Measures Taken at Fukushima Daiichi Nuclear Power Station and Fukushima Daini Nuclear Power Station (December 2011 Edition) List of Documents

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○ Appendix: Voices of field workers

Concerning the records and plant data on accidents at Fukushima Daiichi Nuclear Power Station, refer to the “Records of Operations Relating to Accidents at Fukushima Daiichi Nuclear Power Station and Records of Accidents at the Nuclear Reactor Facilities” (released by TEPCO on April 26 and May 16, 2011) and “Measures Taken Based on Plant Data at Fukushima Daiichi Nuclear Power Station During Earthquake” (released by TEPCO on May 24, 2011). Concerning records and plant data on accidents at “Fukushima Daini Nuclear Power Station, also refer to the “Plant Data, etc. of Fukushima Daini Nuclear Power Station during the Earthquake” (released by TEPCO on August 10, 2011).

End

State of Immediate Response after Disaster Struck at Fukushima Daiichi Nuclear Power Station

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

○ Activities immediately after "14:46 of March 11 when the Tohoku-Pacific Ocean Earthquake occurred until the arrival of first tsunami wave at 15:27"

[Situations when the earthquake occurred]

・ Units 1 to 3 were in service, while Units 4 to 6 were undergoing a regular inspection. Unit 4 was in the process of exchanging shrouds. Unit 5 was undergoing pressure and leak tests of the Reactor Pressure Vessel. Thus, many tasks were in progress on these spots.

Main Office Building

・ At 14:46 on March 11, an earthquake occurred. The vibration gradually began to cause violent shocks. Managers, etc. of departments in the main office building instructed subordinates to protect themselves by squatting down under their desks. Following the instructions, subordinates put on safety helmets and tried to protect themselves.

・ The vibration lasted for a long time. Some of the panels on the ceiling dropped; shelves on the floor fell; items slid off desks and were scattered on the floor and desks also slid around. Some workers were unable to move out of the slanting desks.

・ After the vibration ceased, the workers trapped under the slanting desks were rescued. Employees began to move into the nearby parking space, a designated evacuation location by the Seismic Isolated Building. Managers checked the number of subordinates to ensure none were missing at the parking space. One week or so before the earthquake, the power station held an evacuation drill to ensure workers knew the escape route and place.

・ The manager and staff members of the Disaster Prevention Department, while trembling, managed to reach the emergency broadcasting room and started to broadcast for evacuation. Partway through, however, the broadcasting facility suddenly malfunctioned and was no longer available. Subsequently, the manager and staff members with loudspeakers ran about calling for evacuation.

- The Main Control Room, through paging and PHS systems, issued a notice of the occurrence of the earthquake and for tsunami and evacuation. There was a worker who was unable to step down from the ceiling crane on the fifth story of the Unit 3 Nuclear Reactor Building. The crane operator, with the help of a flashlight, hurried to the spot and lit up the crane so that the worker could step down from it.
- Prior to the earthquake, an oil tanker at the harbor refueled heavy oil into a tank on land. After the earthquake, however, the oil tanker suspended the fueling due to the evacuation and moved offshore to guard against the anticipated tsunami.

[Measures taken by the Power Station Emergency Headquarters (hereafter the "Emergency Countermeasures Headquarters")]

- The emergency staff members moved into the Seismic Isolated Building to take emergency measures.
- The power generation team then begun to check the conditions of each of the plants after the earthquake. The Main Control Room reported to the Emergency Countermeasures Headquarters that Units 1 to 3 in service had successfully scrammed and stopped the reactors. Subsequently, the Emergency Countermeasures Headquarters received a report from the Main Control Room that the offsite powers had been lost and that emergency diesel generators (hereafter the D/Gs) had automatically started up.

[Measures taken by the Main Control Room]

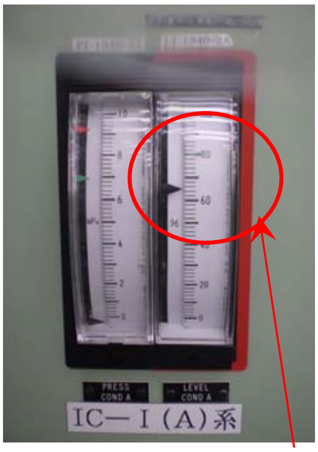
<Main Control Room of Units 1 and 2>

Main Control Room of Units 1 and 2
(photo taken later)

- When the earthquake occurred, a total of 24 operators, consisting of 14 operators on duty and 10 members of the work management group, were in service.
- After the quaking continued, operators started normal SCRAM response operations. The shift supervisor, remaining between the panels of Units 1 and 2, took the initiative and confirmed that the SCRAM was in effect Operators assigned to each of the control panels started monitoring the states under the instruction of the chief operator. The latter then reported the states of the plant and operations to the shift supervisor, who also confirmed that the offsite powers had been lost and that the D/Gs started up to charge the emergency bus lines. After

receiving a report that parameters indicated no problems, the shift supervisor anticipated that the current reactors could be settled (ended) with a cold shutdown.

- After the earthquake, the operator issued a notice concerning the occurrence of earthquake and a tsunami warning and evacuation to Units 1 and 2 through the paging system.
- At 14:52 the same day, an operator confirmed the auto startup of the isolation condenser (hereafter the “IC”) of Unit 1 due to a rise in reactor pressure. Because the reactor indicated an ordinary water level, operators used the IC to control the reactor pressure, and decided to start up the High Pressure Core Injection System (HPCI) if the Reactor water level were to decline.



IC (A) steam pressure gauge and water level indicator (Photo taken later)

IC (B) steam pressure gauge and water level indicator (Photo taken later)

The IC (A) water level that controls the reactor pressure was lower than the IC (B) water level (IC water level is usually approx. 80%). After the tsunami, the pressure indicators and water level indicators showed nothing.

- From 15:03 the same day, the reactor pressure of Unit 1 indicated a rapid decline. The Main Control Room decided that it would be unable to conform to the 55°C/h reactor cleanup water temperature drop rate specified in the operation procedure description, and once “fully closed” the isolation valves of the IC return pipe (MO-3A, 3B). Other valves were set to “open” in ordinary standby. Subsequently, the Main Control Room decided that one IC system was enough to limit the reactor pressure to within around 6 to 7 MPa, and started to operate system A alone by operating opening and closing of the isolation valve of return pipe (MO-3A) for the control of the reactor pressure.
- From 14:50 the same day, operators carried out manual startup of the Reactor Core Isolation Cooling system (hereafter the “RCIC”) of Unit 2. At 14:51, an operator confirmed that the RCIC system had stopped automatically due to high reactor water level stemming from water injected into the reactor. Subsequently, operators manually started up the RCIC system at 15:02, which had stopped automatically again at 15:28 due to high reactor water level. An operator would normally manually restart the RCIC system at 15:39.

<Main Control Room of Units 3 and 4>

- When the earthquake occurred, a total of 29 operators, consisting of nine operators on duty, 8 members of the work management group, and 12 members of the regular inspection team, were in service.
- During the earthquake, clouds of dust stirred up in the Main Control Room. After the quaking ceased to stop, operators started ordinary scamming. The shift supervisor received a report that the scramming had started. The shift supervisor confirmed that after the offsite power was lost, the D/Gs started up and charged the emergency bus lines.
- After the earthquake, the shift supervisor checked other operators for safety and issued a notice on the occurrence of the earthquake, a tsunami warning and an evacuation notice via on-site simultaneous paging.
- At 15:05, operators performed a manual startup of the RCIC system of Unit 3. At 15:25, the shift supervisor confirmed that the RCIC system had stopped automatically due to the high reactor water level, stemming from water injected into the reactor.

<Main Control Room of Units 5 and 6>

- When the earthquake occurred, a total of 44 operators, consisting of nine operators on duty, 8 members of the work management group, and 27 members of the regular inspection team, were in service.
- The shift supervisor at his seat checked the control panel and managed to protect himself until the quaking stopped. Other operators also managed to protect themselves by, for example, stooping down for safety while paying attention to racks and control panels. After the quaking stopped, with almost all alarms functional, the shift supervisor checked the alarms and confirmed that the offsite power was lost and that the D/Gs started up and charged the emergency bus lines.
- After the earthquake, the shift supervisor issued a notice concerning the occurrence of the earthquake and tsunami and evacuation to work sites through paging and PHS systems. Operators on duty gathered together in the waiting room at the work sites before returning to the Main Control Room.
- Although operators tried to monitor the anticipated tsunami with the integrated TVs (ITVs) fixed outside, they did not work.

○ Activities after “15:42 of March 11 when the Power Station Disaster Control HQ

<u>decided and reported on the loss of all the AC power supplies”</u>

[Situation when the tsunami flooded]

- At 15:27, the first tsunami struck, followed at 15:35 by the second tsunami. Operators at the Main Control Room, Seismic Isolated Building, and the parking space (evacuation place) did not hear the sound of these tsunamis. The Main Control Room reported to the Emergency Countermeasures Headquarters that the D/Gs had stopped. Subsequently, the Main Control Room informed the Emergency Countermeasures Headquarters that seawater had reached the entrance of the service building. The Emergency Countermeasures Headquarters also began to confirm the arrivals of the tsunamis.

Some 50m tall spray of tsunami

- At 15:42 the same day, the Power Station Disaster Control HQ decided that what had happened in the nuclear power station was the “loss of all on-site AC power supplies,” which is an event categorized under Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (hereafter the “Nuclear Disaster Prevention Act”). Accordingly, the Power Station Disaster Control HQ reported the event to the competent government departments and agencies.
- At 16:36 the same day, the Power Station Disaster Control HQ was unable to check either the reactor water levels of Units 1 and 2 or water injection and, therefore, deemed the event to be subject to Article 15, Inability of the Emergency Core Cooling to Inject Water System (ECCS), of the Nuclear Emergency Act, and reported to the competent government departments and agencies at 16:45.

Tsunami destroying the breakwater over 10m tall and flooding over

Entire areas of Units 1 to 4 flooded in the tsunami

Tank deformed in the tsunamis
(One of the tanks in the photo above)


Seaside after the tsunamis struck

[Measures taken at the Main Control Room]

<Main Control Room of Units 1 and 2>

- The alarm and status indicators started blinking and then went out all at once. The alarm sound also ceased. Silence prevailed throughout the Main Control Room for a moment. Operators were initially unsure what had happened and wondered whether the things happening in front of them were real. An operator rushed into the Main Control Room from his work site and shouted that seawater was flooding the Power Station site. The operators in the Main Control Room realized that tsunamis were flooding the site.
- The D/Gs ceased to work. All of the AC power supplies were also lost. The Unit 1 side of the Main Control Room had one emergency light alone while the Unit 2 side blacked out. As instructed by the shift supervisor, operators began to check whether each of the facilities was operable.
- To distinguish facilities that could function on DC power supply and those that could not, operators tried to check the IC and HPCI states of Unit 1. Since the status indicator of the IC had already gone out, operators were unable to check whether the IC was opened or closed. Meanwhile, since all the status indicators of the control panel for the HPCI system had gone out, the system was in no state to start up. The operator was unable to identify the status of the RCIC system of Unit 2. The status indicator of the control panel of the HPCI system had gone out and was in no state to start up. The Main Control Room also confirmed around 15:50 that the reactor water levels were also unknown.
- PHS was finally unavailable for use to communicate between the Main Control Room and the Emergency Countermeasures Headquarters. Only two hotlines were available between them. (The situation was the same with the Main Control Room

of Units 3 and 4, and 5 and 6.)

<Main Control Room of Units 3 and 4>

- The D/Gs ceased to work. All of the AC power supplies were lost. However, the status indicators of the RCIC and HPIC systems of Unit 3 that function on a DC power supply remained lit up.
- Since all the AC power supplies were lost, the Main Control Room had only emergency lights. Operators began to use LED lights for lighting. They had been introduced in February to patrol work sites. Unit 4 had been regularly inspected. Thus, operators focused on checking the parameters of facilities and the reactor water level of Unit 3.
- Pursuant to the operation procedure for the loss of all AC power supplies, operators tried isolating loads, except for the minimum loads required for monitoring and operational control, so that the accumulators needed to operate and control the RCIC and HPCI systems could last as long as possible.
- At 16:03, the operator turned on the switch to restart the RCIC system in the Main Control Room and checked the reactor water level, RCIC discharge pressure, and the number of revolutions to ensure the reactor water level.

<Main Control Room of Units 5 and 6>

- Operators confirmed that two D/G units for Unit 5 and two D/G units of Unit 6 had stopped working due to the tsunamis. Another D/G of Unit 6 continued operating after the frequency was adjusted.
- The Main Control Room of Unit 5 lost lighting. The remaining emergency lights gradually went out and the room finally blacked out. Lighting of Unit 6 remained as usual.

[Fire brigade's escape guiding and tsunami monitoring]

- After the earthquake, the fire brigade changed into their uniforms in the Seismic Isolated Building and stood by.
- Since tsunamis arrived repeatedly, members of the fire brigade stepped outside and went up a slope road, called “Shiomizaka” (a slope road leading to the seaside), up to the five-forked junction, where they guided people escaping from tsunamis and stopped people and vehicles intending to head for the seaside. Some of them tried to return to the work site to fetch their personal belongings. However, the five-forked junction overlooked an approaching tsunami. The fire brigade barred their way.
- At around 18:00 the same day, the fire brigade received the Site Superintendent's

instruction to monitor tsunamis. Near the Training Center building located on a height near the sea, members of the fire brigade began to monitor tsunamis during work shifts lasting two- to three hours. After the blackout, the lights of the service vehicle were turned toward the seaside to allow continued monitoring. Before dawn on March 12, the fire brigade received notice that Unit 1 was going to have venting. Thus, the members sheltered in the Seismic Isolated Building.

[Checking the on-site road for soundness]

- At around 16:00 on March 11, there was a report that the road near the main gate had subsided. Two TEPCO employees, together with workers of contractor companies, put on work uniforms, winter clothing, and safety helmets, and went out on foot to the main gate to check the on-site roads for soundness. Although some spots of subsidence remained in the nearby road outside the main gate, vehicle traffic could still pass.
- The employees with the workers went around from the main gate to check the road to the west gate and then went back inside the site.
- Subsequently, the employees with workers headed for the seaside through the on-site road in front of the office building to check the conditions of the road leading to Units 1 to 4. However, there was a heavy oil tank on the road that had been washed there in the tsunamis. Since the tank on the road prevented vehicle traffic, the workers walked off the on-site road to the rear side of the building on the seaside to check the Shallow Draft Quay and roads on the seaside leading to Units 1 to 4.

A heavy oil tank washed away in the tsunami onto the road
(Diameter: 11.7ｍ×Height: 9.2m）

A heavy oil tank was washed away in the tsunamis up to a place near the north side of the Unit 1 turbine building.

- It seemed excessively time-consuming to check the on-site roads for soundness on foot. Thus, the TEPCO employees and workers of contractor companies returned once to the Seismic Isolated Building, reserved and drove a service vehicle through the on-site roads allowing traffic and headed for the seaside. The road on the seaside was full of debris and there was only enough width to barely allow one vehicle to pass.


In-site road with cracks that bars vehicle traffic

- Next, the service vehicle of the employees and workers headed for Units 5 and 6. However, the vehicle was unable to enter the protected areas there. Subsequently, the vehicle headed for the mountainside and, after a while, identified spots of subsidence in the road. Leaving the service vehicle, the passengers started walking ahead on foot to check the condition of the subsided road. It was identified that the slope on the west side of the Unit 5 Reactor Building had subsided, followed by a landslide on the slope, preventing vehicle traffic.
- They returned to the coming road and then headed for the road accessing Units 5 and 6, which are located closer to the mountainside, to check the road for soundness. The access road had bumps on their way to the reactors. Vehicle traffic was impossible. The road needed restoring before the coming recovery of the Power Station.
- At 19:24 March 11, the two TEPCO employees reported to the Emergency Countermeasures Headquarters the results of their road checks for soundness that vehicle traffic could pass via the west gate; traffic in front of the former main office building was unavailable; traffic on the seaside of the Unit 2 turbine building was unavailable; traffic on the Shallow Draft Quay was unavailable due to scattered debris in the area; and there was subsidence 35cm deep in the slope on the west side of the Unit 5 Reactor Building.

[Restoration of on-site roads]

- Based on the checks of on-site roads for soundness, the Power Station Disaster Control HQ decided to restore the access road to Unit 5 and 6.
- The Power Station Disaster Control HQ asked a contractor company, which had mainly been engaging in work to reinforce the earthquake-resistance of the Power

Station, to prepare heavy equipment, and obtained a backhoe (hydraulic excavator) and a dump truck that could transport ballast to fill in bumps in roads.

- Three TEPCO employees who put on service uniforms, winter clothing and helmets left for the road for recovery. In cooperation with the workers of the contractor company, which had brought heavy equipment into the Power Station site, a total of some ten workers started recovery. In addition to ballast brought in by the dump truck, aggregate and ballast, obtained after the pavement of a road, where the traffic on one side was unavailable, was stripped off and used for recovery. The backhoe operating on one side of the road filled in bumps on the other side of the road for recovery.

Damage to the access road to Units 5 and 6
(After restoration. Some pavement on the other side was stripped to obtain ballast and gravel to fill in bumps on the other side of the road.)

- By 22:15 on March 11, recovery was completed. Traffic on the access road to Units 5 and 6 became available. The completion was reported to the Emergency Countermeasures Headquarters.
- After the completion of the recovery, the backhoe was parked by the gymnastic hall for the next operation.

[Reserving routes into the protected areas]

- The gate in the protected areas on the side of Units 1 to 4, which had been used previously, was washed away in the tsunamis, while the roads surrounding the gate at the seaside had scattered debris, making any vehicle traffic impossible.
- On the evening of March 11, the recovery team left for the work site to open gates in other protected areas. The gate near the Seismic Isolated Building was in no state to open due to driftwood, material and equipment having washed there in the tsunamis. Thus, the recovery team decided to open the gate located between Units 2 and 3.
- At around 19:00 on March 11, the team used tools to open the gate between Units 2 and 3 and reserved a vehicle traffic route leading to Units 1 to 4.

[Restoration of temporary lights in the Main Control Room]

- Lights in the Main Control Room had already been lost. Pursuant to an instruction of the Emergency Countermeasures Headquarters, three to four members of the recovery team and seven workers of contractor companies started to reserve lights in the Main Control Room.
- The recovery team installed a compact-type power generator, owned by a contractor company, in the power transformation area on the mountain side of the Reactor Building of Units 1 and 2 and at the entrance of the service building of Units 3 and 4, respectively.
- The recovery team used cable reels to connect the compact-type power generators to the Main Control Rooms of Units 1 and 2 and Units 3 and 4 prior to connecting to the temporary lights. At 20:47 the same day, temporary lights were lit up in limited areas of the Main Control Room of Units 1 and 2 then, at 21:27, in limited areas of the Main Control Room of Units 3 and 4.
- Subsequently, the compact-type power generators were periodically refueled.

Working with a temporary light at the vice shift supervisor seat

[Restoration of instruments in the Main Control Room]

- To restore instruments in the Main Control Room, the recovery team started to prepare the necessary drawings and collect accumulators and cables from other contractor companies on the Power Station site. Work teams, each consisting of two to three members, left the Seismic Isolated Building on foot to visit the on-site offices of other contractor companies. Accumulators collected from them were loaded on the service vehicle loaned from a contractor company and transported through the gate between Units 2 and 3 into the Main Control Room of Units 1 and 2.
- The work teams brought what they could collect into the Main Control Room of Units 1 and 2 one after the other and checked their drawings prior to starting to connect them to the instrument panel in the Main Control Room. An event had occurred, which was classed under Article 15, Inability of the Emergency Core Cooling System to Inject Water (ECCS), of the Nuclear Emergency Act. Hence, the top priority was to grasp the state of water injected into the reactors. With this in mind, work teams started to connect a series of accumulators to the reactor water

level indicators that functioned on a DC power supply for recovery.

- Even after temporary lights had been installed in the Main Control Room, the rear side of the control panel, namely the work site, remained black due to the lack of penetration of lighting from the temporary lights. Using flashlights, however, the work teams checked the wiring diagram for cable numbers, made wiring terminal treatment, and started to connect cables pursuant to the wiring diagram.
- At 21:19 the same day, the reactor water level of Unit 1 was identified, which was followed by the reactor water level of Unit 2 at 21:50.
- Even later, the work team continued to collect accumulators by, for example, detaching accumulators from service vehicles in the Power Station site and requesting helicopters of the Self Defense Forces of Japan to airlift accumulators from Hirono Thermal Power Station.

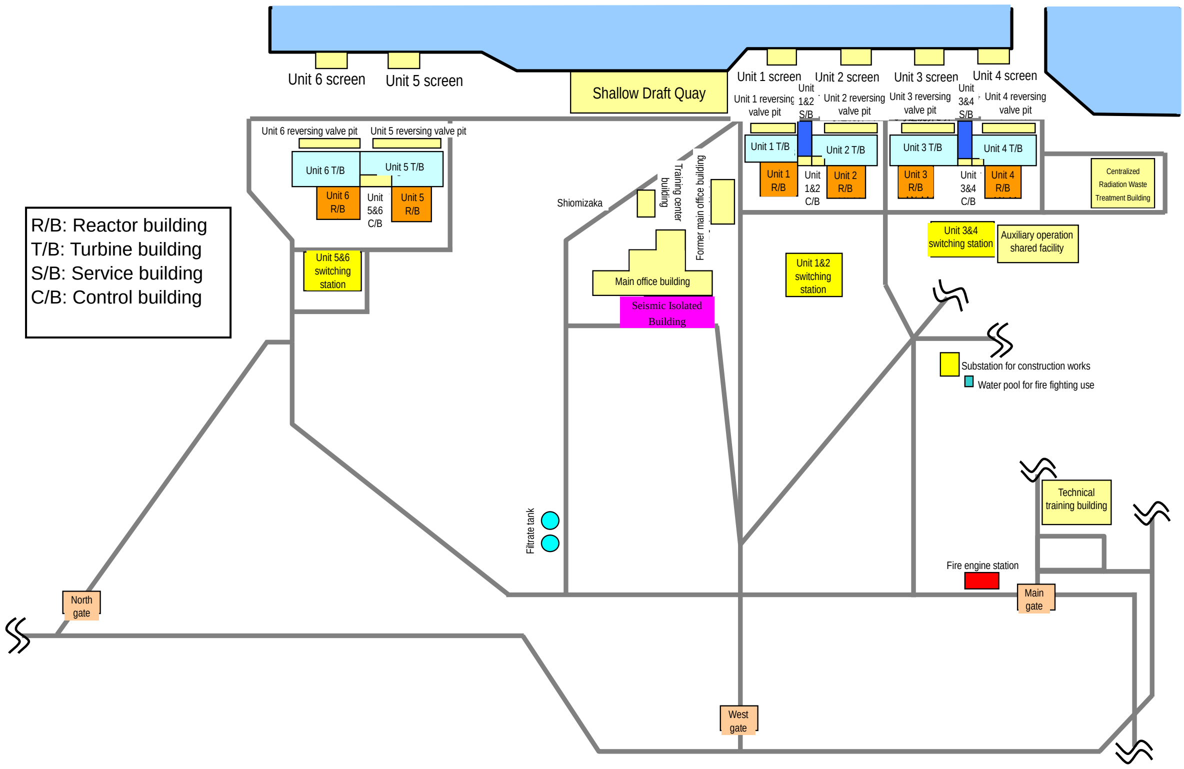
Instruments connected to temporary accumulators as power supplies

Checking indication values using flashlights

Accordingly, means of monitoring the state of the plant were reserved piece by piece, with the help of lighting along with the recovery of some instruments. Meanwhile, however, the work sites remained black. The work teams continued recovery with limited communication tools amid aftershocks and tsunami alarms.

Many of the employees engaged in recovery without confirming whether their family members were safe. Employees off duty on the day also came hurriedly to the Power Station one after the other. Operators encouraged each other with a firm determination to reunite with their families outside the Power Station after settling the event. Some operators dared to wear a wristwatch or ring, precious presents from their families, as talisman and as ID items in the unlikely event, prior to engaging in work. They were well aware that such personal belongings might need to be discarded if they were exposed to radiation.

Under these circumstances, operators and workers continued engaging in recovery work, including water injected into the reactors, Primary Containment Vessel venting and recovery of power supplies, under the command of the Site Superintendent to settle the accident. (For detail, refer to Measures Taken for Water Injection, Measures Taken for the Primacy Containment Vessel venting, and Measures Taken to Restore Power Supplies in the accompanying material.)



Site Map of the Fukushima Daiichi Nuclear Power Station

End

Measures Taken to Restore Power Supplies
at Fukushima Daiichi Nuclear Power Station

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

○ Activities after "15:42 on March 11 when a decision and report were made on the loss of all AC power supplies"

[Reserving power source cars]

- At 16:10 on March 11, the Power Distribution Department of the Head Office instructed all branch offices to reserve high-voltage power supply (HVPS) cars and low-voltage power supply cars and check the routes to transport them to the Fukushima Daiichi Nuclear Power Station (hereafter the "Power Station").
- At around 16:30 on March 11, the Headquarters of the Head Office requested other electric power companies to lend power source cars.
- At 16:50 on March 11, all the power source cars reserved at branch offices left for Fukushima one after another.
- At 17:50 on March 11, the Power Distribution Department of the Head Office requested the Self-Defense Forces of Japan to study the feasibility of transporting power source cars by helicopter due to the damage to roads and traffic jams on land that hindered the transportation of power source cars. Some 30 cars and vehicles owned by contractor companies and TEPCO employees were gathered in the grounds of the Power Station site. The area was then illuminated in order to build a simple heliport on the grounds.
- At around 18:15 on March 11, the Power Distribution Department confirmed that three HVPS cars from Tohoku Electric Power were heading for the Power Station.
- Although studies were made of the transporting power source cars by helicopter of the Self-Defense Forces of Japan and US helicopters, the power source cars were too heavy. Eventually, at 20:50 on March 11, The Power Station Disaster Control HQ gave up on the idea, whereupon all the power source cars available were heading for the Power Station on land.

[Checking the on-site conditions of power supply facilities]

- At around 15:30 on March 11, the Headquarters of the Head Office received a report that Shin-Fukushima Substation had sustained damage. (For details, refer to the "Report Regarding Collection of Reports pursuant to the Provisions of Article 106 Paragraph 3 of the Electric Utility Act" (May 16, 2011)).

- Under tsunami warnings and aftershocks, the Headquarters was aware that checking the conditions of the power supply facilities was essential for the restoration of power supplies. Several experienced members of the restoration team volunteered to conduct on-site surveys. Some posed questions concerning the on-site survey on the seaside due to the risk of incoming tsunamis. However, the task of restoring the power supply was crucial. At 16:39 on March 11, the restoration team was subdivided into station and offsite power supply teams and headed for surveying the spots.

<Station power supplies>

- Debris scattered on the road along the offshore area. Manholes were uncovered. There were many areas of subsidence in the road. A total of four members of the restoration team, etc. started to check the on-site conditions,
  - When the team members entered the Unit 1 Turbine Building via the bulk delivery entrance and checked the 6.9kV high-voltage power supply panel (hereafter the “M/C”) and the 480V low-voltage power supply panel (hereafter the “P/C”) installed on the first floor, the team identified traces of flooding.
  - Secondly, the team headed for the electric equipment room located on the basement floor of the Control Building that encompassed P/C (IC) (ID) and the DC power supply facilities. Since flooded water still covered the sluice (height: 30 to 40 cm) of the electric equipment room, remote visual inspection confirmed traces of the submerged P/C (1C) (1D).

State of M/C on the first floor of the Unit 1 Turbine Building

(Trace of a mud line on the M/C fence submerged in the tsunami (photo taken on a later day))

  - The team then headed for the emergency diesel generator (hereafter “D/G”) room on the same floor, and confirmed a flood trace approx. 1m deep and the submerging of the D/G (IA) control panel and the main D/G unit in the D/G (1B) room lower down.
  - The team then headed for the electric equipment room, housing the Unit 2 P/C on the first floor of the Unit 2 Turbine Building. Although the floor surface of

the electric equipment room was covered with floodwater approx. 5cm deep, the Unit 2 P/C showed no trace of submergence.

- The restoration team tried heading for the basement floor to check the Unit 2 M/C and DC power supply facilities. However, they had to give up attempts to progress further because they identified water approx. 1.5m deep on the basement floor.
- After checking the power supply facilities in the building, the team headed for the Main Control Room of Units 1 and 2. Although a limited number of status indicators were lit on the Unit 1 side, the Unit 2 side remained black.
- The team members left the building, passing a heavy tank that had been washed onto the road in the tsunami, and headed for the outside transformer areas. Although the transformer areas of Units 1 and 2 showed no apparent damage to the equipment, the team confirmed traces of submergence in the tsunami.
- A trailer and debris that blocked traffic were on the road. Thus, the team passed by the trailer to head for the transformer area of Units 3 and 4. All equipment was apparently undamaged. However, the team identified traces of submergence in the tsunami.


Units 3&4 transformer area after a trailer and debris were cleared aside (photo taken on a later day)

- The team then headed for the bulk delivery entrance of Units 3 and 4 in the Turbine Building to check the on-site power supplies for Units 3 and 4. The team, however, was unable to enter the building because of the truck and debris scattered deep behind the bulk delivery entrance of Unit 4. Since the shutter of the bulk delivery entrance of Unit 3 was closed, the team members were unable to enter the building. Subsequently, the team returned to the Seismic Isolated Building.

・ At around 20:56 on March 11, the following states of on-site power supplies, together with the results of inspections conducted by operators, were reported to the Power Station Disaster Control HQ:

- Unit 1: The M/C and P/C were unavailable.
- Unit 2: The P/C might need reworking, while the M/C was not operable.
- Unit 3: The M/C and the P/C were not operable.

<Offsite power>

- Three to four members of the restoration team headed for the switching stations to check conditions of offsite power.
  - ➢ The team identified damage to circuit breakers, etc. in the switching station of Units 1 and 2.
  - ➢ Secondly, the team headed for the substation for the construction work on the 66kV TEPCO Nuclear Power Line. The equipment in the substation for construction works was apparently undamaged. When members checked the on-site power supplies side, however, the team identified a trace of submergence on the M/C, receiving facility, whereupon it was almost impossible to restore offsite power based on the TEPCO Nuclear Power Line.
  - ➢ Subsequently, the team returned once to the Seismic Isolated Building to report on the conditions of the on-site surveys.
  - ➢ The team joined the preparation of a simple heliport in the on-site grounds to receive helicopters transporting power source cars. At 20:34 on March 11, the team headed for the switching station of Units 3 and 4 to check the conditions. Although equipment was apparently undamaged in the switching station of Units 3 and 4, the team identified a trace of submergence in the tsunami.

Part of the circuit breakers, damaged in the tsunami, in the switching station fell off.

- Based on on-site checking of station power supplies and offsite power, it emerged that an early restoration of offsite power was difficult. It also emerged that an early restoration of the main D/G units and the M/C, etc. were difficult because they were flooded or submerged. Accordingly, the restoration team aimed to restore power supplies with the station power supply facilities and available power source cars.
- Along with on-site checks, the Engineering Department started offsite power restoration works, including restoration in the Shin Fukushima Substation, on and after March 12.

[Preparation of power supplies of Units 1 and 2]

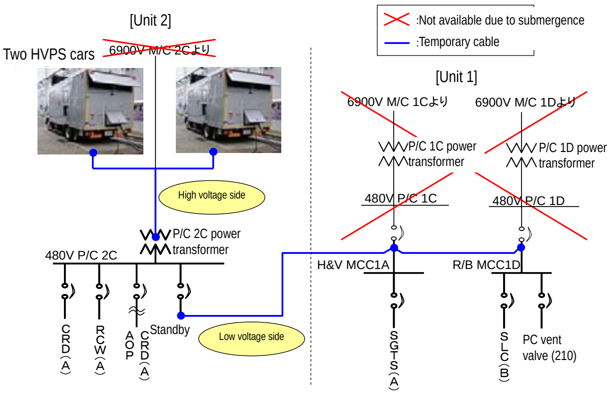
・ The water injection conditions in the reactors of Units 1 and 2 were unknown. Meanwhile, water was injected into the reactor of Unit 3, hence the restoration team focused on the restoration of power supplies to Units 1 and 2. Since the evening of March 11, the team started preparations to restore power supplies by, for example, arranging cables and selecting restoration equipment items.

