to the Governor of Fukushima with regard to limited rice planting in the Restricted Area, the deliberate evacuation area, and the Evacuation-Prepared Area. All possible measures will be taken to make appropriate compensation promptly for damage caused by limited rice planting.

- On May 12, 2011, based on Article 20-3 of the Act on Special Measures Concerning Nuclear Emergency, the head of the Nuclear Emergency Response Headquarters issued instructions to the Governor of Fukushima to painless kill livestock in the Restricted Area with the consent of the owners of the livestock.

(7) Compensation for Damage Caused to Small and Medium Enterprises

<Immediate actions>

- The Third Meeting of the Committee on Examination of Disputes over Compensation for Nuclear Damage established primary regulatory guides, clarifying the government's basic policy for defining the scope of damage such as operational damage or property lost as a result of the government's evacuation and other instructions, as well as inspection and other expenses paid by business operators (April 28).
- In order to ensure swift compensation by TEPCO for the damage caused to small and medium enterprises, the parties concerned will immediately consider a system to make smooth temporary payments to compensate for the damage that small and medium enterprises suffered in their operations in areas such as those to which the government's evacuation and other instructions apply while taking into consideration the fact that there are a wide range of industries, including manufacturing, services, retailing, and construction.

(8) Support to be Provided until Cancellation of Evacuation Area Designation

- ➢ In order to identify the needs of the affected local governments and residents in a carefully thought-out manner, the government will provide support such as dispatching national public servants to the affected municipalities and create an environment that enables it to maintain smooth communication among the parties concerned.
- ➢ In order to ensure the security and safety of the affected residents and the public order of the affected areas, the government will make absolutely sure that law and order are maintained in the alert area.

<Immediate actions>

i) System to provide support and information until cancellation of evacuation area designation

- In order to identify and appropriately respond to the needs of the affected residents, government officials will continue to visit evacuation sites and the affected municipalities in person to have an open exchange of opinions with the heads of the municipalities and other parties concerned.
- The government will establish closer communication with the affected local governments, identify the needs of the affected residents, and provide necessary information mainly by dispatching national public servants to the municipalities affected by the nuclear disaster.

- The government will create an environment that enables simple teleconferencing to maintain a system of close communication among the Nuclear Emergency Response Headquarters, its local nuclear emergency response headquarters, Fukushima Prefecture, and the affected municipalities.

ii) Maintenance of public order in the affected areas

- The patrol units organized to maintain the public order in areas located within 30km of TEPCO's Fukushima Daiichi Nuclear Power Station are on active duty patrolling the areas.
- In addition, following the establishment of the alert area, vehicles entering the area are inspected at ten locations on major roads around the areas located within 20km of TEPCO's Fukushima Daiichi Nuclear Power Station

3. Actions Concerning the Deliberate Evacuation Areas

(Summary)

On April 22, the in-house evacuation instruction that had been given to the areas located within 20-30km of TEPCO's Fukushima Daiichi Nuclear Power Station since March 15 was called off.

However, taking into account the results of radiation dosage measurements and data analyses that had been continuously conducted since the occurrence of the accident, the possible effects of radiation on the health of residents, and other factors, the government established "deliberate evacuation areas." These are areas in which the cumulative radiation dosage during the one-year period after the occurrence of the incident is expected to reach 20mSv due to meteorological, geographical, and other conditions. Residents living in the Area are requested to evacuate outside the Area within about one month (April 22).

Among the municipalities designated as the deliberate evacuation area, Iitate Village and Kawamata Town in particular need additional evacuation sites, and therefore, the government will make doubly sure that their residents can evacuate smoothly, including effective utilization of emergency temporary housing, public housing, employment promotion housing, private houses for rent, and other types of housing.

Furthermore, in order to establish a close system of cooperation with local municipalities that are included in the deliberate evacuation area when carrying out deliberate evacuation, a local government emergency response office where officials from related government agencies and other personnel are permanently stationed will be established in Iitate Village and Kawamata Town to meet the needs of local residents and other parties concerned in a carefully thought-out manner.

In the deliberate evacuation area, the government will only make an exception for business sites and facilities where there is no safety problem if activities are carried out indoors after the safety of workers is fully guaranteed to continue to be engaged in such activities, thus helping them to continue activities under limited conditions.

As in the evacuation area, there is concern about crime prevention in the deliberate evacuation area, and therefore, in cooperation with local municipalities and police authorities, the government will make absolutely sure that the public order of the deliberate evacuation area is maintained.

(1) Establishment of the Deliberate Evacuation Area

- Taking the possible effects of radiation on residents into consideration, the government designated neighboring areas located 20km far and beyond from TEPCO's Fukushima Daiichi Nuclear Power Station where the cumulative radiation dosage during the one-year period after the occurrence of the incident is expected to reach 20mSv as the "deliberate evacuation area" (April 22). Residents living in this Area are asked to evacuate outside the Area within about one month considering the effects on the residents' health.
- In establishing the deliberate evacuation area and taking related measures, taking into account the results of radiation dosage measurements, the condition of the nuclear power station, and other factors, the government listened to the opinions of the Nuclear Safety Commission and made decisions from the viewpoint of ensuring that the health and safety of residents was maintained.

[Reference: Areas Included in the Deliberate Evacuation Area and Their Populations]

Municipalities covered by the Deliberate Evacuation Area	Population of the Deliberate Evacuation Area (persons)
Iitate Village (whole area)	About 6,200
Katsurao Village (outside the 20-km area)	About 1,300
Namie Town (outside the 20-km area)	About 1,300
Kawamata Town (certain areas)	About 1,200
Minamisoma City (certain areas)	About 10
Total	About 10,000

(Note: Estimates based on the quick report on the 2010 Census)

(2) Securing Evacuation Sites

- Among the municipalities designated as the deliberate evacuation area, Iitate Village and Kawamata Town in particular need additional evacuation sites, and therefore, the government will make doubly sure that their residents can evacuate smoothly, including effective utilization of emergency temporary housing, public housing, employment promotion housing, private houses for rent, and other types of housing.

<Immediate actions>

i) Securing Emergency Temporary Housing

- As of May 17, the Fukushima prefectural government is expected to complete about 15,200 houses (including temporary housing for people affected by the earthquake and tsunami) by the first half of August according to the specific requests of municipalities, and if it receives additional requests from the municipalities, it aims to complete additional houses as early as possible by placing orders according to such requests.
- The government will speed up the supply of emergency temporary housing by continuing to support the prefectural government's efforts.

ii) Securing houses for national public servants, public housing, etc.

- The government will provide support so that the required number of houses such as those for national public officers, public houses, employment promotion houses, and private houses for rent are secured.

iii) Securing Short-term Evacuation Sites

- The government will help Fukushima Prefecture and its affected municipalities to establish a cooperation system so that the affected residents can evacuate to *ryokan* (Japanese style hotels), hotels, and other accommodations for a short period of time until the construction of emergency temporary housing is completed.
- In early May Iitate Village and Kawamata Town, both of which have many residents to evacuate, investigated the specific requests of their residents in detail. Based on the results of their investigations, the two municipalities aimed to relocate their residents in late May by hastening the matching of residents' requests and available accommodations. The government will support Iitate Village and Kawamata Town in these efforts through its local government emergency response office.

(3) Response to Persons Requiring Nursing Care, Disabled Persons, etc.

- If the disabled, elderly, and other persons requiring special care who live at home or other places request that they be received by facilities outside the deliberate evacuation area, the government will respond to such requests by working with related local governments.
- In cooperation with Fukushima Prefecture and other parties concerned, some of the nursing care facilities have completed the transportation of persons living in the deliberate evacuation area to outside of the area.
- Mainly from the viewpoint of avoiding the burden of travel on persons living in nursing care facilities, relevant municipalities will allow nursing care and similar facilities to continue their operations within the deliberate evacuation area under certain conditions particularly if they deem it necessary to allow them to do so.

  The government will help build emergency temporary housing with facilities and/or structures that make it easy for persons requiring nursing care or similar to live there. (Repeated)

<Immediate actions>

i) Evacuation of Persons Requiring Nursing Care, Disabled Persons, etc. to the Outside of the Deliberate Evacuation Area

- If the disabled, elderly, and other persons requiring special care who live at home or other places request that they be received by facilities outside the deliberate evacuation area, the government has decided to meet such requests in cooperation with related local governments.

ii) Exceptions of Business Continuation inside Deliberate Evacuation Area (Nursing Care Facilities)

- Mainly from the viewpoint of avoiding the burden of travel on persons living in nursing care facilities and based on the assumption that the safety of persons requiring nursing care and care workers is guaranteed, relevant municipalities will allow nursing care facilities to continue their operations within the deliberate evacuation area under certain conditions such as appropriately managing the radiation dosage of persons requiring nursing care and care workers, particularly if they deem it necessary to allow them to do so.

iii) Support for Installation of Temporary Welfare Houses (Repeated)

- The government will provide financial support so that emergency temporary housing (temporary welfare housing) with equipment and structures (such as slopes and helper rooms) that make it easy for elderly, disabled, and other persons requiring special attention in daily life to live there are installed.

(4) Smooth Implementation of Deliberate Evacuation Plans

- ➢ In order to identify the needs of municipalities and their residents in the deliberate evacuation area in a carefully thought-out manner and establish close cooperation with them, the government will set up its local government emergency response office in Iitate Village and Kawamata Town to ensure smooth evacuation.
- ➢ Mainly from the viewpoint of maintaining a minimum amount of employment, which provides the foundation of municipal continuity on the prerequisite that the health and safety of residents is ensured, the municipalities will take responsibility for allowing businesses to continue their operations in the deliberate evacuation area under certain conditions.
- ➢ Until deliberate evacuation is completed, the level of exposure of residents to radiation will be measured to analyze its effects on their health.

<Immediate actions>

i) Support for Smooth Relocation of Residents

- The government is openly exchanging opinions with the heads of municipalities and other parties concerned to identify the needs of municipalities and their residents in the deliberate evacuation area in a carefully thought-out manner and to ensure smooth deliberate evacuation.

- In addition, the government established its local government emergency response office in Iitate Village and Kawamata Town where nine personnel from its related agencies, including officers in managerial positions, are permanently stationed. This office will perform such duties as assisting with evacuations, providing advice, and providing support for the lives of residents in close cooperation with the prefectural and municipal governments.

ii) Exceptions of Business Continuation in the Deliberate Evacuation Area

- Mainly from the viewpoint of maintaining a minimum amount of employment, which provides the foundation of municipal continuity, and avoiding the burden of travel on persons living in nursing care facilities, on the prerequisite that the safety of employers and persons living at nursing care facilities is guaranteed, relevant municipalities will allow such facilities to continue their operations within the deliberate evacuation area under certain conditions such as appropriately managing the radiation dosage of persons engaged in such operations particularly if they deem it as necessary to allow them to do so.

- The government will provide Fukushima Prefecture and related municipalities with information on the results of environmental monitoring in a timely manner and support them in procuring equipment and materials needed to manage radiation dosage such as dosimeters.

iii) Radiation Management for Residents until End of Deliberate Evacuation

- The government will distribute dosimeters to residents in the deliberate evacuation area upon request so that they can analyze the radiation dosage to which they would have been exposed prior to evacuation.

(5) Handling of Agricultural Products, Livestock, etc. in the Deliberate Evacuation Area

<Immediate actions>

i) Compensation for Damage Caused to Persons Engaged in Agriculture, Forestry, and Fisheries (Repeated)

- The Third Meeting of the Committee on Examination of Disputes over Compensation for Nuclear Damage established primary regulatory guides, clarifying the government's basic policy for compensating for damage caused to persons engaged in agriculture, forestry, and fisheries chiefly due to shipment restrictions imposed by the national government's instructions and voluntary shipment restrictions placed at the prefectural government's requests and other factors (April 28).

- In addition, the Related Ministers Meeting of the Team Responding to Economic Damage Caused by the Accident at the Nuclear Power Station, held on May 12, decided emergency support measures for victims of the nuclear disaster. These measures include temporary payments by TEPCO to persons engaged in agriculture, forestry, and fisheries based on the primary regulatory guides.

ii) Agricultural Products, Livestock, etc. in the Deliberate Evacuation Area

- In accordance with the Special Law of Emergency Preparedness for Nuclear Disaster, the Director-General of the Nuclear Emergency Response Headquarters issued instructions to the Governor of Fukushima Prefecture concerning restrictions on rice planting in the alert area, deliberate evacuation area, and Evacuation-Prepared Area (April 22). The government will make absolutely sure that damage caused by restrictions on crop planting are also compensated swiftly and appropriately (repeated).

- Following the Fukushima prefectural government's announcement of its policy of relocating or shipping livestock in these areas to the outside areas, the national government has put together and notified the relevant parties of inspection, decontamination, and other procedures that should be followed when transporting livestock from farms. In order to support the smooth relocation of livestock, it is also providing human resources to Fukushima Prefecture, including personnel that will help find places to which livestock in these areas can be relocated and personnel specialized in raising livestock.

(6) Compensation for Damage Caused to Small and Medium Enterprises (Repeated)

<Immediate actions>

- The Third Meeting of the Committee on Examination of Disputes over Compensation for Nuclear Damage established primary regulatory guides, clarifying the government's basic policy for defining the scope of damage such as operational damage caused or property lost by the government's evacuation and other instructions, as well as inspection and other expenses paid by business operators (April 28).
- In order to ensure swift compensation by TEPCO for the damage caused to small and medium enterprises, the parties concerned will immediately consider a system to make smooth temporary payments to compensate for the damage of small and medium enterprises suffered in their operations in such areas as those covered by the government's evacuation and other instructions taking into consideration the fact that there are a wide range of industries, including manufacturing, services, retailing, and construction.

(7) Support to be Provided until Cancellation of the Deliberate Evacuation Area Designation

- In order to identify the needs of the affected local governments and residents in a carefully thought-out manner, the government will establish its local government emergency response office. This office will perform such duties as assisting with evacuations, providing advice, and providing support for the lives of residents in close cooperation with the prefectural and municipal governments. It will also create an environment that enables it to maintain a system of close communication among the parties concerned.
- In order to ensure the security and safety of residents, the government will make doubly sure, in cooperation with related local governments, that the public order of the deliberate evacuation area is maintained.

<Immediate actions>

i) Support System and Provision of Information until Cancellation of the Deliberate Evacuation Area Designation

- The government has established its local government emergency response office in Iitate Village and Kawamata Town where nine personnel from its related agencies, including officers in managerial positions, are permanently stationed. In close cooperation with related municipalities and Fukushima Prefecture, this office will perform such duties as assisting with evacuations, providing advice, and providing support for the lives of residents.
- The national government will establish an environment that enables simple teleconferencing to maintain close communication with Fukushima Prefecture and the affected municipalities (repeated).

ii) Maintaining Public Order in the Deliberate Evacuation Area

- The patrol units organized to maintain the public order in areas located within 30 km of TEPCO’s Fukushima Daiichi Nuclear Power Station are on active duty patrolling the areas.
- In addition to striving to prevent crimes and arrest perpetrators by introducing mobile investigation units, the government will protect the Area by assigning units that are responsible for mobile inspections.
- In cooperation with related organizations, local governments, and other parties concerned, the government is considering how to maintain the public order of the designated areas outside the 30 km area.

4. Actions Concerning the Evacuation-Prepared Areas

(Summary)

On April 22, based on the results of radiation dosage monitoring that had been released by TEPCO's Fukushima Daiichi Nuclear Power Station since the occurrence of the accident, the government designated areas where the cumulative radiation dosage was expected to rise in certain parts of the area as the deliberate evacuation area while it decided to cancel its in-house evacuation instruction for the 20-30 km area, excluding the deliberate evacuation area.

Taking into consideration the still unstable condition of the nuclear power station, however, the government decided to designate areas in which residents need to make preparations so that they can immediately evacuate from the area or take shelter indoors in case of an emergency as the "Evacuation-Prepared Area. "

In the Evacuation-Prepared Area, residents are not prevented from working or performing other unavoidable tasks based on the premise that they make preparations so that they can evacuate from the area or take shelter indoors in the event of an emergency. On the other hand, children, the elderly, inpatients, and other persons that are considered to have difficulty evacuating swiftly on their own in an emergency continue to be required not to enter the Evacuation-Prepared Area.

In principle, residents will continue on with their lives, and businesses will continue their operations in the Evacuation-Prepared Area. Therefore, the Nuclear Emergency Response Headquarters will take appropriate actions mainly by working to maintain the foundations of the residents' livelihood in the area and periodically ascertaining the actual condition of the local communities, including postal services, distribution, and other economic activities.

Until the cancellation of the Evacuation-Prepared Area, the government will make doubly sure that the public order of the area is maintained as in the Evacuation and Deliberate Evacuation Areas in close cooperation with Fukushima Prefecture and the affected municipalities.

(1) Establishment of Evacuation-Prepared Area

- The in-house evacuation instruction for areas located within 20-30 km of TEPCO's Fukushima Daiichi Nuclear Power Station has been called off.
- In view of the yet unstable accidental condition of nuclear power station, the government has designated areas where the possibility that residents will be required to evacuate or take other actions in the event of an emergency cannot be ruled out as the "Evacuation-Prepared Area." In this Area, residents are required to make preparations so that they can take shelter indoors or evacuate from the area in case of emergency (April 22).
- In establishing the Evacuation-Prepared Area and taking related measures, taking into account the results of radiation dosage measurements, the condition of the nuclear power station, and other factors, the government listened to the opinions of the Nuclear Safety Commission and made decisions from the viewpoint of ensuring that the health and safety of residents was maintained.

[Reference: Areas Included in the Evacuation-Prepared Area and their Populations]

* The Evacuation-Prepared Area covers areas located within approximately 20-30km of the nuclear power station, excluding areas designated as the Deliberate Evacuation Area. The municipalities listed below are included in the Evacuation-Prepared Area.

* Children, pregnant women, persons requiring nursing care, inpatients, etc. continue to be required not to enter the area.

Municipalities covered by the Evacuation-Prepared Area	Population of the Evacuation-Prepared Area (persons)
Hirono Town (whole area)	About 5,400
Naraha Town (outside 20km area)	About 10
Kawauchi Village (outside 20km area)	About 1,700
Tamura City (certain areas)	About 4,000
Minamisoma City (certain areas)	About 47,400
Total	About 58,500

(Note: Estimates based on the quick report on the 2010 Census)

(2) Maintaining the Foundations of Residents' Livelihood, etc. and Supporting Industrial Activities

- People are not prevented from entering the Evacuation-Prepared Area to work or perform unavoidable tasks or transport of life-related and other materials to the area.
- The national government will take necessary action without fail such as periodically ascertaining the actual condition of the local communities so that the foundations of residents' livelihood in the area, including health care, transport, and distribution, are not hindered.

<Immediate actions>

- On April 25, the collection and delivery of mail and the operation of post offices were resumed in the Evacuation-Prepared Area (excluding post offices that were destroyed), but the government is considering rebuilding one of the destroyed post office taking into account local governments' reconstruction plans and other factors, thereby supporting local initiatives for recovery.
- The government requested transport-related industry organizations to make a list of important points to note when operating buses, taxies, and trucks in the Evacuation-Prepared Area known to their members and gave instructions to endeavor to provide transport services accordingly.
- With respect to hospitalization and health care systems in the Evacuation-Prepared Area, the Fukushima prefectural government, in cooperation with the national government, has started coordination with related local governments and medical institutions for future phased resumption of their services.
- The national government will utilize the Regional Health Care Reconstruction Fund to promote improvement of medical facilities, as well as to work to take such measures as maintaining medical personnel.
- The government will strive to periodically ascertain the actual state of industrial activities, distribution, etc. in the Evacuation-Prepared Area and take appropriate countermeasures as necessary.
- In cooperation with related local governments, the national government has also decided to take action to maintain appropriate care for disabled and other disadvantaged persons living in the Evacuation-Prepared Area.

(3) Handling of Agricultural Products, Livestock, etc. in the Evacuation-Prepared Area

<Immediate actions>

i) Compensation for Damage Caused to Persons Engaged in Agriculture, Forestry, and Fisheries (Repeated)

- The Third Meeting of the Committee on Examination of Disputes over Compensation for Nuclear Damage established primary regulatory guides, clarifying the government's basic policy on compensation for damage caused to persons engaged in agriculture, forestry, and fisheries chiefly due to shipment restrictions imposed by the national government's instructions and voluntary shipment restrictions placed at the prefectural government request and other factors (April 28).
- In addition, the Related Ministers Meeting of the Team Responding to Economic Damage Caused by the Accident at the Nuclear Power Station, held on May 12, decided emergency support measures for victims of the nuclear disaster. These measures include temporary payments by TEPCO to persons engaged in agriculture, forestry, and fisheries based on the primary regulatory guides.

ii) Agricultural Products, Livestock, etc. in the Evacuation-Prepared Area

- In accordance with the Special Law of Emergency Preparedness for Nuclear Disaster, the Director-General of the Nuclear Emergency Response Headquarters issued instructions to the Governor of Fukushima Prefecture concerning restrictions on rice planting in the alert area, deliberate evacuation area, and Evacuation-Prepared Area (April 22). The government will make absolutely sure that damage caused by restrictions on crop planting are also compensated swiftly and appropriately (repeated).

- Following the Fukushima prefectural government's announcement of its policy of relocating or shipping livestock in these areas to the outside areas, the national government has put together and notified the relevant parties of inspection, decontamination, and other procedures that should be followed when transporting livestock from farms. In order to support the smooth relocation of livestock, it is also providing human resources to Fukushima Prefecture, including personnel that will help find places to which livestock in these areas can be relocated and personnel specialized in raising livestock.

(4) Compensation for Damage Caused to Small and Medium Enterprises (Repeated)

<Immediate actions>

- The Third Meeting of the Committee on Examination of Disputes over Compensation for Nuclear Damage established primary regulatory guides, clarifying the government's basic policy for defining the scope of damage such as operational damage caused or property lost by the government's evacuation and other instructions, as well as inspection and other expenses paid by business operators (April 28).
- In order to ensure swift compensation by TEPCO for the damage caused to small and medium enterprises, the parties concerned will immediately consider a system to make smooth temporary payments to compensate for the damage of small and medium enterprises suffered in their operations in such areas as those covered by the government's evacuation and other instructions taking into consideration the fact that there are a wide range of industries, including manufacturing, services, retailing, and construction.

(5) Support to Be Provided until Cancellation of Evacuation-Prepared Area

> - In order to ensure smooth sheltering and evacuation in the event of an emergency, the municipal, prefectural, and national governments will work closely together to take necessary actions. They will also create an environment that enables them to maintain a communication system among the parties concerned.
> - They will make doubly sure that crimes are prevented in the Evacuation-Prepared Area and that public order is otherwise maintained.

<Immediate actions>

i) Support System and Provision of Information until Cancellation of Evacuation-Prepared Area

- Since residents in the Evacuation-Prepared Area are required to make preparations at all times so that they can take shelter indoors or evacuate from the area in the event of an emergency, related local governments and the national government will work closely together to take action in order to ensure smooth sheltering or evacuation in case of an emergency.
- The national government will establish an environment that enables simple teleconferencing to maintain close communication with Fukushima Prefecture and the affected municipalities (repeated).

ii) Maintaining Public Order in the Area

- Police boxes and other functions are maintained in the Evacuation-Prepared Area. In cooperation with the patrol units organized to maintain the public order of areas located within 30 km of TEPCO's Fukushima Daiichi Nuclear Power Station, personnel from these functions are on active duty patrolling the Area.

- In addition to striving to prevent crimes and arrest perpetrators by introducing mobile investigation units, the government will protect the Area by assigning units that are responsible for mobile inspections.

5. Ensuring Security and Safety of Affected Residents

(Summary)

[Maintaining Local Community Ties]

- **Due to the extended staying of sufferers at evacuation sites, the prefectural and municipal governments concerned are moving forward with relocating them from primary evacuation sites to secondary evacuation sites, temporary housing, and other facilities, and in this process, the national government will provide these local governments with the necessary support so that they can relocate the sufferers while ensuring the security and safety thereof and paying due attention to allowing the sufferers' community ties to be maintained.**

[Taking Measures Including the Maintenance of Medical Services, Nursing Care and Other Services, and the Resolution of the Health Concerns of Residents]

- **In order to ensure the security and safety of persons requiring nursing care, and of disabled persons, etc., the government will work with the related local governments to make thorough arrangements, including the transporting of such persons as described above to facilities outside Fukushima Prefecture that can admit and care for them on an ongoing basis.**
- **In order to resolve residents' health concerns regarding radiation exposure, the government will also conduct without fail the screening and decontamination of residents. At the same time, it will establish hotlines to respond to requests for advice on health, to give advice on health and to provide mental care through arrangements including visits by experts so that the health of the residents is managed appropriately.**
- **Furthermore, the National Institute of Radiological Sciences and other organizations will provide cooperation regarding the initiatives of the parties concerned with regard to radiation dosage assessments for residents.**

[Educational support]

- **Day care centers, kindergartens, and elementary, junior high and senior high schools have been temporarily closed, so the government will ensure without fail that schooling opportunities are provided to children at evacuation sites and other places.**
- **In addition, the government will make swift decisions on how to handle contaminated soil, etc. at educational facilities in Fukushima Prefecture taking into consideration the results of environmental monitoring.**

[Improvement of Environmental Monitoring, etc.]

- **In accordance with the Environmental Monitoring Improvement Plan, related organizations including the U.S. Department of Energy will work closely to conduct comprehensive environmental monitoring in order to confirm how much radioactive material is being released from TEPCO's Fukushima Daiichi Nuclear Power Station.**
- **In addition, the government will develop and publish radiation dosage distribution maps and other data and give priority to measuring the radiation dosage at such areas as the Deliberate Evacuation Area, thus obtaining an overall picture of the accident and to utilizing these maps to determine whether the designation of the Deliberate Evacuation Area and of other Area should be cancelled.**
- **The government will work on environmental monitoring at farmland, educational facilities, and other places and establish bases to analyze levels of radioactivity concentration in food, environmental monitoring samples, and other materials, mainly in Fukushima Prefecture.**

[Handling of Rubble, Sewage Sludge, etc.]

- **The government will conduct an on-site survey regarding the disposal of disaster waste including rubble in Fukushima Prefecture and then will take swift action to decide standards and methods for the disposing of such waste, which may have been contaminated by radioactive material, taking into consideration the results of environmental monitoring and of other investigations.**

[Improvement of Public Relations regarding the Nuclear Disaster and Its Victims]

- **The government is holding press conferences daily to swiftly provide the nation with accurate information on the accident.**
- **In order to provide without fail necessary information to sufferers in an easy-to-understand way, the government is broadcasting public relations programs through local radio stations and is posting newsletters at evacuation sites and other locations.**
- **The government will also provide information to those who evacuated from Fukushima prefecture, mainly by taking full advantage of the Internet and nationwide radio broadcasting.**

(1) Maintaining Local Community Ties

> ➢ The government will provide necessary support so that when the prefectural and municipal governments concerned move forward with relocating them from primary evacuation sites to secondary evacuation sites, temporary housing, and other facilities, they can do so while paying due attention to allowing the maintenance of community ties.

<Immediate actions>

- When sufferers, particularly elderly and disabled persons, etc., move into emergency temporary housing, the government will pay attention so that they can live there with a sense of security and also the communities in which they have lived are maintained as much as possible. The government is also giving necessary advice to the local governments that are responsible for choosing who will occupy such housing.
- The government provides support to prefectural governments so that when emergency temporary housing of a certain size or larger is constructed, meeting rooms and other facilities needed to allow the maintenance of community ties are built at the same compound.
- The government will devise means of supporting sufferers so that they can maintain close ties with their community even after they are relocated. One example is taking full advantage of IT.