- The team decided to use the Unit 2 P/C (2C) power transformer (6.9kV/480V), among the potentially operable prospective Unit 2 P/Cs, to restore power supplies after considering the loads of connected cables and their ease of laying, etc. In darkness, the team members used flashlights to perform on-site checks and found that temporary cable penetration for regular inspections of the Unit 2 Turbine Building was available, hence the team decided to park an HVPS car in the vicinity.
- For the initial restoration equipment item, the team, instructed by the Power Station Disaster Control HQs, decided to restore the standby liquid control system (the "SLC") that could perform high pressure water injection into the reactor. To this end, the team checked power supply routes, such as the wiring of the 480V small-capacity low-voltage power supply panel (hereafter the "MCC") that is connected to different items of equipment.
- The team used the equipment layout diagram to determine the distances to lay temporary cables and estimated the distance between the 9kV HVPS car and the P/C (hereafter the "High-Voltage Side") to be approx. 200m and that between the 480V P/C or the MCC and the equipment items (hereafter the "Low Voltage Side") to be approx. 80m.

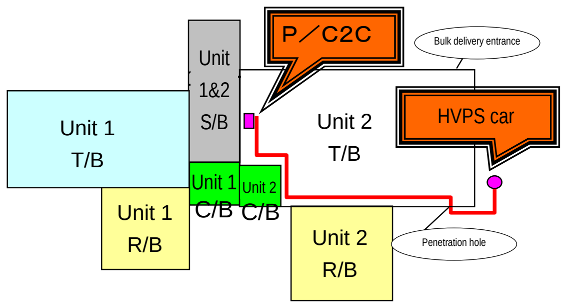
The cable in the photo, weighing 90kg, is approx. 15m long. A cable at least ten times longer than this one was used to restore the power supplies of Units 1 and 2.
(photo taken on a later day)

- The cable for the High Voltage Side was reserved for Unit 4 regular inspection engineering at the office of a contractor located near the Power Station (hereafter a "Contractor Office Outside Power Station Site"). The team started to cut the cable at the Contractor Office Outside Power Station Site. Several hours later, the team members, unaided, completed the cutting of cables from a cable drum approx. 2m tall. The team members wound them into an "8" shape to prevent them from being twisted during laying. At around 24:00 the same day, the members loaded the cables onto a 4t UNIC truck and drove into the Power Station site.

- At around 22:00 on March 11, it was confirmed that one initially dispatched HVPS car, sent by Tohoku Electric Power, had arrived at the Power Station site. After clearing debris scattered on the road during the tsunami and reserving a passage, the HVPS car was guided and parked at a point between Units 2 and 3.
- At around 22:00 on March 11, 3 TEPCO workers headed for the then closed bulk delivery entrance of the Unit 2 Turbine Building to open it and attempted to do so using tools. However, the entrance shutter remained closed. At around 24:00 the same day, heavy equipment from a contractor arrived, whereupon the shutter was opened and the team managed to clear a route to carry the High Voltage Side cable into the turbine building.
- To check the Unit 2 P/C (2C) for soundness and ensure no trace of submergence, three members of the restoration team headed for the Unit 2 Turbine Building. After arriving at the P/C (2C), the members started to remove the permanent cables connected to the P/C. With help of flashlights, the members used cutter knives to notch the insulation tapes folded and fused inside, spending several hours peeling them off the cable and finally removing the permanent cable. Subsequently, members used an instrument to check the insulation resistance and confirmed that the P/C could be operable.
- TEPCO employees other than electrical engineers were also mobilized to lay cables. Some 40 workers, together with workers of contractor companies, were mustered. Prior to laying cables, they received explanations on how to shoulder cables and their assignment to positions in the Seismic Isolated Building.



Route of power supplies of Units 1 and 2



Schematic diagram of cable laying route for Units 1 and 2

A High Voltage Side cable was carried into the building via the bulk delivery entrance and laid up to the P/C (2C) for connection. Subsequently, one end of the cable was laid out of the building via the penetration hole to the outside HVPS car parked near the building.

[Operations to restore the power supplies of Units 1 and 2]

- An HVPS car and a High Voltage Side cable arrived at the work site. Just before starting to laying the cable, an aftershock occurred. The restoration team moved the HVPS car and the High Voltage Side cable to elevation to avoid any tsunami, while the workers sheltered in the Seismic Isolated Building.
- The arrival of one TEPCO HVPS car was confirmed at around 01:20 on March 12. Since the TEPCO HVSP car arrived before starting work to connect the cable, the restoration team decided to use the car and parked it between Units 2 and 3. The HVPS car sent from Tohoku Electric Power, which had been evacuated to elevation, was subsequently moved and parked near the Seismic Isolated Building.

Image of laying cable

Workers upheld a cable at approx. 5m-long intervals or 30kg weight per worker

- Subsequently, the team started laying cables. Some 200m-long High Voltage Side cables, 10 or so cm thick, weighed one metric ton or more. Usually such cable laying with a machine requires a considerable number of hours. The manpower of some 40 workers focused on cable laying with greater urgency.
- During the cable laying, aftershocks occurred, which meant the workers had to

suspend cabling and evacuate onto the second floor of the Turbine Building for an hour or more.

- Workers in ordinary uniforms engaged in cabling. During the period from 4:00 to 5:00 on March 12, however, the radiation dose at the work site began to rise. After an evacuation order had been issued, all the workers evacuated to the Seismic Isolated Building.
- Subsequently, the restoration team reserved the required number of workers and prepared equipment before resuming cabling. The team continued laying the High Voltage Side cabling and the terminal treatment of the cable needed to connect to the P/C. Terminal treatment is special work where workers fix the terminals of a 3-phase (3-line) cable on other terminals to be connected. One cable must be treated at six points (3-lines x 2 (both ends)). It took a few hours for a few workers to complete such terminal treatment.
- Since an electric shock in the event of contact with the connecting points of the HVPS car or the High Voltage Side cable, the team gathered nearby frame scaffolds and built a frame to prevent access as a temporary measure.
- While continuing the High Voltage Side cabling, the team also laid that of the low voltage side. The team confirmed that a contractor within the Power Station site had reserved low voltage side cables in its warehouse. Cables were cut and carried for laying and connecting.
- Work in dark places, sumps, or nearby power supply panels involved the risk of electric shock. Thus, when a worker had a sump beneath his legs, another worker had to temporarily hold the tools and light the area because of the lack of any place to store the tools and flashlight.
- At around 10:15 on March 12, it was confirmed that 72 HVPS cars that had been sent by TEPCO branch offices and Tohoku Electric Power had arrived at Fukushima Nuclear Power Stations. In total, Fukushima Daiichi received 12 HVPS cars and seven low voltage power source cars, while Fukushima Daini received 42 HVPS cars and 11 low voltage power source cars. In addition, HVPS cars from the Self Defense Forces of Japan arrived.
- High Voltage Side cables were laid between the HVPS cars and the Unit 2 P/C (2C) power transformers. Low voltage side cables were laid between the Unit 2 P/C (2C) standby breaker and the Unit 1 MCC cable terminals. The team formed a power supply route to Unit 1 MCC via the Unit 2 P/C from the HVPS cars.

Terminals connected after treatment. Six points (3 lines × 2 (both ends)) needed connecting.

The photo shows connection with the same type of cables used for the restoration of power supplies (Photo taken on a later day)

Connecting a 3-line cable to the power supply panel. The 3-line cable terminals are fixed with bolts and rolled up in insulation tape.

- Two HVPS cars were used to check the Unit 2 P/C (2C) for access to electricity. At around 15:30 on March 12, the team started supplying electricity up to the point before the Unit 1 SLC pump. However, at 15:36, an explosion occurred at Unit 1, whereupon the team was unable to start up the SLC pump.

[Operation to restore the power supplies of Units 3 and 4]

- Following the preparation of cables for Units 1 and 2, the team used a Unic truck to transport a drum of the High Voltage Side cable reserved at a Contractor Office Outside Power Station to the work site and park it there temporarily to restore the power supplies of Units 3 and 4. The team decided to cut cables at the work site needed to restore the power supplies.

Approx. 2-meter tall cable drum (Photo taken on a later day)

○ <u>"Activities after" the explosion at the Unit 1 Reactor Building at 15:36 on March 12"</u>

[State after the explosion]

- Electricity to Unit 2 P/C (2C) was cut off. TEPCO workers and those of the contractor companies evacuated into the Seismic Isolated Building. Two TEPCO workers engaging in restoration were injured due to the explosion. Until checking the state of the explosion, the team was unable to continue further restoration. In particular, without knowing the cause of the explosion at Unit 1, the team was in no state to resume restoration around the same.
- The compact-type generators, installed overnight on March 11 to temporarily light

up the Main Control Room of Units 1 and 2, ceased to supply electricity due to the impact of the explosion.

[Restoration of power supply of Unit 3]

<Checking power supply facilities for soundness>

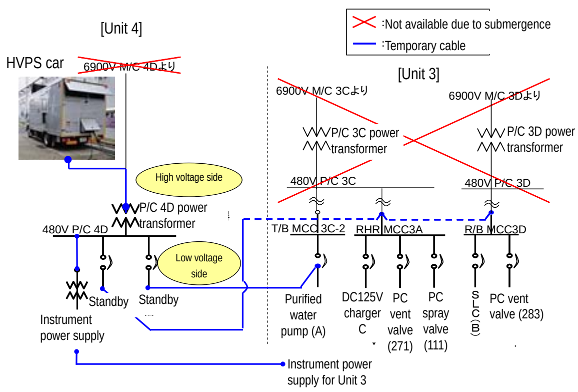
- Since the cause of the explosion at Unit 1 was unknown, the restoration team feared going out to the work site. After a while, two members, consisting of one experienced member of the restoration team and one member of the security team, decided to head and check whether the power supply facilities of Units 3 and 4 were available for restoration.
  - The two members entered the Unit 4 Turbine Building via the bulk delivery entrance, passed by a truck washed in the tsunami to a location far behind the entrance, advanced through the passage where debris was scattered, and headed for the electric equipment room on the first floor of the turbine building, The members confirmed that the Unit 4 P/C was apparently available for service.
  - Subsequently, the two members tried to head for Unit 3. En route, however, they found that the fire door had been deformed when walking through the control building between Units 3 and 4. Since there was no space to get by the deformed fire door, the two members decided to return to the Seismic Isolated Building.
- At 20:05 on March 12, the restoration team reported to the Power Station Disaster Control HQs that the Unit 4 P/C could be available for service.

<Preparation for restoration of power supplies>

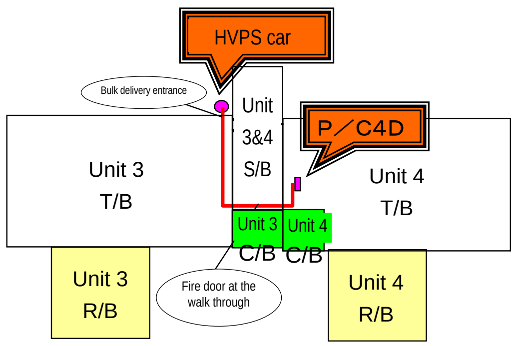
- The restoration team instructed by the Power Station Disaster Control HQ, decided to restore the SLC pump capable of performing high-pressure water injection into the reactor of Unit 3, PCV vent valves, charge panel of the DC power supply facility, etc.
- A backhoe was used to clear obstacles that had washed onto the road before parking an HVPS car. To reserve a cable laying route, the team requested a contractor to fetch compressed gas cylinders stored at the technical training facility in the Power Station site. The team then used the cylinders to fuse the closed shutter of the bulk delivery entrance of Unit 3 Turbine Building and the deformed fire door at the walk through of the control building between Units 3 and 4. The team reserved a cable laying route prior to dawn on March 13.
- The team confirmed that power supply cables for the High Voltage Side, which had been prepared by the team to restore the power supplies of Units 3 and 4, were

damaged and unavailable due to the impact of the explosion at the Unit 1 Reactor Building. At around 6:30 on March 13, two members of the restoration team, together with workers of a contractor, headed for the Contractor Office Outside Power Station Site to re-fetch the High Voltage Side cables. The workers completed the cutting of an approx. 280m-long cable for the High Voltage Side after a few hours and completed the terminal treatment of the cable at the contractor office.

- At around 6:30 on March 13, another restoration team, together with workers of a contractor, headed for the warehouse of the contractor at the Power Station site and completed the cutting of a cable for the low voltage side and the terminal treatment of the same.
- The restoration team reserved some 40 workers to prepare for laying cables. The team met at the Seismic Isolated Building to explain how to shoulder the cables and concerning the assignment of workers to positions. The workers put on full face masks, took iodine tablets, and engaged in other preparation. At around 10:00 on March 13, the workers started on-site cabling.



Power supply route of Units 3 and 4



Schematic diagram of a cable-laying route for Units 3 and 4

The restoration team fused the bulk delivery entrance shutter and the fire door at the walk through and laid a High Voltage Side cable to the P/C 4D from an HVPS car parked in front of the bulk delivery entrance.

<Operation to restore power supplies>

- The team started by laying the low-voltage side cables, the preparation of which had already been completed. During cabling, workers always worked in teams, because the inside of the building was in complete darkness and the number of flashlights was also limited.
- The restoration team laid a low-voltage side cable from the Unit 4 P/C (4D) up to a point immediately before the double door of the Unit 3 Reactor Building. When

members opened the double door to lay cable up to the MCC inside the double door, they found fog prevailing inside. The telecommunication equipment there was barely usable. The members returned to the Main Control Room and reported the conditions via a hotline to the restoration team. Subsequently, the team decided to stop any further cable laying, reeled in the cable and left it temporarily at the entrance at around noon on March 13.

- At that time, a High Voltage Side cable arrived at the work site and the team continued laying the High Voltage Side cabling. After completing the laying of a High Voltage Side cable from the HVPS car up to the Unit 4 P/C (4D), the team started up the service of the HVPS car at around 14:20 on March 13 and electricity was reconnected to the Unit 4 P/C (4D).
- In parallel with the cable laying mentioned above, the team laid another low-voltage side cable line. At around 14:36 on March 14, the team completed the laying of a low-voltage side cable from the Unit 4 P/C (4D) up to the MCC in the Unit 3 Turbine Building.
- Subsequently, to restore the measurement power supply for Unit 3, the restoration team appropriated the cable that had been left in front of the double door in the Reactor Building, to lay a low-voltage side cable from the Unit 4 P/C (4D) up to the measurement distribution panel of Unit 3. At around 4:08 on March 14, the team succeeded in restoring the water temperature gauges of the spent fuel pool of Unit 4 and part of the functions of the Containment Atmospheric Monitoring System (CAMS) of the Unit 3 Primary Containment Vessel.

[Restoration of power supplies of Units 1 and 2]

- At around 8:30 on March 13, the team started up an HVPS car to restore the power supply to the Unit 2 P/C (2C), to which power supply had been suspended due to the explosion at Unit 1. However, the team was unable to restore the power supply to Unit 2 P/C (2C). When checking the route for the cause, the team identified damage to the High Voltage Side cable.
- The team decided to cut off an approx. 30m-long section of damaged cable and replace it with new cable. Workers went to the Contractor Office Outside Power Station Site, cut off the High Voltage Side cable, and brought it to the work site before starting to replace the damaged cable. Just before resuming power supply to the Unit 2 P/C (2C), an explosion occurred at the Unit 3 Reactor Building,

<Restoration of temporary lighting for the Main Control Room of Units 1 and 2>

- The team replaced the compact-type generator that had been damaged due to the impact of the explosion at Unit 1 and fixed it at the entrance to the service building of Units 1 and 2. The team resumed power supply at night on March 12. Subsequently, operators periodically refueled the generator.

○ Activities after "11:01 of March 13 when the explosion occurred at the Unit 3 Reactor Building"

[States after the explosion and temporary evacuation]

- Electricity was cut off to Unit 4 P/C (4D). TEPCO workers and those of contractor companies who had been engaging in the restoration, etc. of power supplies of Units 1 and 2 evacuated into the Seismic Isolated Building.

[Restoration of power supplies]

Restored lighting in main control room (Unit 4)

- The Engineering and Power Distribution Department continued efforts to restore offsite power which had started since March 12. The departments continued spraying water in the spent fuel pool while arranging time. At 15:46 on the 20th day, electricity was successfully connected to Unit 2 P/C (2C). At 10:36 on the 22nd day, electricity was also connected to Unit 4 P/C (4D). By March 29, the departments succeeded in restoring lighting for the Main Control Rooms of all Units from offsite power.

End of file

Chronology of Main Events at Fukushima Daiichi Nuclear Power Station Unit 1 from Impact of Earthquake through Saturday, March 12

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

Friday, March 11, 2011

14:46	**The Tohoku-Pacific Ocean Earthquake strikes. Automatic reactor SCRAM.** Automatic proclamation of Level 3 State of Emergency.
14:47	Automatic shutdown of main turbine, emergency diesel generators start up automatically.
14:52	The isolation condenser (IC) starts up automatically.
15:02	Reactor subcriticality confirmed.
15:03 (approx.)	To conform to a 55°C/h reactor coolant temperature descent rate, the return pipe isolation valves of the IC (MO-3A, 3B) were once fully closed. Subsequently, the reactor pressure regulation via IC begins.
15:06	Extraordinary Disaster Countermeasures Headquarters was set up at the Head Office (to determine damage sustained in the earthquake and restore power supplies, etc.)
15:27	Arrival of first tsunami wave.
15:35	**Arrival of second tsunami wave.**
15:37	Total loss of AC power.
15:42	**A specified event (total loss of AC power) in accordance with stipulations of Article 10, Clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (hereafter abbreviated "Nuclear Emergency Act") was determined to have occurred, government and other authorities were notified.**
15:42	First state of emergency declared. Emergency Countermeasures Headquarters (merged with Emergency Disaster Countermeasures Headquarters).
16:00 (Approx.)	**A check of the in-site roads for soundness started.**
16:10	**The Power Distribution Department of the Head Office instructed all the branch offices to reserve high and low voltage power source cars and check relocation routes.**
16:36	**Reactor water levels could not be confirmed and state of water injection was unknown, thus the specified event (emergency core cooling system water**

	injection impossible) in accordance with stipulations of Article 15, Clause 1 of the Nuclear Emergency Act was determined to have occurred, government and other authorities were notified at 16:45.
16:36	Second state of emergency declared..
16:39	**Checks of power supply facilities (offsite power, in-site power) for soundness started.**
16:45	Reactor water level was confirmed, thus a specified event (emergency core cooling system water injection impossible) in accordance with the stipulation of Article 15, Clause 1 of the Nuclear Emergency Act was determined to be rescinded, government and other authorities were notified at 16:55.
16:50	**High and low voltage power source cars reserved by all the TEPCO offices left for Fukushima one after another.**
16:55	**The on-site check of a diesel fire pump started.**
17:07	Confirmation of reactor water level again became impossible, thus a specified event (emergency core cooling system water injection impossible) in accordance with stipulations of Article 15, Clause 1 of the Nuclear Emergency Act and accordingly reported the event to the competent government departments and agencies at 17:12.
17:12	**Site Superintendent ordered staff to study a method for water injection into the reactors through the Fire Protection System line, which had been installed as part of the accident management measures, and through fire engines.**
17:30	Although the diesel fire pump started automatically due to the failure recovery operation, the pump ceased to operate due to no formation of an alternative reactor water injection system line (which was later kept suspended to prevent restart).
18:18	The return pipe isolation valve (MO-3A) of the IC and the supply pipe isolation valve (MO-2A) were opened. Generation of steam was confirmed.
18:25	The return pipe isolation valve (MO-3A) of the IC was shut off.
18:38	The formation of an alternative reactor water injection system line started.
19:00 (Approx.)	**The gate between Units 2 and 3 was opened, which opened a vehicle traffic route to Units 1 to 4.**
19:24	**The results of checking the in-site-roads for soundness were reported to the Emergency Countermeasures Headquarters.**
20:47	The temporary lights in the Main Control Room were lit up.
20:50	After the alternative reactor water injection system line had been set up, the

	suspension state was lifted. The diesel fire pump automatically started failure recovery operation (a state enabling water injection after reduction in the reactor pressure).
20:50	The Fukushima Prefecture government issued an evacuation order to local residents staying in areas within a 2km radius of Fukushima Daiichi Nuclear Power Station.
20:56	**The results of checking the power supply facilities (offsite power, station power supply) for soundness were reported to the Emergency Countermeasures Headquarters.**
21:19	The reactor water level was identified as top of active fuel (hereafter "TAF") +200 mm.
21:23	The Prime Minister issued an evacuation order to local residents staying in areas within a 3km radius of Fukushima Daiichi Nuclear Power Station and an order confining local residents indoors staying in areas within a 3 to 10km radius of the power station.
21:30	The return pipe isolation valve (MO-3A) of the IC was opened. Generation of steam was confirmed.
21:51	The radiation dose in the Reactor Building rose. An order to prohibit entry into the Reactor Building was issued.
22:00 (Approx.)	**The arrival of an initially dispatched high voltage power source (hereafter "HVPS") car from Tohoku Electric Power was confirmed.**
22:10	It was reported to the competent government departments and agencies that the reactor water level was around TAF+450 mm.
23:00	It was reported to the competent government departments and agencies at 23:40 that the survey results had indicated rises in the radiation dose in the turbine building (1.2 mSv/h in front of the double doors on the north side of the first floor of the turbine building and 0.5 mSv/h in front of the double doors on the south side of the first floor of the turbine building).

Saturday, March 12, 2011

0:06	**There was a possibility of the drywell (hereafter the "D/W") pressure exceeding 600kPa abs, which could require venting of the Primary Containment Vessel (hereafter "Vent/Venting"). Thus, the Site Superintendent ordered to prepare for Venting.**
0:30	It was confirmed that the government's measure to evacuate local residents had been completed (evacuation of local residents staying in Futaba-machi

	(town) and Okuma-machi (town) within a 3-km radius of Fukushima Daiichi Nuclear Power Station, which was reconfirmed at 1:45).
0:49	Possibility of the D/W pressure exceeding 600kPa abs exists, so a specified event (abnormal rise in containment vessel pressure) in accordance with stipulations of Article 15, Clause 1 of the Nuclear Emergency Act was determined to have occurred, government and other authorities were notified at 0:55.
1:20 (Approx.)	The arrival of a TEPCO HVPS car was confirmed.
1:30 (Approx.)	Proposal to vent Units 1 and 2 made to the Prime Minister, Minister of Economy, Trade and Industry, and Nuclear and Industrial Safety Agency and consent obtained.
1:48	It was confirmed that the diesel fire pump had been stopped.
2:03	Emergency Countermeasures Headquarters started studying a method whereby a fire engine would be connected to the water supply pipe inlet of the Fire Protection System line.
2:47	Emergency Countermeasures Headquarters reported to the competent government and other authorities at 2:30 that the D/W pressure had risen to 840kPa abs.
3:06	Press release on Vent operation
4:00 (Approx.)	**Freshwater injection into the reactors started from the fire engine through the Fire Protection System. Injection of 1,300 liters completed.**
4:01	The result of assessing radiation exposure in the event of operating Venting was reported to the competent government departments and agencies.
4:55	It was confirmed that radiation dose in the Power Station site had risen (Near the main gate: 0.069μSv/h (4:00) → 0.59μSv/h (4:23)). The rise was reported to the competent government departments and agencies.
5:14	The radiation dose in the Power Station site was rising, while the D/W pressure was on the decline. Emergency Countermeasures Headquarters decided that an "outside leak of radioactive materials" had occurred and accordingly reported the event to the competent government departments and agencies.
5:44	The Prime Minister issued an evacuation order to local residents staying in the areas within a 10-km radius of Fukushima Daiichi Nuclear Power Station.
5:46	**A fire engine resumed freshwater injection into the reactors through the Fire Protection System.**
5:52	The fire engine completed 1,000 liter freshwater injection into the reactor through the Fire Protection System line.
6:30	The fire engine completed 1,000 liter freshwater injection into the reactor through

	the Fire Protection System line.
6:33	It was confirmed that a study was underway to evacuate residents of Okuma-machi into Miyakoji areas.
6:50	The Minister of Economy, Trade and Industry ordered Venting operation (manual Vent) in accordance with law.
7:11	The Prime Minister arrived at Fukushima Daiichi Nuclear Power Station.
7:55	The fire engine completed 1,000 liter freshwater injection into the reactor through the Fire Protection System line.
8:03	The Site Superintendent instructed operators to manipulate Vent at 9:00.
8:04	The Prime Minister left Fukushima Daiichi Nuclear Power Station.
8:15	The fire engine completed 1,000 liter freshwater injection into the reactor through the Fire Protection System line.
8:27	It was confirmed that part of the residents of Okuma-machi had not completed evacuation.
8:30	The fire engine completed 1,000 liter freshwater injection into the reactor through the Fire Protection System line.
8:37	Emergency Countermeasures Headquarters informed Fukushima Prefecture Office of its preparation to start venting around 9:00. The headquarters made an adjustment that it will vent after confirming the situation of evacuation.
9:02	It was confirmed that residents of Okuma-machi (part of Kuma district) had completed evacuation.
9:04	**Operators headed for the work site to Vent.**
9:05	Press release on Vent operation
9:15	The fire engine completed 1,000 liter freshwater injection into the reactor through the Fire Protection System line.
9:15 (Approx.)	The vent valve (MO valve) of the Primary Containment Vessel (hereafter the "PCV") opened manually.
9:30 (Approx.)	Operators tried manipulating the small valve of the vent valve (AO valve) of the Suppression Chamber (hereafter the "S/C"). However, they had to give up the efforts because of high radiation dose.
9:40	The fire engine completed 15,000 liter freshwater injection into the reactor through the Fire Protection System line.
9:53	Emergency Countermeasures Headquarters again reported to the competent government departments and agencies the result of its dosage assessment in the event that Vent was operated.
10:15 (Approx.)	It was confirmed that 72 power source cars sent from TEPCO branch offices and

	from Tohoku Electric Power had arrived at Fukushima Nuclear Power Stations (Fukushima Daiichi received 12 HVPS cars and seven low voltage power source cars, while Fukushima Daini received 42 HVPS cars and 11 low voltage power source cars).
10:17	The Man Control Room opened the small valve of the vent valve (AO valve) of the S/C (in anticipation of residual pressure in the compressed air system for instrumentation)
10:40	Since the surrounding of the main gate and monitoring post No. 8 indicated a higher radiation dose, it was judged that the rise would be highly attributable to the Vent operation that had led to emission of radioactive materials.
11:15	Radiation dose is falling, thus indicating that venting was not likely sufficiently effective.
11:39	Emergency Countermeasures Headquarters reported to the competent government departments and agencies that one of the employees who had entered the reactor building for Vent operation had an exposed dosage beyond 100mSv (106.30 mSv).
14:30	**When the restoration team installed a temporary air compressor around 14:00 to operate the large valve of vent valve (AO valve) of the S/C, the team identified a decline in the D/W, decided that the decline was attributed to "emission of radioactive materials," and reported the event to the government and other authorities at 15:18.**
14:53	**The fire engine completed approx. 80,000 liter freshwater injection into the reactor (in total of accumulation).**
14:54	**The Site Superintendent ordered operators to inject seawater in the reactor.**
15:18	The restoration team was advancing the restoration of the standby liquid control system. The team planned to perform injection into the reactor by starting up the pump of the standby liquid control system as soon as it is ready. Emergency Countermeasures Headquarters also informed the competent government departments and agencies of its plan that the seawater would be injected in the reactor through the Fire Protection System when the preparation is completed.
15:30 (Approx.)	The restoration team formed a route where electricity from an HVPS car is supplied to the Unit 1 MCC through the Unit 2 P/C. The team started supplying electricity up to a point just before the standby liquid control system.
15:36	**An explosion occurred at the reactor building.**
16:27	Surrounding of monitoring post No. 4 measured a radiation dose beyond 500μSv/h (1,015μSv/h). Emergency Countermeasures Headquarters accordingly

decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Paragraph 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies.

17:20 (Approx.)	The restoration team left the building to check the situation of the fire engine, buildings, etc.
18:05	TEPCO Head Office and the power station shared the information that the Minister of Economy, Trade and Industry had issued an order (water injection) in accordance with law.
18:25	The Prime Minister issued an evacuation order to local residents staying in areas within a 20-km radius of Fukushima Daiichi Nuclear Power Station.
18:30 (Approx.)	The results of checking the state of the fire engine, buildings, etc. confirmed that these areas were in a mess. **Damage was also identified to the power supply facility for the standby liquid control system and to the seawater injection hose that had been reserved. They were confirmed as unworkable.**
19:04	**The fire engine started seawater injection into the reactor through the Fire Protection System line.**
20:45	Seawater was injected in the reactor after being mixed with boric acid.

End

Fukushima Daiichi Nuclear Power Station Unit 1
State of Alternate Coolant Injection

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

<u>○ Activities after "16:36 on March 11 when "Inability to Inject Water of the Emergency Core Cooling System" was determined and reported on</u>

[Checking the reactor water level]

- At 16:44 on March 11, the Main Control Room reported to the Emergency Countermeasures Headquarters that the control room could temporarily determine the reactor water level, which was not previously possible (equivalent to TAF+250cm).
- Since the Main Control Room could check the water level, the Emergency Countermeasures Headquarters decided to cancel the occurrence of the specified event (Inability of the Emergency Core Cooling System to Inject Water) subject to the provisions of Article 15 Paragraph 1 of the Nuclear Disaster Prevention Act and accordingly reported the cancellation to the competent government departments and agencies at 16:55 on March 11.
- The Main Control Room continued monitoring the reactor water level. However, at 17:07 on March 11, the control room was again unable to check the reactor water level. The Power Station Disaster Control HQ decided to trigger a specified event (Inability of the Emergency Core Cooling System to Inject Water) subject to the provisions of Article 15 Paragraph 1 of the Nuclear Disaster Prevention Act and accordingly reported this event to the competent government departments and agencies at 17:12.

[Check, examination and operation of means to inject water into the reactor]

<Measures taken for the diesel-driven fire pump (hereafter the "DDFP")--1>

- At 16:35 on March 11, when operators were checking facilities for workability instructed by the shift supervisor, an operator identified that the DDFP status indicator for the Main Control Room was lit up while the DDFP was shut down.
- At 16:55 on March 11, operators headed for the Fire Protection System (hereafter "FP") pump room where the "DDFP is installed on the basement floor of the turbine building." On the way, they found something resembling a tool rack that

had been dislocated into the middle of the corridor of the first floor of the turbine building. Because it hindered their passage, the operators bypassed it. When the operators approached the double door of the reactor building, an operator watching for tsunamis on the roof of the service building informed the operators of an incoming tsunami by PHS on line, hence the operators once returned.

<Measures taken for the High-Pressure Cooling Injection System (hereafter "HPCI")>

- Since all the status indicators of the Main Control Room had gone out and the DC power supply needed for operation control had been lost, the HPCI was also unavailable.
- At 16:39 on March 11, the restoration team started checking power supply facilities after the earthquake and tsunamis. The electric equipment room, housing DC power supplies and located on the basement floor of the control building, was submerged up to the sluice (height: 30 to 40cm). Thus, the restoration team stopped the inspection.

○ **Activities after "17:12 on March 11 when the Site Superintendent ordered that an alternative means of water injection be studied as part of accident management (hereafter "AM") measures and a method for injecting water into the reactor using fire engines (installed on a lesson from the "Chuetsu-oki Earthquake")"**

<Study and operation of an alternative line of water injection into the reactor>

- At 17:12 on March 11, the Emergency Countermeasures Headquarters started studying an alternative means of water injection (the Fire Protection System (hereafter the "FP"), replacement water condensate system, and containment cooling system) set up as part of the AM measures, and on the use of fire engines.
- Operators at the Main Control Room removed the AM operation procedure description, applied the shift supervisor seat to check alternative means of water injection into the reactor and confirmed alternative lines of water injection. At 18:35 on March 11, the operation room used the DDFP to form an alternative line of water injection into the reactor through the Core Spray System (hereafter the "CS") from the FP line. Since no power supply was available, the Main Control Room had no control over the line. A total of five members, consisting of four operators and one member of the power generation team, wore full-face masks and headed for the Reactor Building. With the help of flashlights, the members reached the Reactor Building where they manually opened five motor valves, including the CS, and at around 20:30, completed the formation of an alternative line of water injection into the reactor.
- The CS injection valve in particular has a manual handle, with a long stroke of the

stem and approx. 60cm diameter, hence the members' full-face masks after the manual operation were all in a sweat.