(2) Taking Measures Including the Maintenance of Medical Services, Nursing Care and Other Services, and the Resolution of the Health Concerns of Residents]

- In cooperation with related local governments, the national government will take without fail measures for persons requiring nursing care, and for disabled persons, etc. in a way that suits the actual situation in the evacuation area and of other areas.
- In order to resolve residents' health concerns regarding radiation exposure, the government will also conduct without fail the screening and decontamination of residents. At the same time, it will establish hotlines to respond to requests for advice on health, to give advice on health and to provide mental care through arrangements including visits by experts so that the health of the residents will be managed appropriately.
- The National Institute of Radiological Sciences and other organizations will provide cooperation regarding the initiatives of the parties concerned with regard to radiation dosage assessments for residents.

<Immediate actions>

i) Maintaining medical service, nursing care, and other services in each area

(All areas)

- In all Areas, residents (including those who move out of the Area after the evacuation or due to other instructions) do not need to pay their share of fees for medical services at the cashier of medical institutions. Nor do they need to pay nursing care use fees (copayment) when using nursing care services.

(Evacuation Area) (reprinted)

- In response to Fukushima Prefecture's request, the government coordinated with facilities for the disabled in other prefectures so that they would admit and care for persons who live at such facilities in Fukushima Prefecture who had temporarily evacuated from the evacuation area to other facilities, and completed the evacuation of such persons to facilities in other prefectures that could admit and care for them on an ongoing basis.

- The government investigated how far nursing homes and other facilities in other prefectures could admit and care for persons requiring support and provided the results of its investigation to Fukushima Prefecture. It also established a system for the admittance and care of such persons and completed the evacuation from the prefecture of persons living at nursing homes in the evacuation area.

- If persons living at nursing homes who evacuated to facilities in other prefectures wish to return to other areas in Fukushima Prefecture, the government will work with related local governments to provide support so as to comply with such persons' wishes.

(Deliberate Evacuation Area) (repeated)

- If the disabled, the elderly, and other persons requiring special care who live at home or other places wish to be received by other facilities outside the certain area, the government will take necessary action in cooperation with related local governments.

(Evacuation-Prepared Area) (repeated)

- With respect to hospitalization and health care systems in the evacuation-prepared area, the Fukushima prefectural government has in cooperation with the national government started coordinating with related local governments and medical institutions for the future phased resumption of these services.
- The national government will utilize the Regional Health Care Reconstruction Fund to promote improvement of medical facilities, as well as take measures such as securing medical personnel.

(Other)

- Residents of 13 municipalities in Fukushima Prefecture can apply for exemption from having to pay for national pension insurance premiums even if the degree of damage to houses or other property in monetary terms is less than half of the payments in question.

ii) Screening and Decontamination of Residents

- Sufferers and other persons have been screened for surface contaminants since March 13. Government officials have visited evacuation sites in Fukushima Prefecture and continued carrying out screening and decontamination there, and the number of people who had undergone screening and decontamination had exceeded 180,000 by May 5. The results of measurement or re-measurement after taking off their outer clothing indicated that all values were lower than the maximum permissible level, and no cases have been confirmed in which the level of radiation dosage would affect the health of residents.
- Thyroid screening was conducted for children in areas in which SPEEDI-based trial calculations made by the Nuclear Safety Commission showed that the radiation dosage for the thyroid would be relatively high. From March 26 to 30, some 1,000 children aged 10 to 15 in Iwaki City, Kawamata Town and Iitate Village underwent thyroid screening, the results of which confirmed that there were no cases in which the radiation dosage had exceeded the highest allowable level.
- In response to Fukushima Prefecture’s request, the government dispatched doctors and other personnel to conduct screening and other kinds of testing at evacuation sites and elsewhere in order to resolve clearing up residents’ concerns about radiation exposure and is helping with or coordinating the dispatch of doctors and other personnel to related prefectures.
- The government is dispatching radiation experts, doctors, nurses, and other personnel from designated public institutions (the Japan Atomic Energy Agency and the National Institute of Radiological Sciences), universities, and other organizations to facilitate the screening and decontamination of residents in the areas affected by the nuclear accident.

iii) Health Care and Mental Care for Residents

- With the cooperation of the Japan Atomic Energy Agency and the National Institute of Radiological Sciences, the government established hotlines to explain and give advice on the effects of radiation to residents in areas near Fukushima.
- In the areas affected by the nuclear accident, public health nurses dispatched by local governments nationwide, including Fukushima, visit evacuation sites and perform other duties to provide necessary health care and welfare services while responding to requests for health advice.
- By May 10, the government had secured eight mental care teams consisting of psychiatrists and other experts. These teams are working mainly in the areas to which victims have evacuated from the evacuation area.
- The government has also requested that local governments nationwide establish systems that enable them to take action such as giving advice to people concerned on the effects of radiation outside Fukushima Prefecture and on how to measure radiation dosage.

iv) Long-term Health Care for Residents (Assessment of Radiation Dosage)

- The National Institute of Radiological Sciences will cooperate in the initiatives of the parties concerned for assessing radiation dosage for residents of which data is required for the long-term health care of the residents.

(3) Support for Education

- ➢ Nursery schools, kindergartens, elementary schools, junior high schools, and high schools are closed in the evacuation area, deliberate evacuation area and evacuation-prepared area. We will make doubly sure to assure learning opportunities of children in places to which they have evacuated.
- ➢ We will take prompt action to handle soil and other conditions of educational facilities in Fukushima Prefecture based on results of environmental monitoring measurements.

<Immediate actions>

i) Assurance of learning opportunities of children in places to which they have evacuated

- The government is asking prefectural boards of education to accept affected students, provide them with textbooks free of charge, and flexibly handle school expense subsidies. To fully restore school management and provide students with psychological care, the government will assign additional teachers and other staff working in schools in affected prefectures and also in prefectures that accept affected students. The government will also take measures to support affected students to go to school and urgently dispatch school counselors.
- The government will secure emergency temporary school buildings, for example, by

repairing facilities of closed schools and empty classrooms.

- The government is asking universities, colleges, and other educational institutions to provide affected students with economic support, give them a grace period for paying school fees, and reinforce counseling systems. In response to this, universities, colleges, and other educational institutions have adopted reduction and/or exemption of school fees to assure learning opportunities of affected students.
- To support students of which family income has drastically reduced due to the disaster, the government has prepared a supplementary budget to expand the range of scholarship recipients. The Japan Student Services Organization is continually accepting applications for emergency interest-free scholarship.
- The government will take measures to give more good international students learning opportunities in Japan, including those who returned to their countries after the earthquake.

ii) Use of school buildings and schoolyards

- Fukushima Prefecture carried out environmental radioactivity monitoring conducted by Fukushima Prefecture for about 1,600 schools, including elementary schools, junior high schools, kindergartens, nursery schools and special schools for children with physical or mental disabilities in the prefecture (except the restricted area within 20 km). Based on the monitoring results, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) conducted a resurvey on 52 schools where measured radiation dosages were relatively high. (April 14)
- The government established a provisional concept on making judgments on use of buildings, yards and other facilities of schools in Fukushima Prefecture based on the above-mentioned monitoring results and in consideration for recommendations given by the International Commission on Radiological Protection(ICRP) and advices given by the NSC. (April 19)
- In cooperation with Fukushima Prefecture, the government will continuously measure air dose rates at the 52 schools subject to the resurvey. The government will also let teachers and other staff working in schools carry cumulative dosimeters to measure actual exposure situations and make dust sampling to evaluate influences on internal exposures. Results of these measurements will be reported to the NSC every two weeks or more frequently.
- One of measures to minimize radiation dosage is to exchange surface soil and under soil in schoolyards and other grounds. To verify effects of this measure and specific methods, the government asked the Japan Atomic Energy Agency (JAEA) to conduct on-the-spot investigations in cooperation with Fukushima University. (May 8)
- Based on results of these on-the-spot investigations, the government informed the Fukushima Prefectural Board of Education and other bodies concerned on May 11 that there are two effective measures for reducing air dose rates in schoolyards and other grounds from the aspect of reducing exposure dose of children; one is to bury possibly-contaminated soil collectively in the ground and the other is to exchange surface soil and under soil.

(4) Reinforcement of Environmental Monitoring and Other Activities (Environmental monitoring reinforcement plan)

- We will implement comprehensive radiation monitoring to grasp situations of release of radioactive materials from Fukushima-Daiichi NPS under the Environmental monitoring reinforcement plan through close cooperation among bodies concerned, including the United States Department of Energy.
- We will develop and publish a radiation dosage distribution map and other data, take measurements mainly in the deliberate evacuation area, and utilize the data and measurement results for getting a whole picture of accident situations and releasing restricted areas.
- We will carry out environmental monitoring at farmlands and education and other facilities and also prepare bases for analyzing radioactivity concentrations of foods and environmental monitoring samples mainly in Fukushima Prefecture.

<Immediate actions>

i) Implementation of continuous environmental monitoring

- To grasp situations of release of radioactive materials around Fukushima-Daiichi NPS and assure safety and security of people, the government is conducting comprehensive radiation monitoring using various means and publish the monitoring results. In particular, we are implementing monitoring of air dose rates and sampling investigations of dust in the air, soil and other materials in cooperation with Fukushima Prefecture, JAEA, electric power companies and other bodies.
- Since April 22, the government has reinforced implementation system of the monitoring by establishing the “Environment monitoring reinforcement plan” to focus on measurements in the deliberate evacuation area and other areas and utilize measurement results for getting a whole picture of accident situations and releasing restricted areas.
- As part of reinforcement of the monitoring system, we are taking measurements of cumulative radiation dosages by utilizing simplified dosimeters in areas where radiation dosage rates are high. Also under this program, the government will increase the number of fixed measuring points, reinforce soil monitoring and expand the target areas of offshore area monitoring in the deliberate evacuation area and areas where radiation dosage rates are high.
- The government is monitoring air dose rates and situations of accumulated radioactive materials on the ground in the area of 80 km from Fukushima-Daiichi NPS in cooperation with the United States Department of Energy. Fukushima University is carrying out monitoring in the prefecture and national universities and other facilities across the nation are also carrying out monitoring.
- The government instructs and supervises TEPCO to properly carry out environmental monitoring in sites of its nuclear power stations and in neighboring offshore areas.

ii) Development of a radiation dosage measurement map

- The government published a radiation dosage measurement map and an estimated cumulative dosage map as of April 24 under the Environmental monitoring reinforcement plan. (April 26) The government is planning to update them about twice a month. (They were updated on May 16.) We will also develop a soil concentration map.
- The government will utilize the radiation dosage measurement map and other materials mentioned above to grasp a whole picture of accident situations and release restricted areas.

iii) Implementation of environmental monitoring in farmlands

- To grasp concentrations of radioactive materials in soil in farmlands, the government prepared a supplementary budget for procuring radiation measuring devices and making analyses.
- The government will grasp a tendency in distribution of concentrations of radioactive materials in soil in farmlands.

iv) Implementation of environmental monitoring in offshore areas

- The government has carried out monitoring in offshore areas of Fukushima-Daiichi NPS and published the results, through seawater sampling, dust sampling and other investigations carried out by Japan Agency for Marine-Earth Science and Technology (JAMSTEC) as well as measurements and analyses carried out by JAEA.
- To expand target areas of offshore area monitoring, MEXT and the Fisheries Agency will collaboratively implement wide-area investigations in offshore areas of Miyagi, Fukushima and Ibaragi Prefectures and expand monitoring of marine products.

v) Implementation of monitoring of radioactive materials in foods and tap water

- The government determined provisional regulation limits of radioactive materials in foods under provisions of the Food Sanitation Law referring to indexes specified in the guideline established by NSC, “Emergency measures at nuclear power facilities.”
- The government gives instructions about monitoring inspections of radioactive materials in foods according to guidelines and the latest information, and related local governments are implementing inspection plans they have established.
- Local governments are continuously inspecting tap water for radioactive materials and the national government publishes the results every day. The government has asked water supply operators to announce restriction of tap water intake if inspection results exceed indexes or other regulation limits.

vi) Implementation of environmental monitoring at education and other facilities

- To allow schools and local residents to check radiation dosages for their safety and security, the government will make continuous investigations in schools and other facilities by using cumulative dosimeters in cooperation with the Fukushima Prefectural Board of Education. The government will also grasp situations of environmental radioactivity by combining the investigations with dust sampling and soil monitoring in order to reduce exposure doses of children and local residents in Fukushima Prefecture.

vii) Improvement of environmental sample analysis capabilities in Fukushima Prefecture

- The government will prepare bases for analyzing radioactivity concentrations of foods and environmental monitoring samples in Fukushima Prefecture.

(5) Handling of Rubble, Sewage Sludge and Other Wastes

> ➢ The government will take prompt measures to handle disaster wastes in Fukushima Prefecture, such as rubble and sludge generated from sewage treatment plants, by implementing on-the-spot investigations and examining standards and processing methods for disaster wastes that may have been contaminated by radioactive materials according to results of monitoring and other investigations.

<Immediate actions>

i) Disposal of rubble

- The government determined policies of immediate disposal of disaster wastes in Fukushima Prefecture in consideration for possibilities of contamination by radioactive materials and based on coordination in the national government and advices given by NSC. (May 2)
- Under these policies, the government will promote measures to dispose disaster wastes in Fukushima Prefecture as follows:
  (a) Disaster wastes in the evacuation area and the deliberate evacuation area will not be moved or disposed of for the time being.
  (b) Disaster wastes in Hamadori and Nakadori areas except the evacuation area and the deliberate evacuation area will be collected in temporary yards, without disposal, for the time being. Disposal of disaster wastes will be considered based on results of on-the-spot investigations of situations of contamination of disaster wastes.
  (c) Disaster wastes in other areas will be systematically disposed of as usual.
- The government will establish a study group composed of men of knowledge and experience in the Ministry of the Environment to immediately examine standards and treatment methods of disaster wastes that may have been contaminated by radioactive materials based on results of monitoring and other investigations.

ii) Handling of sewage sludge

- The government established provisional concepts regarding a problem of radioactive materials detected in sewage sludge and other wastes in sewage treatment plants in Fukushima Prefecture, based on examination in the national government and advices given by NSC. (May 12)

- The government will promote measures to handle sewage sludge and other wastes in Fukushima Prefecture for the time being based on the following concepts:
  - (a) Materials, such as dewatered sludge and slag in blast furnaces, will be temporarily collected and monitored in sewage treatment plants, controlled disposal plants and similar facilities in the prefecture in principle.
  - (b) Dewatered sludge and similar materials to be recycled as cement materials will be verified whether or not they have not exceeded the clearance level. Cement already produced were evaluated for influences of radiation and verified to be safe for use. We will ask people to refrain from using sewage sludge and similar materials as compost (fertilizers) for the time being.

- The government will continue to examine how to treat dewatered sludge and similar materials that have been temporarily collected.

(6) Enhancement of the Public Relation Activities for Nuclear Disaster Sufferers

- ➢ The government holds daily press conferences to precisely and immediately convey information on accidents to people.
- ➢ The government provides an announcement program through local radio stations and post newsletters in evacuation sites and other locations to provide sufferers with necessary information without fail and in easy-to-understand ways.
- ➢ The government will also provide information to sufferers staying outside the prefecture by utilizing the Internet, national radio programs and other means.

<Immediate actions>

- The government prepares and issue press releases and hold press conferences every day to precisely and immediately convey information on accidents to people.

- The government provides information through a radio program titled “Protect Fukushima!” (broadcasted every day by Radio Fukushima and FM Fukushima) to provide sufferers with information without fail and in an easy-to-understand way.

- The radio program answers questions from listeners and timely provides information on important matters regarding nuclear disasters (for example, designation of restricted areas and determination of TEPCO’s policies about provisional compensation payment).

- The government provides information meeting local needs, (for example, information about the procedure of getting support without submitting disaster victim certificates and about standards of tap water) by posting newsletters in evacuation sites.

- In addition, the government will provide information to sufferers staying outside the prefecture by providing these contents through the Internet (for example, by pod cast delivery of radio programs) and utilizing government bulletins (for example, by providing a nationwide radio program titled “Earthquake disaster information from the Prime Minister Office, issuing handbooks and wall newspapers, and making an announcement through newspapers).

(7) Other Measures

<Immediate actions>

- The government puts "Message on the Harmful Rumor by Radiation Exposure" on the website of the Ministry of Justice to prevent abuse of human rights due to rumors about radiation exposure as one of public relation activities. (April 22)
- The government has been making public relation activities in suitable ways for actual situations in each area, for example, by distributing leaflets to Regional Legal Affairs Bureaus and District Legal Affairs Bureaus across the country, distributing them in evacuation sites, and posting them in public institutions and convenience stores (since April 27).

6. Ensuring Employment and Agricultural/Industrial Support

(Summary)

[Basic policy]

Taking into consideration damage characteristic to nuclear disasters, including damage caused by harmful rumors, the government will make concerted efforts to ensure employment and to support agriculture and industry. The government will discuss assistance measures to help people return to their hometowns and put their lives in order after the alert in the evacuation areas and other areas is called off and to revitalize local economies.

[Ensuring Employment]

- **The government will promote employment measures, based on the Japan as One Work Project.**
- **Giving priority to local people, the government will promote employment measures focused on restoration from the disaster, such as the removal of rubble, and use the job-creation fund to provide job opportunities in areas affected by the disaster.**
- **The government will take special measures regarding employment adjustment subsidies and unemployment benefits to ensure employment and stabilize people's lives in areas affected by the disaster.**
- **In addition, in order to assist disaster sufferers, including students from the affected areas, in finding new employment, the government will work together with relevant organizations such as job-placement offices to provide employment support in local areas and at evacuation sites.**

[Support for agricultural, livestock and fishery industries]

- **The government will take all possible measures to provide appropriate and immediate compensation to farmers, foresters and fishermen who have been obliged by the government to suspend shipments and cultivation of agricultural crops or to destroy farm animals inside and outside the areas of evacuation.**
- **With regard to agricultural, forestry and fishery products from areas affected by the disaster and from other areas, the government will provide domestic and relevant overseas organizations, including the agencies of foreign governments, with appropriate information and at the same time will collect information on matters such as unreasonable import restrictions, and will ask foreign governments not to impose such restrictions. Simultaneously, the government will take measures to prevent the damage caused by harmful rumors and to promote the export of agricultural, forestry and fishery products and foods.**

- **The government will immediately verify the safety impact of radioactive material on agricultural, forestry and fishery products and on soil, and shall address technical issues.**
- **In addition, in order to support farmers, foresters, and fishermen who have been obliged to suspend the shipment of their products, the government will implement support measures for them so that they may stay in business, such as by guaranteeing the bridge loans offered by Japan Agriculture Cooperatives and Japan Fishery Cooperatives.**

[Measures for small and medium sized businesses]

- **The government has established an emergency credit guarantee program and special loan program for recovery from the Great East Japan Earthquake so as to provide more lenient loan conditions and will take appropriate measures according to the actual situations of the small-and medium-sized businesses affected by the disaster, such as by changing the terms of existing loans, including the establishment of a debt moratorium program.**
- **In order to support the restoration of buildings such as factories and shops, the government will take in an integrated manner measures necessary to enable small-and medium-sized businesses to restore and repair their facilities and to construct temporary factories and shops.**
- **The government will immediately and specifically discuss the design of the interest-free loan program agreed in principle between the Ministry of Economy, Trade and Industry and Fukushima Prefecture, under which long-term interest-free loans will be offered, in principle without any collateral being required, to small-and medium-businesses forced to relocate from the evacuation areas.**
- **The government will take all possible measures to ensure that appropriate compensation is provided to small-and medium-sized businesses that suffered a drop in revenue in areas from which people were instructed by the government to evacuate.**

[Support for manufacturing and retailing]

- **In order to prevent harmful rumors and to support industrial exports, the government will provide foreign governments with appropriate information and request them to respond calmly to the situation. At the same time, the government will strengthen the domestic inspection system and provide support for necessary inspections.**

[Support for transport and tourism]

- **For transport and tourism, which are particularly vulnerable to harmful rumors, the government will provide domestic and relevant overseas organizations, including foreign governments, with accurate information**

and will urge foreign governments to review any unreasonable regulations they may have established in connection with the disaster. In addition, the government will provide domestic and overseas businesses with information about overseas trends.

- **In addition, the government will provide support to local banks in areas affected by the nuclear disaster and will provide consumers with appropriate information.**

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(1) Ensuring Employment

> ➢ The government will promote employment measures based on the Japan as One Work Project
> ➢ Giving priority to local people, the government will promote employment measures focused on recovery from the disaster, such as the removal of rubble, and will use the job-creation fund to provide job opportunities in the affected areas.
> ➢ The government will take special measures regarding employment adjustment subsidies and unemployment benefits to ensure employment and stabilize people's lives in areas affected by the disaster.
> ➢ In addition, in order to assist disaster sufferers, including students from the affected areas, in finding new employment, the government will work together with relevant organizations such as job-placement offices to provide employment support in localities and at evacuation sites, such as by finding companies willing to employ disaster sufferes and providing matching opportunities.

<Immediate Action>

i) Creation of employment through recovery projects, etc.

- Giving priority to local people, the government will promote employment measures focused on recovery from the disaster, such as the removal of rubble, and will use the job-creation fund to provide job opportunities in the affected areas.
- Through the relaxation of regulations and the use of the job-creation fund program, to which additional funds have been added, the government will encourage prefectural and municipal governments to directly employ disaster sufferers or to outsource their recruitment to private companies, NPOs, and other organizations. In addition, by providing care for the elderly and children in evacuation sites and temporary housing, and by implementing public relations activities for agricultural products and tourist spots, employment opportunities will be created for disaster sufferers.

ii) Maintenance of employment and stabilization of people's lives

- With regard to employment adjustment subsidies, the government will implement special measures, such as increasing the maximum benefit period to 300 days regardless of how many days the subsidy has been already been received, and offering the subsidy to companies that have paid less than 6 months of installments, in order to assist those companies that have been forced to downsize their business for economic reasons in maintaining staff numbers.

  *1 For companies that have been forced to downsize their business because their areas were designated as an evacuation area or deliberate evacuation area, no employment adjustment subsidy will be granted. However, the subsidy will be granted to companies that are preparing to continue business outside such areas.

  *2 In the evacuation-prepared areas, where people need to prepare to stay indoors or evacuate in case of emergency, companies can continue business even if their offices are located in such an area. However, the subsidy will be granted to companies that have been forced to downsize their business after their areas were designated as an evacuation-prepared area.

- For employees who have been instructed to evacuate and have been obliged to absent themselves from work or temporarily leave their jobs, special measures will be taken to grant unemployment benefit and increase the benefit period (in principle, 60 days) to 120 days in order to provide stability to their lives.

iii) Support for finding new jobs

- Local governments and relevant organizations, led by the committee established for the Japan as One Work Project, will work together to provide livelihood and employment support. In addition, staff from job-placement offices and other organizations will visit evacuation sites to provide counseling and use their nation-wide networks to ensure job opportunities for disaster victims and support employment in local areas and in areas to which such sufferers evacuated.
- The government will offer joint enterprise employment fairs targeted at disaster sufferers and will request industry groups and small business associations to find companies willing to employ such people.
- By using the employment subsidy program (a subsidy program for employing disaster victims) and other methods, the government will promote the employment of disaster victims, including people evacuating due to the nuclear disaster. At the same time, using the outplacement benefit program and other methods, the government will assist disaster victims in finding jobs outside their hometowns.
- The government will strengthen support for students from areas affected by the disaster, such as arranging job offers for them, preventing the cancellation of job offers to new graduates, and holding employment fairs for companies willing to employ such students. In addition, the government will provide support for the provision of matching opportunities (dream match project) for those who have not gotten a job offer and to small-and medium-sized companies in the affected areas, such as the provision of a system that allows students from affected areas to search for companies that are flexible

with regard to dates for interviews and the commencement of employment.

- The government will find and announce companies that have been participating in the new graduate internship program and that are willing to employ new graduates from areas affected by the disaster. The government will ask companies involved in this program to be flexible; for example, by shortening internship periods in accordance with the circumstances of new graduates in the affected areas.
- The relevant ministries and agencies will work together, with the help of relevant organizations, to offer free accommodation for students from areas affected by the disaster who visit metropolitan areas for job hunting.

(2) Agricultural, Livestock and Fishery Industries, etc.

- ➢ The government will take all possible measures to provide appropriate and immediate compensation to farmers, foresters and fishermen who have been obliged by the government to suspend the shipment and cultivation of agricultural crops or to put down farm animals inside and outside the areas of evacuation.
- ➢ With regard to agricultural, forestry and fishery products from areas affected by the disaster and from other areas, the government will provide domestic and relevant overseas organizations, including the agencies of foreign governments, with appropriate information and at the same time will collect information on matters such as unreasonable import restrictions, and will ask foreign governments not to impose such restrictions. Simultaneously, the government will take measures to prevent the damage caused by harmful rumors and to promote the export of agricultural, forestry and fishery products and foods.
- ➢ The government will immediately verify the safety impact of radioactive material on agricultural, forestry and fishery products and on soil, and shall address technical issues.
- ➢ In addition, in order to support farmers, foresters, and fishermen who have been obliged to suspend the shipment of their products, the government will implement support measures for them so that they may stay in business, such as by guaranteeing the bridge loans offered by Japan Agriculture Cooperatives and Japan Fishery Cooperatives.

<Immediate action>

i) Impact of the suspension of shipments and future action

- At its third conference, the Dispute Reconciliation Committee for Nuclear Damage set up its first guidelines for compensating farmers and fishermen for losses they suffered and determined the concept of compensation for losses caused by the suspension of shipments imposed by the government, the voluntary suspension of shipments requested by local governments, etc.

- Japan Agriculture Cooperatives and other organizations that represent farmers have asked for compensation for losses caused by the disaster. On April 28, JA Ibaraki and JA Tochigi made the first claim for compensation against TEPCO.
- Emergency support measures for those affected by the nuclear accident were determined at the Nuclear Power Plant Accident Economic damage Response Team Ministerial Conference held on May 12, including provisional compensation payments from TEPCO to the farmers, foresters, and fishermen based on the first guidelines.

ii) Measures to prevent harmful rumors and to support the export of agricultural, forestry, and fishery products and foods

(Provision of information to domestic businesses and consumers)

- The government has asked distributers etc. to respond calmly on a scientific and objective basis, and the Minister of Agriculture, Forestry and Fisheries has sent messages requesting consumers and retailers to buy and sell goods as usual. In addition, the government is working together with consumer groups, local governments, NPOs, and private businesses to run a campaign called "Food Action for Japan," which promotes the consumption of agricultural, forestry and fishery products from areas affected by the disaster, and will more actively provide information by releasing public service announcements and by using other methods.
- The government will immediately publicize the results as reported by the local governments of screening for radioactive materials in foods, even if the values in the provisional regulations have not been exceeded.

(Provision of information to foreign governments, etc.)

- In order to recover from negative publicity about the safety of Japanese agricultural, forestry and fishery products and foods, the government is publishing information about the results of the measures taken for such products and foods. In addition, the Japanese Foreign Minister has made contributions to English-language newspapers, published information using the websites of Japanese diplomatic offices (in 40 languages), and has briefed overseas industries in major cities such as Beijing and New York, etc..

(Collection of information on and actions to unreasonable import restrictions)

- The government is collecting information about measures taken regarding the agricultural, forestry, and fishery products exported from Japan through its diplomatic offices and embassies in each country and region. In addition, the government is presenting the results of measures and inspections implemented by the Japanese government and is requesting other counties not to impose unreasonable restrictions on imports of agricultural, forestry, and fishery products from Japan through bilateral consultation, and through WTO and other international conferences.