<Measure taken for the DDFP--2>

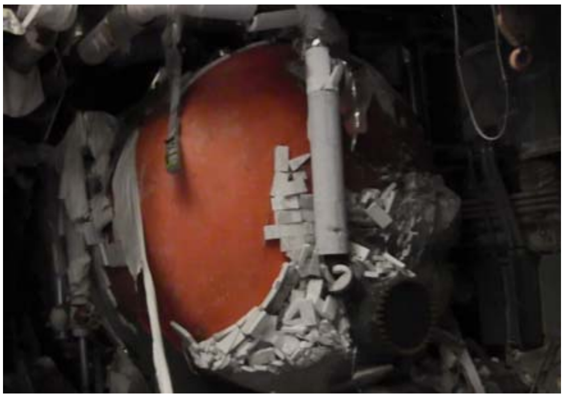
- The operator who had headed for the DDFP to check but later returned from the turbine building obtained information from the operator monitoring tsunamis that the tsunami having arrived was not high. At 17:19 on March 11, the operator once again headed for the FP pump room on the basement floor of the turbine building to check the conditions. Although the basement floor of the turbine building was submerged, the operator, wearing rubber boots for outside patrol, entered the FP pump room.
- At 17:30 on March 11, the operator confirmed that the trouble indication light of the FP control panel in the FP pump room was lit up. When the operator pressed the trouble restoration button on the FP control panel, the DDFP engaged in automatic start up. The operator under instruction stopped the DDFP, which was scheduled to restart after an alternative line of water injection had been established.
- For three hours subsequently, operators worked in rotation in the Main Control Room to maintain the “stop” position switch of the DDFP and thus prevent automatic startup.

<Measures taken for the isolation condenser (hereafter the “IC”)-- 1>

- Due to the loss of power supplies, the monitoring instruments and indication lamps in the Main Control Room had gone out, which prevented operators from checking the IC. At 17:19 on March 11, an operator, who wore an ordinary uniform and rubber boots while checking the on-site conditions, took a flashlight and a GM tube and headed out to check the conditions, including the water with the water meter level on the IC shell side installed in the Reactor Building. In the area surrounding the Reactor Building entrance, however, the radiation reading indicated a higher dose than usual, hence the operator once returned at 17:50.
- Some of the DC power supplies for the Main Control Room were restored. As a result, an operator happened to find the indication lamps of the return pipe isolation valve (MO-3A) and the supply pipe isolation valve (MO-2A) of the IC were lit up. When the operator checked the lighting, the valves were in a “closed” state.
- The supply pipe isolation valve (MO-2A) of the IC, which is normally in an “opened” state, was in a “closed” state and there was the possibility that the IC isolation signals* were being output.

  (* Isolation signals are output when the circuit to detect “IC pipe rupture” is activated due to the loss of the control power supply of the IC (DC power supply).)

・ Although a “closed” state lamp was lit up, moving the battery may have led to an earth fault if had been submerged, which would prevent further operation of the valve. It was anticipated that the inner isolation valves (MO-1A, 4A) of the Primary Containment Vessel would be open, when an operator manipulated opening operation on the operation switch of the return pipe isolation valve. When an operator performed the opening operation of (MO-3A) and the supply pipe isolation valve (MO-2A) of the IC at 18:18 on March 11, the status indicator read “opened” from a “closed” state.



Appearance of the IC
(Photo taken on Oct. 18, 2011)

(The vermillion colored part indicates the IC shell. The silver-colored insulation material was seemingly stripped off due to the impact of the explosion.)

・ After opening operation, the operator identified the generation of steam by the sound of steam generation and steam over the Reactor Building. The quantity of steam generation was small and subsided after a while.

・ The cause of no steam generation could have been attributable to the possibility that the inner isolation valves (MO-1A, 4A) of the Primary Containment Vessel had been in a “closed” state due to the output of isolation signals. Conversely, operators also feared that water on the shell side used to cool the IC might have been lost.

・ Operators estimated that the IC had malfunctioned. Considering that the piping needed to supply water for the shell side had not been formed, an operator set the return pipe isolation valve (MO-3A) to a “closed” state at 18:25 on March 11. In addition, since no alternative line of water injection into the reactor had been formed, establishing an alternative line formation of water injection by the DDFP was prioritized.

・ Operators anticipated the restoration of the DC power supply of the HPCI, like that of the IC, because both power supplies were installed in the same area. Despite expectations at start up, however, the status indicator did not light up.

<Reversing water sources for the reactor water injection>

- Operators identified spouts from fire hydrants and leaks from disaster prevention piping for transformers. The fire brigade and power generation team started work to stop these leaks from the filtrate tank, the FP water source, to prevent loss of water. To stop the leak from the disaster prevention piping for transformers, the work team closed the valve near the Main Office Building. However, it did not stop completely. Thus, the work team started an operation to close the outlet valve of the filtrate tank. Since the Seismic Isolated Building is too distant from the filtrate tanks, wireless telecommunication via PHS was not possible, hence a liaison operator was assigned midway between them to communicate. The outlet valves were too heavy to operate and besides, had a long stroke. Members of the fire brigade operated the handle in rotation.

Leak from the disaster prevention piping for transformers

A different pipe to support the nearby disaster prevention piping leaned on the link of the piping due to a landslide

- At around 19:18 on March 11, the fire brigade and the power generation team closed the outlet valves of the filtrate tanks for lines other than the FP line needed for the reactor water injection.

Filtrate tanks

Outlet valve of a filtrate tank

Outlet valves for other than the FP line needed for the reactor water injection were closed.

<Checking the whereabouts of fire engines>

- Three fire engines were installed in the Power Station, while a fire engine parked at the garage was available for service. A fire engine parked near the Protection HQ of Units 1 to 4 failed due to the tsunami. The fire engine parked on the side of Units 5 and 6 was also unavailable due to traffic disruption, stemming from damage to the road and scattered debris. There was also unconfirmed information that the fire engine had been washed away in the tsunami.

<Confirming the reactor pressure>

- At 20:07 on March 11, the monitoring instruments in the Main Control Room indicated no values due to the loss of power supplies. An operator entered the dark Reactor Building, went up to the second floor, and confirmed using the reactor pressure indicator there that the reactor pressure was 6.9MPa.

<Measures taken for the DDFP--3>

- Preparation to establish an alternative line of water injection into the reactor was completed. At 20:40 on March 11, an operator tried cancelling the "stop" state of the DDFP operation switch in the Main Control Room but it did not work.
- Because there were limited means of telecommunication between the control room and the other work site, an operator was assigned to a spot between them to mediate communications. The operator cancelled the "stop" state of the operation switch in the Main Control Room while the operator at the other worksite continued pressing the trouble restoration button. At 20:50 on March 11, the operator at the work site confirmed the startup of the DDFP. It was set to a state allowing the injection of water after the reactor pressure had been reduced (a state where the discharge pressure of the DDFP exceeded the pressure in the reactor).

<Measures taken for the IC--2>

- The formation of an alternative line of water injection into the reactor was completed. When checking alternative possible means of water injection into the Main Control Room, the operator identified that the “closed” status indicator of the return pipe isolation valve (MO-3A) of the IC was nearly going out.
- Based on the IC technical material, the operator confirmed that the IC could be operated for some ten hours without replacement water being supplied to the shell side. Judging from the operating conditions to date, the operator estimated that water still remained on the IC side. The DDFP was in service and replacement water could have been supplied to the IC shell side, if needed, by operating the valve. Although it was unknown whether the operation of the IC was available in future, in anticipation of forthcoming operation, the operator tried re-opening the return pipe isolation valve (MO-3A), which had been once closed, at 21:30. The operation valve was opened. The operator confirmed the generation of steam with the sound of steam generation and saw steam over the Reactor Building. In addition, the power generation team went out of the Seismic Isolated Building and confirmed the state of steam generation.

IC vent tube
(commonly called as "Buta-no-hana")

- Afterwards, two operators headed for the Reactor Building to check the water level on the IC shell side and the reactor water level. Leaving one of the operators in front of the double door of the “Reactor Building, the other operator entered the building. Since the value of the alarm pocket dosimeter (APD) immediately rose, the two operators gave up the on-site check and returned.
- The Safety Parameter Display System (hereafter the “SPDS”) normally enables the Head Office and the Emergency Countermeasures Headquarters to promptly monitor and determine the plant states. Due to the loss of power supplies, however, the process computers shut down, which resulted in no transmission of plant parameters to the SPDS for use. Communication means were limited. Only the hotline of the Main Control Room was available to communicate with the

Emergency Countermeasures Headquarters. In addition, while the Emergency Countermeasures Headquarters was dealing with the six plants concurrently, an operator confirmed at 21:19 on March 11 that the reactor water level was at TAF+200mm and remained unchanged since then. Therefore, the Emergency Countermeasures Headquarters estimated that the IC was functioning.

<Measures taken for the DDFP--4>

- At around 1:25 on March 12, an operator checked the DDFP for operation in the FP pump room on the basement floor of the Turbine Building and found that the DDFP had stopped. It was confirmed that fuel had run dry at 1:48 since no fuel had been supplied from the refueling line. When an operator checked the DDFP startup battery for the voltage on the FP control panel, it indicated a low voltage. At 2:03, the circumstances were reported to the Emergency Countermeasures Headquarters.
- The Emergency Countermeasures Headquarters started studying a method for connecting a fire engine to the FP line up to the outlet.

○ Activities after "2:03 of March 12 when starting to study a method for connecting a fire engine to the FP line up to the outlet"

[Restoration of the DDFP]

<Refueling>

- At around 2:10 on March 12, operators started refueling through the DDFP. Four operators walked carefully with the help of a flashlight through scattered debris, and obtained tens of containers (approx. 0.5 liter in capacity) to fill with light oil.
- While another operator was watching for tsunamis on the third floor of the service building, other operators, using flashlights to light the work area, removed the sealing plug of the light oil transfer pipe supplying the D/G, etc., opened the valve and filled the containers with light oil.
- Operators placed the containers filled with light oil in baskets in the locker room located in the controlled area and carried them on a hand truck and by hand up to the bulk delivery entrance of the Turbine Building, through the road strewn with debris. Afterwards, operators carried them by hand into the FP pump room on the basement floor of the Turbine Building and refueled the fuel tank. At 2:56 on March 12, operators completed refueling and tried operating the DDFP. However, the DDFP did not start up.

<Replacing the batteries>

- At around 2:10 on March 12, operators requested the restoration team to replace the startup batteries of the DDFP.

- At 6:34 on March 12, the restoration team loaded a vehicle with 12 2V batteries (approx. 10 kg each sent from Hirono Thermal Power Station) and transported them up to the bulk delivery entrance of the Turbine Building. Operators repeated carrying individual batteries by hand into the FP pump room on the basement floor of the building and replaced the batteries.
- The operation was interrupted once because of a possible tsunami. At 12:53 on March 12, the battery replacement operation was completed and operators tried starting up the DDFP at 12:59. However, it did not start up. At 13:21, operators reported to the Emergency Countermeasures Headquarters that the DDFP was unavailable due to the earth fault of the cell motor.

[Preparation of water injection with fire engines]

- Preparation of water injection was underway with an available fire engine standing by in the garage.
- Before dawn on March 12, TEPCO employees and workers from a contractor company, wearing winter clothes and helmets, started clearing debris around the bulk delivery entrance of the Unit 1 Turbine Building to find the outlet of the FP line that would inject water into the reactor of Unit 1. Workers drove two backhoes, which had been used to restore the roads, and then parked near the gymnastic hall, to the bulk delivery entrance of the Unit 1 Turbine Building. On the way, the backhoes cleared the vehicles and debris on the road.
- There were many bulky items and debris, such as gates, which had been washed up during the tsunamis. It took time for the backhoes to reach the bulk delivery entrance of the Unit 1 Turbine Building. One backhoe cleared debris around the gates in the protection areas of Units 1 and 4, while the other cleared debris around the bulk delivery entrance of the Unit 1 Turbine Building. Although operators strove to find the outlet of the FP line, they were ultimately unable to do so. The work team returned to the Seismic Isolated Building.

Outlet of Fire Protection System of Unit 1

- At around 2:00 on March 12, the power generation team and fire brigade headed for the target area to find the outlet of the FP line outside the building. At the work site, several operators who had been refueling the DDFP with light oil joined the work teams to find the outlet of the FP line, but were unable to do so.

- At around 3:30 on March 12, together with a TEPCO employee who was familiar with the site, the work team again headed for the site and finally found the outlet. At around 4:00, freshwater (1,300 liters) loaded in a fire engine was injected. A fire engine had malfunctioned in the tsunami near the Security HQ on the side of Units 1 to 4. When the work team tried pumping water from the fire engine to inject water, the radiation dose in the work site started rising at around 4:20. Thus, the work team temporarily suspended the water injection operation and returned to the Seismic Isolated Building. Later, contamination monitoring confirmed contamination. The contaminated members of the work team were isolated in another room.
- The Emergency Countermeasures Headquarters arranged additional fire engines and promoted preparation so that the Self-Defense Forces of Japan could transport water from outside.
- At 2:45 on March 12, the Main Control Room succeeded in restoring the power supply to reactor pressure meters. The meters indicated 0.8MPa.

○ **Activities after "5:46 of March 12 when a fire engine resumed freshwater injection into the reactor through the FP line"**

<Resuming and continuing freshwater injection>

- Facing circumstances where the radiation dose was in the work site was rising and some contaminated members had to be isolated, the captain of the fire brigade requested that a contractor company extend its cooperation as before. The contractor company accepted the request to drive the fire engine and operate the reactor pressure meter on the same.
- At 5:46 on March 12, three members, led by the fire brigade captain, wore full-face masks, headed for the work site and resumed water injection with the fire engine.
- The work team thought that the discharge pressure of the fire engine was insufficient, based on the position of the fire protection water tank located on the Unit 1 side. Accordingly, the fire engine drew water from the fire protection water tank, moved near the Turbine Building and injected it into the reactor from the outlet of the FP line. It took considerable time for the fire engine to fetch water between the two places, mainly because it had to proceed carefully under buildings in disrepair.
- Afterwards, the members of the work team returned to the Seismic Isolated

Building and, when undergoing a contamination check, were found to be contaminated and isolated in another room.

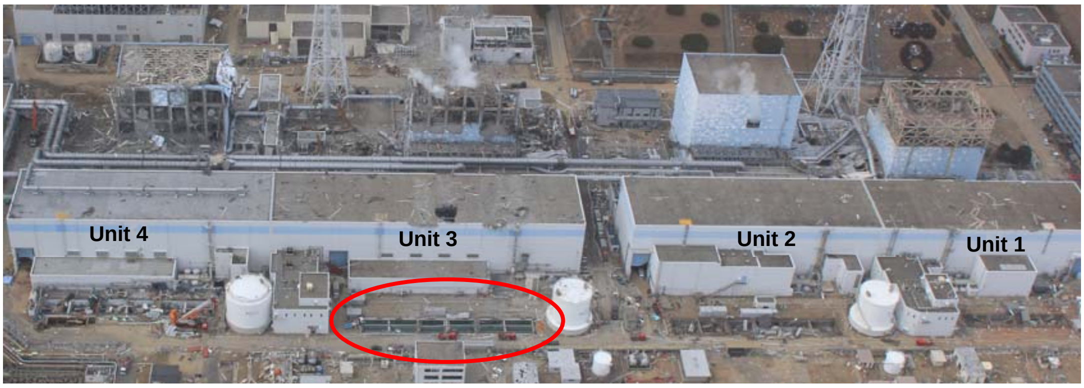
- To continue injecting water into the reactor, the other fire brigade members headed for the work site with the fire engine. However, since there were many obstacles on the road, including debris, due to the earthquake and tsunamis, it took considerable time for the fire engine to fetch water between the two places. Thus, the hose fixed to the fire engine was used to form a continuous water injection line between the fire protection water tank on the Unit 1 side and the outlet of the FP line. Subsequently, the fire brigade continued injecting water.
- At around 10:30 on March 12, fire engines arrived from Kashiwazaki-Kariwa Nuclear Power Station, while fire engines of the Self-Defense Forces of Japan also arrived in the morning. These fire engines started transporting freshwater from neighboring fire protection tanks to those on the Unit 1 side.

A fire protection tank just before installation

Intake cover of a fire protection tank

<Starting preparation for seawater injection>

- In parallel with ongoing freshwater injections, the fire brigade started to prepare for seawater injection as instructed by the Site Superintendent. This was due to the limited freshwater reserved for the fire protection tanks.
- Considering the road condition on the Power Station site, and the distance from Unit 1, etc., the fire brigade decided to draw water not directly from the sea but use the reversing valve pit of Unit 3 as a water source, which had been flooded with seawater in the tsunami.
- At 14:53 on March 12, the injection of approx. 80,000 liters of freshwater was completed (total accumulation).



Reversing valve pit of Unit 3
(The reversing valve pit of Unit 3, where seawater containing less debris had accumulated, was used as the water source.)

- At 14:54 on March 12, the Site Superintendent ordered the fire brigade to inject seawater into the reactor. Since there was little fresh water left in the fire protection tank on the Unit 1 side, water was hurriedly transported from other fire protection tanks. Meanwhile, the fire brigade promoted the preparation to shift to seawater injection.
- Three fire engines were scheduled to be linked serially from the reversing valve pit of Unit 3 to form a seawater injection line. Before the completion of the line formation, however, an explosion occurred at Unit 1.

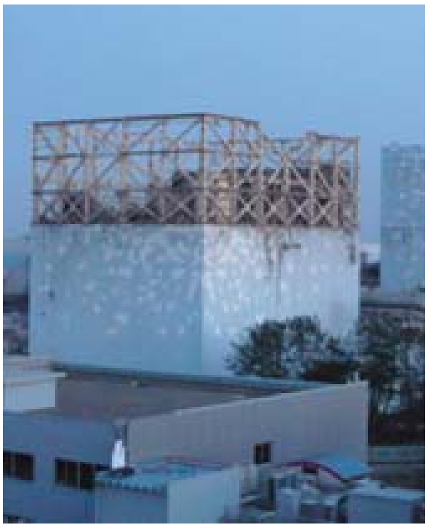
○ Activities after "15:36 of March 12 when an explosion occurred at Unit 1 of the Reactor Building"

[Situations at the explosion]

- The entire Main Control Room shook vertically with a thundering sound. The whole room was covered in dust. Operators were unable to do anything.
- Together with workers of a contractor company, the fire brigade was operating the fire engine to inject water into the reactor near the reversing valve pit of Unit 1. When members were outside the vehicle to refuel the fire engine, a terrible shock occurred. The members squatted down on the spot. When they looked up, debris was spreading all over the sky and then falling. Workers of the contractor company were led to the condensate storage tank beside the nearby Unit 1 Turbine Building to shelter from flying debris. Shortly after the explosion, a worker of the contractor company by the fire engine was identified as being unable to stand. Although a member of the fire brigade called him, the worker was unable to walk. Thus, two members stood on both sides of the worker and shouldered him to take away slowly away from the spot to escape. "It's exploding!" they shouted and headed for the gate between Units 2 and 3. On their way to the Main "Anti-Earthquake Building", they loaded the immobile worker into a nearby car and returned to the building.
- Other fire brigade members, together with soldiers of the Self-Defense Forces of Japan, were moving on a fire engine of the Self-Defense Forces to form a seawater injection line. At the moment when the fire engine traversed a spot between the

Main Control Room after the explosion

(Cornices of the ceiling area lighting dropped during the shakes, leaving the emergency lights alone)



Reactor building of Unit 1 after the explosion

Turbine Building for Units 2 and 3 respectively, the members saw the ground surface as if deformed, followed by a thundering explosion sound. The blast instantly shattered the windscreen of the fire engine. Debris flew in all directions, injuring one of the members. The fire brigade members got on the fire engine and returned to the Seismic Isolated Building.

[Post-explosion measures taken]

- At 15:36 on March 12, the Seismic Isolated Building heard sounds of explosion and felt large vertical shakes. The Main Control Room of Units 1 and 2 reported to the Emergency Countermeasures Headquarters that the control room was no longer able to monitor the D/W pressure, though it maintained communications with the headquarters.
- At around 15:40 on March 12, pictures of a large explosion at the Reactor Building of Unit 1, smoking, and bare reinforcing steel frames were televised on a TV in the Seismic Isolated Building.
- At 15:49 on March 12, it was reported to the Emergency Countermeasures Headquarters that several persons had been injured. Under instructions for evacuation from the work sites, the Emergency Countermeasures Headquarters started to rescue injured persons and writing task for work sites around 15:54.
- At 15:57 on March 12, the Main Control Room of Units 1 and 2 reported to the Emergency Countermeasures Headquarters that the control room kept checking the reactor water level. Thus, the headquarters estimated that the Reactor Pressure Vessel had not been impacted in the explosion but remained in a sound state. After the explosion, the temporary lights in the Main Control Room were no longer available due to the damage to the compact generator that had been restored the previous day.

Vehicle heavily damaged in the blast

(It was used for transporting batteries in the 11th day night and then parked on the main exhaust stack side of Unit 1.)

- Around this time, TEPCO employees and workers who had been working at work sites when the explosion occurred began to return to the Seismic Isolated Building and begun to explain the circumstances at their work sites. An employee in the passenger seat of the fine engine who had been working to establish a seawater reactor injection line on the fire engine was injured due to flying debris through the broken windscreen of the fire engine that was shattered in the blast. It was reported to the Emergency Countermeasures Headquarters that preparation of a power supply for the standby liquid control system (hereafter the "SLC") that had received transmitted electricity from a power source car would need new preparation. Under circumstances where the cause of the explosion remained unknown, the Emergency Countermeasures Headquarters continued checking employees and workers for safety, rescuing the injured, and writing tasks for work sites, etc. Under these circumstances, however, there was an urgent need to resume water injection into the reactor. At 16:15 on March 12, we decided to go to the work site to check whether the fire engine was available.

- At 16:17 on March 12, it was confirmed that monitoring post No. 4 indicated 569μSv/h at 15:31, which was a specified event subject to Article 15 of the Nuclear Disaster Prevention Act and accordingly reported to the competent government departments and agencies. (At 16:53 on March 12, the report was corrected, stating that the radiation dose had been 1,015μSv/h at 15:29.)
- At 16:58 on March 12, the Emergency Countermeasures Headquarters checked employees and workers for safety and identified five persons injured in the explosion (three TEPCO employees and two workers of contractor companies who were engaged in the water injection operation involving the fire engine.) Four of them were sent to hospital.

Main office building with shattered windows in the blast

Former main office building with shattered windows (Unit 1 on the extreme right)

○ Activities after "around 17:20 of March 12 when leaving to check the fire engine and buildings, etc."

- At 17:20 on March 12, the ceiling of the Reactor Building of Unit 1 was lost in the explosion, whereupon the spent fuel pool on the 5th floor was exposed. Thus, the Emergency Countermeasures Headquarters decided to use a helicopter to check the condition of the spent fuel pool the following day when it became light.
- The explosion at Unit 1 injured workers of contractor companies. There was also the potential for additional explosions. After consultation, the contractor companies agreed to extend cooperation to TEPCO. At around 17:20 on March 12, the fire brigade started checking fire engines and other work sites.
- At 17:30 on March 12, although the pressure of the Primary Containment Vessel had not yet reached the vent pressure, the Site Superintendent ordered the operators to start preparing the formation of vent lines for Units 2 and 3.
- At around 18:30 on March 12, operators began to report on the circumstances of different work sites. The hose that had been prepared for seawater injection had been damaged and was no longer available.
- The surrounding area of Unit 1 showed scattered debris with high radiation dose. Under the supervision of the security team, the fire brigade cleared the scattered debris (iron plates, etc. around the Reactor Building of Unit 1) and promoted the re-laying hoses by gathering them from outside hydrants.
- The fire brigade succeeded in connecting three fire engines in series to form a water injection line, using the reversing valve pit of Unit 3 as a water source. The fire brigade started seawater injection at 19:04 on March 12.

Water injection by a fire engine (photo taken on a later day)

End of file

Fukushima Daiichi Nuclear Power Station Unit 1
Circumstances of Venting of Containment Vessel

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

○ Activities after "16:36 of March 11 when deciding and reporting on the Inability of the Emergency Core Cooling System to Inject Water"

- While the restoration of instruments in the Main Control Room was underway, the Emergency Countermeasures Headquarters carried out the following operations:

[Preparation for venting operation]

- Operators at the Main Control Room took out the accident management (hereafter "AM") operation procedural description and put on the shift supervisor seat to check the content. In addition, together with the valve checklist, operators started to confirm the valves needed for venting and their locations.
- While watching the AM operation procedural description, the power generation team started to study the venting operation in case no power supply was available.
- The recovery team examined related drawings and made inquiries with contractor companies to check whether the type and structure of the vent valve (air-operated valve (hereafter "AO valve")) of the suppression chamber (hereafter the "S/C") needed for venting operation would allow manual operation. Based on the drawing, the team confirmed the presence of a handle attached to the S/C small vent valve (AO valve) that is available for manually "opening" operation, which was reported to the Main Control Room.

[Radiation dose started increasing in the building]

- At 21:51 on March 11, entrance to the Reactor Building was prohibited because the radiation dose in the building rose.
- At around 22:00 on March 11, it was reported to the Emergency Countermeasures Headquarters that an alert pocket dosimeter (hereafter "APD") in the work site of the Reactor Building had risen to 0.8mSv within a very short time.
- At 23:00 on March 11, due to the impact of the rise in the radiation dose, the radiation dose in the Turbine Building also rose (1.2mSv/h in front of the double doors on the north side on the 1st floor of the Turbine Building and 0.5mSv/h in front of the south side of the same).

[Rise in drywell (hereafter the "D/W") pressure confirmed]

- At around 23:50 on March 11, when a member of the recovery team in the Main Control Room connected a compact generator, installed for temporary restoration of lighting for the Main Control Room, to the D/W pressure meter in the Main Control Room, the value indicated 600kPa[abs] in confirmation. It was reported to the Emergency Countermeasures Headquarters.

○ <u>Activities after "0:06 of March 12 when the Site Superintendent instructed for preparation ... because of the possibility of the D/W pressure having exceeded 600kPa[abs]"</u>

[Starting to study specific venting procedure]

- Operators at the Main Control Room gathered piping instrumentation drawings, AM operation procedural descriptions, drawings of valves, and other materials, as well as an acrylic board for writing, and started confirming specific procedures, including how to operate valves and operation procedures,
- At around 1:30 on March 12 when the Emergency Countermeasures Headquarters proposed the venting operation to the Prime Minister, the Minister of Economy, Trade and Industry, and the Nuclear and Industrial Safety Agency, the headquarters obtained their approval. The Head Office Disaster Control HQ notified the Emergency Countermeasures Headquarters that the Emergency Countermeasures Headquarters strongly wished to operate the motor-operated valve (hereafter the "MO valve") by any means. The Minister of Economy, Trade and Industry and TEPCO are going to announce a venting operation at 3:00. Venting shall be operated after the announcement."

[Continuous study on the venting operation procedure]

- At 2:24 on March 12, the emergency exposure limit (100mSv) was set to 17 minutes' work time under a 300mSv/h environment (self-contained breathing apparatus time set to 20 minutes. Workers required to take iodine tablets), the result of a work time assessment for a worker who carried out venting at the work site, was reported to the Emergency Countermeasures Headquarters.
- At 2:30 on March 12, it was confirmed that the D/W pressure had reached 840kPa[abs] (maximum allowable working pressure 427kPa[gage]*).

  * Maximum allowable working pressure 427 kPa[gage] is 528.3kPa[abs] when converted into absolute pressure)

(528.3kPa[abs] = 427kPa[gage] + 101.3kPa)

- At around 3:45 on March 12, the Head Office Disaster Control HQ conducted a surrounding radiation dose assessment on the venting operation and shared the details with the Emergency Countermeasures Headquarters. When the double doors of the Reactor Building were opened to measure the radiation dose inside, operators saw white "fumes" inside and immediately closed the double doors, hence the radiation dose was not measured.
- Operators at the Main Control Room repeated confirmation of the order of valve operations, arrangement of valves and their heights, etc. in the torus room, for the venting operation. In addition, the Emergency Countermeasures Headquarters collected fireproof coats, self-contained breathing apparatus, APDs, survey meters and as many flashlights as possible that were needed for the operation.
- At around 4:30 on March 12, the Emergency Countermeasures Headquarters prohibited the Main Control Room to engage in site work because of the potential for tsunamis due to aftershocks.
- At around 4:45 on March 12, the Emergency Countermeasures Headquarters delivered APDs set to 100mSv to the Main Control Room. At around 4:50, workers who had returned to the Seismic Isolated Building were found to be contaminated. Subsequently, all the workers had to put on a "full-face mask + charcoal filter + B equipment, C equipment or coverall" before leaving the gate of the Seismic Isolated Building. Later, at around 5:00, a similar instruction was issued to the operators at the Main Control Room, who were also required to put on similar equipment, namely "full-face masks + charcoal filters + B equipment."
- Since the radiation dose was rising in the Main Control Room, the shift supervisor instructed operators to move onto the side close to Unit 2 where the dose was low.
- At 6:33 on March 12, it was confirmed that a study was underway to evacuate residents of Okuma-machi into Miyakoji areas.
- At 8:03 on March 12, the Site Superintendent instructed operators to set the target time of Unit 1 venting to 9:00.
- The operators at the Main Control Room were organized into three teams, each consisting of two operators. This was because a solo operator could have hardly done anything in the work site in complete darkness; high radiation doses were anticipated at the work site; and teams may have been forced to return anytime in the event of aftershocks. In addition, no telecommunication means was available at the work site. In case of emergency, there was a possibility that any rescue attempt could have been hopeless. With this in mind, only one of the three teams engaged in the work at a time.

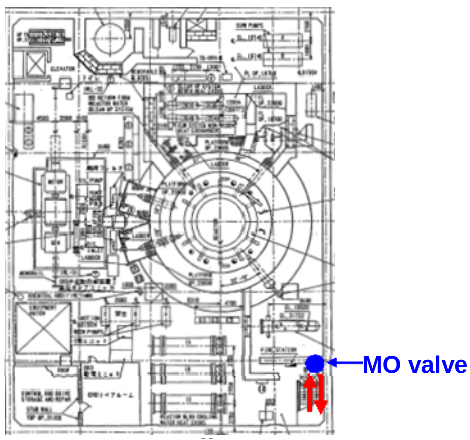
When the team returned to the Main Control Room, another team left the building for the work site. In selecting members to work at the work site, some young operators volunteered. However, such members had to fully equip themselves and were exposed to high radiation doses. The situation at the work site was unknown. Young operators were suitable for these circumstances, but instead, the shift supervisor and deputy shift supervisors were assigned to these teams.

- When the Emergency Countermeasures Headquarters checked the circumstances of evacuating local residents, a TEPCO employee who had been assigned to the Okuma-machi town office reported to the headquarters at 8:27 on March 12 that some of the residents in Okuma-machi had not evacuated.
- At 8:37 on March 12, the Emergency Countermeasures Headquarters informed the Fukushima local government of its preparation for venting operation from 9:00. Consequently, arrangements were only made for the headquarters to carry out venting once the evacuation circumstances had been confirmed.
- At 9:02 on March 12, the Emergency Countermeasures Headquarters confirmed that the residents of Okuma-machi (part 5 of the Kuma district) had evacuated. At 9:03, the Emergency Countermeasures Headquarters informed the Fukushima local governments of its venting plan to announce at 9:05 before actual venting.

<u>○ Activities after “9:04 of March 12 when operators left for the work site to perform venting operation”</u>

[Opening the PCV vent valve (MO valve)]

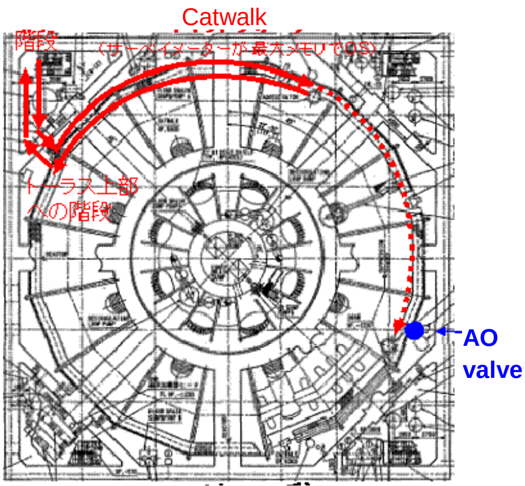
- At 9:04 on March 12, the two operators of the 1st team, wearing fireproofing coats, self-contained breathing apparatus and APD and flashlights, left the Main Control Room in complete darkness due to the loss of power supplies to manually open the PCV vent valve (MO valve) for venting operation on the 2nd floor of the Reactor Building. At around 9:15, the operators opened the valve up to 25% as stated in the operation procedural description and returned to the Main Control Room. The exposure dose was approx. 25mSv.



2nd floor of the R/B

[Opening the S/C small vent valve (AO valve)]

- At 9:24 on March 12, the 2nd team left the Main Control Room to manually open the S/C small vent valve (AO valve) and headed for the torus room on the 1st floor of the basement of the Reactor Building. On their way, however, the radiation dose rose to an extent likely to exceed the 100mSv exposure dose limit, hence both operators returned at around 9:30.
- Since the radiation dose remained high, the Main Operation Room cancelled the scheduled work by the 3rd team, which was reported to the Emergency Countermeasures Headquarters.



1st floor of the basement of R/B

Catwalk (Unit 5, with light)

In complete darkness, operators using flashlights headed for the AO valve site. As the radiation dose was on the rise, however, they had to return.