(Provision of information about overseas trends to domestic and overseas businesses)

- At the website of the Ministry of Agriculture, Forestry and Fisheries of Japan, the government provides and updates information on import restrictions imposed by other counties and on considerations that need to be made when exporting agricultural, forestry, and fishery products. It also provides consultation services regarding the export of agricultural, forestry and fishery products, and handles inquiries from prefectural governments and private businesses.

(Issuance of certificates of radioactive materials inspection to foreign countries)

- Exporting foods etc. to the EU and other counties and regions requires certificates indicating the date and place of production (this rule came into force in the EU on March 28). Therefore, the government is establishing a system under which such certificates are, in principle, issued by prefectural governments. In the case of fishery products and alcoholic beverages, however, such certificates are issued by the national government.

- In inspections of radioactive materials, the government will use the supplementary budget etc. to grant subsidies to prefectural governments and private organizations for the introduction of radiation testers for exports of agricultural, forestry and fishery products. In addition, the government will conduct market analysis, etc. in order to restore confidence in Japanese agricultural, forestry and fishery products and foods and to prevent harmful rumors. For alcoholic beverages, the national government will introduce radiation testers and issue certificates indicating the beverages are free from radiation as soon as the system is in place, and conduct market analysis etc.

iii) Impact of radioactive material on agricultural, forestry, and fishery products and soils and future actions

- To ensure that information regarding efforts to ensure safety in agricultural work around Fukushima Dai-ichi NPS and reduce radioactive contamination affecting agricultural crops is communicated to farmers, the government issued technical guidance (April 18) and published a Q & A for farmers.

- With regards to farm animals, in response to the request made by the Fukushima prefectural government to move farm animals out of evacuation-prepared areas, etc, the government is making the necessary arrangements and notifications, such as with regard to inspections and decontamination, and providing support by, for example, finding places to move farm animals to and sending specialists. The government has published provisional regulation values for radioactive material in crops fed to cows and other farm animals as guidance for the production of milk and meat in order that the provisional regulation values set by the Food Sanitation Act are not exceeded. Based on the results of the inspections of feed crops conducted by prefectural governments, the government is providing guidance on the use of roughage harvested after the accident and on grazing.

- With regard to wheat, it is difficult to harvest this crop in the evacuation areas, Restricted Areas, and deliberate evacuation areas, and it is likely that harvesting in the evacuation-prepared areas will be limited to some extent. With regard to rice, farmers were directed on April 22 not to plant rice in the evacuation areas, deliberate evacuation areas and evacuation-prepared area. In areas where inspections have been determined to be necessary based on the levels of radiation in the air and of radioactive material in the soil, the government will inspect samples and ban shipments where the provisional regulation values on the Food Sanitation Act are exceeded. The government will discuss the inspection method, and is discussing how to handle straw and dispose of or use rice, wheat, etc. (including residue) in cases where the provisional regulation values are exceeded.

- The government will examine the impact of radioactive material on logs with regard to mushrooms, will sample and examine logs for mushrooms in and around areas affected by the disaster to verify their safety and put together measures to ensure a stable supply.
- With regard to fishery products, the government has been working with prefectural governments to monitor radioactive material in the fishery products. On May 2, the government formulated the basic policy on the inspection of radioactive material in the fishery products, and is strengthening the inspection of radioactive material in the fishery products by increasing the number of fishery products to be inspected and in other ways. The monitoring results and a Q & A on the impact of radioactive material on fish are available at the website.

iv) Support for business activities

- The government decided to guarantee the bridge loans offered by Japan Agriculture Cooperatives and Japan Fishery Cooperatives to farmers, foresters, and fishermen forced to suspend the shipments of their products, so that bridge loans can be offered by agriculture and fishery credit guarantee fund associations without collateral or a guarantor and so that loans can be smoothly offered to even people in default.

- The government will provide support to food producers and distributors affected by the disaster using the long-term, low-interest financing system established to provide assistance with recovery from the disaster.

(3) Measures for Small and Medium-sized Businesses

- The government has established an emergency guarantee program and special loan program for restoration from the Great East Japan Earthquake to ease loan conditions and will take appropriate measures according to the actual condition of the affected small-and medium-sized businesses, such as changing the terms of existing debts, including moratorium.
- In order to support the restoration of buildings such as plants and shops, the government will take measures necessary for the small-and medium-sized businesses to restore and construct their facilities and construct temporary plants and shops in a comprehensive manner.
- The government will immediately and specifically discuss the design of the interest-free loan program agreed in principle between the Ministry of Economy, Trade and Industry and Fukushima Prefecture, by which a long-term interest-free loan is offered, in principle, without security to small-and medium-businesses forced to relocate out of the restricted areas.
- The government will take all possible measures to ensure that appropriate compensation is provided to the small-and medium-sized businesses that suffered sales losses in the areas where people were instructed by the government to evacuate.

<Immediate actions>

(Financial support)

- For small-and medium-sized businesses that suffered significant damage directly or indirectly caused by the earthquake, including those affected by the nuclear accident and harmful rumors, the government has established an emergency guarantee program for restoration from the Great East Japan Earthquake, separately from the existing disaster-related guarantee programs and safety-net guarantee programs. With regard to the existing financing systems implemented by Japan Finance Corporation and other organizations, the government has established a special loan program for restoration from the Great East Japan Earthquake (including no-interest loans), by which loans are offered with higher loan ceilings and lower interest rates.
- For small businesses, the government has simplified documentation for the management improvement loan program for small businesses, by which loans are offered without security, and has increased the loan ceilings and lowered the interest rates for small businesses that suffered a certain amount of damage directly or indirectly by the earthquake.
- The government is requesting Japan Finance Corporation, Shoko Chukin Bank, and National Federation of Credit Guarantee Corporations to change the existing terms of existing debts, including moratorium, speed up their loan processes, and assume a flexible attitude to them when asking for collateral.
- Japan Finance Corporation, Shoko Chukin Bank, and National Federation of Credit Guarantee Corporations have set up special help desks to provide counseling services to those affected by the disaster.

- The government has agreed in principle with Fukushima Prefecture that it will use Organization for Small & Medium Enterprises and Regional Innovation to offer special long-term, no-interest loans, in principle, without security to small-and medium-sized businesses that have establishments in the restricted areas but are forced to relocate them out of the areas (April 22). The government will immediately and specifically discuss the design of such a loan program.

(Support for restoration of buildings such as plants and shops)

- The prefectural governments will approve the reconstruction plans launched jointly by small-and medium-sized businesses in the affected areas, and the national government will work together with the prefectural governments to subsidize the restoration and construction of facilities essential for the plan.
- Organization for Small & Medium Enterprises and Regional Innovation will construct temporary plants and shops and lease them for free through municipal governments.
- The government will send counselors and experts and provide small-and medium-sized businesses with counseling services that match their requests and problems.

(Compensation of damages suffered by small-and medium-sized businesses)

- The dispute reconciliation committee for nuclear damage set up the first guideline for compensation of damages suffered by small-and medium-sized businesses at its third conference and determined the concept of the scope of compensation for sales loss and property value loss caused by the evacuation directed by the government, and the inspection costs borne by the businesses. (April 28)
- In order for TEPCO to promptly compensate damages suffered by small-and medium-sized businesses, the government will immediately discuss with relevant parties a system to smoothly make temporary payment of compensation, taking it into consideration that the affected small-and medium-sized businesses consist of various industries, such as manufacturing industry, service industry, retailing industry, and construction industry.

(Other)

- The government has requested private businesses (approximately 22,000 companies) to (a) continue and restart business with small-and medium-sized subcontractors and give priority to them when placing orders, and (b) do business with small-and medium-sized businesses on a scientific and objective basis to prevent harmful rumors caused by the nuclear disaster.

(4) Manufacturing Industry, Retailing Industry, etc.

> ➢ To prevent harmful rumors and support the export of industrial products, the government will provide foreign governments with appropriate information, request them to respond calmly, strengthen domestic inspection systems, and support inspections.

<Immediate actions>

i) Prevention of harmful rumors and support for export of industrial products etc.

(Provision of information to foreign governments etc.)

- To provide information to other countries, Foreign Minister contributed to English newspapers and sent messages at the websites of Japanese diplomatic offices (40 languages).
- The government is explaining the current situation and its efforts made after the nuclear accident to foreign governments and businesses and requesting them to respond based on scientific data. In major cities, such as Beijing and New York, etc., the overseas offices of Japan External Trade Organization and diplomatic offices are working together to explain about the nuclear accident and Japan's efforts to foreign industries.
- At international exhibitions and Japan-related events held overseas, the government is considering running a Tohoku booth for sales support.

(Collection of information about unreasonable import restrictions and actions)

- The government is collecting information about restrictions imposed by other countries on the industrial and medical products exported from Japan and requesting foreign governments to avoid placing Japanese businesses at a disadvantage.

(Provision of information about overseas movements to domestic businesses)

- At the homepages of the Ministry of Economy, Trade and Industry, Japan External Trade Organization, and other organizations, information about radiation inspections conducted by other counties is available to domestic businesses. In addition, Japan External Trade Organization and Nippon Export and Investment Insurance set up helpdesks to provide counseling services and respond to inquiries from individual businesses.

(Support for inspections)

- The government has provided support such as lending survey meters owned by Advanced Industrial Science and Technology to Fukushima Technology Center and sent experts to set up a temporary technical help desk for radiation measurement in Fukushima City. The government will continue to support efforts to strengthen the inspection system in Fukushima Prefecture.
- To reduce burden on businesses that are required to conduct radiation dosage inspections on their exports, the government will subsidize the cost of radiation dosage inspections of exports from the supplementary budget (small and medium-sized businesses: 90% of the total cost, large-sized businesses: 50% of the total cost).

- The government issues radiation-free certificates for ships and boats built in Japan and marine products made in Japan if radiation measurement is requested.

(Cooperation with relevant organizations and groups)

- To prevent suspension of business transactions, reduction of orders, and unreasonable terms and conditions, the government has issued a request to relevant industry groups etc. (April 28)
- Japan External Trade Organization is collecting information, giving explanations to foreign governments and businesses, setting up emergency counseling desk and disseminating information about the issuance of certificates at public agencies and Chambers of Commerce in which radiation inspections are conducted.
- Nippon Export and Investment Insurance has extended the insurance claim periods for the affected small-and medium-sized businesses, has set up a counseling desk, and is disseminating information about the losses covered by the trade insurance to prevent harmful rumors.

ii) Support for business activities

- The government will grant subsidies for early restoration of industrial water services.
- With regard to the application of green area regulations under the Factory Location Act, the government has given a notification to relevant local governments, including Fukushima prefectural government, requesting flexible application of these regulations in the restoration of production facilities.

(5) Transit / Transport Industry

- ➢ For domestic businesses, the government is providing necessary information and has instructed the taxi industry to refuse passengers without reasonable reason.
- ➢ The government will explain to foreign governments about measures taken against radiation in the seaports and airports in Japan and the safety in these areas and provide domestic businesses with appropriate information about overseas movements.

<Immediate actions>

(Provision of information to domestic businesses and consumers)

- The government has instructed the taxi associations in Tochigi Prefecture, Ibaragi Prefecture, and Chiba Prefecture to collect accurate information and remind their drivers not to refuse passengers without reasonable reason. In addition, the government has given the same instruction to Japan Federation of Hire-Taxi Associations. (March 19)

(Provision of information to foreign governments etc.)

- To provide information to other countries, Foreign Minister contributed to English newspapers and sent messages at the websites of Japanese diplomatic offices (40 languages).
- The government is explaining to other countries and regions through their diplomatic offices about measures taken against radiation in the seaports and airports in Japan and the safety in these areas.

(Provision of information about overseas movements to domestic businesses)

- Every time a press release is issued by International Maritime Organization, the government publicizes the details of the press release and provides information to shipping agents, port managers, and diplomatic offices.
- On April 22, the government released "Measures against Radiation in Sea Ports." On the same day, the government disseminated information about it to International Maritime Organization and foreign governments through diplomatic offices and gave explanations to diplomats and overseas media in Tokyo, Japanese Shipowners' Association, and other organizations.

(6) Tourism

- ➢ In cooperation with relevant bodies, the government will continue taking various measures to restore domestic and overseas demand for traveling, including organizing public and private promotion campaigns for travel, along with providing accurate information overseas.
- ➢ In case of excessive passage regulations and others to Japan, the government will make actions to demand their reconsideration.

<Immediate actions>

(Revitalization of domestic and overseas tourism exchanges)

- In order to cope with the tendency to hesitate to travel to Japan, especially to affected areas, and to cope with the damage caused by rumors, the government will devise a plan to restore demand for travel by revitalizing domestic trips including public and private promotion campaigns for travel and advertising and providing accurate information overseas through "Visit Japan" activities. The government will continue such efforts in cooperation with relevant bodies.

(Efforts to remove actions such as excessive passage regulations)

- The government will provide up-to-date and accurate information as well as make efforts to reconsider excessive passage regulations, if any, to the authority of each country or region through diplomatic and consular offices in foreign countries, with priority given to 15 key market countries and regions of "Visit Japan" activity.

(7) Other Countermeasures

<Immediate actions>

i) Support for local financing

- The government will examine revision of the Act on Special Measures for Strengthening Financial Functions including making exceptions concerning application requirements due to the earthquake disaster. This act stipulates the framework for supporting local economy and small and medium sized businesses facing difficult situations by strengthening financial intermediation functions of financial institutions through the government's capital participation. The government will ensure underpinning for local economy from the financial side, by for instance, urging active examination of application of this act, when a financial institution considers financing to be appropriate from its management's point of view.

ii) Financial support for disaster victims and affected businesses

- When clients directly or indirectly affected by the disaster apply for modifications of conditions of a loan such as an extension of the term of redemption or for provision of an emergency fund or other monies, the government requires financial institutions to make efforts to accept them as much as possible, taking into account the intention of the Act on Provisional Measures for the Facilitation of Financing to Small and Medium Sized Businesses. Based on that, the financial institutions share this view with the authorities and endeavor to fulfill their financial intermediation functions, even though they are victims of the disaster themselves.

iii) Appropriate provision of information for consumers

- Concerning the safety of food, the government will provide accurate information in a simplified way to consumers about shipping and intake restrictions as well as partial lifting of shipping restrictions of vegetables and other food products, along with releasing the messages from the Minister of State for Consumer Affairs requesting a calm reaction from consumers.