[Studying measures to open the S/C vent valve (AO valve) large valve]

- Since the operators were unable to manually open the S/C small vent valve (AO valve) on-site, the recovery team started arranging for temporary compressors to compress the air needed for the remote operation of the S/C large vent (AO valve), and connection points.

[Remote opening of the S/C small vent valve (AO valve)]

- The Main Control Room decided to open the S/C small vent valve (AO valve) in anticipation of the air pressure remaining in the instrumentation compressed air (hereafter “IA”) system. The control room tried opening the small valve three times at 10:17, 10:23, and 10:24 on March 12 by exciting the solenoid valves of the S/C small vent valve (AO valve) to which electricity was supplied by the compact generator for temporary lights of the Main Control Room, as the power supply. However, the Main

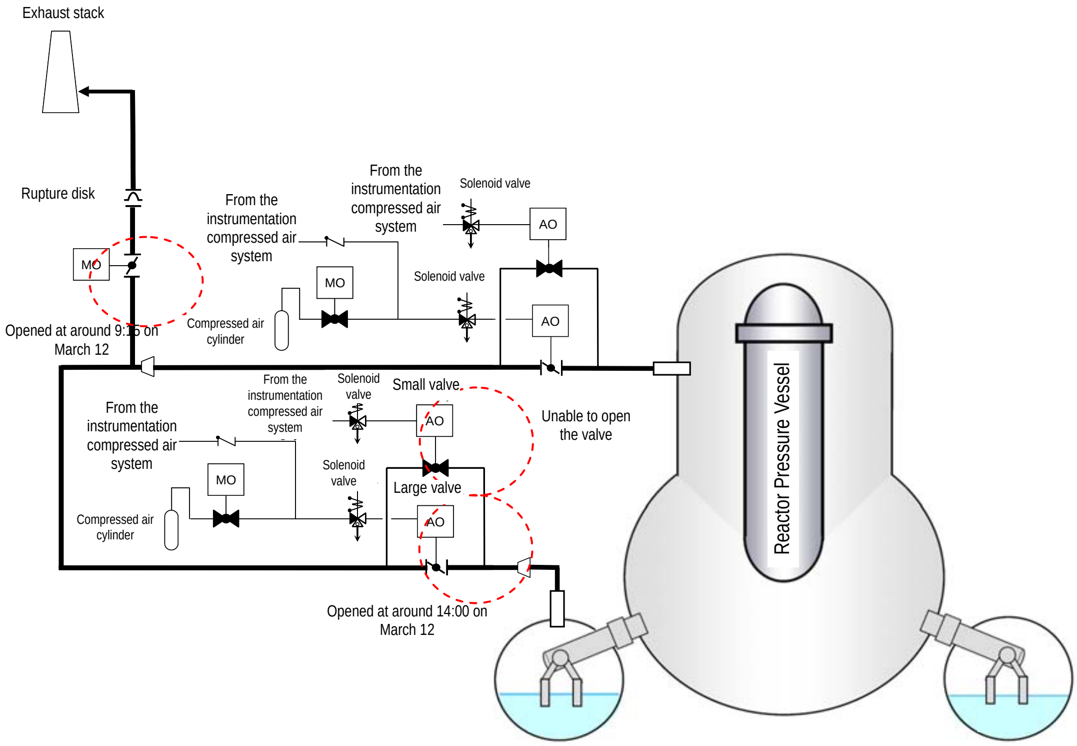
Control Room was unable to check whether or not the valve was opened.

- At 10:40 on March 12, it was confirmed that radiation doses in the vicinity of the main gate of the Power Station and surrounding monitoring posts were on the rise. The Emergency Countermeasures Headquarters estimated that the venting operation probably led to the emission of radioactive materials. At 11:15, however, the radiation dose was in decline. The Emergency Countermeasures Headquarters confirmed that that there was a possibility of the venting effect being insufficient.

[Opening the S/C vent valve (AO valve) large valve]

- When the recovery team sought a temporary compressor, it learned that a contractor company in the Power Station site held such compressor, thus a member of the team decided to visit the office of the contractor company. The temporary compressor in question also required an adaptor, thus the team studied a connection point by using the pipe instrumentation drawing and selected the copper header of the IA system in the instrument rack of the liquid nitrogen gas supply panel outside the bulk delivery entrance of the Reactor Building as the connection point. Members of the recovery team took photos of the connection point and returned to the Emergency Countermeasures Headquarters.
- At around 12:30 on March 12, the team members went out to find an adaptor and also found a temporary compressor in the office of the contractor company. Given the high radiation dose, the members moved the compressor with a Unic truck and installed it near the liquid nitrogen tank outside the bulk delivery entrance of the Reactor Building and then connected to the copper header of the IA system in the instrument rack of the liquid nitrogen gas supply panel. At around 14:00, the recovery team started up the temporary compressor.
- At 14:30 on March 12, the team confirmed that the D/W pressure was declining and attributed the cause to the “emission of radioactive materials” through venting.

  D/W pressure 750kPa[abs]→580kPa[abs](14:50)



Valves Operated to Form a Venting Line

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Chronology of Main Events at Fukushima Daiichi Nuclear Power Station Unit 2 from Impact of Earthquake through Tuesday, March 15

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

Friday, March 11, 2011

14:46	**The Tohoku-Pacific Ocean Earthquake occurred.** Automatic proclamation of Level 3 State of Emergency.
14:47	**Automatic reactor SCRAM.** The main turbine shut down automatically. The emergency diesel generator started up automatically.
14:50	The Reactor Core Isolation Cooling system (hereafter the "RCIC") was started up manually.
14:51	The RCIC shut down automatically (reactor water level high).
15:01	The reactor in a subcritical status confirmed.
15:02	The RCIC started up automatically.
15:06	The Extraordinary Disaster Countermeasures Headquarters was set up at the Head Office (to grasp damage in the earthquake and restore power supplies, etc.)
15:27	A first tsunami wave arrived.
15:28	The RCIC shut down automatically (reactor water level high).
15:35	**A second tsunami wave arrived.**
15:39	**The RCIC started up automatically.**
15:41	All of the AC power supplies were lost.
15:42	**The Emergency Countermeasures Headquarters decided and reported to the competent government departments and agencies on the occurrence of a specified event (loss of all the AC power supplies) subject to the provisions of Article 10 Clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (hereafter the "Nuclear Disaster Prevention Act").**
15:42	The Emergency Countermeasures Headquarters issued a first-level alert, which was followed by the setup of the Emergency Control HQ (Joint HQ with the Disaster Control HQ).
16:00 (Approx.)	**Check of the in-site roads for soundness started.**
16:10	**The Power Distribution Department of the Head Office instructed all the branch offices to reserve high and low voltage power source cars and**

	check relocation routes to Fukushima Power Station.
16:36	**The Emergency Countermeasures Headquarters was able to check neither the reactor water levels nor the water injection conditions. Thus, the Emergency Countermeasures Headquarters decided and reported to the competent government departments and agencies on the occurrence of a specified event (Inability of Water Injection by the Emergency Core Cooling System) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act at 16:45.**
16:36	The Emergency Countermeasures Headquarters issued a second-level alert.
16:39	**Checks of power supply facilities (offsite power, in-site power) for soundness started.**
16:50	**High and low voltage power source cars reserved by all the TEPCO offices left for Fukushima one after another.**
17:12	**The Site Superintendent ordered to study on the method for water injection in the reactors through the Fire Protection System line, which had been installed as part of the accident management measures, and through fire engines.**
19:00 (Approx.)	**The gate between Units 2 and 3 was opened, which reserved a vehicle traffic route to Units 1 to 4.**
19:24	**Results of checking the in-site-roads for soundness were reported to the Emergency Countermeasures Headquarters.**
20:47	Temporary lights in the Main Control Room were lit.
20:50	The Fukushima Prefecture government issued an order of evacuation to the local residents staying in the areas within a 2km radius of Fukushima Daiichi Nuclear Power Station.
20:56	**Results of checking the power supply facilities (offsite power, station power) for soundness were reported to the Emergency Countermeasures Headquarters.**
21:02	**Since the headquarters was able to check neither the reactor water level nor the water injection in the reactor through the RCIC, the Emergency Countermeasures Headquarters reported to the competent government departments and agencies that the reactor water level might reach the top of active fuel (hereafter the "TAF").**
21:13	The Emergency Countermeasures Headquarters assessed the TAF reach time as 21:40 and reported to the competent government departments and agencies.

21:23 The Prime Minister issued an order of evacuation to the local residents staying in the areas within a 3km radius of Fukushima Daiichi Nuclear Power Station and an order of in-house evacuation to the local residents staying in the areas within a 3km to 10km radios of the power station.

21:50 The reactor water level was confirmed as being at TAF+3400mm. The Emergency Countermeasures Headquarters assessed that it would take time before reaching the TAF and reported the assessment to the competent government departments and agencies at 22:10.

22:00 (Approx.) It was confirmed that one fist dispatch of high voltage power source (hereafter "HVPS") car from Tohoku Electric Power arrived.

Saturday, March 12, 2011

0:30 It was confirmed that the government's measure to evacuate local residents had been completed (evacuation of local residents staying in Futaba-machi and Okuma-machi within a 3km radius of Fukushima Daiichi Nuclear Power Station, which was confirmed again at 1:45).

1:20 It was confirmed that a diesel-driven fire pump (DDFP) had been in a halt.

1:20 (Approx.) It was confirmed that a TEPCO HVPS car arrived.

1:30 (Approx.) The Emergency Countermeasures Headquarters made a request to the Prime Minister, Minister of Economy, Trade and Industry, and Nuclear and Industrial Safety Agency for venting Units 1 and 2, and obtained their approval.

2:55 It was confirmed that the RCIC was in service.

3:06 Press release on Vent operation

3:33 The Emergency Countermeasures Headquarters reported the result of its dosage assessment in the event that Vent was operated to the competent government departments and agencies.

4:20 Shifting the water source for the RCIC started.

4:55 It was confirmed that radiation dose in the Power Station site rose (Near the main gate: 0.069μSv/h (4:00) → 0.59μSv/h (4:23)). The rise was reported to the competent government departments and agencies.

5:00 Shifting the water source for RCIC completed.

5:44 The Prime Minister issued an order of evacuation to the local residents staying in the areas within a 10km radius of Fukushima Daiichi Nuclear Power Station.

6:50 The Minister of Economy, Trade and Industry ordered Venting operation (manual Vent) in accordance with law.

7:11 The Prime Minister arrived at Fukushima Daiichi Nuclear Power Station.

8:04 The Prime Minister left Fukushima Daiichi Nuclear Power Station.

10:15 (Approx.) It was confirmed that 72 power source cars sent from TEPCO branch offices and from Tohoku Electric Power had arrived at Fukushima Nuclear Power Stations (Fukushima Daiichi received 12 HVPS cars and seven low voltage power source cars, while Fukushima Daini received 42 HVPS cars and 11 low voltage power source cars).

15:30 (Approx.) The restoration team formed a route where electricity from an HVPS car is supplied to the Unit 1 MCC through the Unit 2 P/C. The team started supplying electricity up to a point just before the standby liquid control system.

15:36 An explosion occurred at the reactor building of Unit 1.

16:27 Surrounding of monitoring post No. 4 measured a radiation dose beyond 500μSv/h (1,015μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in the radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies.

17:30 The Site Superintendent ordered operators to start Venting operation.

18:25 The Prime Minister issued an order of evacuation to the local residents staying in the areas within a 20km radius of Fukushima Daiichi Nuclear Power Station.

Sunday, March 13, 2011

8:10 The vent valve (MO valve) of the Primary Containment Vessel (hereafter the "PCV") was opened.

8:30 An HVPS car was started up to re-supply electricity to Unit 2 P/C. Due overcurrent relays activated , however, no electricity was transmitted.

8:56 Surrounding of monitoring post No. 4 measured a radiation dose beyond 500μSv/h (882 μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 9:01.

10:15 The Site Superintendent ordered operators to operate Venting.

11:00 The formation of a Venting line, except for the rupture disk, was completed.

11:20	Press release on Venting operation
12:05	**The Site Superintendent ordered operators to promote preparation for using seawater.**
13:10	A formation was completed where a battery was connected to the Safety Release Valve (hereafter the "SRV") control panel so as to control opening operation on the operation switch.
14:15	Surrounding of monitoring post No. 4 measured a radiation dose beyond 500μSv/h (905μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 14:23.
15:18	The Emergency Countermeasures Headquarters again reported to the competent government departments and agencies the result of its dosage assessment in the event that Venting was operated.

Monday, March 14, 2011

2:20	Surrounding of the main gate measured a radiation dose beyond 500μSv/h (751μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 4:24.
2:40	Surrounding of monitoring post No. 2 measured a radiation dose beyond 500μSv/h (650μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 5:37.
4:00	Surrounding of monitoring post No. 2 measured a radiation dose beyond 500μSv/h (820μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 8:00.
9:12	Surrounding of monitoring post No. 3 measured a radiation dose beyond

500μSv/h (518.7μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 9:34.

11:01	**An explosion occurred at the Reactor Building of Unit 3.**
12:50	It was confirmed that the circuit for the solenoid valves that excite the large valve of the vent valve (AO valve) of the suppression chamber (hereafter the "S/C") had been dislocated into a "closed" state.
13:05	The water injection line whose preparation had already been completed became not available because of damage to the fire engine and hose. Thus, preparation to form a seawater injection line, including fire engines, was resumed.
13:18	Since the reactor water level was on the decline, The Emergency Countermeasures Headquarters proposed immediate preparation for seawater injection operation, etc. to the competent government departments and agencies.
13:25	Since the reactor water level declined, there was a possibility that the RCIC function had been lost. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act (Loss of reactor cooling function) and reported the event to the competent government departments and agencies at 13:38.
15:28	The Emergency Countermeasures Headquarters assessed the TAF reach time as 16:30 and reported the assessment to the competent government departments and agencies.
16:30	Fire engines were started up to inject seawater in the reactor.
16:34	The Emergency Countermeasures Headquarters started reduction of the reactor pressure and reported its plan to start seawater injection from the Fire Protection System line to the competent government departments and agencies.
17:17	The reactor water level reached the TAF. At 17:25 of the day, the Emergency Countermeasures Headquarters reported the event to the competent government departments and agencies.
18:00 (Approx.)	Reduction of the reactor pressure started (reactor pressure : 5.4MPa → 19:03 0.63MPa).

18:22	The reactor water level reached TAF-3,700mm. The Emergency Countermeasures Headquarters estimated that the entire fuel had been exposed and accordingly reported the event to the competent government departments and agencies at 19:32.
19:20	It was confirmed that the fire engine to use for seawater injection in the reactor has been out of fuel and halted.
19:54	**Fire engines started seawater injection in the reactor through the Fire Protection System line (individual fire engines started up at 19:54 and 19:57, respectively).**
21:00 (Approx.)	**The small valve of the vent valve (AO valve) of the S/C valve was opened. The formation of a vent line, except for the rupture disk, was completed.**
21:20	Two SRV valves were opened. It was confirmed that the reactor water level was being restored. The Emergency Countermeasures Headquarters reported the formation to the competent government departments and agencies at 21:34 (as of 21:30, the reactor water level was TAF-3,000mm).
21:35	Surrounding of the main gate measured a radiation dose beyond 500μSv/h (760μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 22:35.
22:50	Since the drywell (hereafter the "D/W") pressure exceeded the maximum allowable working pressure of 427kPa[gage], the Emergency Countermeasures Headquarters decided on the occurrence of a specified event (Abnormal rise in the pressure of the Primary Containment Vessel) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 23:39.
23:35 (Approx.)	Since the pressure on the S/C side was lower than rupture disk working pressure and the pressure on the D/W was on the rise, the Emergency Countermeasures Headquarters decided to operate venting by opening the small valve of the vent valve.

Tuesday, March 15, 2011

0:01	**It was confirmed that the small valve of the vent valve (AO valve) of the D/W was closed several minutes after the small valve had been opened.**

3:00 Since the D/W pressure exceeded the maximum allowable working pressure in design, the Emergency Countermeasures Headquarters tried reducing the pressure and injecting water in the reactor. However, the pressure was not successfully reduced. The Emergency Countermeasures Headquarters reported the situations to the competent government departments and agencies at 4:17.

5:35 The Joint Accident Control HQ of Fukushima Nuclear Power Station was set up.

6:00 to 6:10 (Approx.) A large impulsive sound thundered. The indication value of the S/C pressure turned 0 MPa[abs].

6:50 Sounding of the main gate measured a radiation dose beyond 500μSv/h (583.7μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in the radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 7:00.

7:00 The Emergency Countermeasures Headquarters informed the competent government departments and agencies of a temporary evacuation of personnel to Fukushima Daini except for the personnel needed for monitoring and other operations.

8:11 Sounding of the main gate measured a radiation dose beyond 500μSv/h (807μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal emission of radioactive materials on fire or explosion, etc.) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 8:36.

8:25 It was confirmed that smoke (something like steam) was rising from around the 5th floor of the reactor building. The Emergency Countermeasures Headquarters reported the event to the competent government departments and agencies at 9:18.

11:00 The Prime Minister issued an order of in-house evacuation to the local residents staying in the areas ranging from a 20km up to a 30km radius of Fukushima Daiichi Nuclear Power Station.

16:00 Sounding of the main gate measured a radiation dose beyond 500μSv/h (531.6μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in the radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear `Disaster Prevention Act and reported the event to the competent government departments and agencies at 16:22.

23:05	Sounding of the main gate measured a radiation dose beyond 500μSv/h (4584μSv/h). The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in the radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 23:20.

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Fukushima Daiichi Nuclear Power Station Unit 2
State of Alternate Coolant Injection

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

<u>○ Activities after "16:36 on March 11 when "Inability to Inject Water of the Emergency Core Cooling System" was determined and reported on</u>

[Study and preparation for alternative means of water injection]

- From 17:12 on March 11, the Site Superintendent ordered operators to start studying the methods to inject water into the reactor via alternative means (Fire Protection System (hereafter the "FP"), makeup water condensate)) installed as part of the accident management (hereafter "AM") measures and with fire engines (installed following lessons learned from the Chuetsu-oki Earthquake).
- The operators at the Main Control Room took out the AM operation procedure description and placed it on the shift supervisor seat to check and confirm alternative means of water injection into the reactor.
- Considering the radiation dose in Unit 1, the Emergency Countermeasures Headquarters decided to form an alternative line of water injection into the reactor via the residual heat removal system (RHR) before the radiation dose rose. After completing the formation of an alternative line of water injection for Unit 1, from around 21:00 on March 11, operators started forming such line for Unit 2. However, the operators were unable to work in the Main Control Room due to the lack of power. The operators therefore

RHR injection valve fixed on a pipe of approx. 60cm diameter (Unit 5, with light)

Image of rotating the RHR injection valve (Unit 5,

The manual handle was very heavy to rotate in the narrow area.

wore full-face masks, took flashlights to light their way in complete darkness to the Reactor Building, and manually opened four solenoid valves, including the RHR valve. During March 11, they completed the formation of an alternative line of water injection.

- In particular, the RHR injection valve fixed on a pipe of approx. 60 cm diameter, pipe had a manual handle, also approx. 60 cm in diameter, which was very heavy to rotate. In addition, since the stroke of the stem was a large and long valve, operators had to climb up a ladder into the small spot for operation. A total of ten operators in rotation rotated the handle and it took approx. one hour to open the valve. (Normally, it takes approx. 24 seconds to fully open the valve electrically by operating switches at the Main Control Room.)
- The status indicator of the diesel-driven fire pump (hereafter the "DDFP") in the Main Control room had gone out. Since the basement of the Turbine Building where the DDFP was installed was submerged in approx. 60 cm of water, operators were unable to enter the FP pump room. However, operators confirmed that the DDFP was in service because they saw smoke from the DDFP exhaust duct outside the building. Even subsequently, the operators continued to check the exhaust duct for smoke. At 1:20 on March 12, however, operators saw no further smoke from the exhaust duct and confirmed that the DDFP had halted.

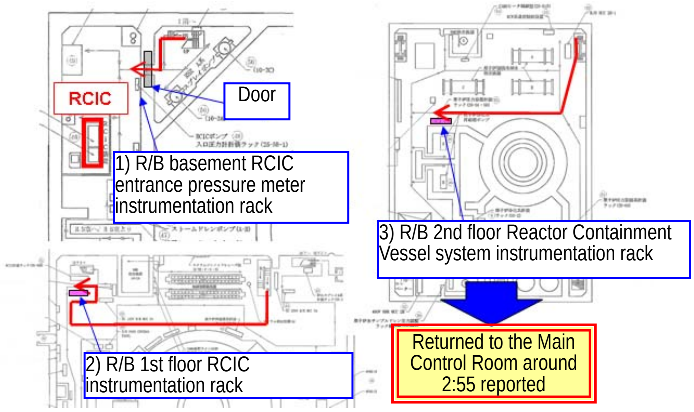
[Checking the state of the Reactor Core Isolation Cooling System (RCIC)]

- At around 1:00 on March 12, operators headed for the work site to check the state of the RCIC operation, wearing self-contained breathing apparatus and with flashlights. Dedicated boots, used for entering controlled areas, had been washed away and submerged, hence operators wore long rubber boots, normally used for outside patrols. The water in front of the RCIC room in the basement of the Reactor Building was deep, meaning their long boots were almost submerged in the water. When an operator opened the door of the RCIC room, water flowed from the room, hence the operator soon closed the door. Although operators were unable to enter the RCIC room, they heard metallic clank screaming. Since operators were unable to check the rotary unit, they were also unable to determine the operating state. Because no PHS was available for communication, they returned to the Main Control Room and reported the

Self-contained breathing

situation.

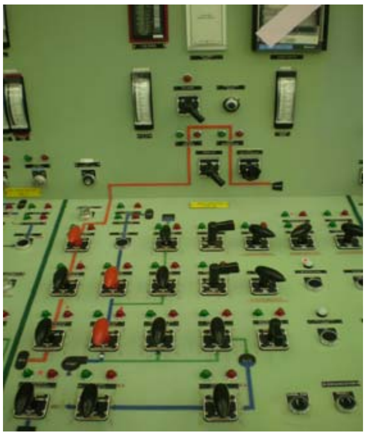
- At around 2:10 on March 12, operators headed back to the RCIC room to check the operation state. Although the water level in front of the door exceeded before, operators opened the door to check the operation state of the RCIC. Although water slowly flowed from the room, the operators entered the room and identified the pointer of the pump inlet pressure meter shaking in the pressure instrumentation rack at the entrance to the RCIC and again heard the operation sound. Subsequently, the operators confirmed that the RCIC instrumentation rack on the 1st floor of the Reactor Building indicated an RCIC discharge pressure of 6.0MPa and that the reactor pressure in the instrumentation rack of the Reactor Pressure Vessel system on the 2nd floor of the Reactor Building indicated 5.6MPa. Since the RCIC discharge pressure exceeded the reactor pressure, the RCIC was seemingly in service (functioning). The operators returned to the Main Control room and reported the situation at 2:55 to the Emergency Countermeasures Headquarters.



- The work site was in complete darkness amid continuing alarms against a large tsunami and frequent aftershocks. It took considerable time for operators to engage in special preparations, including putting self-contained breathing apparatus on and off. Eventually, it took approx. one hour for them to check a site that would normally take approx. 10 minutes during ordinary operation.

[Checking the state of the high pressure coolant injection system (HPCI)]

- Since all of the DC power supplies needed for operation control were lost and the status indicators of the Main Control room had gone out, the HPCI was no longer workable.
- From 16:39 on March 11, the restoration team started checking the on-site conditions of power supply facilities after the earthquake and tsunami. Since the service building where DC power supplies are installed was submerged approx. 1.5-meter deep on the basement floor, the restoration team gave up checking.



HPCI control panel (photo taken on a later day)
All the status indicators went out on the day.

<u>○ Activities after "2:55 on March 12 when confirming the RCIC in service"</u>

[Shifting water source of the RCIC]

- Operators decided to shift the water source to the S/C from the CST, considering the fact that the water level of the condensate storage tank (hereafter "CST"), the water source of the RCIC, was declining, the water level of the suppression pressure (hereafter the "S/C") was likely to rise: and that the CST would be the water source for alternative water injection facilities. From 4:20 on March 12, four operators, putting on C equipment and full-face masks, headed for the RCIC room.
- With the help of flashlights in darkness, operators entered the RCIC room. The floor was covered in water, up to the top of the long boots worn by the operators, while the humidity was also high, like a sauna.
- All lighting in the RCIC room had gone out. Amid the echoing operating sound of the RCIC, operators using flashlights

RCIC (with light, Unit 5)

The silver color (insulation material) body in the center is a turbine, while the green color unit behind is a pump. There are many pipes and supporting posts. Operators using flashlights moved around on the flooded floor to perform operations.

manipulated three solenoid valves to shift the water source formation line from the CST to the S/C. All the valves, with long stem strokes and manual handles, were very heavy to rotate. In addition, since the operating site was located so high and without scaffolding, operators had to climb up a ladder from and extend their arms to rotate the handle.

・ One operator was assigned to the entrance of the RCIC room to monitor the pressure indicated by the pump inlet pressure meter in the instrumentation rack near the entrance, while two operators in rotation engaged in handling the valves. The remaining operator carefully played the role of lighting and coordinating worker, with the operator monitoring the pressure to prevent the RCIC from halting. The operation was completed at 5:00 on March 12. (Normally, such a shift would take no more than five minutes by manipulating the electrical operation switch in the Main Control Room.)

[Confirming the RCIC operation state]

・ Under circumstances where the DDFP and the HPCI, which are facilities to inject water into the reactor requiring no power supply, were unavailable for operation, operators continued periodical checking of the operating state of the RCIC, the only water injection facility left.

➢ At around 21:00 on March 12, after checking the parameters in the Reactor Pressure Vessel instrumentation rack installed on the 2nd floor of the Reactor Building, an operator went downstairs and confirmed an operation sound on the way to the basement of the Reactor Building.

➢ At around 10:40 on March 13, an operator confirmed that the discharge pressure indicated pressure ranging from 6.0 to 6.4MPa in the RCIC instrumentation rack installed on the 1st floor of the Reactor Building, while the reactor pressure indicated 6.1MPa in the Reactor Pressure Vessel instrumentation rack installed on the 2nd floor of the Reactor Building. Thus, the operator confirmed that the RCIC discharge pressure exceeded the reactor pressure.

➢ At around 13:50 on March 13, an operator confirmed that the discharge pressure in the RCIC instrumentation rack installed on the 1st floor of the Reactor Building showed 6.3MPa, indicating the continuous operation of the RCIC.

[Preparing for a reduction in reactor pressure by seawater injection and with the safety release valve (hereafter the "SRV")]

・ For Unit 3, ten 12V batteries as a DC power supply (125V) were needed to drive the

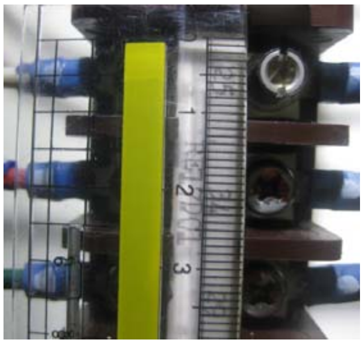
SRV that would reduce the reactor pressure by injecting water. At around 7:00 on March 13, the Emergency Countermeasures Headquarters asked its employees staying the Seismic Isolated Building to offer the batteries of their private cars.

- Such batteries would also be required for Unit 2 later. Thus, at the same time, the Emergency Countermeasures Headquarters asked its employees to offer batteries. The required number of persons who were ready to offer batteries gathered together. Each removed the battery from his/her vehicle and took it to the front of the Seismic Isolated Building..
- Five members of the restoration team transported batteries in their private cars to the Main Control Room of Unit 3, and then returned to the Anti-Earthquake Building to transport batteries to Unit 2. When they reached the entrance of Units 1 and 2, they received temporary evacuation instructions, because the Primary Containment Vessel of Unit 3 was going to have venting operation. Thus, the members of the restoration team moved toward the main gate of the Power Station and stood by there. They confirmed that smoke was flowing from the main stack of Units 3 and 4.
- After the Primary Containment Vessel of Unit 3 had vented, the five members of the restoration team resumed the transportation of batteries in their private cars to the Main Control Room of Unit 2.
- At 12:05 on March 13, the Site Superintendent instructed operators and other members to prepare for seawater injection into the reactor. In preparation against the RCIC halt, operators and workers promoted efforts to form a seawater injection line, whereby the reversing valve pit of Unit 3 was used as the water source in order to shift to seawater injection, in case. The fire brigade arranged fire engines to lay hoses and prepared for the startup of the fire engines to start seawater injection.

・ At 13:10 on March 13, the operators connected batteries to the SRV control panel in the Main Control Room so as to open the SRV valve on the operation switch of the SRV control panel, as they had done for Unit 3, to maintain the reduction in the reactor pressure.

- Although temporary lights were installed in the Main Control Room, their light did not reach the rear of the control panel where operators had been working in complete darkness. Even though operators used flashlights, terminals, cable numbers and drawings were not easy to see and read. Worse still, they had to work in a confined space while wearing full-face masks and rubber gloves.
- Operators connected ten 12 batteries serially to supply the DC power needed to start up the SRV. Wire-cutting and coat stripping needed fine finger work. Wires and terminals were directly connected and fastened with insulation vinyl tape, which could have resulted in accidental electric shock and/or short circuit. Using flashlights alone, the full-face mask provided a narrow view. The insulation vinyl tape sometimes twisted around the rubber gloves. At times, the wire accidentally came into contact with the battery, sparking and fusing part of the terminal.
- The utmost caution was needed for workers wearing two pairs of rubber gloves in picking and grasping small screws for terminals while tightening them with a screwdriver.

Rear side of the control panel
(Photo with light taken on a later day)



Terminal block (photo taken on a later day)
The block was approx. 1cm wide to connect with wire.

○ <u>Activities after "11:01 of March 14 when an explosion occurred at the reactor building of Unit 3"</u>

[Resuming the formation of a seawater injection line]

・ After the explosion, workers were suspended from operation at their work sites. However, following the instruction by the Site Superintendent, the fire brigade headed for the work sites at 13:05 on March 14. Exposed to a high radiation dose caused by scattered debris, the fire brigade checked the target sites. The water injection line, the formation of which had already been completed, had sustained damage to the fire engines and hoses, which were no longer usable.

- Since the fire engine that had been supplying seawater to the reversing valve pit of Unit 3 from the Shallow Draft Quay was undamaged in the explosion, the fire brigade decided to use it to inject seawater into the reactors of Units 2 and 3 from the Shallow Draft Quay as the water source. Thus, the fire brigade promoted efforts to establish an alternative line of water injection by, for example, replacing damaged hoses.
- At 13:18 on March 14, the reactor water level was found to be declining. At 13:25, the Site Superintendent decided that the RCIC had lost its function, and anticipated reaching the TAF around 16:30, judging from the facing conditions. The fire brigade continued preparation for seawater injection into the reactors. At around 14:43, the fire brigade succeeded in connecting the fire engine to the water supply outlet of the FP.
- From past 15:00 to 16:00 on March 14, aftershocks occurring in a Fukushima offing as the seismic center led to the suspension of work and temporary evacuation.
  - 15:13: Fukushima Prefecture offing, seismic intensity of 3, M6.3
  - 15:18 : Fukushima Prefecture offing, seismic intensity of 3, M5.3
  - 15:52: Fukushima Prefecture offing, seismic intensity of 3, M5.2
- At around 16:30 on March 14, the fire brigade started up a fire engine and made arrangements to restart water injection after reducing the reactor pressure.

[Reducing the reactor pressure]

- Prior to starting water injection with a fire engine, operators needed to open the SRV to reduce the reactor pressure. The previous day, the SRV was set to a state to perform opening operation. However, the S/C had high temperature and pressure (149.3℃ and 486kPa[abs] pressure as of 12:30 on March 14). Thus, there was the possibility that even if the SRV had been opened, steam in the S/C might not have condensed and the pressure could not have been reduced. Thus, the Emergency Countermeasures Headquarters decided to prepare to vent the Primary Containment Vessel (hereafter “Vent/Venting/”) prior to opening the SRV to reduce the reactor pressure and perform seawater injection.
- At around 16:20 on March 14, it was forecast that it would take time before the vent valve could be opened. Around 16:28, the Site Superintendent prioritized reducing the reactor pressure by using the SRV and instructed operators to promote venting

preparation concurrently.

- At 16:34 on March 14, the SRV puffing sound, along with rises in the reactor pressure, reached the calm Main Control Room. Operators tried opening the SRV on the operation switch but the SRV did not open.
  - Operators checked the connection points with the SRV control circuit and the circuit for opening operation, connected to another SRV and tried opening the operation switch. However, the SRV did not open.
  - In addition, operators tried connecting with two other SRVs one by one and tried opening the SRV on the operating switch. However, the SRV did not open.
  - All ten batteries were once disconnected from the wiring and then all re-connected serially.

Ten 12V batteries in serial connection
(Photo with light taken on a later day)

Wires and terminals were tightened with insulation vinyl tape. Accidental electric shocks and/or short circuits occurred, sparkling and fusing part of the terminal.

- At around 18:00 on March 14, the serial batteries were connected directly to solenoid valves that opened a discrete SRV for excitation. During the 5th SRV opening operation, the reactor pressure began to decease.

［Performing seawater injection］

- At around 16:30 on March 14, a fire engine was started up and members of the fire brigade started operation to reduce the reactor pressure from 16:34. Although pressure reduction started at around 18:00, the S/C had a high temperature and pressure that were unlikely to have condensation.

  Reactor pressure: 6.998MPa (16:34) → 6.075MPa (18:03) → 0.63MPa (19:03)
- At 19:03 on March 14, the reactor pressure declined to 0.63MPa.
- During this time, members of the fire brigade had to check the operating conditions of the fire engine, etc. in rotation amid high radiation doses at the work site. At 19:20 on March 14, a member found that the fuel of the fire engine used to inject the water had run out and it was no longer functional. After refueling the fire engine, the fire engine started seawater injection into the reactor through the Fire Protection System line. (At 19:54 and 19:57 on March 14, fire engines were started up respectively.)

- At around 21:00 on March 14, the reactor pressure rose. One more SRV was added to open, but did not open. When another SRV was used for the opening operation, the SRV opened at 21:20. While the reactor pressure was decreasing, the indicator showing the downscaled reactor water level meter showed an increase. Subsequently, the Emergency Countermeasures Headquarters continued reading the reactor water level, reactor pressure and D/W pressure every few minutes. While focusing on plant behavior, the headquarters continued water injection into the reactor. (For detail, refer to the “Measures Taken for Venting the Primary Containment Vessel.”)

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Fukushima Daiichi Nuclear Power Station Unit 2
Circumstances of Venting of Containment Vessel

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

○ Activities after "16:36 of March 11 when deciding and reporting on the Inability of the Emergency Core Cooling System to Inject Water"

- After operations to restore instruments, at 21:50 on March 11, the reactor water level was identified (TAF+3400mm). At 23:25, the drywell (hereafter the "D/W") pressure was identified (141kPa[abs]). Since the operation of the Reactor Core Isolation Cooling System (hereafter the "RCIC") was identified at 2:55 on March 12, the Emergency Countermeasures Headquarters decided to prioritize the venting operation of Unit 1 and accordingly promoted the venting preparation of Unit 1 while continuing to monitor the parameters of Unit 2.

○ Activities after "17:30 of March 12 when the Site Superintendent ordered to prepare for venting operation"

[Preparation for venting operation]

- Water injection into the reactor through the RCIC continued. Although the D/W pressure was stable at around 200 to 300kPa[abs], subsequent venting was likely to be required anyway. Accordingly, the Emergency Countermeasures Headquarters started to study the formation of a venting line of Unit 2, together with Unit 3. Since the radiation dose at the work site was low, the Emergency Countermeasures Headquarters decided to keep opening the valves needed for venting except for the rupture disk.
- At 0:06 on March 12, the D/W pressure of Unit 1 was determined as likely to have exceeded 600kPa[abs]. With this in mind, when starting to study specific venting preparation, the Emergency Countermeasures Headquarters examined valve drawings to check whether the valves needed for venting could be opened manually and whether jigs could be applied to forcibly open the same.
- As a result of these studies and based on piping instrumentation drawings, accident management procedure description, and Unit 1 venting procedure description, etc., the Emergency Countermeasures Headquarters confirmed that the valves needed for venting (the Primary Containment Vessel ("PCV") valve, (motor-operated valve (MO valve")) could be opened manually and that the suppression chamber(hereafter the

"S/C") vent valve (air-operated valve (hereafter the "AO valve") could not be opened manually. The Emergency Countermeasures Headquarters accordingly prepared the venting procedure and confirmed the positions of valves with a valve check-sheet.

(Works on March 13)

[Opening the PCV vent valve (MO valve) and the S/C large vent valve (AO valve)]

- For manual opening of the PCV vent valve (MO valve), operators wearing full-face masks and other required apparatus headed, with the help of flashlights, to the Reactor Building.
- At 8:10 on March 13, the operators succeeded in opening the PCV vent valve (MO valve) by 25% as indicated in the procedural description.
- At 10:15 on March 13, the Site Superintendent ordered operators to perform venting. To open the S/C large vent valve (AO valve), the recovery team opened the existing air cylinder outlet valve and activated the solenoid valves using the compact generator for temporary lights for the Main Control Room as a power supply to open the S/C large vent valve (AO valve).
- At 11:00 on March 13, the formation of a venting line, except for the rupture disk, was completed.

(Since the D/W pressure was lower than the rupture disk working pressure (427kPa[gage]), venting did not start. While keeping the vent valve open, operators continued monitoring the D/W pressure.)

- To keep the S/C large vent valve (AO valve) open, the Power Station Disaster Control decided to install temporary compressors, in addition to the air cylinders, and started the arrangement. At around 22:20 on March 13, the availability of temporary compressors kept at Fukushima Daini Nuclear Power Station and Kashiwazaki Kariwa Nuclear Power Station was notified.

(Works on March 14)

- At around 1:55 on March 14, a temporary compressor arrived from Fukushima Daini Nuclear Power Station. At around 3:00, the temporary compressor was installed near the air storage tank of the instrumentation compressed air (hereafter "IA") system on the first floor of the Turbine Building. After connecting the compressor to the IA pipe, operators started supplying water. Subsequently, under a high radiation dose at the work site, the compressor was refueled at intervals of several hours to maintain the operating state of the temporary compressor.

○ Activities “after 11:01 of March 14 when an explosion occurred at the Unit 3 reactor building”

[Impacts of the explosion]

- After the explosion, all the workers except for the operators at the Main Control Room suspended their work and evacuated into the Seismic Isolated Building. Restoration was suspended for a while to check the safety of workers and the conditions at work sites.
- At 12:50 on March 14, it was confirmed that the circuit to excite the solenoid valves of the S/C large vent valve (AO valve) had been dislocated and closed due to the impact of the explosion.
- The D/W pressure remained stable at around approx. 450kPa[abs], which was lower than the post-venting pressure.

[Opening the S/C small vent valve (AO valve)]

- After cancelling the evacuation order after the explosion, the reactor pressure had to be reduced by opening the safety release valve (hereafter the “SRV”) before a fire engine started injecting water into the reactor. At around this time, the S/C had high temperature and pressure and opening the SRV was unlikely to compress steam and reduce the pressure. Thus, the Emergency Countermeasures Headquarters decided to prepare for venting before opening the SRV to reduce the reactor pressure. At around 16:00 on March 14, the operators started to open the S/C large vent valve (AO valve).
- At around 16:20 on March 14, although the solenoid valves were excited, the SRV did not open because of inadequate air pressure supplied by a temporary compressor. Thus, at around 16:28, the Emergency Countermeasures Headquarters decided to prioritize reducing the reactor pressure by opening the SRV valve. The Site Superintendent ordered operators to promote venting preparation concurrently.
- At around 18:00 on March 14, operators started reducing the reactor pressure.
- Since the D/W pressure indicated no decrease, at around 18:35, operators continued to restore the venting line; not only for the S/C large vent valve (AO valve) but also for the S/C small vent valve (AO valve). Since it was confirmed that the S/C large vent valve (AO valve) had air compressed by the temporary compressor, the inability to open the SRV was considered attributable to the defect (earth fault) of a solenoid valve.
- At around 21:00 on March 14, the S/C small vent valve (AO valve) was opened slightly due to the excitation of the solenoid valves, which led to the completion of formation of a venting line except for the rupture disk.
  (Since the D/W pressure was lower than the rupture disk working pressure (427kPa[gage]), no venting took place. While keeping the vent valve open, operators

continued monitoring the D/W pressure.)

- At 22:50 on March 14, both the reactor and D/W pressures rose (reactor pressure: 1.823MPa[gage], D/W pressure: 540kPa[abs]). Since the D/W pressure exceeded the maximum allowable working pressure of 427kPa[gage], the Emergency Countermeasures Headquarters deemed the event as coming under the category set forth in Article 15 of the Nuclear Disaster Prevention Act, namely "Abnormal rise in the pressure of the Primary Containment Vessel."
- At 23:00 on March 14, the reactor pressure indicated 2.070MPa[gage], while the D/W pressure indicated 580kPa[abs]. Since the reactor pressure was rising, there was the possibility that the SRV remained closed. Since it was estimated that the power of the batteries remained but no air was left to drive the SRV, operators started to open other SRVs.
- Data calling continued at several intervals. At 23:25 on March 14, the reactor pressure indicated 3.150MPa[gage], while the D/W pressure indicated 700kPa[abs].

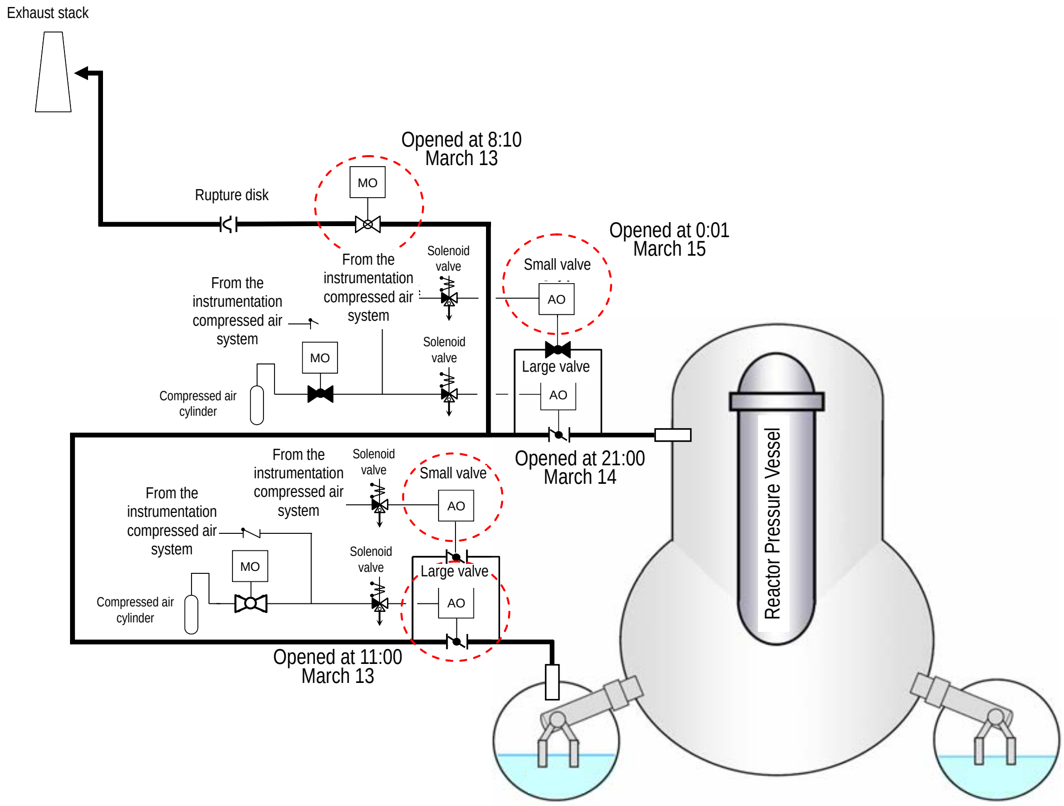
[Opening the small D/W vent valve (D/W pressure alone started to rise)]

- At around 23:35 on March 14, an operator confirmed that the S/C small vent valve (AO valve) had not opened. While the D/W pressure was rising, the S/C pressure remained stable at approx. 300 to 400kPa[abs]. Namely, the pressures were uneven. Since the pressure on the S/C side was lower than the rupture disk working pressure and the D/W side pressure was rising, the Emergency Countermeasures Headquarters decided to adopt a policy whereby the D/W small vent valve (AO valve) was opened for venting. At 23:30, data calling was performed. The reactor pressure indicated 1.913MPa[gage], while the D/W pressure indicated 700kPa[abs]. Whereas the reactor pressure was declining, the D/W pressure remained high, requiring venting, hence the operators hurried to open the D/W small vent valve (AO valve).
- At 23:40 on March 14, the reactor pressure was 1.170MPa[gage], whereas the D/W pressure was 740kPa[abs]. The S/C pressure was 300kPa[abs]. The reactor pressure was declining, the D/W pressure remained constant. At 23:46, the D/W pressure indicated 750kPa[abs].
- The Emergency Countermeasures Headquarters and the Main Control Room that was operating the D/W small vent valve (AO valve) had only two hot lines to communicate. One was used for the Main Control Room to have data calling while the other was used for communicating reports and instructions with the Emergency Countermeasures Headquarters. In addition, areas near the control panel of the Main Control Room that

were engaging in opening valves remained in complete darkness due to the lack of temporary lighting. As a result, operators kept opening the D/W small vent valve (AO valve).

(Works on March 15)

- At 0:01 on March 15, the Emergency Countermeasures Headquarters excited the solenoid valves to open the D/W small vent valve (AO valve). However, it was confirmed several minutes later that the small valve was closed.
- At 0:05 on March 15, the reactor pressure was 0.653MPa[gage]; the D/W pressure was 740kPa[abs]; and the D/W pressure remained constant. At 0:10, the reactor pressure was 0.833MPa[gage]; the D/W pressure was 740kPa[abs]; and the S/C pressure was 300kPa[abs] or so and remained unchanged. The reactor pressure began to rise. The recovery team received an order to prioritize connecting batteries to excite the SRV solenoid valves required to open the SRV. The recovery team continued the operations.



Valves Operated to Form a Venting Line

- At 0:22 on March 15, the reactor pressure was 1.170MPa[gage]. The D/W pressure was 735kPa[abs]. Since the reactor pressure was rising, the operators tried opening another SRV. However, at 0:45, the reactor pressure rose to 1.823MPa[gage], hence the SRV did not open and the operators tried to open other SRVs.
- At 1:10 on March 15 when the operators tried opening an SRV, the reactor pressure began to decline. The D/W pressure, however, remained constant at around 730kPa[abs]. The S/C pressure remained at around 300kPa[abs] and stable. Subsequently, the reactor pressure remained at around 0.63MPa[gage] and stable. At 2:22, the reactor pressure was rising and reached 0.675MPa[gage]. Thus, the operators began to open the next SRV. In addition, the D/W pressure rose slightly and at 2:45 reached 750kPa[abs].
- The recovery team at the Main Control Room engaged in opening the SRV to reduce the rising reactor pressure and opening the vent valve to reduce the rising pressure of the D/W since the evening of March 14. Following the instructions of the Emergency Countermeasures Headquarters to cope with the plant conditions, members of the recovery team put on full-face masks and rubber gloves. With the help of flashlights, members connected wires, while keeping the SRV open to stabilize the reactor pressure

and strove to form a venting line.

- At 5:35 on March 15, the Joint Fukushima Nuclear Power Station Accident Control HQ was set up.

○ Activities "after 6:00 to 6:10 on March 15 when a large impulsive sound thundered, causing the S/C pressure to show a reading of 0 kPa[abs]"

- At around 6:00 to 6:10 on March 15, a large impulsive sound thundered.
- An operator who engaged in monitoring the plant at the Main Control Room of Units 1 and 2 felt shocks that differed from the explosion at Unit 1. The operator who engaged in collecting data almost at the same time confirmed that the S/C pressure had an indication value of 0kPa[abs] and reported it to the Emergency Countermeasures Headquarters .
- At around this time, the ceiling on the Unit 4 side of the Main Control Room of Units 3 and 4 shook with an impulsive sound.
- Three operators heading for the Main Control Room of Units 3 and 4 for a work shift at 6:00 on March 15 felt wind pressure on their backs when entering the service building of Units 3 and 4. After entering the Main Control Room and checking the situation, the power generation team informed them of the temporary evacuation. Six operators, consisting of three operators and a further three operators staying at the Main Control Room, started to evacuate into the Seismic Isolated Building. When they left the service building of Units 3 and 4, the surroundings were full of debris. The six operators got in the car that they had just came in and headed for the Seismic Isolated Building. When they looked up at the Reactor Building of Unit 4 on the way, they confirmed that the area around the 5th floor was damaged. The road near the Reactor Building was full of scattered debris and the car could no longer advance. The six operators left the car, ran away from the Reactor Building of Unit 4, and then walked toward the Seismic Isolated Building. On their way there, they came across cars heading for the main gate to evacuate the Power Station. The six operators finally reached the Seismic Isolated Building and reported on the conditions of Unit 4 to the Emergency Countermeasures Headquarters.

Damage to Unit 4 (right side in photo)
(Unit 3 is on left side in photo)

- At around 6:30 on March 15, the Emergency Countermeasures Headquarters decided to temporarily move personnel into Fukushima Daini Nuclear Power Station, except for the personnel monitoring the plant and needed for emergency recovery. Each of the team leaders of the Emergency Countermeasures Headquarters appointed the persons needed for the abovementioned operations. Approx. 650 workers started to move into Fukushima Daini. Immediately after the evacuation, some 70 workers were left in the Emergency Countermeasures Headquarters.

- Operators went to the Main Control Room to collect data, including parameters and D/W parameters every few hours.
  - At around 11:25 on March 15, operators confirmed that the D/W pressure had declined.
    (730kPa[abs](7:20) → 155kPa[abs](11:25))

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Chronology of Main Events at Fukushima Daiichi Nuclear Power Station Unit 3 from Impact of Earthquake through Tuesday, March 15

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

Friday, March 11, 2011

14:46	**The Tohoku-Pacific Ocean Earthquake occurred.** Automatic proclamation of Level 3 Status of Emergency.
14:47	**Automatic reactor SCRAM.** The main turbine was tripped manually.
14:48 (Approx.)	The emergency diesel generator started up automatically.
14:54	The subcritical status of the reactor was confirmed.
15:05	The Reactor Core Isolation Cooling system (hereafter the "RCIC") was started up manually.
15:06	The Extraordinary Disaster Countermeasures Headquarters was set up at the Head Office (to determine damage sustained in the earthquake and restore power supplies, etc.)
15:25	The RCIC shut down automatically (reactor water level high).
15:27	The first tsunami arrived.
15:35	The second tsunami arrived.
15:38	All AC power supplies were lost.
15:42	**The Emergency Countermeasures Headquarters determined and reported the occurrence of a specified event to the competent government departments and agencies (loss of all AC power supplies) subject to the provisions of Article 10 Clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (hereafter the "Nuclear Disaster Prevention Act").**
15:42	The Emergency Countermeasures Headquarters issued a first-level alert, which was followed by the establishment of the Emergency Control HQ (Joint HQs with the Disaster Control HQ).
16:00 (Approx.)	**A check of the in-site roads for soundness started.**
16:03	**The RCIC was started up manually.**
16:10	**The Power Distribution Department of the Head Office instructed all the branch offices to reserve high and low voltage power source cars and check relocation routes to Fukushima Power Station.**

16:36	The Emergency Countermeasures Headquarters issued a second-level alert.
16:39	**Checks of power supply facilities (offsite power, station power) for soundness started.**
16:50	**High and low voltage power source cars reserved by all TEPCO offices left for Fukushima one after another.**
19:00 (Approx.)	**The gate between Units 2 and 3 was opened, which opened a vehicle traffic route to Units 1 to 4.**
19:24	**The results of checking the in-site-roads for soundness were reported to the Emergency Countermeasures Headquarters.**
20:50	The Governor of Fukushima Prefecture issued an evacuation order to local residents in areas within a 2km radius of the Fukushima Daiichi Nuclear Power Station.
20:56	**The results of checking the power supply facilities (offsite power, station power) for soundness were reported to the Emergency Countermeasures Headquarters.**
21:23	The Prime Minister issued an evacuation order to local residents staying in areas within a 3km radius of Fukushima Daiichi Nuclear Power Station and an order confining local residents indoors staying in areas within a 3 to 10km radius of the power station.
21:27	The temporary lights of the Main Control Room were lit up.
22:00 (Approx.)	**The arrival of an initially dispatched high voltage power source (hereafter "HVPS") car from Tohoku Electric Power was confirmed.**

Saturday, March 12, 2011

0:30	It was confirmed that the government's measure to evacuate local residents had been completed (evacuation of local residents staying in Futaba-machi and Okuma-machi within a 3km radius of Fukushima Daiichi Nuclear Power Station, which was reconfirmed at 1:45).
1:20 (Approx.)	It was confirmed that a TEPCO HVPS car had arrived.
3:27	The diesel-driven fire pump (hereafter "DDFP") did not start up.
4:55	It was confirmed that the radiation dose in the power station site had risen (Near the main gate: 0.069μSv/h (4:00) → 0.59μSv/h (4:23)). The rise was reported to competent government departments and agencies.
5:44	The Prime Minister issued an evacuation order to local residents staying in areas within a 10km radius of Fukushima Daiichi Nuclear Power Station.
7:11	The Prime Minister arrived at Fukushima Daiichi Nuclear Power Station.

8:04	The Prime Minister left Fukushima Daiichi Nuclear Power Station.
10:15 (Approx.)	It was confirmed that 72 power source cars sent from TEPCO branch offices and from Tohoku Electric Power had arrived at Fukushima Nuclear Power Stations (Fukushima Daiichi received 12 HVPS cars and seven low voltage power source cars, while Fukushima Daini received 42 HVPS cars and 11 low voltage power source cars).
11:13	The DDFP started up automatically.
11:36	The DDFP stopped.
11:36	**The RCIC stopped automatically.**
12:06	**The DDFP activated and started an alternative S/C spray.**
12:35	**The High Pressure Coolant Injection System (hereafter the "HPCI") started up automatically (reactor water level low).**
16:27	In the area around the monitoring post No. 4 measured a radiation dose exceeding 500μSv/h (1,015μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in the radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies.
17:30	**The Site Superintendent instructed operators to start preparation for venting.**
18:25	The Prime Minister issued an evacuation order to the local residents staying in areas within a 20km radius of Fukushima Daiichi Nuclear Power Station.
20:36	The reactor water level became unknown due to the loss of the power supplies to the reactor water meters.

Sunday, March 13, 2011

2:42	**The HPCI was stopped in order to shift to the DDFP as an alternative means of water injection into the reactor.**
2:45	An operator tried opening one Safety Release Valve (hereafter "SRV") but the valve did not open. Subsequently, the operator tried opening all the valves one by one but none of them opened.
3:05	It was reported to the Main Control Room that the formation of an alternative line of water injection into the reactor had been completed.
3:51	The reactor water level meters were restored.
4:52	It was confirmed that although an operator had opened the large valve of the

	vent valve (AO valve) of the suppression chamber (hereafter the "S/C"), it closed because the filling pressure of the air cylinder was 0.
5:08	Alternative spraying the S/C with the DDFP started (discontinued at 7:43).
5:10	The Power Station failed to inject water into the reactor through the RCIC. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (loss of the reactor cooling function) subject to the Provisions of Article 15 Clause 1 of the Disaster Prevention Act and reported this to the competent government departments and agencies at 5:58.
5:15	**The Site Superintendent instructed operators to complete the formation of a vent line except for the rupture disk.**
5:23	Operators started replacing air cylinders to perform an "open" operation of the large valve of the vent valve (AO valve) of the S/C.
5:50	Press release on vent operation.
6:19	The Emergency Countermeasures Headquarters decided on the reach of the top of active fuel (hereafter "TAF") at 4:15 and reported the event to the competent government departments and agencies.
7:35	The Emergency Countermeasures Headquarters reported the result of its dosage assessment in the event that the vent was operated to the competent government departments and agencies.
7:39	Operators started spraying the primary containment vessel. The Emergency Countermeasures Headquarters reported the operation to the competent government departments and agencies at 7:56.
8:35	Operators opened the vent valve (MO valve) of the primary containment vessel ("hereafter the "PCV").
8:41	**By opening the large valve of the vent valve (AO valve) of the S/C, the formation of a vent line, except for the rupture disk, was completed, and reported to the competent government departments and agencies at 8:46.**
8:56	In the area around monitoring post No. 4, a radiation dose exceeding 500μSv/h (882μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 9:01.
9:08 (Approx.)	Operators manipulated the safety release valve to rapidly reduce the reactor pressure. The Emergency Countermeasures Headquarters informed the

	competent government departments and agencies at 9:20 of its plan to start water injection into the reactor through the Fire Protection System line.
9:25	A fire engine started freshwater (containing boric acid) injection into the reactor through the Fire Protection System line.
9:36	**It was confirmed that the venting operation had triggered a decrease in the drywell (hereafter the "D/W") pressure at around 9:20. The Emergency Countermeasures Headquarters also reported to the competent government departments and agencies that it had started water injection into the reactor through the Fire Protection System line.**
10:30	**The Site Superintendent instructed operators to work with seawater injection in mind.**
11:17	It was confirmed that the large valve of the vent valve (AO valve) of the S/C had been in a "closed" state (due to a decrease in the pressure of the operational air cylinders).
12:20	**Injection of freshwater completed.**
12:30	The large valve of vent valve (AO valve) of the S/C was opened (operational air cylinders replaced).
13:12	**The fire engine started seawater injection into the reactor through the Fire Protection System line.**
14:15	In the area around monitoring post No. 4, a radiation dose exceeding 500μSv/h (905μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose in the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 14:23.
14:20	A high voltage power source car started supplying electricity to the Unit 4 P/C.
14:31	The measurement results of radiation doses were reported, which indicated 300mSv/h or more at the double door on the north side of the Reactor Building and 100mSv/h on the south side.
14:45 (Approx.)	The radiation dose in the area surrounding the double door of the Reactor Building was on the increase. Like the Reactor Building of Unit 1, there was a possibility of hydrogen having accumulated in the Reactor Building of Unit 3. Since the risk of explosion was high, workers started to evacuate their work sites (work resumed at around 17:00).

Monday, March 14, 2011

1:10	There was little seawater left being supplied to the reactor. Thus, the fire engine was halted to supply seawater into the reversing valve pit.
2:20	In the area around the main gate, a radiation dose exceeding 500μSv/h (751μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose in the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 4:24.
2:40	In the area around monitoring post No. 2, a radiation dose exceeding 500μSv/h (650μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 5:37.
3:20	The fire engine resumed seawater injection.
4:00	In the area around monitoring post No. 2, a radiation dose exceeding 500μSv/h (820μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 8:00.
5:20	An operator started the “open” operation of the small valve (AO valve) of the vent valve of the S/C.
6:10	An operator confirmed the “open' state of the small valve of the vent valve (AO valve) of the S/C.
6:30 (Approx.)	The D/W pressure increased and there was a possibility of explosion, hence workers started evacuation (work resumed at around 7:35).
9:05	Seawater supply started from the Shallow Draft Quay to the reversing valve pit.
9:12	In the area around monitoring post No. 3, a radiation dose exceeding 500μSv/h (518.7μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event

(Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 9:34.

11:01 **An explosion occurred at the Reactor Building.**

13:05 Since the fire engine and hose had been damaged in the explosion and were not available for use in the seawater injection line, preparation resumed to form a seawater injection line, including fire engines.

16:30 (Approx.) **The fire engine and hose sustained damage in the explosion, which led to the discontinuance of seawater injection. The fire engine and hose were thus replaced and a new line of water injection into the reactor from the Shallow Draft Quay was formed. Seawater injection was resumed.**

21:35 In the area around the main gate, a radiation dose exceeding 500μSv/h (760μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 22:35.

Tuesday, March 15, 2011

5:35 The Joint Accident Control HQ of Fukushima Nuclear Power Station was set up.

6:00 to 6:10 (Approx.) **A large impulsive sound broke out. The ceiling on the Unit 4 side of the Main Control Room shook.**

6:50 In the area around the main gate, a radiation dose exceeding 500μSv/h (583.7μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 7:00.

7:00 The Emergency Countermeasures Headquarters informed the competent government departments and agencies of a temporary evacuation of personnel to Fukushima Daini, except for the personnel needed for monitoring and other operations.

7:55 It was confirmed that steam was rising on the upper side of the Reactor Building, which was reported to the competent government departments and agencies.

8:11 In the area around the main gate, a radiation dose exceeding 500μSv/h (807μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal emission of radioactive materials on fire or explosion, etc.) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 8:36.

11:00 The Prime Minister issued an order confining local residents indoors staying in areas within a 20 to 30-km radius of the Fukushima Daiichi power station.

16:00 In the area around the main gate, a radiation dose exceeding 500μSv/h (531.6μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 16:22.

23:05 In the area around the main gate, a radiation dose exceeding 500μSv/h (4548μSv/h) was measured. The Emergency Countermeasures Headquarters accordingly decided on the occurrence of a specified event (Abnormal rise in radiation dose on the site boundary) subject to the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act and reported the event to the competent government departments and agencies at 23:20.

End of file

Fukushima Daiichi Nuclear Power Station Unit 3
State of Alternate Coolant Injection

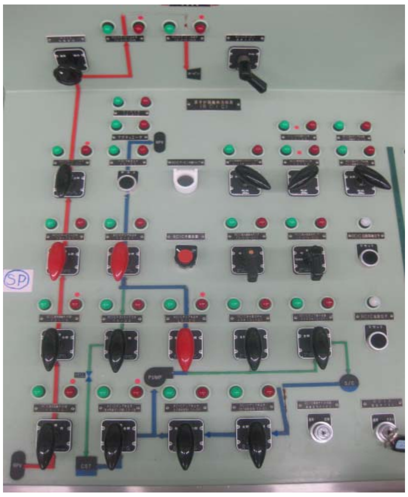
This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

○ Activities after “16:03 of March 11 when manually starting up the Reactor Core Isolation Cooling System (hereafter the “RCIC”)”

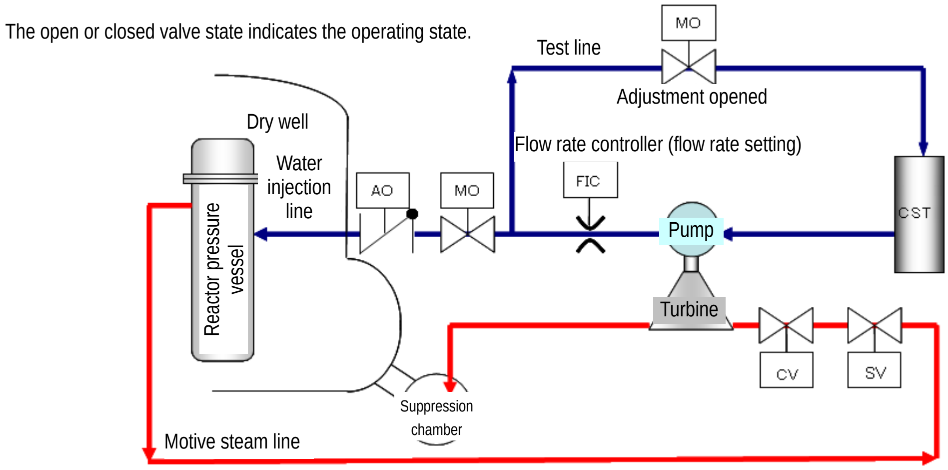
Although all the AC power supplies were lost, the DC power supply remained intact and available. Pursuant to the operation procedure description, the Emergency Countermeasures Headquarters worked to reserve the reactor water level by using the Reactor Core Isolation Cooling System (hereafter the “RCIC“) and the High Pressure Coolant Injection System (hereafter the “HPCI“), both of which use DC power for operation control.

[Reserving the reactor water level by the RCIC]

- To stabilize the reservation of the reactor water level by the RCIC, operators took measures to prevent automatic shutdown due to high reactor water level and to save the battery power needed for operation control.
  - To prevent automatic shutdown due to the high reactor water level, the Main Control Room operated the RCIC control panel to form the following two lines that supply water to a water injection line in the reactor and a test line used for regular functional tests (from the condensate storage tank (hereafter the “CST”), water source, to a line returning to the CST), while monitoring the reactor water level. The Main Control Room defined the range of water level arrangements used to reserve the water level.