- In the framework of the "Rehabilitation Action," the "Let's properly understand FUKUSHIMA" project started on April 28. The government will (a) organize symposia, seminars, etc. in cooperation with consumer groups who have their main activities in Eastern Japan, (b) prepare Q&A to provide information about the safety of food in a simplified way, (c) ascertain consumers' feelings with regard to food safety, etc.

7. Support for affected local governments

(Summary)

The entire government as a single body will support affected local governments through, for example, dispatching national public officials to the affected local governments in addition to constructing temporary government buildings for the affected municipalities, performing maintenance on information systems for them, among other measures, at the same time the government will carefully consult with leaders as needed about current situations, problems, and demands so that the affected local governments will be able to provide administration services unhindered.

The government will help the local governments that relocated their functions as public offices due to the nuclear disaster, at the same time, will take into account the support for the local governments accepting sufferers.

Furthermore, given the situation that the evacuation area has been extended and the evacuation period prolonged, the government will hereafter examine what appropriate support should be provided for affected local governments and local governments accepting sufferers.

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(1) Efforts for the Recovery of Functions of the Affected Local Governments

- The entire government as a single body will support affected local governments through, for example, dispatching national public officials to the affected local governments in addition to constructing temporary government buildings of the affected municipalities, performing maintenance on information systems for them, among other measures, at the same time the government will carefully consult with leaders as needed about current situations, problems, and demands so that the affected local governments will be able to provide administration services unhindered.

<Immediate actions>

- The government is dispatching 246 national public officials to Fukushima prefecture, affected municipalities, and other places in an attempt to respond to their demands.

［For reference：Details on the dispatch of national public officials to Fukushima prefecture］
Ministry of Public Management, Home Affairs, Posts and Telecommunications: 8 officials, Ministry of Foreign Affairs: 2 officials, Ministry of Finance: 35 officials, Ministry of Education, Culture, Sports, Science and Technology: 12 officials, Ministry of Health, Labour and Welfare: 68 officials, Ministry of Agriculture, Forestry and Fisheries: 4 officials, Ministry of Economy, Trade and

Industry: 74 officials, Ministry of Land, Infrastructure, Transport and Tourism: 17 officials, Ministry of the Environment: 1 official, Ministry of Defense: 1 official, National Police Agency: 22 officials, and Financial Services Agency: 2 officials

- In addition to dispatch through the individual channels of each Cabinet or Ministry, the government will ask the National Governors' Association, the Japan Association of City Mayors, and the National Association of Towns and Villages for their support and cooperation with regard to dispatching local public officials through their systems in order to provide physical support for the affected local governments in a way that meets their needs.

- Also, in an effort to seek temporary restoration of administration functions of the affected municipalities, the government will support the construction of temporary government buildings, preparation of information and other systems of the affected municipalities by means of the supplementary budget.

- The government will continue responding to various requests for consultation through the "Support hotline for municipality administration functions."

- The government has created the "National Information System for Sufferers" which offers information provided by sufferers that have evacuated to other municipalities, including their locations, to their original prefecture and municipalities in order to give information to other sufferers. The government is accepting information from sufferers and hereafter will continue trying to ascertain sufferer locations.

- The original purpose of the fund previously prepared by means of the subsidies for locations of electric power plants was modified so that it can be used for restoration and recovery from the disaster.

- Furthermore, in April the government decided to grant subsidies that are usually granted in June, if the affected local governments that are eligible for the subsidies for locations of electric power plants apply for these subsidies. For those applications, the Ministry of Economy, Trade and Industry sends the person in charge of this matter to the temporary office of the local government in the municipality to which it has evacuated so as to advise about subsidies undertakings and support administrations related to the subsidies.

(2) Support for Municipalities that Relocated their Functions as Public Offices and Local Governments Accepting Sufferers

- ➢ The government will help the local governments that relocated their functions as public offices due to the nuclear disaster and at the same time take into account support for the local governments accepting sufferers.
- ➢ Furthermore, given the situation that the evacuation area has been extended and the evacuation period prolonged, the government will hereafter examine what appropriate support should be provided for affected local governments and local governments accepting sufferers.

<Immediate actions>

- In order to maintain the close contact system among the Nuclear Emergency Response Headquarters, Local Nuclear Emergency Response Headquarters, Fukushima prefecture, and affected municipalities, the government will prepare the means to hold simple teleconference sessions (repeated).

- The government will support eight towns and villages which have relocated their functions as public offices due to the nuclear disaster by installing PCs, multifunction devices, etc. in an attempt to strengthen their communication system with the government. At the same time, the government will continue helping them carry out and arrange equipment including PCs.

- When prefectures not affected by the disaster help affected prefectures by responding to their requests for setting up evacuation sites, for instance, their costs are covered by the National Treasury through the affected prefectures. Moreover, it has been decided that the Ministry of Health, Labour and Welfare would arrange the application procedures from each prefecture for the three affected prefectures (Iwate, Miyagi and Fukushima prefectures) to reduce the time and effort the affected prefectures need to expend for those procedures.

- The government will inform each prefecture and the public at large through the website of the Ministry of Public Management, Home Affairs, Posts and Telecommunications regarding the call center created by Fukushima prefecture to verify the locations of sufferers who resided in the towns and villages that have relocated their functions as public offices.

8. Compensation for sufferers, affected businesses and others

(Summary)

Pursuant to the Act on Compensation for Nuclear Damage, sufferers will be compensated in a prompt, impartial and appropriate manner.

The Committee for Adjustment of Compensation for Nuclear Damages Disputes formulates guidelines regarding amongst other things determination of the scope of what is included under nuclear damage based on the probability that a loss falls under nuclear damage, in order from high to low probability, in light of the necessity to give prompt, impartial and appropriate relief to disaster victims.

Based on a decision (dated April 15) regarding the "Emergency support measures for victims of the nuclear accident," TEPCO has commenced to pay temporary compensation to residents who have been obliged to evacuate or shelter following instructions pursuant to the Act on Special Measures Concerning Nuclear Emergency, and is aiming to finish most of the electronic bank transfers in May.

In addition, another decision (dated May 12) regarding the "Emergency support measures for those affected by the nuclear accident" stipulates that the immediate necessary funds should be paid as soon as practicable to businesses that had shipping restrictions and other restrictions enforced on them by the government's instructions and to those that were obliged to destroy their livestock due to evacuation instructions. In response to this decision, TEPCO aims to begin paying temporary compensation before the end of May.

A Cabinet meeting related to the Response Team for Economic Damage Incurred by the Nuclear Power Station Accident established the "Framework of governmental support to TEPCO to compensate for damage caused by the accident at Fukushima nuclear power station" (on May 13).

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(1) Regarding Guidelines Formulated by the Committee for Adjustment of Compensation for Nuclear Damages Disputes

- The government will ensure that TEPCO's compensation of disaster victims is paid in a prompt, impartial and appropriate manner.
- The Committee for Adjustment of Compensation for Nuclear Damages Disputes formulates guidelines regarding amongst other things determination of the scope of what is included under nuclear damage based on the

probability that a loss falls under nuclear damage, in order from high to low probability, in light of the necessity to give prompt, impartial and appropriate relief to disaster victims.

<Immediate action>

- The Committee for Adjustment of Compensation for Nuclear Damages Disputes was established by Cabinet Order so that the compensation of TEPCO to disaster victims is paid in a prompt, impartial and appropriate manner (April 11).

- The government will formulate guidelines regarding amongst other things determination of the scope of what is included under nuclear damage based on the probability that a loss falls under nuclear damage, in order from high to low probability, in light of the necessity to give prompt, impartial and appropriate relief to disaster victims.

- The third meeting of the Committee for Adjustment of Compensation for Nuclear Damages Disputes decided on a primary regulatory guide making clear their viewpoint on compensation for losses resulting from evacuation and the suspension of shipment of agricultural products due to the government's instructions (dated April 28).

- The government notified relevant ministries and agencies and each prefecture of this guide by, for instance, releasing it on the web site.

- Items of loss and their scope that were not included in the primary regulatory guide are also under consideration.

(2) Regarding Payment of Temporary Compensation

- ➢ Based on a decision (dated April 15) regarding the "Emergency support measures for victims of the nuclear accident," TEPCO has commenced to pay temporary compensation to residents who have been obliged to evacuate or shelter following instructions pursuant to the Act on Special Measures Concerning Nuclear Emergency Preparedness, and is aiming to finish most of the electronic bank transfers in May.
- ➢ In addition, another decision (dated May 12) regarding the "Emergency support measures for those affected by the nuclear accident" stipulates that the immediate necessary funds should be paid as soon as practicable to businesses that had shipping restrictions and other restrictions enforced on them by the government's instructions and to those that were obliged to destroy their livestock due to evacuation instructions. In response to this decision, TEPCO aims to begin paying temporary compensation before the end of May.

<Immediate action>

- The Response Headquarters for Economic Damage Incurred by the Nuclear Power

Station Accident (See Note) decided on the “Emergency support measures for victims of the nuclear accident” (dated April 15).
(Note) Reorganized into the Response Team for Economic Damage Incurred by the Nuclear Power Station Accident

- On the basis of this decision, TEPCO is distributing claim notes and holding explanatory meetings in cooperation with each municipality. They began actual payments on April 26 and aim to finish most of the electronic bank transfers of temporary compensation in May.

- A Cabinet meeting related to the Response Team for Economic Damage Incurred by the Nuclear Power Station Accident decided on another “Emergency support measures for victims of the nuclear accident” on May 12. It stipulates that the immediate necessary funds should be paid as soon as practicable to businesses that had shipping restrictions and other restrictions enforced on them by the government’s instructions and to those that were obliged to get their livestock put down due to evacuation instructions.

- In response to this decision, TEPCO announced that they aimed to begin paying temporary compensation by around the end of May in cooperation with producer’s groups and others.

(3) Regarding the Framework of Governmental Support to TEPCO to Compensate for Damage Caused by the Accident at Fukushima Nuclear Power Station

> ➢ A Cabinet meeting related to the Response Team for Economic Damage Incurred by the Nuclear Power Station Accident established the “Framework of governmental support to TEPCO to compensate for damage caused by the accident at Fukushima nuclear power station” (on May 13).

<Immediate actions>

- On May 13, a Cabinet meeting related to the Response Team for Economic Damage Incurred by the Nuclear Power Station Accident established the “Framework of governmental support to TEPCO to compensate for damage caused by the accident at Fukushima nuclear power station.”

- This framework establishes a supporting organization to help the payment of compensation and others for cases of nuclear damages in an effort to (a) realize prompt and appropriate compensation for the damage, (b) avoid adverse effects on businesses and others involved in the stabilization and incident management of the nuclear power station, and (c) ensure a stable electricity supply sufficient for people’s lives.

9. Action for the return of sufferers to their homes

(Summary)

To enable sufferers to return, it is a basic premise that residents' health and safety can be guaranteed, and it is vital that radioactive materials from the power station have been brought under control and radiation dosage amounts have been reduced to a minimum.

First, this makes it extremely important to work on immediate restoration from the accident in accordance with the roadmap and considering work environments and effects on safety and the environment.

On this basis, the Nuclear Emergency Response Headquarters will enhance and implement appropriate environmental monitoring in order to fully understand the distribution of radioactive materials and other substances, so that the government can at any time start reviewing lifting the designation of evacuation areas as well as get an overall perspective on the current status of the accident.

In addition, in order to make steady steps toward the return of sufferers to their homes, the relevant organizations will work hard together to take care of debris and to undertake monitoring, screening, decontamination and so forth of the soil and other elements, which form a basis for residents' lives and their agricultural and industrial activities.

Moreover, in cooperation with relevant organizations such as the "Reconstruction Design Council in Response to the Great East Japan Earthquake", and discussing closely with Fukushima prefecture and related local governments, the government will urgently proceed with an examination of reactions to the challenges to be dealt with in revitalizing the local communities of the regions affected by the nuclear disaster.

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(1) Summary of Viewpoints on Lifting the Designation of Evacuation Areas

- The government will enhance and implement appropriate environmental monitoring to fully understand the distribution of radioactive materials and others.

- ➢ The government will examine revision of each area based on the results of monitoring, once the government has decided that the release of radioactive materials from the power station is basically under control.

<Immediate actions>

- The government will implement monitoring to fully understand the distribution of radioactive materials within an appropriate range, including the area around TEPCO Fukushima-Daiichi Nuclear Power Station, and will prepare for future dose assessment and evaluation of accumulation of radioactive materials in each area (restricted area, deliberate evacuation area and evacuation-prepared area).

- To that end, the government will maintain continuous monitoring based on the Environmental Monitoring Enhancement Plan, aiming to make extensive use of various techniques to make comprehensive measurements of environmental radioactivity levels. In particular, the government will use monitoring in order to get an overall perspective of the status of the accident and to consider area designations and so forth by placing importance on measurement of environmental radioactivity levels in deliberate evacuation areas and other areas, as well as to determine and release a "radiation dosage distribution map" and other documents.

- In reviewing lifting the designation of evacuation areas, the government will review evacuation areas, deliberate evacuation areas and evacuation-prepared areas in consultation with the Nuclear Safety Commission and based on the results of monitoring up to the point in time when systems to enable sound and long-term cooling of both nuclear reactors and spent fuel pools are assured, when nuclear reactors are in a cold shutdown state and the release of radioactive materials are basically under control. The government will proceed in reviewing and revising its viewpoint on lifting the designation of evacuation areas.