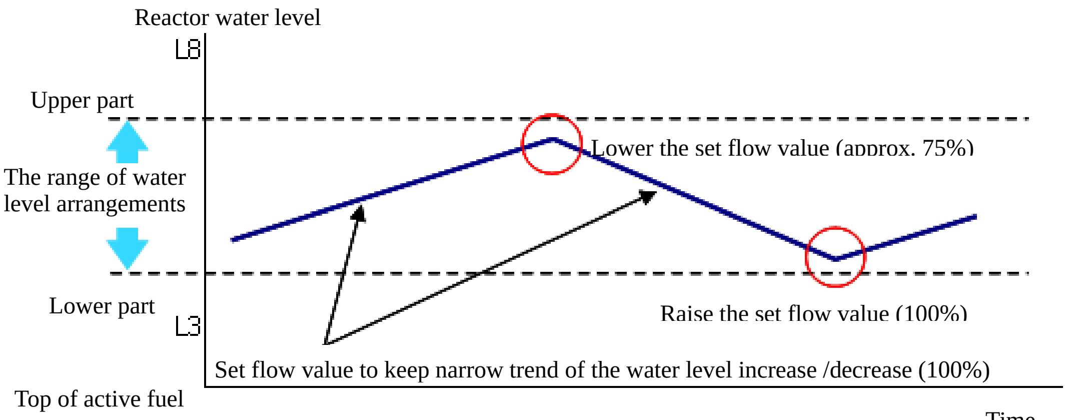
RCIC control panel (photo taken on a later day)



Overview of RCIC and HPCI reactor water injection

- Two operators were assigned to monitor the reactor water level, while a further two operators were assigned to operate the RCIC and exchanged information with each other. In addition, for the next means of water injection, operators prepared for smooth HPCI startup after stopping the RCIC by, for example, tagging switches, etc. on the HPCI control panel.
- It was crucial to preserve battery power. Thus, the operators set flow rates by adjusting the opening of valves on the test line and with the FIC so that the reactor water level would change slowly, meaning a reduced number of valves in operation and the flow instrument controller (hereafter the "FIC") operation. Operators also repeated the method involving an operator changing the flow rate setting when the reactor water level approaches the upper or lower end of the water level adjustment range (rated flow: 25.2L/s) within the range 100% to approx. 75%).

RCIC flow rate controller (FIC)
(Photo taken on a later day)



Method of adjusting reactor water level (Image)

- To save even more battery power, operators disconnected the loads of monitoring instruments, control panels and computers from others except those facilities crucial for monitoring and operation control. Monitoring instruments are doubled into systems A and B, only one of which was used at any one time to reduce the battery power consumption. In addition, emergency lights and clocks in the Main Control Room were disconnected while fluorescent lights of other rooms were pulled off.
- To disconnect loads, operators checked the loads with power supply wiring diagrams and system specification descriptions before setting them to "disconnect" on the power panel breaker in the cable bolt room on the first floor of the Control Building. Since no communication facility was available with the Main Control Room, persons were assigned to entrances of the work sites and of the Main Control Room between the cable bolt room, which is a controlled area, and the Main Control Room, which is a non-controlled area, to loudly and repeatedly convey instructions of load disconnection and check conditions for any disorder.

[Starting up the diesel-driven fire pump (hereafter the "DDFP") and alternative spraying of the S/C ("S/C")]

- After the earthquake, the status indicator of the DDFP, used for alternative water injection, indicated a halt state in the Main Control Room. At 3:27 on March 12, an operator tried manipulating operation switches in the Main Control Room. However, the DDFP did not start up.
- Since the RCIC was injecting water into the reactor, steam from the motive turbine was exhausted into the S/C, hence from March 12, the drywell (hereafter the "D/W")

pressure was on the rise. Accordingly, the Emergency Countermeasures Headquarters studied alternative spraying of the S/C using the DDFP, to limit the rises in S/C and D/W pressures. To this end, operators confirmed operation procedures and locations of valves based on the AM operation procedure description.

- Operators were subdivided into two teams to form an alternative line of spraying the S/C through the residual heat removal system ("RHR") from the Fire Protection System ("FP") line. The two teams headed for the Reactor Building and the Turbine Building. Since the solenoid valves for the line had no power source, the Main Control Room was unable to operate those valves. Putting on a full-face mask, operators using flashlights amid complete darkness manually opened five valves, including the RHR valve on the morning of March 12.
- While manually opening the S/C spray valve, the operators knew that the safety release valve ("SRV") was in service to regulate the reactor pressure and heard the sound of the reactor steam in the torus room being emitted into the S/C.
- When an operator checked the DDFP at the work site, the trouble indicator on the FP control panel in the FP pump room was lit up. At 11:13 on March 12, an operator pressed the trouble recovery button on the FP control panel to check the auto startup and also confirmed that the DDFP status indication in the Main Control Room indicated a startup state. After checking the DDFP for startup, the operator stopped the DDFP by pressing the operation switch in the Main Control Room. However, the DDFP re-started automatically. An operator headed for the work site again and at 11:36 pressed the emergency shutdown button on the FP control panel to stop the DDFP.
- At 12:06 on March 12, an operator pressed the trouble recovery button of the FP control panel, allowing the DDFP to start up automatically and perform alternative spraying of the S/C automatically.

○ Activities "after 11:36 of March 12 when stopping the RCIC"

[Stopping and re-starting the RCIC]

- While operators were steadily maintaining the reactor water level, the RCIC status indicator in the Main Control Room indicated a halt state. Consequently, the indication values, including those of flow rates and discharge pressure meters, also indicated zero, hence operators confirmed that the RCIC had stopped. However, no "stop" alarming functioned due to the loss of power.
- Although an operator tried starting up the RCIC on its control panel in the Main

Control Room, the RCIC soon ceased to operate after starting up, hence two operators headed for the RCIC room in the basement of the Reactor Building to check the conditions. They wore a full-face mask and long boots used for outside patrols. Using flashlights, they entered the RCIC room through the HPCI room and found that the floor was covered in water ankle-deep. Water also dropped from the ceiling of the room on the steam stop valve, etc. of the RCIC.

- The operators checked the site and confirmed that there was no defect of the of the steam stop valve mechanical structure units. When an operator in the Main Control Room tried starting up the RCIC, the steam stop valve closed soon after startup, and the RCIC stopped.

[Maintaining the reactor water level and reducing reactor pressure with the HPCI]

- Operators were urged to check the conditions of the halted RCIC and for startup operation. At 12:35 on March 12, the HPCI automatically started up due to the low reactor water level and resumed water injection into the reactor. Since the motive turbine of the HPCI spent the steam from the reactor, the reactor pressure started to go down.
- As was done for the RCIC, operators manipulated switches on the HPCI control panel to form two water supply lines, namely the reactor water injection line and the test line. Two operators were assigned to monitor the reactor water level, and a further two operators to operate the HPCI. Since the flow rate of the latter exceeded that of RCIC, the reactor water level rose rapidly, making it difficult for the operators to set the HPCI flow rate. Thus, after setting more variable water level adjustment, the operators maintained the reactor water level to prevent automatic shutdown of the HPCI due to the high reactor water level. In addition, operators set the minimum flow valve to shut down to prevent a rise in the water level of the destination S/C.
- To save battery power, as with RCIC measures, the operators set flow rates by adjusting the opening of the valves

HPCI flow instrument controller (FIC) (Photo taken on a later day)

HPCI control panel

To limit the rising S/C water level, the keying circuit of the minimum flow valve was fully closed.

on the test line and with the FIC so that the reactor water level changes slowly. The operators repeated the method whereby they changed the flow rate settings when the reactor water level approached the upper or lower ends of the water level adjustment range (flow rate: 268L/s) within a range of 100 to approx. 75%.

- The Emergency Countermeasures Headquarters and Main Control Room had sought water injection methods in order to adopt the existing facilities, the RCIC prior to HPCI, and then HPCI prior to DDFP for water injection.
- Following the reduction in the reactor pressure, the inlet steam pressure of the drive turbine decreased, resulting in slower turbine rotation. The HPCI pump discharge pressure was in service at a low pressure. The Emergency Countermeasures Headquarters and the Main Control Room instructed all operators to shift to DDFP for water injection, in the event water injection by the HPCI becomes unstable. To this end, both shared information on the HPCI operational state periodically.
- At 20:36 on March 12, the power of the reactor water level meter was lost, which resulted in the reactor water level not being monitored by operators. The flow rate setting of the HPCI was thus raised slightly to monitor the operational state with the reactor pressure and HPCI discharge pressure, etc.

○ Activities "after 2:42 on March 13 when the HPCI halted"

[State of the HPCI halt]

- The rotation speed of the HPCI turbine was lower than the operational range specified in the operation procedure description, while the discharge pressure of the HPCI was so low that it could have stopped anytime. Consequently, operators were unable to monitor the reactor water level, which hence remained unknown.
- Operators monitored the reactor pressure, the HPCI discharge pressure, etc. while considering whether "water was being injected into the reactor," "whether the reactor water level is being maintained," and "when to shift to the DDFP," etc.
- Under the circumstances, from 2:00 on March 13, the reactor pressure that had remained stable at approx. 1MPa began to decline. The power generation team and the Main Control Room were afraid of possible damage to facilities due to the decline in the reactor pressure, since it would trigger a further decline in the rotation speed of the HPCI turbine, exposing the facilities to greater vibration and possibly causing damage.* In addition, since the reactor pressure and HPCI discharge pressure were nearly equal, The Power Station estimated that the HPCI was unable to inject water into the reactor. Under these circumstances, the Power Station decided to inject water into the reactor through the DDFP, as an alternative means,

and stop the HPCI, hurriedly.

* In the event that damage occurs around the HPCI turbine, steam from the reactor will be emitted in the HPCI room as motive steam.

- Operators headed for the Reactor Building prior to stopping the HPCI, in order to check the DDFP operational state and manually open the RHR injection valve prior to shifting to alternative water injection into the reactor from the alternative spray of the S/C.
- At 2:42 on March 13, an operator informed the power generation team of the HPCI of the halt, pressed the HPCI button on the HPCI control panel in the Main Control Room, closed the steam inlet valve of the HPCI turbine with the switch, and halted the HPCI.

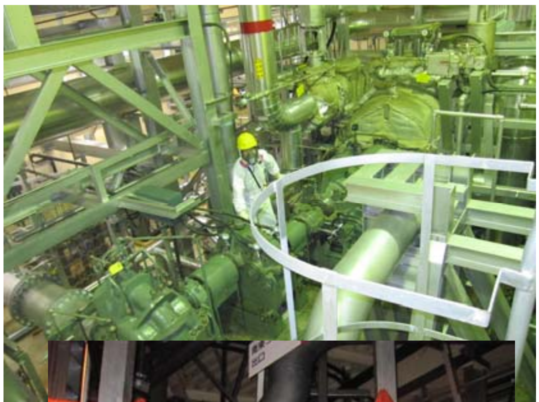
[Shifting to an alternative water injection line in the reactor with the DDFP]

- In order to shift to an alternative water injection line in the reactor with the DDFP from HPCI, from 2:45 on March 13, operators tried opening the SRV1 valve with the operation switch on the SRV control panel in the Main Control Room to reduce and maintain reactor pressure. However, the SRV1 valve did not open. Subsequently, operators tried opening all of the SRV valves one by one with the corresponding operation switch but none opened. An operator then reported to the Emergency Countermeasures Headquarters that the reactor pressure had risen and water injection with the DDFP had failed.
- Meanwhile, the Main Control Room received a report at 3:05 that an alternative water injection line into the reactor by manually opening the RHR water injection valve, which had been promoted by operators at the work site before the HPCI was stopped, had been established.
- Operators thought that such valve would not be opened unless nitrogen gas to drive the SRVs were supplied. They headed for the work site to try to feed the gas from the supply line. However, valves on the supply line are air-operated and their structure did not allow the operators to open them manually.
- Under the circumstances, given the rising reactor pressure, operators studied efforts to try the HPCI and the RCIC startups for high pressure water injection. Subsequently, the Emergency Countermeasures Headquarters promoted the restoration of power with a power source car, the preparation of which had started from March 12 concurrently, and started studying attempts to inject water into the reactor through the standby liquid control system (“SLC”), enabling high pressure water injection and arrange a fire engine.
- From 3:44 on March 13, the reactor pressure rose to 4.1MPa.

[Restoration of the RCIC and HPCI]

- At 3:35 on March 13, when an operator checked the HPCI control panel in the Main Control Room to start up the HPCI, the FIC indication for operation control had gone out and the HPCI could not be restarted. To reserve water to inject in the reactor, operators headed for the basement of the Reactor Building to restore the RCIC.
- When entering the HPCI room, the operators confirmed there was no defect in the HPCI stoppage, and then entered the RCIC room. The operators checked the bite-in state of the mechanical structure of the RCIC steam stop valve, adjusted the same and rechecked it before startup.
- From 5:08 on March 13, operators tried starting up the RCIC on the RCIC control panel in the Main Control Room after setting a low flow rate with the FIC so that the bite-in state of the mechanical structure would have no impact during the RCIC startup. However, the mechanical structure of the steam stop valve was dislocated, resulting in the closure of the valve and stoppage of the RCIC.
- Since the RCIC startup failed, the Emergency Countermeasures Headquarters decided at 5:10 on March 13 that the event came under the category of a specified event (Loss of reactor cooling function) as defined in the provisions of Article 15 Clause 1 of the Nuclear Disaster Prevention Act, and reported the event to the competent government departments and agencies at 5:58.

RCIC (Unit 5, with light)



There are many pipes and supporting posts in the RCIC ar ... ved around the flooded floor to perform operations.

[Alternative line of spraying the S/C and D/W with the DDFP]

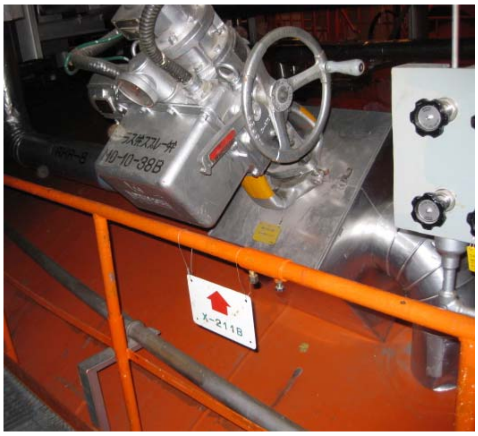
- Although the pressure of the D/W

Torus room entrance (Unit 5, with light)

Operators headed for the muggy room to manipulate the S/C spray valve manually using flashlights in complete darkness.

and the S/C was on the rise, the formation of a line to vent the Primary Containment Vessel was not completed, hence the Emergency Countermeasures Headquarters decided to limit the pressure of the S/C with an alternative spraying line.

- At 5:08 on March 13, operators manually closed the RHR injection valve on the reactor water injection line. The operators then moved into the torus room and manually opened the S/C spray valve to start the S/C spraying.
- The torus room, where the S/C spray valve was installed, was very muggy. Besides, without a flashlight, the room was in complete darkness due to the loss of lighting. Furthermore, since the working SRV was making large discontinuous buzzing noises throughout the room, emitting steam into the S/C, operators felt considerable fear at the large vibrations. In addition, the occurrence of the earthquake on March 11 was followed by strong and frequent aftershocks, hence operators engaged in their work in a tense atmosphere.
- From 7:39 on March 13, operators shifted to the D/W spray line from the S/C spray line and manually operated the valve to start the D/W spraying. At 7:43, operators manually closed the S/C spray valve.
- When operators closed the S/C spray valve, the torus room was at a higher temperature. When the operator placed his/her boots on the upper torus, the bottom rubber part melted. In addition, the operation handle of the S/C spray valve was so hot that the operator was unable to grasp the handle for an extended period.
- The D/W spraying limited rises in the D/W and S/C pressures and kept leveling-off. The Emergency Countermeasures Headquarters hurried to form a line to vent the Primary Containment Vessel and decided to stop the D/W spray to perform early venting of the Primary Containment Vessel.



S/C spray valve (Unit 5, with light)

The orange area is a torus; The S/C spray valve is located on the upper torus. The operator cannot manipulate the handle without placing his/her feet on the torus.

- From 8:40 to 9:10 on March 13, operators manually opened the RHR injection valve and manually closed the D/W spray valve to shift to an alternative water injection line on the reactor.

[Preparing an alternative water injection line in the reactor with a fire engine]

- While restoring the SLC and other permanent reactor water injection facilities, the Emergency Countermeasures Headquarters concurrently arranged fire engines.
- At around 5:30 on March 13, fire engines owned by Kashiwazaki Kariya Nuclear Power Station, which stood by in Fukushima Daini, left Fukushima Daini and arrived at Fukushima Daiichi at around 6:30. When operators checked the fire engines on the side of Units 5 and 6 at around 6:00, they were identified as available for operation and thus collected for water injection into the reactor of Unit 3.
- As was done for Unit 1, the formation of a seawater injection line from the reversing valve pit of Unit 3 as a water source was completed. Subsequently, however, the line was changed to a freshwater injection line from the anti-fire water tank as a water source.

[Reducing the reactor pressure with SRV and injecting water into the reactor alternatively with fire engines and the DDFP]

- It was found that power restoration with a power source car had taken time to use the SLC of Unit 3 for the reactor water injection. Consequently, there were no other means available except the DDFP and fire engines to inject water into the reactor.
- Water injection into the reactor with the DDFP or fire engines required a reduction of the reactor pressure with SRV. The Emergency Countermeasures Headquarters estimated that ten 12V batteries (DC power 125V) would be necessary to start up the SRV. However, such batteries had been used for the restoration, etc. of the instruments of Units 1 and 2.
- At around 7:00 on March 13, the Emergency Countermeasures Headquarters asked TEPCO employees in the Seismic Isolated Building to offer batteries of their private cars. After a sufficient number of willing employees had gathered, they removed the batteries from their cars. These batteries were then gathered together in front of the Seismic Isolated Building, whereupon five members of the recovery team transported them with their private car to the Main Control Room of Unit 3.
- When two members of the recovery team were starting to connect ten 12V batteries serially, an operator explained that the reactor pressure had declined.
- At around 9:08 on March 13, the SRV was opened. Reduction of the reactor pressure started rapidly. Along with reduction of the reactor pressure, operators started water injection with the DDFP and from 9:25, with fire engines. The Emergency Countermeasures Headquarters requested additional freshwater supply from others. The fire brigade drew up water from the simulant fuel pool in the Technical Training Center in the Power Station site and other sources, which was then supplied to the anti-fire water tank to continue water injection.

SRV control panel (photo taken

- At around 9:40 on March 13, the operation to connect ten batteries serially was completed and they were connected to the SRV control panel. Operators opened the SRV with the operation switch and maintained the reduction in pressure

[Studying measures to prevent explosions]

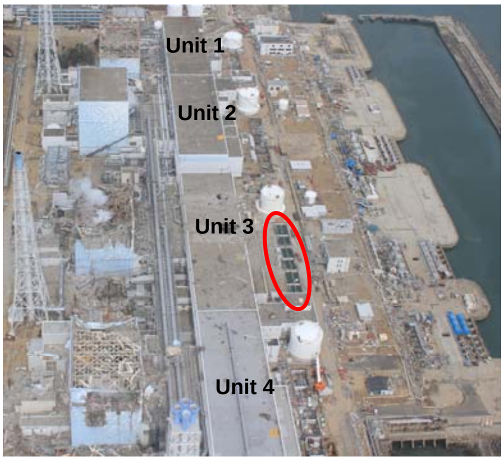
- After the explosion at the Reactor Building of Unit 1, the Nuclear Restoration Team of the Head Office Disaster Control HQ believed from an early stage that hydrogen had caused the explosion and accordingly started to study how to release accumulating gas in the Reactor Building.

- At around 9:40 on March 13, the Site Superintendent explained the key to preventing similar explosions, although the cause of the explosion may not have been hydrogen. Together with the Head Office Disaster Control HQ, the Emergency Countermeasures Headquarters started to study preventive measures.

○ Activities after "10:30 on March 13 when the Site Superintendent ordered operation in view of seawater injection"

[Shifting to seawater injection]

- The fire brigade was injecting freshwater from the anti-fire water tank to which water was being supplied. At 12:20 on March 13, however, the nearby anti-fire water tanks had little freshwater left. The fire brigade started to shift the water injection line to the seawater injection line of the reversing valve pit of Unit 3. Because the fire brigade had prepared for the shift in a short time, the formation of an alternative line was completed at 13:12 and seawater injection commenced.



Condenser reversing valve pit of Unit 3

- The DDFP was in service during interruption when the water source was switched to seawater for the fire engine-based reactor water injection.

【Evacuating before explosion and study on methods to prevent explosions】

- At around 14:45 on March 13, the radiation dose behind the double doors of the Reactor Building indicated approx. 300mSv/h. The Emergency Countermeasures Headquarters anticipated another explosion of accumulated hydrogen in the Reactor Building like that of Unit 1 and, therefore, decided to temporarily evacuate workers in the Main Control Room and field.
- After the evacuation, at around 17:00 on March 13, the Emergency Countermeasures Headquarters cancelled the evacuation of the workers engaged in checking venting lines for soundness and reworked the seawater injection line. Workers resumed operations.

- On the afternoon on March 13, the Chief Cabinet Secretary held a press conference on the situation of Unit 3 at the Prime Minister's Office and announced a possible explosion of hydrogen.
- Subsequently, as means of releasing the hydrogen in the Reactor Building, a number of methods were proposed including "release of the blowout panel," "piercing the ceiling of the Reactor Building," and "using a water jet to make a hole in the Reactor Building wall." Methods other than the “water jet” carried a high risk of explosion due to the sparks created when making a hole. The high radiation dose on the work site also prevented the adoption of other methods.
- The Emergency Countermeasures Headquarters focused on studying the "water jet" method and made arrangement for facilities.

【Interruptions of seawater injection due to the decline of water in the reversing valve pit and resumption】

- The Emergency Countermeasures Headquarters had continued to request supporting fire engines from the Head Office Disaster Control HQ. However, due to exposure to a high radiation dose at the Power Station site, the contamination problem, and poor road conditions to the Power Station, fine engines were unable to reach the Power Station directly, hence fire engines were delivered to TEPCO employees and workers of contractor companies at the Offsite Center and the J Village, etc. These fire engines were then driven one after the other to the Power Station.
- To supply water to the reversing valve pit of Unit 3, the fire brigade drew water from other water sources.
  - A water wagon and a vacuum truck for civil engineering work left in the Power Station site were used to draw water from reservoirs and repeatedly supply it to the reversing valve pit.
  - To use the seawater having accumulated in the basement of the Turbine Building of Unit 4, the fire brigade opened the shutter of the bulk delivery entrance of the Turbine Building, drove a fire engine nearby and tried drawing the seawater with the fire engine. However, the fire engine was unable to draw up seawater because the water level was low.
  - Although the fire brigade tried to draw up water from the seawater intake of Unit 4, the road up to the seawater intake subsided and prevented vehicles from passing. The fire brigade then opened a manhole and access hole, of the drain to draw seawater. However, the fire engine was unable to draw seawater because of the considerable distance from the seawater surface level.

・ At 1:10 on March 14, the reversing valve pit of Unit 3 had little seawater left. The fire brigade thus stopped supplying water from the pit via the fire engine and thus prevented the fire engine pump from burning out. The fire brigade was able to draw in seawater to inject into Unit 3 by approaching the fire engine beside the reversing valve pit of Unit 3 and lowering the sucking position of the hose and resumed seawater injection from 3:20.

【Evacuation before explosion and supplying seawater to the reversing valve pit】

・ At 5:03 on March 14, four fire engines from TEPCO thermal power stations arrived. The fire brigade promoted preparations to collect seawater directly from the sea and supply it to the reversing valve pit of Unit 3.

・ At around 5:50 on March 14, the D/W pressure exceeded 2:00 or so and kept rising, despite injecting more water into the reactor.

・ At 6:10 on March 14, opening the S/C small vent valve (AO valve) was completed.

・ At around 6:30 on March 14, the D/W pressure rose to 495kPa[abs], indicating a possible explosion. The Site Superintendent ordered the employees and workers to evacuate for safety.

・ At around 7:20 on March 14, the D/W pressure, which had risen to 520kPa[abs] at 7:00, declined and stabilized at 500kPa[abs]. Accordingly, the Emergency Countermeasures Headquarters, together with workers evacuated from their work sites, started examining what they could do. Since the reversing valve pit of Unit 3 needed water to inject in the reactor, employees headed for the work site at around 7:35 to supply seawater from the Shallow Draft Quay to the reversing valve pit of Unit 3.

・ At 7:43 on March 14, the Emergency Countermeasures Headquarters received confirmation from the Self Defense Forces of Japan that a water wagon could be used for transporting freshwater.

・ By 8:52 of 14th day, the injection of boric acid into the reversing valve pit of Unit 3 was completed.

・ At 9:05 on March 14, the fire brigade started up a fire engine to supply water from the Shallow Draft Quay to the reversing valve pit of Unit 3, and then continued supplying water.

・ At 10:53 on March 14, seven 5-ton water wagons of the Self Defense Forces of Japan arrived at the Power Station. Two of them headed for the reversing valve pit of Unit 3.

○ Activities after “11:01 of March 14 when an explosion occurred at the Reactor Building”

[State of the explosion]

- The fire brigade, which had been monitoring the water level of the reversing valve pit of Unit 3 and the pressure and flow rate of the fire engine that was injecting water, guided water wagons for water supply to the reversing valve pit of Unit 3. While the fire brigade was guiding several water wagons, an explosion occurred, whereupon the surroundings immediately turned white due to smoke, etc. After a while, debris began to drop from the sky, clattering. To protect themselves, the fire brigade members escaped behind nearby pipes. Although the shelter was inadequate, miraculously, all workers were unscathed.
- When the surrounding smoke eased off, two injured employees were walking near the service building of Unit 3. The fire brigade, after calling for workers at the work sites to gather together, started walking to evacuate through the road between Units 2 and 3 where debris was scattered.
- When the fire brigade members and other workers passed the gate between Units 2 and 3, a truck of the Self Defense Forces of Japan arrived. All the members then got on the loading space of the truck and returned to the Seismic Isolated Building.

[Post-explosion measures taken]

- At 11:01 on March 14, an explosion occurred at Unit 3, smoking. Later, pictures of the building were broadcasted on TV.
- The Site Superintendent instructed subordinates to evacuate and check for safety. The Site Superintendent also ordered the security team to measure and report radiation doses. Since a tsunami warning had been issued, Site Superintendent ordered the earliest evacuation.

Appearance of Unit 3 immediately after the explosion
(Photo taken on March 21, 2011)

- Workers other than operators at the Main Control Room suspended their work and evacuated to the Seismic Isolated Building.
- At 11:15 on March 15, the parameters of Unit 3 were reported. The reactor pressures of systems A and B were respectively 0.195 and 0.203MPa. The D/W pressure was 380kPa[abs]. The S/C pressure was 390kPa[abs]. Since parameters remained

available and based on the measurement values of the reactor pressure and the Primary Containment Vessel pressure, the Site Superintendent decided that these facilities remained sound.

- At around 11:30 on March 14, the results of checking personnel for safety were immediately reported to the Emergency Countermeasures Headquarters. According to initial reports, some 40 persons were missing and there were several injuries. The Emergency Countermeasures Headquarters requested ambulances via the Head Office Disaster Control HQ (the total injured included four TEPCO employees, three workers of contractor companies, and four soldiers of the Self Defense Forces of Japan).
- At around 11:40 on March 14, the Emergency Countermeasures Headquarters confirmed the safety of operators at the Main Control Room. It was reported that a total of seven persons, consisting of six soldiers of the Self Defense Forces of Japan and one worker of a contractor company, were missing. Later, the Self Defense Forces of Japan retreated.
- At around 12:50 on March 14, it was reported to the Emergency Countermeasures Headquarters that the reactor water level of Unit 2 had begun to decline while the reactor pressure began to rise.
- At 13:05 on March 14, when all the operators and workers still remained shocked at a second explosion following that of Unit 1, the Site Superintendent issues the following instruction to take measures for control Unit 2: “The reactor water level of Unit 2 is confirmed as declining. If this state continues, the reactor will reach the TAF (top of active fuel) at around 16:00. We will form a reactor water injection line and restore the reversing valve pit of Unit 3, the water source, by 14:30. Be careful to avoid other explosions. The explosion at Unit 3 might have disrupted facilities. Do not easily assume that facilities are available for operation.”

・ At 13:17 on March 14, the Site Superintendent requested the Head Office Disaster Control HQ to take swift measures to release the blowout panels of Unit 2 or make a hole in the Reactor Building,
・ At 14:50 on March 14, it was reported to the Emergency Countermeasures Headquarters that the blowout panels on the sea side of Unit 2 were open. (A subsequent survey identified that the explosion at Unit 1 had caused the opening.)

[Resuming water injection into the reactor]

・ From 13:05 on March 14, immediately after the instruction of Site Superintendent, the fire brigade headed for the work sites to check the situation. They were exposed to high radiation doses when passing through roads with scattered debris. The water injection line was also unavailable because the fire engine and hose had damage.

The fire-engine-based water injection from the Shallow Draft Quay

・ The fire engine that supplied seawater from the Shallow Draft Quay to the reversing valve pi of Unit 3 remained in service and available for operation. Thus, the Emergency Countermeasures Headquarters decided to use the fire engine to supply seawater from the Shallow Draft Quay to Units 2 and 3 and promoted preparation for a water injection line.
・ At around 16:30 of the 14th, The fire engine was started up to resume the seawater injection line.

End of file

Fukushima Daiichi Nuclear Power Station Unit 3
Circumstances of Venting of Containment Vessel

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

○ Activities since "the Site Superintendent instructed the start of preparations for ventilation at 17:30 on March 12"

[Advance preparations for venting]

- Discussion of the venting procedure started in the main control room after 21:00 on March 12. The order and the position for valve operation were inspected and written on the white board.
- The Power Generation Team reviewed the vent operation procedure with the Restoration Team with reference to the Vent Operation Procedures for Unit 1 and the Accident Management Operation Procedures for Unit 3 after the development of the Vent Operation Procedures for Unit 1. The developed procedures were communicated to the main control room.
- At 20:36 on March 12, due to loss of the power source for measurement, the reactor vessel level became unavailable. The Restoration Team started instrument restoration work, such as carrying of a battery into the main control room, preparation for drawings, checking of joints, and connecting, in the main control room lit only by temporary lights, wearing gears such as a full-face mask and rubber gloves, along with the S/C vent valve (AO valve) large valve opening operation.

(Works on March 13)

- At 3:51 on March 13, the reactor vessel level instrumentation system recovered.
- At 4:52 on March 13, in order to open the S/C vent valve (AO valve) large valve, the solenoid valve was forcibly excited by a small generator for temporary lighting in the main control room. Then a reactor operator inspected the state of the S/C vent valve (AO valve) large valve in the torus room on the basement floor of the reactor building, and found that the degree of openness showed that the valve was closed with the charging pressure of the air cylinder for operation of the S/C vent valve (AO valve) large valve indicating zero. At that time, the torus room was hot and humid, and was in complete darkness due to loss of the power source for lighting. The work was conducted by torchlight only. Also large vibration and noise were produced by the

steam being released into the S/C as the safety relief valve (hereinafter abbreviated as "SRV") was operated.

[Implementation of Venting line up]

- At 5:15 on March 13, the Site Superintendent instructed to complete venting line up except for the ruptured discs and prepare for the press conference.
- About 5:23 on March 13, the Restoration Team started the restoration work given the charging pressure of the air cylinder for operation of the S/C vent valve (AO valve) large valve indicating zero. They removed one of the three cylinders for calibration of the D/W oxygen densitometer placed on the first floor of the reactor building, replaced it with a cylinder placed on the air cylinder rack for operation of the AO valve on the south side on the first floor of the reactor building to inspect leakage from the cylinder connection, and confirmed that the cylinder was sound including the cylinder pressure.
- At 5:50 on March 13, a press release was issued regarding the implementation of vent operations.
- Later, a reactor operator went to the torus room on the basement floor of the reactor building to inspect the open/close condition of the S/C vent valve (AO valve) large valve and found that the temperature in the torus room had increased further. When he stepped on the upper part of the torus with the intent of inspecting the open/close condition of the S/C vent valve (AO valve) large valve, the boots he wore melted by heat and hence he gave up inspecting the open/close condition. About 8:00 on March 13, he returned to the main control room.

Condition of torus room (Unit 5, lighted)

The orange-colored section is the torus. The S/C vent valve is located in the upper area of the torus room (inside the red circle of the right photo) and the valve cannot be inspected without stepping on the torus. When the operator stepped on the torus relying only on torchlight in total darkness, his shoes melted by heat.

Image of the S/C vent valve inspection work

- At 8:35 on March 13, the vent valve (MO valve) was manually operated and opened 15%.

○ Activities since the "vent line configuration was completed except for the ruptured discs by opening the suppression chamber vent valve (AO valve) large valve at 8:41 on March 13."

[Maintenance of the vent line]

- It was reported to the Fukushima Nuclear Power Plant Disaster Countermeasures Headquarters at 8:41 on March 13 that vent line up was completed, waiting for ruptured discs ruptured.
- Around 9:08 on March 13, the SRV opened and the reactor started to rapidly depressurize. It was confirmed that the D/W pressure increased from 470 kPa [abs] (8:55) to 637 kPa [abs] (9:10) and then decreased to 540 kPa [abs] (9:24), and the Fukushima Nuclear Power Plant Disaster Countermeasures Headquarters judged around 9:20 that venting had occurred.
- Around 9:28 on March 13, the D/W pressure showed a rising trend. The Restoration Team in the main control room inspected the condition of the air cylinder for the S/C vent valve (AO valve) large valve drive at the air cylinder rack for operation of the AO valve on the south side on the first floor of the reactor building, found leakage from the connection, and repaired it. The cylinder was left as it was because gas remained in it, and the second cylinder for D/W oximeter calibration was removed and set aside as a spare cylinder for subsequent replacement.
- In the meantime, as it became hazy on the first floor of the reactor building as if filled with mist, with the dosimeter readings increased, the Restoration Team evacuated from the site. Given the possibility that the connection of the spare cylinder for replacement may not have been well engaged, we looked for a proper connection for the cylinder in the partner company's warehouse with operators of the partner company, and prepared for resumption.
- At 11:17 on March 13, the Restoration Team started opening the S/C vent valve (AO valve) large valve that had been closed as a result of depressurization of the cylinder. Given that it was highly likely to be high both in temperature and humidity on the first floor of the reactor building, the Restoration Team decided to engaged in the cylinder clearing work in two teams by wearing a self-contained breathing apparatus (for an operating time of 15 minutes).
- Team 1 replaced the drive cylinder with the second cylinder for D/W oximeter calibration, which had been prepared in the vicinity of the air cylinder rack for

operation of the AO valve on the south side on the first floor of the reactor building and finished installation. Team 2 confirmed leakage and cylinder pressure, and then confirmed at 12:30 on March 13 that the S/C vent valve (AO valve) large valve had opened. After that, the D/W pressure started decreasing [*1].

* 1:480 kPa [abs] (12:40) → 300 kPa [abs] (13:00)

- In the meantime, the Restoration Team tried to lock the opening of the S/C vent valve (AO valve) large valve in vain.

[Increase in on-site dose]

- It was reported at 14:31 on March 13 that, as a result of the survey, the radiation dose on the north side of the double door of the reactor building was higher than 300 mSv/h (inside the double door was hazy) and that on the south side was 100 mSv/h. At 15:28, the radiation dose on the side of Unit 3 of the main control room increased to 12 mSv/h and hence transferable reactor operators moved to the side of Unit 4 and continued plant surveillance.
- Around 15:00 on March 13, as the D/W pressure started to increase again[*], we decided to place a temporary compressor in addition to a cylinder for D/W oximeter calibration. The Restoration Team procured a temporary compressor from a partner company and headed to the site to install the temporary compressor around 17:52.

  * 230 kPa [abs] (14:30)→260 kPa [abs] (15:00)
- The Restoration Team transported the temporary compressor to a location near the air receiver of the compressed instrument air system (hereinafter referred to as “IA") on the first floor of the turbine building by a UNIC crane vehicle because the radiation dose was high, and finished installing the temporary compressor in the IA line around 19:00 on March 13. Later, it continuously refueled the temporary compressor every several hours to maintain the operational status. The capacity of the temporary compressor was so small that it took much time for the entire IA line to be pressurized and the D/W pressure did not show a downward trend for the time being.
- About 21:10 on March 13, we judged that the S/C vent valve (AO valve) large valve was opened as a result of a decrease in D/W pressure[*].

  *425 kPa [abs] (20:30) → 410 kPa [abs](20:45) → 395 kPa [abs] (21:00)

(Works on March 14)

- Around 3:40 on March 14, as a problem was confirmed in the excitation circuit of the S/C vent valve (AO valve) large valve with a small generator for temporary lighting in the main control room, the solenoid valve was excited again in the main control room.

- In the early morning of March 14, we obtained a new temporary compressor from the Fukushima Daini Nuclear Power Station and replaced it with the existing one installed.

[Addition of the vent line]

- From around 2:00 on March 14, the D/W pressure continued to increase* and the rising trend could not be stopped even by increasing the amount of water to be injected to the reactor. Accordingly, we decided to open the S/C vent valve (AO valve) small valve and started the operation of opening the S/C vent valve (AO valve) small valve at 5:20. Then we finished the opening operation at 6:10.
  * 255 kPa [abs](1:30) → 265 kPa [abs](2:00)
- At 11:01 on March 14, an explosion occurred in the Unit 3 Reactor Building.

(Works on March 15)

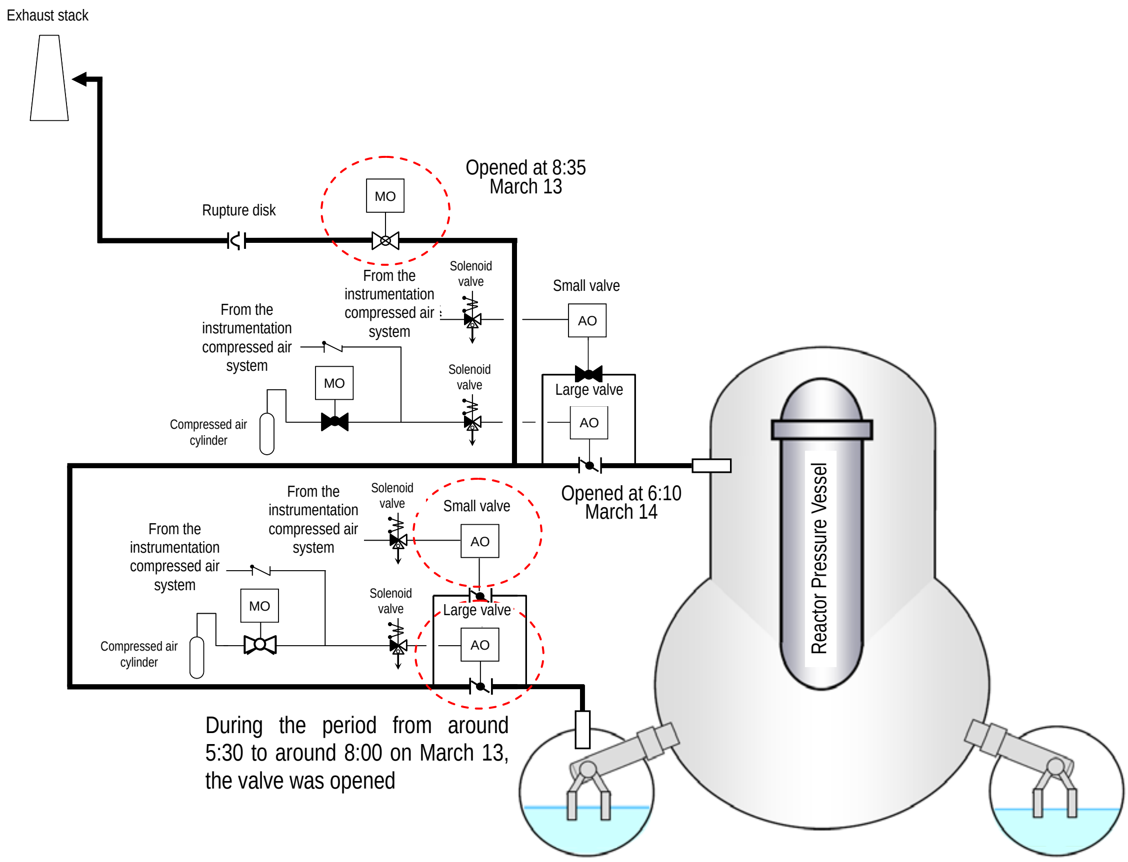
- At 16:00 on March 15, it was confirmed that the S/C vent valve (AO valve) large valve was closed due to the failure of the small generator that had been used for excitation of solenoid valves of the large and small valves. Then we conducted the opening operation at 16:05 by replacing the small generator and exciting the S/C vent valve (AO valve) large solenoid valve.
- The valve was difficult to keep open due to the difficulty in keeping the drive air pressure and the excitation of the solenoid valve in the air supply line for the S/C vent valve (AO valve) large and small valves, and hence the opening operation was conducted several times.

(S/C vent valve (AO valve) large valve)

- At 21:00 on March 17, the valve was confirmed to be closed; around 21:30 on March 17, opening operation was conducted
- At 5:30 on March 18, the valve was confirmed to be closed; around 5:30 on March 18, opening operation was conducted
- At 11:30 on March 19, the valve was confirmed to be closed; around 11:25 on March 20, opening operation was conducted
- Around 18:30 on April 8, the valve was confirmed to be closed.

(S/C vent valve (AO valve) small valve)

- At 1:55 on March 16, opening operation was conducted
- Around 18:30 on April 8, the valve was confirmed to be closed.



Valve operated for vent line configuration

End

Chronology of Main Events at Fukushima Daiichi Nuclear Power Station Unit 4 from Impact of Earthquake through Tuesday, March 15

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

[Reference: Condition of Unit 4 on the occurrence of the earthquake]

- Unit 4 had been out of service for regular inspection since November 30, 2010. All the fuel was removed from the reactor to the spent fuel pool for shroud construction.

Friday, March 11, 2011

14:46	**The Tohoku-Pacific Ocean Earthquake occurred.** Official announcement of level 3 emergency conditions
15:06	The Extraordinary Disaster Countermeasures Headquarters were established at the head office (for understanding damages due to the earthquake and restoration from blackout, etc.).
15:27	First tsunami wave arrived.
15:35	**Second tsunami wave arrived.**
15:38	Loss of all AC power supply in Unit 4.
15:42	It was judged that a special event (loss of all AC power supply) as defined by Article 10, Clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (hereafter, referred to as the "Special Law for Nuclear Emergency") had occurred in Unit 1*, Unit 2*, Unit 3*, Unit 4*, and Unit 5*, and the government agencies and other relevant organizations were notified accordingly. * On April 24, 2011, corrected was made to the effect that the specific event had occurred only in Unit 1, Unit 2, and Unit 3.
15:42	Official announcement of first emergency organization. Setup of the Technical Support Center (that later became the joint headquarters with the emergency disaster countermeasures headquarters).
16:00 (Approx.)	**Integrity confirmation of plant roads started.**
16:10	**The Power Distribution Division of the Head Office instructed all branches to secure high/low-voltage power supply cars and to confirm travel routes.**
16:36	Official announcement of second emergency organization.

16:39	**Integrity confirmation of power supply systems (offsite power, station power) started.**
16:50	**High/low-voltage power supply cars left all branches for Fukushima one after another.**
19:00 (Approx.)	**The gates between Unit 2 and Unit 3 were opened and traffic routes were secured for vehicles traveling to Units 1- 4.**
19:24	**The results of the integrity inspection for plant roads were reported to the Fukushima Nuclear Power Plant Disaster Countermeasures Headquarters.**
20:50	Fukushima Prefecture issued an evacuation order for residents living within a 2km radius of the Fukushima Daiichi Nuclear Power Station.
21:23	The Prime Minister ordered the evacuation of people within a 3km radius of the Fukushima Daiichi Nuclear Power Station and the sheltering indoors of people within a 3km to 10km radius of it.
21:27	Temporary lighting was initiated in the main control room.
22:00 (Approx.)	**Confirmation of the arrival of the first wave of the Tohoku Electric Power task team and one high-voltage power supply car.**

Saturday, March 12, 2011

0:30	Confirmation that the evacuees ordered from national government had taken shelter (confirmation that the citizens of Futaba-machi and Okuma-machi within a 3km radius had taken shelter, checked again at 1:45)
1:20 (Approx.)	Confirmation of the arrival of a TEPCO's high-voltage power supply car.
4:55	The increase in the radiation level inside the power plant was confirmed and reported to the government agencies and other relevant organizations.
5:44	The Prime Minister ordered the evacuation of the residents within a 10km radius of the Fukushima Daiichi Nuclear Power Station.
7:11	The Prime Minister arrived at the Fukushima Daiichi Nuclear Power Station.
8:04	The Prime Minister departed from the Fukushima Daiichi Nuclear Power Station.
10:15 (Approx.)	Confirmation that 72 power supply cars dispatched by TEPCO and Tohoku Electric Power had arrived in Fukushima (12 high-voltage power supply cars for Fukushima Daiichi and 42 for Fukushima Daini, and 7 low-voltage power supply cars for Fukushima Daiichi and 11 for Fukushima Daini).
16:27	A radiation dose exceeding 500μSv/h (1,015μSv/h) was measured around the MP No.4, hence it was judged that a special event (abnormal increase in

	radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations.
18:25	The Prime Minister ordered the evacuation of the residents within a 20-km radius of the Fukushima Daiichi Nuclear Power Station.

Sunday, March 13, 2011

8:56	A radiation dose exceeding 500μSv/h (882μSv/h) was measured around the MP No. 4, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 9:01.
14:15	A radiation dose exceeding 500μSv/h (905μSv/h) was measured around the MP No. 4, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 14:23.
14:20	Power transmission was started from the high-voltage power supply cars to Unit 4 P/C.

Monday, March 14, 2011

2:20	A radiation dose exceeding 500μSv/h (751μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 4:24.
2:40	A radiation dose exceeding 500μSv/h (650μSv/h) was measured around the MP No. 2, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 5:37.
4:00	A radiation dose exceeding 500μSv/h (820μSv/h) was measured around the MP No. 2, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 8:00.

4:08 The temperature in the spent fuel pool of Unit 4 was confirmed as 84°C.

9:12 A radiation dose exceeding 500μSv/h (518.7μSv/h) was measured at the MP, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 9:34.

21:35 A radiation dose exceeding 500μSv/h (760μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 22:35.

Tues day, March 15, 2011

5:35 Consolidation of the Fukushima Nuclear Power Station Disaster Countermeasures Headquarters was established.

6:00 to 6:10 (Approx.) Large impulsive noise occurred. In the main control room, the ceiling on the Unit 4 side shook.

6:50 A radiation dose exceeding 500 μSv/h (583.7 μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 7:00.

6:55 Damage was discovered around the roof on the 5th floor of the Unit 4 R/B.

7:55 The confirmation of the damage around the roof of the 5th floor of Unit 4 R/B was notified to the government agencies and other relevant organizations.

8:11 Damage to the Unit 4 R/B was confirmed. A radiation dose exceeding 500 μSv/h (807 μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal release of radioactive substances due to a fire and an explosion) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organizations at 8:36.

9:38 A fire was confirmed near the northwestern corner on the 3rd floor of the Unit 4 R/B. The same was notified to the governmental agencies and other relevant organizations at 9:56.

11:00 The Prime Minister instructed evacuation of the residents within a 20 km to

30 km radius of the Fukushima Daiichi Nuclear Power Station.

11:00 (Approx.)	Workers of TEPCO conducted an on-site investigation of the fire that occurred in the Unit 4 R/B, and they confirmed that the fire had self-extinguished. The same was notified to the government agencies and other relevant organizations at 11:45.
16:00	A radiation dose exceeding 500μSv/h (531.6μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency . The same was notified to the government agencies and other relevant organizations at 16:22.
23:05	A radiation dose exceeding 500μSv/h (4548μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 23:20.

End

Chronology of Main Events at Fukushima Daiichi Nuclear Power Station Unit 5 from Impact of Earthquake through Reactor Cold Shutdown

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

[Reference: Condition of Unit 5 on the occurrence of the earthquake]

・ Unit 5 had been suspended since January 3, 2011 due to a periodic inspection. When the earthquake occurred, the pressure leak tests of the RPV were being conducted with fuel loaded in the reactor.

(The reactor pressure was approx. 7 MPa, the reactor water temperature was approx. 90°C, and the spent fuel pool temperature was approx. 25°C.)

Friday, March 11, 2011

14:46	**Tohoku-Pacific Ocean Earthquake occurred**. Official announcement of level 3 emergency conditions.
14:47	The emergency diesel generators (hereinafter referred to as “DGs”) were automatically activated.
15:06	The Emergency and Disaster Countermeasures Headquarters were established at the head office (for understanding damages due to the earthquake and restoration from blackout, etc.).
15:27	First tsunami wave arrived.
15:35	**Second tsunami wave arrived.**
15:40	**Loss of all AC power supply.**
15:42	It was judged that for Unit 1*, Unit 2*, Unit 3*, Unit 4*, and Unit 5*, a specific event (loss of all AC power supply) as defined by Article 10, Clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (Special Law for Nuclear Emergency) had occurred, and the government agencies and other relevant organizations were notified accordingly. * On April 24, 2011, correction was made to the effect that the specific event had occurred only in Unit 1, Unit 2, and Unit 3.
15:42	Official announcement of first emergency organization. Setup of the Technical Support Center (that later became the joint headquarters with the emergency disaster countermeasure headquarters).

16:00 (Approx.) **Integrity confirmation of plant roads started.**

16:10 **The Power Distribution Division of the Head Office instructed all branches to secure high/low-voltage power supply cars and to confirm travel routes.**

16:36 Official announcement of second emergency organization.

16:50 **High/low-voltage power supply cars left all branches for Fukushima one after another.**

19:24 **The results of the integrity confirmation of plant roads were reported to the Fukushima Nuclear Power Plant Disaster Countermeasures Headquarters.**

20:50 Fukushima Prefecture issued an evacuation order for residents living within a 2km radius of the Fukushima Daiichi Nuclear Power Station.

21:23 The Prime Minister ordered the evacuation of people within a 3km radius of Fukushima Daiichi Nuclear Power Station and the sheltering indoors of people within a 3km to 10km radius of it.

22:00 (Approx.) **Confirmation of the arrival of the first wave of the Tohoku Electric Power task team and one high-voltage power supply car.**

Saturday, March 12, 2011

0:09 **TEPCO departed for the site at Unit 5 and Unit 6 to inspect the station power supply system.**

0:30 Confirmation that the evacuees ordered from national government had taken shelter (confirmation that the citizens of Futaba-machi and Okuma-machi within a 3km radius had taken shelter, checked again at 1:45).

1:20 (Approx.) Confirmation of the arrival of a TEPCO's high-voltage power supply car.

1:40 (Approx.) **The safety relief valve (hereinafter referred to as "SRV") was automatically opened. (Since then, pressure of the reactor was maintained at approx. 8 MPa through repeated opening and closing.)**

4:55 The increase in the radiation level inside the power plant was confirmed and reported to the government agencies and other relevant organizations.

5:44 The Prime Minister ordered the evacuation of the residents within a 10km radius of the Fukushima Daiichi Nuclear Power Station.

6:06 **Pressure reduction of the RPV was performed by the opening operation of the valve on the top of RPV.**

7:11 The Prime Minister arrived at the Fukushima Daiichi Nuclear Power Station.

8:04 The Prime Minister departed from the Fukushima Daiichi Nuclear Power

Station.

8:13 **Electric power interchange with Unit 5 (part of the direct-current power supply) was enabled by the cable provided from the DG of Unit 6.**

10:15 (Approx.) Confirmation that 72 power supply cars dispatched by TEPCO and Tohoku Electric Power had arrived in Fukushima (12 high-voltage power supply cars for Fukushima Daiichi and 42 for Fukushima Daini, and 7 low-voltage power supply cars for Fukushima Daiichi and 11 for Fukushima Daini).

14:42 **With the power supply from the DG, the air conditioning system on the side of Unit 6 of the MCR emergency ventilation and air conditioning system of Unit 5/6 was manually started and cleaning of air in the MCR of Unit 5/6 was started.**

16:27 A radiation dose exceeding 500μSv/h (1,015μSv/h) was measured around the MP No.4, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations.18:25 The Prime Minister ordered the evacuation of the residents within a 20km radius of the Fukushima Daiichi Nuclear Power Station.

Sunday, March 13, 2011

8:56 A radiation dose exceeding 500μSv/h (882μSv/h) was measured around the MP No. 4, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 9:01.

14:15 A radiation dose exceeding 500μSv/h (905μSv/h) was measured around the MP No. 4, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 14:23.

18:29 **Supply of power by the temporary cable from the DG of Unit 6 to the make-up water system (hereinafter referred to as “MUWC”) was started.**

20:54 **The MUWC pump was manually started.**

21:01 **The standby gas treatment system (SGTS) was manually started.**

Monday, March 14, 2011

2:20 A radiation dose exceeding 500μSv/h (751μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 4:24.

2:40 A radiation dose exceeding 500μSv/h (650μSv/h) was measured around the MP No. 2, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 5:37.

4:00 A radiation dose exceeding 500μSv/h (820μSv/h) was measured around the MP No. 2, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 8:00.

5:00 Opening operation of the SRV was performed and pressure reduction was performed on the RPV. (After that, the opening operation was conducted intermittently.)

5:30 Water injection into the reactor by the MUWC was started. (After that, water was injected intermittently.)

9:12 A radiation dose exceeding 500μSv/h (518.7μSv/h) was measured around the MP No. 3, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 9:34.

9:27 Supply of water to the spent fuel pool was started. (After that, the supply was conducted intermittently.)

21:35 A radiation dose exceeding 500μSv/h (760μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 22:35.

Tuesday, March 15, 2011

5:35	Consolidation of the Fukushima nuclear power plant disaster countermeasures headquarters was established.
6:50	A radiation dose exceeding 500 μSv/h (583.7 μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency The same was notified to the government agencies and other relevant organizations at 7:00.
8:11	A radiation dose exceeding 500 μSv/h (807 μSv/h) around the main gate was measured, hence it was judged that a special event (abnormal release of radioactive substances due to a fire and an explosion) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organizations at 8:36.
11:00	The Prime Minister ordered the evacuation of the residents within a 20km to 30km radius of the Fukushima Daiichi Nuclear Power Station.
16:00	A radiation dose exceeding 500μSv/h (531.6μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organizations at 16:22.
23:05	A radiation dose exceeding 500μSv/h (4548μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organizations at 23:20.

Wednesday, March 16, 2011

22:16	**Change of water in the spent fuel pool was started.**

Thursday, March 17, 2011

5:43	**Change of water in the spent fuel pool was completed.**

Friday, March 18, 2011

13:30	**Making holes (at three locations) on the roof of the reactor building was**

completed.

Saturday, March 19, 2011

1:55	**The temporary seawater pump for the residual heat removal system (hereinafter referred to as "RHR") was activated by the temporary power supply from the power supply car.**
4:22	**The second DG of Unit 6 was started**
5:00 (Approx.)	**The RHR was manually started. (Cooling of the spent fuel pool was started in emergency thermal load mode.)**
8:58	A radiation dose exceeding 500μSv/h (830.8μSv/h) was measured around the west gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organizations at 9:15.

Sunday, March 20, 2011

10:49	**The RHR was manually stopped. (Emergency thermal load mode)**
12:25	**The RHR was manually started. (Cooling of the reactor was started in stop cooling mode.)**
14:30	**The water temperature of the reactor fell below 100°C and the reactor achieved cold shutdown.**

End

Chronology of Main Events at Fukushima Daiichi Nuclear Power Station Unit 6 from Impact of Earthquake through Reactor Cold Shutdown

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

[Reference: Condition of Unit 6 on the occurrence of the earthquake]

・ Unit 6 had been suspended since August 14, 2010 due to a periodic inspection. When the earthquake occurred, the reactor was stopped over a long period of time due to defect of flammability control system, and in a cold shutdown condition loaded with fuel.

(The reactor pressure was approx. 0 MPa, the reactor water temperature was approx. 25°C, and the spent fuel pool temperature was approx. 25°C.)

Friday, March 11, 2011

14:46	**Tohoku-Pacific Ocean Earthquake occurred**. Official announcement of level 3 emergency conditions.
14:47	Three emergency diesel generators (hereinafter referred to as "DGs") of Unit 6 were automatically activated.
15:06	The Emergency and Disaster Countermeasures Headquarters were established at the head office (for understanding damages due to the earthquake and restoration from blackout, etc.).
15:27	First tsunami wave arrived.
15:35	**Second tsunami wave arrived.**
15:36	**The two DGs of Unit 6 tripped.**
15:42	Official announcement of first emergency organization. Setup of the Technical Support Center (that later became the joint headquarters with the emergency disaster countermeasure headquarters).
16:00 (Approx.)	**Integrity confirmation of plant roads started.**
16:10	**The Power Distribution Division of the Head Office instructed all branches to secure high/low-voltage power supply cars and to confirm travel routes.**
16:36	Official announcement of second emergency organization.
16:50	**High/low-voltage power supply cars left all branches for Fukushima one after another.**
19:24	**The results of the integrity confirmation of plant roads were reported to**

	the Fukushima Nuclear Power Plant Disaster Countermeasures Headquarters.
20:50	Fukushima Prefecture issued an evacuation order for residents living within a 2km radius of the Fukushima Daiichi Nuclear Power Station.
21:23	The Prime Minister ordered the evacuation of people within a 3-km radius of Fukushima Daiichi Nuclear Power Station and the sheltering indoors of people within a 3-km to 10-km radius of it.
22:00 (Approx.)	**Confirmation of the arrival of the first wave of the Tohoku Electric Power task team and one high-voltage power supply car.**

Saturday, March 12, 2011

0:09	**TEPCO departed for the scene at Unit 5 and Unit 6 to inspect the station power supply system.**
0:30	Confirmation that the evacuees ordered from national government had taken shelter (confirmation that the citizens of Futaba-town and Okuma-town within a 3km radius had taken shelter, checked again at 1:45).
1:20 (Approx.)	Confirmation of the arrival of a TEPCO's high-voltage power supply car.
4:55	The increase in the radiation level inside the power plant was confirmed and reported to the government agencies and other relevant organizations..
5:44	The Prime Minister ordered the evacuation of the residents within a 10km radius of the Fukushima Daiichi Nuclear Power Station.
6:03	**The line configuration for on-site power supply from the DG of Unit 6 was started.**
7:11	The Prime Minister arrived at the Fukushima Daiichi Nuclear Power Station.
8:04	The Prime Minister departed from the Fukushima Daiichi Nuclear Power Station.
8:13	**Electric power interchange with Unit 5 (part of the direct-current power supply) was enabled by the cable provided from the DG of Unit 6.**
10:15 (Approx.)	Confirmation that 72 power supply cars dispatched by TEPCO and Tohoku Electric Power had arrived in Fukushima (12 high-voltage power supply cars for Fukushima Daiichi and 42 for Fukushima Daini, and 7 low-voltage power supply cars for Fukushima Daiichi and 11 for Fukushima Daini).
14:42	**With the power supply from the DG, the air conditioning system on the side of Unit 6 of the MCR emergency ventilation and air conditioning system of Unit 5/6 was manually started and cleaning of air in the MCR of Unit 5/6 was started.**

16:27 A radiation dose exceeding 500μSv/h (1,015μSv/h) was measured around the MP No. 4, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency . The same was notified to the government agencies and other relevant organizations..

18:25 The Prime Minister ordered the evacuation of the residents within a 20km radius of the Fukushima Daiichi Nuclear Power Station.

Sunday, March 13, 2011

8:56 A radiation dose exceeding 500μSv/h (882μSv/h) was measured around the MP No. 4, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 9:01.

13:01 The make-up water system (hereinafter referred to as "MUWC") pump was manually started.

13:20 With the power supply from the DG, water injection into the reactor by MUWC was started. (After that, water was injected intermittently.)

14:15 A radiation dose exceeding 500μSv/h (905μSv/h) was measured around the MP No. 4, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 14:23.

18:29 Supply of power to the MUWC of Unit 5 by the temporary cable from the DG started.

Monday, March 14, 2011

2:20 A radiation dose exceeding 500μSv/h (751μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 4:24.

2:40 A radiation dose exceeding 500μSv/h (650μSv/h) was measured around the MP No. 2, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 5:37.

4:00	A radiation dose exceeding 500μSv/h (820μSv/h) was measured around the MP No. 2, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 8:00.
9:12	A radiation dose exceeding 500μSv/h (518.7μSv/h) was measured around the MP No.3, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 9:34.
14:13	**Supply of water to the spent fuel pool was started. (After that, the supply was conducted intermittently.)**
21:35	A radiation dose exceeding 500μSv/h (760μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 22:35.

Tuesday, March 15, 2011

5:35	Consolidation of the Fukushima nuclear power plant disaster countermeasures headquarters was established.
6:50	A radiation dose exceeding 500 μSv/h (583.7 μSv/h) was measured around the main gate,, hence it was judged that a special event (abnormal increase in radiation dose at the boundary of the premises) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to the government agencies and other relevant organizations at 7:00.
8:11	A radiation dose exceeding 500 μSv/h (807 μSv/h)was measured around the main gate, hence it was judged that a special event(abnormal release of radioactive substances due to a fire and an explosion) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same

	was notified to government agencies and other relevant organizations at 8:36.
11:00	The Prime Minister ordered the evacuation of the residents within a 20km to 30km radius of the Fukushima Daiichi Nuclear Power Station.
16:00	A radiation dose exceeding 500μSv/h (531.6μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organization at 16:22.
23:05	A radiation dose exceeding 500μSv/h (4548μSv/h) was measured around the main gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organization at 23:20.

Wednesday, March 16, 2011

13:10	**Fuel Pool Cooling and Filtering System (hereinafter referred to as "FPC") was manually started. (Cycle operation without heat removal capability).**

Friday, March 18, 2011

17:00	**Making holes (at three locations) on the roof of the reactor building completed.**
19:07	**The DG seawater pump was started.**

Saturday, March 19, 2011

4:22	**The second DG was started.**
8:58	A radiation dose exceeding 500μSv/h (830.8μSv/h) was measured around the west gate, hence it was judged that a special event (abnormal increase in radiation dose measured at site boundary) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organization at 9:15.
21:26	**With the temporary power supply of the power supply car, the temporary seawater pump for the residual heat removal system (hereinafter referred to as "RHR") was started.**
22:14	**The RHR was manually started. (Cooling of the spent fuel pool was started in emergency thermal load mode.)**

Sunday, March 20, 2011

16:26	**The RHR was manually stopped. (Emergency thermal load mode)**
18:48	**The RHR was manually started. (Cooling of the reactor was started in stop cooling mode.)**
19:27	**The water temperature of the reactor fell below 100°C and the reactor achieved cold shutdown.**

End

Fukushima Daiichi Nuclear Power Station Unit5/6
The Response Situation Through Reactor Cold Shutdown

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

○Activities from the Earthquake Occurrence at 14:46 until First Tsunami Wave Arrived at 15:27 on March 11

・ See "Response Immediately After Disaster Struck at Fukushima Daiichi Nuclear Power Station"

○ Activities from Determination and Notification of Station Blackout at 15:42 on March 11 Through Cold Shutdown on March 20 (at 14:30 for Unit 5 and at 19:27 for Unit 6)

[State of Unit 5/6 Main Control Room]

・ See "Response Immediately After Disaster Struck at Fukushima Daiichi Nuclear Power Station"

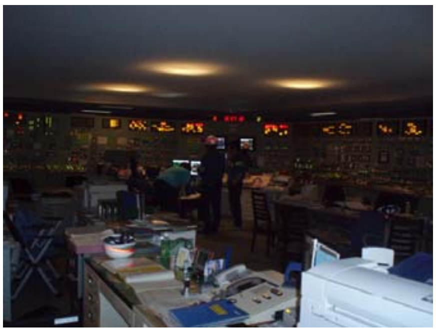
・ **Because one unit (6B) of the Unit 6 emergency diesel generators ("DG") was not affected by the tsunami and maintained operability and the high-voltage electric panels (M/C) in the reactor complex building were usable, the supply of power was maintained to part of the emergency equipment (B system) even after the tsunami arrived at Unit 6.**

・ **At Unit 6, because of the fact that power supply to lighting and monitoring instruments was secured, the parameters of the reactor and spent fuel pool could be verified.**

・ Meanwhile, on the Unit 5 side, emergency lights gradually went out, reaching a state of total darkness, but some of the monitoring instruments were operating on DC power supply even after the station blackout, **and the indicated values necessary for conducting Unit 5 recovery operations could be verified.**

・ **At 14:42 on March 12, one unit of the emergency heating, ventilation and air-conditioning system**

Unit 5/6 main control room: Unit 6 side



Unit 5/6 main control room: Unit 5 side
(Lighting only from emergency lights)

was manually started using power supplied from the Unit 6 DG. As a result of this, an environment was maintained where full-face masks did not need to be worn inside the main control room.

- It is noted that early recovery of an external power source was difficult, that power continued to be supplied by only one Unit 6 DG unit, and that there were concerns about insufficient fuel (depletion). Consequently, fuel oil (diesel fuel) was provided. From the Kanto region beginning on March 18, **tank lorries transported diesel fuel to the nuclear power station daily to continue replenishing the Unit 6 diesel fuel tank and ensure fuel for the DG**. **It is also noted that company employees carried out the tank lorry transport to the power station within the area directed for evacuation (currently, the closed area) and replenished the diesel fuel tanks** (up to 20 round trips were carried out per day).