(2) Monitoring, Screening, Decontamination and so forth of Soil

- ➢ The relevant organizations will work hard together to effectively and efficiently (1) monitor and screen, and if necessary (2) decontaminate and improve, the soil and other elements, which form a basis for residents' lives and their agricultural and industrial activities.

<Immediate actions>

i) Monitoring and screening of the soil of agricultural land and others

- Since March 18, the government has continued to monitor the soil around the TEPCO Fukushima-Daiichi Nuclear Power Station. After April 22, the government will draw up a "map of concentration levels of radioactive material in the soil" based on the Environmental Monitoring Enhancement Plan so that the accumulation of radioactive materials in the soil surface can be fully investigated.

- The supplementary budget includes costs for the analysis and procurement of dosimeters so that concentration levels of radioactive materials in agricultural soil can be fully investigated.

ii) Decontamination and improvement of agricultural and other soil

- The government will study. practicable techniques for decontaminating agricultural soil contaminated with radioactive materials and promote implementation of the results.

(3) Challenges to be Examined toward Revitalization of Local Communities

> ➢ It is necessary to tackle the various medium- and long-term challenges described below in revitalizing local communities in the regions affected by the nuclear disaster, and the government will proceed urgently with an examination of this in concert with relevant bodies, including the "Reconstruction Design Council in Response to the Great East Japan Earthquake," and discussing closely with Fukushima prefecture and related local governments.

<Principal challenges to be examined>

○ Countermeasures against harmful rumors from within Japan and overseas

○ Long-term management of residents' health, with a particular emphasis on children

○ Removal and final processing of soil, rubble and sewage sludge containing radioactive materials

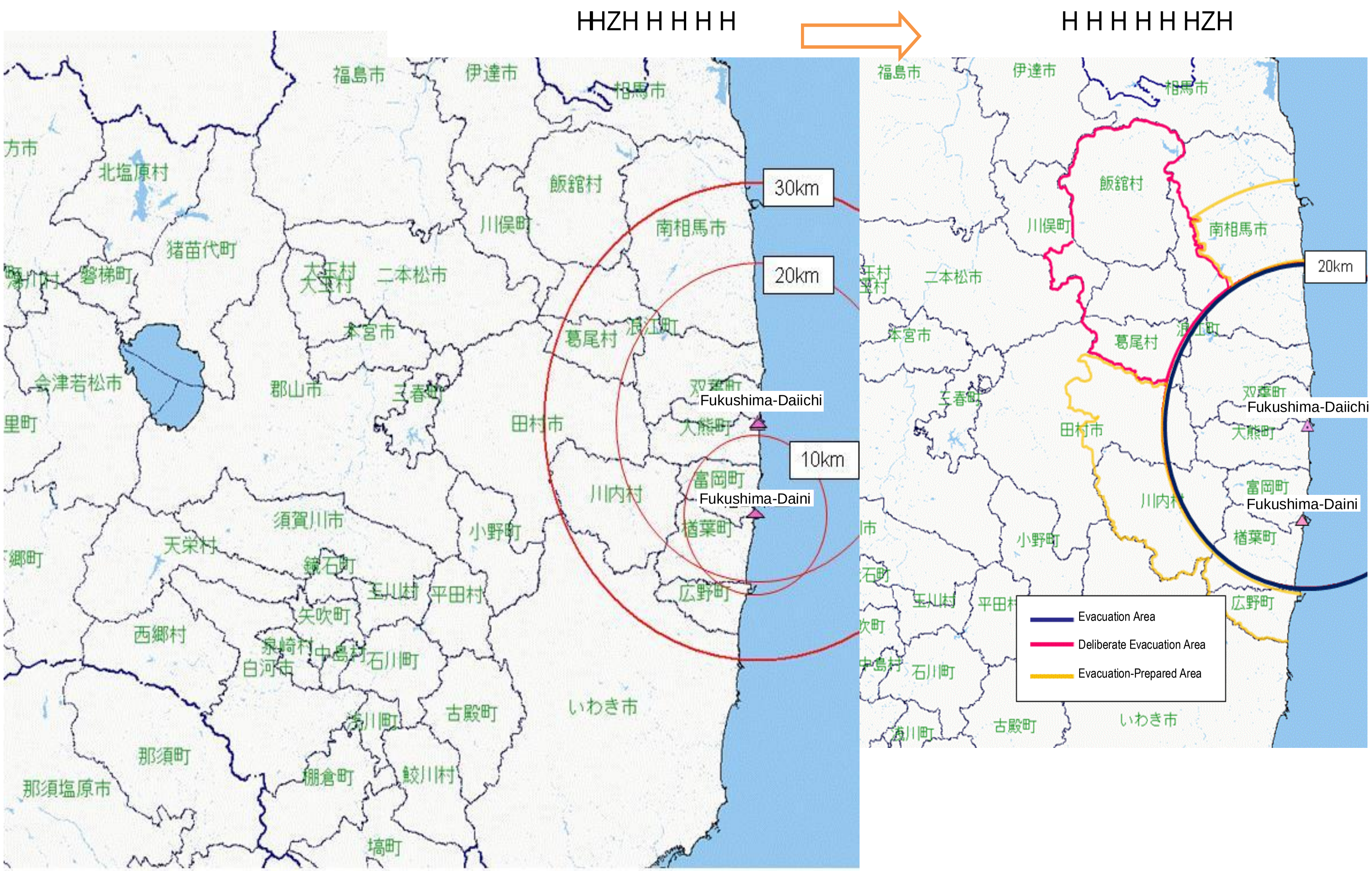
○ What the appropriate support should be for business operators and others who return home to maintain their agricultural or industrial enterprises

○ What the appropriate support should be for future urban development, including ensuring job security and creating new industry, and how it can be realized

○ What the appropriate governmental support should be to aid the ongoing work toward the recovery of the local infrastructure lost due to the nuclear disaster and the revitalization of local communities in the affected regions

○ What the national government system should be in order to promote in a centralized manner and on a long-term basis the support for the restoration and rehabilitation of the regions affected by the nuclear disaster

[For reference: Areas covered by the Deliberate Evacuation Area and Evacuation-Prepared Area]



Specific Countermeasures in Japan Based on the Lessons Learnt from the Accident at Fukushima Dai-ichi Nuclear Power Station of Tokyo Electric Power Co. Inc.

I. Emergency Safety Measures, etc.

1. Emergency Safety Measures

On March 30, the Minister of Economy, Trade and Industry instructed the electric utilities, etc. to implement the following emergency safety measures for other nuclear power stations (NPSs) based on the accident at Fukushima Dai-ichi and Dai-ni NPSs of Tokyo Electric Power Co. Inc. (TEPCO). On May 6, the Nuclear and Industry Safety Agency (NISA) confirmed that these measures (excluding Onagawa, Fukushima Dai-ichi and Dai-ni NPSs) were implemented properly. (Please refer to XI for the overview.) These measures were implemented as necessary measures to avoid serious consequences such as core damage even when there is a total loss of AC power supply, taking into consideration the recent earthquake, and with the understanding that tsunamis pose a clear risk.

These measures ensure the necessary safety against the same level of tsunami attack as the case of the Accident at TEPCO's Fukushima Dai-ichi NPS.

① Measures for the Total Loss of AC Power Supply, etc. [Short Term Measures]

(i) Development and inspection of an emergency response plan

Emergency response plans were developed that took into account estimated damages by a tsunami. Diversification of access routes to areas where required operations are conducted, as well as procedures and authorities related to venting and seawater injection were clarified.

(ii) Securing the power supply in an emergency

Alternative power supplies such as power supply vehicles were secured so that expedient supply of required power would become possible in case the on-site power supply is lost and emergency power cannot be obtained.

(iii) Securing the emergency heat removal function and the emergency cooling function for the Spent Fuel Pool

Recovery measures using expedient heat removal functions such as fire engines and pump trucks, and measures to supply cooling were prepared, in case seawater facilities or functions are lost and the cooling of the Spent Fuel Pool is suspended, or regular supply of on-site water to the pool is suspended.

(iv) Implementation of emergency response drills and emergency inspection

Emergency inspections on facilities and equipment used for responding to tsunami-induced emergencies were conducted, and the procedure was established through drills that were carried out in connection with measures for the total loss of AC power supply due to a tsunami.

② Actions against Flooding of Buildings [Short-Term Measures]

(v) Measures against flooding of buildings

Measures against flooding were taken for equipment that is used for part of measures for the total loss of AC power supply, so that they would not be impacted by the tsunami.

③ Measures for Improving Reliability by Implementing Speedier Cold Shutdowns [Medium to Long Term Measures]

(vi) Securing back-up equipment such as electric motors for seawater pumps

Plans were developed to secure back-up electric motors for seawater pumps or alternative seawater pumps that are required for the recovery of the permanent Heat Removal System, etc. in order to enable a speedier cold shutdown.

(vii) Installation of air-cooled emergency power generators, etc.

Plans were developed so that large power generators with the capacity to activate heat exchange pumps for removing decay heat would be placed on higher grounds, etc. to make them less susceptible to tsunamis.

④ Protective Measures against Tsunamis [Medium to Long Term Measures]

(viii) Installation of seawalls at the waterfront, installation of flood barriers around the buildings, and making buildings watertight

In order to improve the reliability of the emergency safety measures even further, plans were developed to install seawalls and flood barriers, and to make buildings watertight, so that important equipment for the safety of reactor facilities would not be affected by the tsunami.

2. Instructions to Secure the Reliability of External Power Supplies

On April 15, NISA instructed the electric utilities to establish measures to connect each reactor unit to every circuit of multiple power transmission lines, and to reinforce the transmission towers (power supply lines) as well as anti-flooding measures for switchboards, from the viewpoint of improving the reliability of each NPS by receiving power from off-site power supplies.

3. Other Efforts at the NPSs

In each NPS, there are equipments for observing earthquakes, etc. which record data.

4. Actions by the National and Local Governments, etc.

・Enhancement of environmental monitoring

With regard to environmental monitoring, we measured the radiation dose using monitoring cars, etc. and disclosed the information. In addition, the Fukushima Prefectural Government is developing and implementing environmental monitoring plans.

・Enhanced decision making functions at the national and local levels

Emergency response in the accident was carried out using peripheral facilities such as the Fukushima Prefectural Office and J-Village, etc. In addition, organizations such as the Integrated Response Headquarters for the Fukushima NPS Accident (currently called the Government-TEPCO Integrated Response Office, hereinafter referred to as the "Integrated Response Office") and Nuclear Sufferers Life Support Team were formed in a flexible manner and actions such as sharing of information or provision of quick support were taken according to the issues.

・Enhancement of public relations

The national government strived to enhance communication with local residents, etc. by dispatching staffs, including top officials from related government ministries and agencies, distributing newsletters to evacuation centers, providing information through local radio programs, etc., and giving briefings about the response to the accident at TEPCO's Fukushima NPSs and about the emergency safety measures to local governments of the prefectures with NPSs.

・Responding to support from each country and enhancement of communication with the international community

The national government has tried to build collaborative relationships within the government and with donor countries in order to receive assistance from each country. In addition, the government has been striving to provide prompt and accurate information to the International Atomic Energy Agency (IAEA) and to each country through the IAEA. The government has also strived to promote correct understanding about the accident and the effects of the accident as well as the government's response, by briefing foreign embassies in Tokyo and foreign media. Furthermore, the government has been urging the international community to respond to the import bans on Japanese products by foreign countries on scientific grounds.

・Accurate understanding and estimation of the impact of the release of radioactive materials

The government has been publishing analyses based on SPEEDI (System for Prediction of Environmental Emergency Dose Information) from the viewpoint of effectively utilizing SPEEDI.

・Clarification of the definition of the wide-area evacuation during a nuclear hazard and the radiation protection standards

The government established the Deliberate Evacuation Area and Evacuation-Prepared Area in Case of Emergency, and carried out the evacuations after giving a clear explanation on the government's point of view. In addition, provisional regulation values were established related to the standards for food safety, and indicators, etc. were established related to the restriction of intake of tap water.

・Enhancement of the regulatory and administrative structure for nuclear safety

The government responded and established organizations in a flexible manner, such as the Nuclear Emergency Response Headquarters, the Integrated Response Office, and Nuclear Sufferers Life Support Team, etc. according to the issues, in order to share information and provide quick support.

・Maintenance and enhancement of the legal system, standards and guidelines

The government ensured that aging management is steadily implemented and conducted on-site inspections to confirm and evaluate the implementation status of aging nuclear plants.

・Enhancement of health management of workers engaged in emergency work and confirmation of the management structure

The government has been ensuring that radiation dose exposure management of workers and ad-hoc health examinations would be thoroughly implemented. The government has also been confirming the radiation exposure management by requiring notices to be submitted when certain emergency work is conducted. In addition, long term health management of workers will be carried out by building a database for radiation exposure dose, etc.

・Securing personnel related to nuclear safety and nuclear disaster prevention

NISA, the agency responsible for regulating nuclear safety, has established HR development programs and has actively promoted training, etc. of personnel.

II. Additional Emergency Safety Measures

In addition to the above-mentioned emergency safety measures, NISA also requested that the utilities implement the following measures by the end of June as part of additional emergency measures taking into consideration the accident at TEPCO's Fukushima NPS, from the viewpoint of enabling more speedy action in case a severe accident breaks out. The government also decided to establish measures immediately.

・Enhancing measures against hydrogen explosions

For BWRs, the utilities are required to establish procedures for the measures aiming to prevent hydrogen explosions, as well as carry out drills, and obtain outlets for venting hydrogen such as by securing the means to open the blow-out panels. For PWRs, the utilities are required to obtain power supply for annulus exhaust facilities using power supply vehicles, and obtain power supply for igniters (hydrogen combustors) using power supply vehicles in case there is a leakage of hydrogen and the emission of hydrogen is required.

・Enhancing the environment for accident response

The utilities are required to improve the infrastructure for responding to accidents by obtaining emergency power supplies for the PHS communication facilities inside the plant, by securing communication means inside the plant such as transceivers, by obtaining portable lighting equipment, and by maintaining the radiation shielding function in the Main Control Room by installing HVAC systems using emergency power supply cars.

・Enhancing the management for radiation exposure control during an accident

Considering the number of workers to be engaged in operation during an emergency, the utilities are required to obtain sufficient number of personal dosimeters in case of an accident. In addition, they were required to establish a structure that will enable the expansion of radiation control staff during an accident.

・Management of emergency response supplies and equipments

In order to carry out recovery work promptly during an accident, the utilities are required to deploy sufficient number of heavy machineries for the removal of rubble, etc. They are also required to obtain protective masks and protecting clothing for carrying out work under high radiation dose conditions and to clarify procedures that would enable utilities to share the supplies amongst one another when accident response work is being carried out.

・Enhancement of external communication

The government will give detailed explanations to local governments, etc. about new measures including this report, and ways to ensure security and nuclear disaster prevention in the future.

・Accurate understanding and estimation of the impact of the release of radioactive materials

The government will review the manual that describes the procedure for the prompt disclosure of the SPEEDI analysis results and explanation to local governments and residents, based on the assumption that sufficient information regarding the source of the release is not available due to the accident.

III. Medium to Long Term Measures for Further Safety Enhancement

In addition to the above-mentioned short-term measures, we decided to include the following points to be implemented in the future in addition to the already planned emergency safety measures, taking into consideration new facts that would come out before the measures are implemented, as part of medium to long-term measures that would make the accident response at TEPCO’s Fukushima Dai-ichi NPS become more secure, prompt and permanent.

1. Enhancement of Preventive Measures against Severe Accidents

・Enhancement of measures against earthquakes and tsunamis

A mechanism analysis, etc. on the occurrence of the recent earthquake and tsunami will be conducted, and the findings will be reflected on the seismic back check. The current seismic back check will be accelerated and terminated at an early timing. In addition, we will consider whether it is necessary to legally require conformity to the revised Regulatory Guide for

Reviewing Seismic Design of Nuclear Power Reactor Facilities (introduction of backfit), with the aim to implement them within the next three years. Furthermore, we will consider whether further revision of the regulatory guide (including the classification of the importance of facilities) based on the recent accident is required. Regarding back checks, we will consider whether means to implement anti-earthquake and tsunami measures by setting target levels in advance would be required, since it takes a long time to estimate earthquakes based on historical earthquakes and tsunamis, and fault investigations. In addition, we will consider whether the establishment of seawalls and other anti-tsunami measures should be included in the regulations.

Furthermore, since measures against terrorism, which is another external event, are becoming more and more important in recent years, and because the measures that take into account the recent accident are also conducive to effective counterterrorism, we will request the utilities to establish measures to further enhance protective measures, by thoroughly implementing intrusion prevention of unauthorized personnel, etc. by collaborating with the security authorities in order to make assurance doubly sure.

・Securing power supply

We will request the utilities to establish measures for securing emergency power supply such as installing large capacity secondary batteries, and making them rechargeable from existing back-up power supplies, distributed deployment of control equipment and power panels that are important for safety, such as by placing them on higher floors or grounds in order to prevent total loss of function due to flooding, seismic reinforcement of switchyard facilities, seismic enhancement of fuel tanks for emergency power supplies, and improvement of fuel oil procurement systems necessary for securing emergency power supply, etc. We will also consider whether the diversification of cooling methods of on-site power supplies (e.g. air-cooling and water-cooling) should be legally required.

・Securing reliable cooling functions for reactors and PCVs

We will request the utilities to establish measures necessary for obtaining the water source for injecting water into the reactors and PCVs, such as seismic reinforcement of water intake pits and large size fresh water tanks, measures required for obtaining the secure means of water injection, such as enhancement of inspection on PCV spraying equipment, etc., installation of suction pumps at storage ponds and seawater pits, and installation of pumps and injection equipment that will enable external injection into the reactors and steam generators without power supplies (e.g. DG-driven pumps, pressurized pumps, etc.). Furthermore, we will request the utilities to establish necessary measures for securing heat sinks in order to remove waste heat from decay heat and components, etc. by installing water intake pits for cooling using seawater, deployment of reserve intake pumps, diversification of intake points, and development and establishment of air-cooling type cooling systems, etc.

・Securing reliable cooling functions for the Spent Fuel Pool

We will request the utilities to establish measures required for obtaining secure cooling functions for the Spent Fuel Pool such as seismic reinforcement of pipes, etc. that are part of the Cooling System for the Spent Fuel Pool, obtaining power supply for the water level gauge and temperature gauge of the Spent Fuel Pool from emergency power supplies, enhancement of the inspection of cooling pumps, etc. for the Spent Fuel Pool, enhanced monitoring (ITV, etc.) of the condition for the Spent Fuel Pool, and the introduction of dry cask storage. We will also review the regulation regarding the storage (e.g. location, storage period) of spent fuel.

・Thorough implementation of accident management (AM)

The government will examine measures to prevent severe accidents that occur only rarely but can cause tremendous damage by reviewing design requirements and utilizing the Probabilistic Safety Assessment (PSA) methodology. We will also legalize the AM measures with expanded coverage. In this process, we will establish and utilize the methodologies for fire and earthquake PSA.

*Probabilistic Safety Assessment (PSA): The methodology for calculating the probability of core damage due the occurrence of an initiating event such as the loss of external power supply. By utilizing the PSA method to identify design vulnerabilities in advance, we can use the information to prevent accidents from occurring or exacerbating.

・Response to issues regarding multiple reactor locations

We will request utilities to establish measures required to respond to issues where multiple reactors are located on the same site, such as proper isolation of units and buildings to ensure safety, and obtaining independence of the locations of multiple units from an engineering standpoint, etc. (such as appropriate layout of reactor buildings and turbine buildings).

・Basic design considerations for the layout, etc. of NPSs

We will consider whether to review the regulations regarding storage (e.g. location) of spent fuel (already announced) and require the utilities to place reactor buildings and turbine buildings based on appropriate layouts (already announced).

・Water-tightening of the important equipment and facilities

We will request utilities to establish measures required for making important equipment and facilities water-tight, such as placing control equipment that are important for safety in dispersed locations and on higher floors or ground. (Already announced.)

2. Enhancement of Measures Against Severe Accidents

・Reinforcement of measures against hydrogen explosions

We will request utilities to establish measures required for reinforcing the measures against hydrogen explosions such as implementation of measures to prevent hydrogen buildup by installing combustible gas concentration control systems in BWR reactor buildings, installation of hydrogen detectors inside the BWR reactor buildings based on investigation of the event (leakage path) that occurred in TEPCO's Fukushima Dai-ichi NPS, installation of hydrogen venting equipment (hydrogen vents) in the BWR reactor buildings, and installation of static/catalytic hydrogen bonding equipment for PWR PCVs.

・Enhancement of PCV venting systems

We will request utilities to establish measures required for enhancing PCV venting systems by installing filters, etc. in the vents, evaluating and reviewing the design and operation conditions of the rupture discs, installing accumulators in the AO valves of the vents, and enhancing the independence of the vent exhaust line (prevention of leakage to the neighboring reactor unit) assuming an accident scenario.

・Enhancement of accident response environment

We will request utilities to establish measures for enhancing the environment for responding to accidents such as reinforcing the communication system (diversification of power supplies, etc.), enhancing the functionality of the emergency response office (earthquake resistance, shielding, securing capacity of accommodating the required personnel, etc.), and seismic reinforcement of the administrative building, etc.

・Enhancement of training for responding to sever accidents

We will request the utilities to enhance training to respond to severe accidents envisioning severe accidents caused by incidents such as a rupture of the primary coolant pipe, etc., which become prolonged and aggravated.

We will also request the utilities to enhance training for anti-terrorism which is becoming more and more important in the recent years.

・Enhancement of instruments to assess the situation of reactors and PCVs

We will request utilities to enhance instruments for assessing the situation by developing and equipping the instruments for RPVs, PCVs and Spent Fuel Pools that function sufficiently even in a severe accident.

・Maintenance of supplies and equipment for emergency response and establishment of rescue teams

We will request the utilities to establish a central control system to manage the emergency supplies and equipments including robots and unmanned helicopters, to establish a rescue team that has a good disaster response expertise to operate this equipment, and to enhance collaboration with authorities concerned.

3. Enhancement of Nuclear Disaster Response

・Facilitation of local and central decision making processes

The government will enhance the facilities in the off-site centers including communication systems and review the operation manual of them.

In addition, we will arrange alternative centers (back up off-site centers) and reinforce the frontline bases (for on-site activities) on the NPS site, functions of which are equivalent to those of J-Village and Onahama Call Center had currently. Through these measures, the local Nuclear Emergency Response Headquarters will be able function more sufficiently in terms of both hardware side and software side.

Furthermore, we will consider improving network between all utilities and related authorities by the TV conference system for the emergency, which currently connects the prime minister's office and government agencies, including NISA.

Moreover, by reviewing the relevant laws and regulations, we will consider reinforce the relevant laws to enable the local and government headquarters, the central government, the off-site and on-site center to respond quickly.

・Enhancement and reinforcement of nuclear disaster drills

The government will consider enhancing and reinforcing comprehensive disaster-preparedness drills by clarifying and disseminating information about the disaster response procedures, etc. based on the challenges seen in the response to the recent accident at TEPCO's Fukushima Da-ichi NPS.

・Response to combination of natural disasters and nuclear accidents

The government will review measures not only for individual disasters, but also for combination of disasters in the Central Disaster Prevention Council, etc., in a cross-ministerial manner. The agenda will include the review of full readiness and the command structure of the relevant ministries. The local governments will be requested to reflect the outcome of the discussion on their disaster prevention plans.

・Enhancement of environmental monitoring

The government will establish measures to enhance environmental monitoring by establishing procedures to promptly collect and disclose on-site and off-site monitoring data, enhancing unmanned airborne monitoring, and introducing wide-area diffusion assessment in order to build a structure to implement environmental monitoring in a steady and planned manner.

・Enhancement of public relations

From the viewpoint of enhancing information disclosure to the public and issuing instructions for evacuation, etc. to residents in the surrounding areas, the government will consider expanding the Emergency Planning Zone (EPZ)and request the local government to review the disaster prevention plan, and also establish procedures of publication about the evaluation of the accident and the progress of the accident response (risk communication).

・Enhancement of response to assistance from foreign countries and information provision to the international community

The government will confirm and strengthen the collaborative structure within the government and with donor countries in order to receive assistance such as supplies and equipments from foreign countries. With regard to the provision of information to the international community, we will improve the relevant international frameworks, offer more accurate information promptly that will facilitate response based on scientific grounds, and review the way information is shared with other countries, international organizations and foreign media.

・Improvement of estimation of the impact of the release of radioactive materials

The government will enhance the ERSS (Emergency Response Support System) to obtain data about the impact of the release of radioactive materials more accurately and inclusively, establish the procedure of swift publication about the drawings of the release of radioactive materials on an hourly basis from SPEEDI, and introduce wide-area diffusion assessment.

・Clarification of the standard of wide-area evacuation and radiation protection standards during a nuclear accident

The government will review the Emergency Planning Zones (EPZ) related to radiation protection, establish standards for foods, and establish the standard of the exposure of the general public divided into those for adults and children during a nuclear accident.

4. Enhancement of the Infrastructure for Securing Nuclear Safety

・Enhancement of the nuclear safety regulations and emergency preparedness and response system

The government will clarify the mandate of each ministry and agency related to nuclear safety regulations and environmental monitoring, by separating NISA from the Ministry of Economy, Trade and Industry, and starting discussion about the other organization such as NSC.

The government will also improve disaster prevention scheme, including emergency response at the plants, evacuation and securing the safety of residents, assistance for nuclear sufferers, environmental monitoring, radiation protection (suspension of shipment of foods and restriction of intake of foods and tap-water), medical support and anti-terrorism measures, through reforming the roles, mandates and organizations and expanding.

・Reform of Provision and enhancement of the regulatory framework, standards and guidelines

The government will review the regulatory framework and standards related to nuclear safety and emergency preparedness and response incorporating the findings from the causes of this accident, and consider legislations of so-called back fit, which applies new laws and regulations to already licensed facilities. In addition, based on the analysis of the recent accident, we will conduct detailed evaluation on whether the deterioration based on aging (such as embrittlement, fatigue, thermal aging, cable insulation deterioration of the PCV) has any effect on the damage or decline of functions of the facilities. We will also verify the connection between the types of reactors and the cause of the accident, as well as evaluate and improve the reactor designs (by utilizing periodic safety reviews, etc.) in order to improve the reliability of the existing reactors based on the technological advancement in reactor designs.

・Securing human resource related to nuclear safety and emergency preparedness and response

In order to obtain sufficient personnel related to nuclear safety and emergency preparedness and response, the government will work with the utilities to strengthen collaboration with educational institutions to build a network of nuclear specialists, enhance HR development in regulatory agencies and specialized agencies, conduct active hiring and exchange of specialists between the public and private sectors, and organize specialists to enable response from both on-site and off-site centers.

・Enhancement of regulatory requirements to ensure independence and diversity of safety systems

The government will consider safety regulatory requirements about locations of safety equipments such as emergency power generators and seawater cooling systems (e.g., location of a seawater intake), and also about independence and diversity of cooling methods.
(E.g., Dispersed layouts taking into account hazards such as tsunami, and adoption of both air-cooling and seawater cooling methods).

・Effective utilization of Probabilistic Safety Assessment (PSA) methods for risk management

The government will review the design requirements for NPSs, promote the introduction of PSA for fires, earthquakes and tsunami, and develop legislations for measures against severe accidents, in order to realize measures to improve safety utilizing the PSA methodology.

5. Comprehensive Implementation of a Safety Culture

・Comprehensive implementation of a safety culture

The government and utilities will establish organizational safety targets, promote, evaluate and improve activities to foster the safety culture among individuals and organizations, enhance collaboration with educational institutions and train personnel for the regulatory agency so that every person engaged in nuclear power will be familiar with a safety culture and make continuous improvements for nuclear safety.