[Power Supply Interchange from Unit 6 to Unit 5]

- **In the Unit 5 building where the lights had gone out and which was in a state of total darkness, operators held flashlights to verify the inundation condition of the electric panel room and the usability of the electric panels.** It was confirmed that all of the Unit 5 high-voltage electric panels (M/C) were unusable.
- Because the continuous operation of the DG ensured the capacity for an internal power source for Unit 6, **a cable, which had been laid for interchanging power between adjacent plants, was used as an accident management measure between Unit 6 and Unit 5** to interchange power to Unit 5 at 8:13 on March 12. As a result of this, power was able to be supplied to some of the DC-powered equipment (A systems) in Unit 5.
- In addition, by laying temporary power cable directly from the instrumentation electric panels in the Unit 6 service building to the instrumentation electric panels in the Unit 5 control building, power could be supplied to the Unit 5 monitoring instruments in the main control room that operate on AC power supply.
- Later, because power could not be supplied to the Unit 5 low-voltage electric panels (MCC) due to submersion of the Unit 5 high-voltage electric panels (M/C), a temporary power cable was begun to be laid directly from the low-voltage electric panels (MCC) in the Unit 6 turbine building to the equipment necessary for recovery operations for Unit 5. **The Unit 5 stand-by gas treatment system was started up at 21:01 on March 13 (the Unit 6 stand-by gas treatment system continued to operate after the earthquake). As a result of this, the Unit 5 and Unit 6 reactor buildings maintained negative pressure thereafter, and a state was maintained in which the release of radioactive materials, if there were such a contingent event, would be checked.**

[Operation to Depressurize the Unit 5 Reactor Pressure Vessel]

- When the earthquake occurred, Unit 5 was in outage and being tested for leaks in the reactor pressure vessel, and the reactor water level was at the high-water level and pressurized to approximately 7MPa.
- After the earthquake, the reactor pressure slowly rose due to decay heat, so the operators attempted a depressurization operation using successively the reactor core isolation cooling system steam line, high pressure coolant injection system (HPCI) steam line, and HPCI exhaust line, but the reactor pressure did not change.
- Even after that, the pressure rose. However, because pressure was maintained at approximately 8MPa, it was determined that the SRV would automatically operate to open. It is noted that there was no power source for indicator lights in the main control room and the situation was one where the operational status of the SRV could not verified by indicator lights, but because of the operation of an air supply line for the valve on the top of the reactor pressure vessel, which will be discussed later, **an operator heading toward the site confirmed the sound of the SRV operating inside the reactor building.**
- By manually operating on site the valves inside the reactor building to lower the reactor pressure, a line was configured to supply air to open the valve on top of the reactor pressure vessel, and, at 6:06 on March 12, an operation to open the valve on the top of the reactor pressure vessel was performed in the main control room. As a result of this, **the reactor pressure was able to be brought down to the atmospheric level.**
- Later, the reactor pressure once again rose due to decay heat, so beginning before dawn on March 14, recovery work on the SRV was commenced (because of the tests being conducted for leaks, the SRV was set so that it could not be operated from the main control room). The electric fuses were restored and the valves on the nitrogen gas supply line, which is inside the primary containment vessel, were operated manually on site to complete configuration of a line, and the SRV was set so that it could be operated from the main control room. **At 5:00 on March 14, an operation was performed to open the SRV and depressurization of the reactor pressure vessel was commenced.**

[Alternative Coolant Injection into the Unit 5 and Unit 6 Reactors]

- After the soundness of the Unit 5 condensate water transfer pump was verified by the recovery team on March 13, a temporary electric supply cable was laid directly from the Unit 6 low-voltage electric panels (MCC), and the power supply was able to be restored at 18:29, so after depressurization of the reactor by means of the SRV, **at 5:30 on March 14, the injection of coolant into the reactor was commenced by using an alternative**

coolant injection line, which connected the fire protection system line and the residual heat removal system line and was used as an accident management measure.

- The Unit 6 condensate water transfer pump was in an operable condition due to the supply of power from the Unit 6 DG, and **at 13:20 on March 13, the injection of coolant into the reactor was commenced utilizing the line being used for accident management.**

[Curbing Rise in Temperature of the Unit 5 and Unit 6 Spent Fuel Pool]

- All of the Unit 5 and Unit 6 seawater pumps were unusable due to the impact of the tsunami, and the spent fuel pool where the spent fuel was stored could not be cooled.
- After assessing the rate of the rise in temperature with regard to the decay heat in the spent fuel pool, the spent fuel pool water temperature continued to be monitored until heat removal capability was restored.
- The Unit 5 and Unit 6 condensate water transfer pump was restored, so **on March 14, the line used for accident management was utilized to replenish the water in the spent fuel pool until it was almost at the high level.**
- Later, on March 16 to check the rate at which the temperature of the spent fuel pool was rising until the heat removal capacity was restored, **after draining some of the spent fuel pool water the temperature of which had risen at Unit 5, the line used for accident management was utilized to replenish the water by means of the condensate water transfer pump.**
- Power was able to be supplied to the Unit 6 FPC pump from the Unit 6 DG, so on March 16, the FPC pump was started up in a circulating operation (no heat removal capacity), and the water of the spent fuel pool was agitated to curb the rate at which the temperature of the spent fuel pool was rising.

[Restoration of Unit 5 and Unit 6 RHR Heat Removal Capacity]

- Due to the outage, approximately 2.5 months had passed since Unit 5 had been shut down and approximately 7 months since Unit 6 had been shut down, and **the decay heat inside the reactor at the time of the earthquake was comparatively less than when the plant is operating.**
- As a result of verifying the soundness of the Unit 5 and Unit 6 RHR seawater pumps, the recovery team determined that the pumps could not be used. In cooperation with the Head Office, consideration

Work conditions for installation of underwater pump

began to be given to **connecting general service underwater pumps to a seawater system pipe temporarily for restoration as an RHR alternative cooling seawater pump.**

Underwater pump installation conditions (arrangement done at later date)

- Starting on March 17, work was commenced to remove debris from the area around where the underwater pump was to be installed and work was undertaken to prepare a work road. On March 18, a temporary power supply cable was laid from a high-voltage power generating vehicle and the installation of the outdoor pump operation panel was completed, so **the temporary RHR seawater pumps were started up and restored for Unit 5 at 1:55 and for Unit 6 at 21:26 on March 19.**
- Because the permanent power supply for the Unit 5 RHR pump was in operable due to the Unit 5 high-voltage electric panels (M/C) in the underground level of the turbine building having been inundated by the tsunami, **on March 18, approximately 200 meters of temporary power supply cable was laid from the Unit 6 high-voltage electric panels (M/C) to supply power directly to the Unit 5 RHR pump.**
- It is noted that **for the Unit 6 RHR pump, there was a high-voltage electric panel (M/C) load from the Unit 6 DG, and power was able to be supplied.**
- As a result of the restoration of the RHR pump and the RHR seawater pump, the heat removal capacity of one system for Unit 5 and Unit 6 was usable, so it was decided to **alternate between cooling the reactor and the spent fuel pool by switching the system configuration of the RHR.**
- After the temperature of the spent fuel pool water decreased, the RHR system configuration was switched and moved to cooling the reactor. **The reactor water temperature fell below 100℃ and a cold shutdown of the reactor was achieved (at 14:30 for Unit 5 and at 19:27 for Unit 6 on March 20).**
- It is noted that at Unit 5, the FPC pump was started up at 16:35 on June 24, with the spent fuel pool being cooled by the same pump and the reactor being cooled by the RHR.

[Preventing Retention of Hydrogen Gas in Unit 5 and Unit 6 Reactor Buildings]

- Since the earthquake occurred, the water levels of the reactor and the spent fuel pool were maintained and conditions were not such that hydrogen gas would build up. However, because there was also the risk that coolant injection capacity and heat removal

Work conditions on the roof

capacity might be lost due to aftershocks, as a precaution, it was decided **to examine measures for preventing the retention of hydrogen gas. On March 18, a boring machine was used to drill holes at three locations (diameter ranging from approximately 3.5 centimeters to approximately 7 centimeters) on the roof (concrete) of the Unit 5 and Unit 6 reactor buildings.**

・ The work was commenced early in the morning on March 18. Four station employees and four contractor personnel **equipped themselves with full-face masks, charcoal filters, and coveralls, went up onto the roof of the reactor building, and performed the work for approximately 11 hours total for both Unit 5 and Unit 6** (work was completed at 13:30 on Unit 5 and at 17:00 on Unit 6).

[Restoration of Unit 6 Emergency Diesel Generator]

・ **With regard to the seawater pump for cooling the Unit 6 DG (6A), although it had been covered with seawater in the tsunami, operators and recovery teams conducted a visual inspection of the inundation situation of the outdoor seawater pump area, the external condition of the damage and other such conditions, and carried out measurements of insulation resistance and other functions** to verify soundness, and it was started up at 19:07 on March 18.

Condition of seawater pump area
(indicates the DG (6A) seawater pump)

・ At 4:22 on March 19, the Unit 6 DG (6A) was started up, ensuring that two DG units would be used as emergency power sources for Unit 5 and Unit 6.

END

Chronology of Main Events at Fukushima Daini Nuclear Power Station Unit 1 from Impact of Earthquake through Reactor Cold Shutdown

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

Friday, March 11, 2011

14:46 **Tohoku-Chihou-Taiheiyo-Oki Earthquake strikes.**
Automatic proclamation of Level 3 State of Emergency.

14:48 **Automatic reactor SCRAM**

14:48 One of the Tomioka lines shuts down (power continues to be received from another line).

15:00 Reactor subcriticality confirmed.

15:06 Extraordinary Disaster Countermeasures Headquarters established at company Head Office (assess extent of earthquake damage, restore lost power)

15:22 **First tsunami wave confirmed (thereafter, tsunami waves are confirmed until 17:14).**

15:33 Circulating water pump (“CWP”) (C) manually shut down.

15:34 Emergency diesel generators (A) (B) (H) automatically started up/immediately thereafter, they were shut down due to the tsunami impact.

15:36 Main steam isolation valve fully closed manually.

15:36 Reactor core isolation cooling system (“RCIC”) manually started up (thereafter, starts-stops occur as the circumstances demand).

15:50 Iwaido line is fully shut down.

15:55 Depressurization of reactor commenced (safety relief valve opened) (thereafter, valve is repeatedly opened and closed to control reactor pressure).

15:57 CWP (A) (B) automatically shut down.

17:35 **Given the fact that a “high drywell pressure” alert was issued and that the alarm typer recorded “MSIV reactor water level low (L-2),” the possibility of a reactor coolant leak inside the primary containment vessel (“PCV”) cannot be denied as being the cause of the pressure rise, thus a specified event (reactor coolant leak) in accordance with stipulations of Article 10, Paragraph 1 of the Nuclear Disaster Special Measures Law (hereafter abbreviated "Nuclear Disaster Law") was determined to have occurred, government and other authorities were**

	notified at 17:50. (Subsequently, with confirmation of the relevant parameters, a leakage of reactor coolant was not verified. Therefore, at around 18:33 on the same day, it was determined that the event in question did not fall within such purview.).
17:53	Drywell cooling system manually started up.
18:33	**Because startup of a sea water pump for equipment having the capability to remove heat from the reactor could not be confirmed, a specified event (loss of reactor heat removal capability) in accordance with stipulations of Article 10 Paragraph 1 of Nuclear Disaster Law was determined to have occurred, government and other authorities were notified at 18:49.**

Saturday, March 12, 2011

0:00	**Alternative coolant injection is commenced using the make-up water condensate system ("MUWC")**
3:50	Rapid depressurization of the reactor is commenced.
4:56	Rapid depressurization of the reactor is concluded.
4:58	RCIC manually shut down.
5:22	**Because the pressure suppression chamber ("S/C") temperature had risen to over 100℃, specified event (loss of pressure suppression capability) in accordance with stipulations of Article 15 Paragraph 1 of Nuclear Disaster Law was determined to have occurred, government and other authorities were notified at 5:48**
6:20	S/C cooling implemented using coolant (MUWC) from the flammability control system ("FCS").
7:10	Drywell spraying implemented using MUWC (thereafter, implemented as circumstances demand).
7:37	S/C spraying implemented using MUWC (thereafter, implemented as circumstances demand).
7:45	Prime Minister issued directive for evacuation within 3-km radius and take refuge indoors within the 10-km radius from Fukushima Daini Nuclear Power Station.
7:45	S/C cooling using FCS coolant (MUWC) is shut down.
10:21	Configuration of a PCV hardened venting line commenced.
13:38 (approx.)	Power received through one Iwaido line.
14:05	Government confirms completion of measures for evacuating residents (confirmed measures for evacuating residents of Naraha-machi (town) and

Tomioka-machi (town) within 3 km).

17:39 Prime Minister issued directive for evacuation within 10-km radius from Fukushima Daini Nuclear Power Station.

18:30 Configuration of the PCV hardened venting line completed.

Sunday, March 13, 2011

5:15 (approx.) Power received through second Iwaido line.

20:17 Residual heat removal equipment cooling seawater system pump (B) manually started up.

21:03 Residual heat removal equipment cooling system pump (D) manually started up.

Monday, March 14, 2011)

1:24 Residual heat removal system ("RHR") (B) manually started up (S/C cooling mode commenced), thus a specified event (loss of reactor heat removal capability) in accordance with the stipulations of Article 10 Paragraph 1 of the Nuclear Disaster Law was determined to be rescinded.

1:44 Emergency auxiliary cooling system pump (B) manually started up.

3:39 RHR (B) S/C spray mode commenced.

10:05 In the RHR (B) low-pressure coolant injection mode, coolant is injected into the reactor.

10:15 Because the pressure suppression chamber ("S/C") temperature had fallen below 100℃, it was determined that the plant recovered from a specified event (loss of pressure suppression capability) in accordance with stipulations of Article 15 Paragraph 1 of Nuclear Disaster Law, government and other authorities were notified at 10:35

17:00 Reactor water temperature fell below 100℃, and cold shutdown of the reactor was achieved.

End

Chronology of Main Events at Fukushima Daini Nuclear Power Station Unit 2 from Impact of Earthquake through Reactor Cold Shutdown

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

Friday, March 11, 2011

14:46	**Tohoku-Chihou-Taiheiyo-Oki Earthquake strikes.** Automatic proclamation of Level 3 State of Emergency.
14:48	**Automatic reactor SCRAM**
14:48	One of the Tomioka lines shuts down (power continues to be received from another line).
15:01	Reactor subcriticality confirmed.
15:06	Extraordinary Disaster Countermeasures Headquarters established at company Head Office (assess extent of earthquake damage, restore lost power)
15:22	**First tsunami wave confirmed (thereafter, tsunami waves were confirmed until 17:14).**
15:34	Emergency diesel generator (“DG”) (H) automatically started up/immediately thereafter, it was shut down due to the tsunami impact.
15:34	Main steam isolation valve fully closed manually.
15:35	Residual heat removal system (“RHR”) (B) manually started up (shuts down automatically at 15:38).
15:35	Circulating water pump (“CWP”) (C) manually shut down and CWP (A) (B) automatically shut down.
15:41	DG (A) (B) automatically started up/immediately thereafter, they were shut down due to the tsunami impact.
15:41	Depressurization of reactor commenced (safety relief valve opened) (thereafter, valve is repeatedly opened and closed to control reactor pressure).
15:43	Reactor core isolation cooling system (“RCIC”) manually started up (thereafter, starts-stops occur as the circumstances demand).
15:50	Iwaido line was fully shut down.
18:33	**Because startup of a sea water pump for equipment having the capability to remove heat from the reactor could not be confirmed, specified event (loss of reactor heat removal capability) in accordance with stipulations of Article 10 Paragraph 1 of Nuclear Disaster Law was determined to**

have occurred, government and other authorities were notified at 18:49

20:02	Drywell cooling system manually started up.

Saturday, March 12, 2011

4:50	**Alternative coolant injection is commenced using the make-up water condensate system ("MUWC").**
4:53	RCIC automatically shuts down.
5:32	**Because the pressure suppression chamber temperature has risen to over 100℃, specified event (loss of pressure suppression capability) in accordance with stipulations of Article 15 Paragraph 1 of Nuclear Disaster Law was determined to have occurred, government and other authorities were notified at 5:48**
6:30	Suppression chamber ("S/C") cooling implemented using coolant (make-up water purified system ("MUWP")) from the flammability control system ("FCS").
7:11	Drywell spraying implemented using MUWC (thereafter, implemented as circumstances demand).
7:35	S/C spraying implemented using MUWC (thereafter, implemented as circumstances demand).
7:45	Prime Minister issued directive for evacuation within 3-km radius and take refuge indoors within the 10-km radius from Fukushima Daini Nuclear Power Station.
7:52	S/C cooling using FCS coolant (MUWP) is shut down.
10:33	Configuration of a primary containment vessel ("PCV") hardened venting line commenced.
10:58	Configuration of the PCV hardened venting line completed.
13:38 (approx.)	Power received through one Iwaido line.
14:05	Government confirms completion of measures for evacuating residents (confirmed measures for evacuating residents of Naraha-machi(town) and Tomioka-machi(town)within 3-km).
17:39	Prime Minister issued directive for evacuation within 10-km radius from Fukushima Daini Nuclear Power Station.

Sunday, March 13, 2011

5:15 (approx.)	Power received through second Iwaido line.

Monday, March 14, 2011

3:20	Emergency auxiliary cooling system (B) manually started up.
3:51	Residual heat removal equipment cooling seawater system pump (B) manually started up.
5:52	Residual heat removal equipment cooling system pump (D) manually started up.
7:13	**RHR (B) manually started up (S/C cooling mode commenced), thus a specified event (loss of reactor heat removal capability) in accordance with the stipulations of Article 10 Paragraph 1 of the Nuclear Disaster Law was determined to be rescinded.**
7:50	RHR (B) S/C spray mode commenced.
10:48	In the RHR (B) low-pressure coolant injection mode, coolant was started to be injected into the reactor.
15:52	**Because the pressure suppression chamber temperature has fallen below 100℃, it was determined that the plant recovered from a specified event (loss of pressure suppression capability) in accordance with stipulations of Article 15 Paragraph 1 of Nuclear Disaster Law, government and other authorities were notified at 16:15.**
18:00	**Reactor water temperature fell below 100℃, and cold shutdown of the reactor was achieved.**

End

Chronology of Main Events at Fukushima Daini Nuclear Power Station Unit 3 from Impact of Earthquake through Reactor Cold Shutdown

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

Friday, March 11, 2011

14:46	**Tohoku-Chihou-Taiheiyo-Oki Earthquake strikes.** Automatic proclamation of Level 3 State of Emergency.
14:48	**Automatic reactor SCRAM**
14:48	One of the Tomioka lines shuts down (power continues to be received from another line).
15:05	Reactor subcriticality confirmed.
15:06	Extraordinary Disaster Countermeasures Headquarters established at company Head Office (assess extent of earthquake damage, restore lost power)
15:22	**First tsunami wave confirmed (thereafter, tsunami waves are confirmed until 17:14).**
15:34	Circulating water pump (“CWP”) (C) manually shut down.
15:35	Emergency diesel generators (“DG”) (A) (B) (H) automatically started up/immediately thereafter, DG (A) shuts down due to the tsunami impact.
15:36	Residual heat removal system (“RHR”) (B) manually started up (suppression chamber (“S/C”) cooling mode commenced).
15:37	Main steam isolation valve fully closed manually.
15:38	CWP (B) manually shut down.
15:46	Depressurization of reactor commenced (safety relief valve opened) (thereafter, valve is repeatedly opened and closed to control reactor pressure).
16:06	Reactor core isolation cooling system (“RCIC”) manually started up (thereafter, starts-stops occur as the circumstances demand).
16:48	CWP (A) automatically shut down.
20:12	Drywell cooling system manually started up.
22:53	**Alternative coolant injection is commenced using the make-up water condensate system (“MUWC”)**
23:11	RCIC manually shut down.

Saturday, March 12, 2011

0:06	Preparations commenced for configuration of RHR (B) reactor shutdown cooling system (“SHC”) mode.
1:23	RHR (B) manually shut down (in preparation for SHC mode).
2:39	RHR (B) manually shut down (S/C cooling mode commenced).
2:41	RHR (B) S/C spray mode commenced.
7:45	Prime Minister issued directive for evacuation within 3-km radius and take refuge indoors within 10-km radius from Fukushima Daini Nuclear Power Station.
7:59	RHR (B) manually shut down (S/C cooling mode and S/C spray mode shut down).
9:37	RHR (B) manually shut down (operation of SHC mode commenced).
12:08	Configuration of a primary containment vessel (“PCV”) hardened venting line commenced.
12:13	Configuration of a PCV hardened venting line completed.
12:15	**Reactor water temperature fell below 100℃, and cold shutdown of the reactor was achieved.**

End

Chronology of Main Events Resulting in Reactor Cold Shutdown in Fukushima Daini Nuclear Power Station Unit 4 Following the Earthquake

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

Friday, March 11, 2011

14:46	**Tohoku-Pacific Ocean Earthquake occurred.** Official announcement of level 3 emergency conditions.
14:48	**The reactor automatically shut down.**
14:48	One of the Tomioka circuits shut down (the system continued to receive electricity from the other circuit).
15:05	The sub-criticality of the reactor was confirmed.
15:06	The Emergency and Disaster Countermeasures Headquarters were established at the head office (for understanding damages due to the earthquake and restoration from blackout, etc.)
15:22	**The first tsunami wave was confirmed. (After that the tsunami was continuously confirmed until 17:14).**
15:33	The circulating water pump (hereinafter referred to as "CWP") (C) was manually shut down.
15:34 (Approx.)	Diesel generators (hereinafter referred to as "DGs") (A), (B), and (H) were automatically activated. Immediately after the activation, they shut down due to the tsunami.
15:35	CWP (A) (B) were automatically shut down.
15:36	The MSIV was fully closed manually.
15:36	The residual heat removal system (hereinafter referred to as "RHR") (B) was manually started (the system was automatically shut down at 15:41).
15:37	RHR (A) was manually started (it was manually shut down at 15:38).
15:46	Depressurization of the reactor commenced (SRV automatically opened) (thereafter, the valve was repeatedly opened and closed to control reactor pressure).
15:50	Iwaido line fully shutdown.
15:54	RCIC was manually started (thereafter, starts-stops occurred as circumstances demanded).
18:33	**Given the fact that the start of the seawater pump of the facility for heat removal of the reactor was not confirmed, it was determined that a**

	special event (loss of function to remove heat from the reactor) had occurred based on Article 10, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organizations at 18:49.
19:14	The Drywell Cooling System was started by manual operation.

Saturday, March 12, 2011

0:16	**RCIC was automatically stopped. Alternative water injection was started by make-up water system (hereinafter referred to as "MUWC").**
6:07	**Because the temperature of the suppression chamber exceeded 100°C, it was determined that a special event (loss of the function to control pressure) had occurred as defined by Article 15, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organizations at 6:18.**
7:23	Cooling down of the suppression chamber (hereinafter referred to as "S/C") was performed using cooling water of the flammability control system (hereinafter referred to as "FCS").
7:35	S/C spray was performed using MUWC.
7:45	The Prime Minister ordered the evacuation of people within a 3km radius of the Fukushima Daiichi Nuclear Power Station and the sheltering indoors of people within a 3km to 10km radius of it.
11:17	Water injection into the reactor was switched from MUWC (alternative injection) to the High Pressure Core Spray System (hereinafter referred to as "HPCS").
11:44	Started configuration of the Primary Containment Vessel (hereinafter referred to as "PCV") pressure control vent line.
11:52	Completed configuration of the PCV pressure control vent line.
13:38 (Approx.)	Power received from Iwaido line No.1
13:48	Water injection into the reactor by HPCS was stopped (from this time on, this procedure was performed as required).
14:05	Confirmation that the evacuees ordered from national government had taken shelter (confirmation that the citizens of Naraha-machi (town) and Tomioka-machi (town) within a 3-km radius had taken shelter).
17:39	The Prime Minister ordered the evacuation of the residents within a 10-km radius of the Fukushima Daini Nuclear Power Station.

Sunday, March 13, 2011

5:15 (Approx.)	Power received from Iwaido line No. 2

Monday, March 14, 2011

11:00	Emergency Equipment Cooling Water System (B) was manually started.
13:07	RHRS (D) was manually started.
14:56	RHRC (B) was manually started.
15:42	**RHR (B) was manually started (started S/C cooling mode). It was determined that a special event (loss of the heat removal function of the reactor) defined by Article 10, Clause 1 of the Special Law for Nuclear Emergency had been canceled by the start of RHR (B).**
16:02	RHR (B) spray mode was started.
18:58	RHR (B) started water injection into the reactor in LPCI mode (stopped at 19:20) (from this point on, it was started/stopped as required).
22:07	Given the fact that a radiation dose exceeding 5μGy/h was detected at MP (No.1), it was judged that a special event (increase in radiation dose at site boundary) had occurred as defined by Article 10, Clause 1 of the Special Law for Nuclear Emergency. The same was notified to government agencies and other relevant organizations at 22:13. (The rise of the radiation dose was likely due to the release of radioactivity into the air associated with the accident in the Fukushima Daiichi Nuclear Power Station.)

Tuesday, March 15, 2011

0:12	Because the radiation dose measured exceeds 5 μGy/h at a monitoring post (No. 3), **a specified event (increase in radiation dose at site boundary) in accordance with stipulations of Article 10 Paragraph 1 of Nuclear Disaster Law was determined to have occurred, government and other authorities were notified at 0:16** (the cause of the dose increase is surmised to be due to the effects of radioactive material released into the atmosphere following the accident at Fukushima Daiichi Nuclear Power Station).
7:15	**Because the pressure suppression chamber temperature has fallen below 100℃, it is determined that a recovery has been achieved from the conditions of the specific event (loss of pressure suppression capability) in accordance with stipulations of the provision of Paragraph 1 of Article 15 of Nuclear Disaster Law, government and other authorities were notified at 7:35.**

7:15 **Reactor water temperature fell below 100℃, and cold shutdown of the reactor was achieved.**

End

Fukushima Daini Nuclear Power Station
The Response Situation through Reactor Cold Shutdown

This document is compilation of facts as they are known at the present time based on a variety of report and eye witness accounts. If and when new facts come to light hereafter as the investigation continues, they will be disclosed at that time.

○Activities conducted during the period after "the earthquake occurred at 14:46 on March 11" until "the first tsunami wave was confirmed at 15:22" on the same day

[Evacuation and safety confirmation]

- In the Administration Office Building, the operators were evacuated to the parking lot, which had been designated as an evacuation area, to engage in safety confirmation. Later, the disaster countermeasures personnel moved to the Seismic Isolated Building to start countermeasures and the other staff were evacuated to the athletic field.

[SCRAM operation]

- The earthquake occurred. The shaking was so strong that the reactor operators had to crouch down low in front of the control panel while holding onto the handrail. The shift supervisor notified the reactor operators that SCRAM operation would start and instructed them to start it once the shaking ceased.
- The deputy shift supervisor reported that an earthquake had occurred and instructed the operators to evacuate by the broadcast paging system. He communicated to local control operators by PHS and instructed them to evacuate.
- At 14:48 all the main control rooms confirmed automatic reactor SCRAM. Later, sub-criticality of the nuclear reactor was also confirmed.
- Judging that operators could not hear the instructions due to the many alarms and the loud noise of the fire alarm, the shift supervisor gave directions using a handheld microphone equipped at the rear of his seat as an emergency tool. (The fire alarm was later proven to be false.)
- Upon receipt of the information about the issuance of large tsunami warnings from the Power Plant Technical Support Center (hereinafter referred to as the "Fukushima Nuclear Power Plant Disaster Countermeasures Headquarters"), the shift supervisor instructed the operators by broadcast paging to start emergency evacuation for issuance of large tsunami warnings.

[Offsite power condition]

- The offsite power supply system consists of four circuits (two Tomioka circuits and two Iwaido circuits). Before the earthquake occurred, the system had received electricity from three circuits except for one Iwaido line that had been out of service for inspection.

- After the earthquake occurred, one of Tomioka circuits tripped and the other Iwaido circuit shut down due to facility failure in the new Fukushima transformer substation. The system, however, continued to receive electricity from one Tomioka circuit.
- One Iwaido circuit was restored at 13:38 on March 12 and the other at 5:15 on March 13, and thus the offsite power supply system consisted of three circuits (the remaining one Tomioka circuit was restored and the system started receiving electricity on April 15).

○ Activities conducted during the period after "the first tsunami wave was confirmed at 15:22 on March 11" until "the reactor cold shutdown"

[Countermeasures operations conducted immediately after tsunami arrival]

- Unit 1/2 main control rooms confirmed the tsunami was approaching the breakwater and Unit 3/4 main control rooms confirmed that the circulating water pump (hereafter, referred to as the "CWP") was half submerged in their site surveillance cameras, respectively.
- After the tsunami arrival, alarms on the control panels in the main control rooms of each unit were wholly or partly turned off, or turned on and off repeatedly. **All the units, however, could survey the plant condition because Unit 1 had secured approximately half of the instruments and indicator lamps necessary for parameter surveillance and for confirmation of operational status of equipment, and Units 2, 3 and 4 had secured all instruments and indicator lamps.**
- While continuing the surveillance chiefly on the reactor system control panel, the shift supervisor allocated operators to control panels for the surveillance of operational conditions of seawater systems vital for heat removal from the reactor in consideration of the impacts of the tsunami and instructed them to send information as required.

Main control room after tsunami arrival

- Each main control room confirmed that the operated pumps were shut down by checking the operation/shutdown indicator lamps for the seawater systems vital for heat removal from the reactor.
- Each unit shut down the CWP in accordance with the emergency operation procedures in the event of a tsunami. Given that the shutdown rendered the main steam condensation by the condenser unavailable, reactor injection by the reactor core isolation cooling

Submerged seawate pump (the photo was taken at a later date) system (hereinafter referred to as “RCIC") and the reactor pressure control by the main steam safety relief valve (hereinafter referred to as “SRV") was started to control the pressure in the reactor with the main steam isolation valve (hereinafter referred to as “MSIV") fully closed.

[Response Operation Through Reactor Cold Shutdown]

< Alternative Coolant Injection Using MUWC >

Valve operation at main control room AM panel (photo of work conditions at a later date)

- The RHR, which has the primary function of injecting coolant to cool the reactor, could not be start up due to the impact of the tsunami, so, in preparation for cooling and injecting coolant to cool the reactor after the RCIC shut down along with the reactors, **preparations were commenced for alternative coolant injection using the make-up water condensate system (“MUWC”) which was introduced as an accident management (“AM”) measure. At Units 2, 3 and 4, the line was configured and the flow rate confirmed by means of a valve operation from the AM panel in the main control room. With regard to Unit 1, power had been lost due to the impact of the tsunami for the valves necessary for configuring the line, so the opening operation was implemented manually on site. After the line configuration was finished, the coolant injection valve was set to open and the flow rate confirmed from the main control room.**
- Subsequently, following a decrease in reactor pressure, the RCIC shut down, but the reactor water level could be maintained without problem by means of alternative coolant injection using MUWC.
- With regard to Unit 4, the high-pressure core spray system (“HPCS”) was started up on March 12, and the injection of coolant into the reactor was switched from MUWC to HPCS. Subsequently, the reactor water level was controlled while repeatedly starting up and shutting down the HPCS.

< PCV Pressure Rise Control Measures >

- At Units 1, 2 and 4, some of the seawater pumps were disabled due to the effect of the heat exchanger building (“Hx/B”) having been inundated by the tsunami, and the situation was such that the suppression chamber (“S/C”) could not be cooled. The temperature and pressure of the S/C rose due to the injection of coolant into the reactor by means of the RCIC and the decrease in reactor pressure by means of the SRV, and the power station countermeasures headquarters examined means and methods for cooling the S/C. In accordance with advice from the power station countermeasures headquarters, the Shift Supervisor instructed the operators to utilize the drainage line to S/C from the cooler on the flammability control system ("FCS") to implement cooling of the S/C by means of the MUWC or make-up water purified system ("MUWP"). Subsequently, the implementation was carried out from units where preparations had been readied.

- **Alternative coolant injection into the reactor using MUWC was switched as circumstances required to the drywell ("D/W") spray and S/C spray in an effort to control the rise in PCV pressure.**
- In the main control room for Units 1 and 2, an effect of suppressing a rise in PCV pressure was expected and the D/W cooler (without a cooling source) was manually started up. Immediately after startup, the D/W temperature fell, so the information was provided to the Shift Supervisor at Units 3 and 4. The Shift Supervisor at Units 3 and 4 imitated this to conduct a similar response and confirmed that the D/W temperature decreased.

< PCV Hardened Venting Preparation >

- At the power station countermeasures headquarters, **reactor water level, D/W pressure and other plant parameters were able to be obtained at all times through communication (PHS) with the main control room, so it could be ascertained that the PCV pressure was tending to rise. At Units 1, 2 and 4, there was anticipation that it would take time to restore the reactor heat removal capability, and it was decided to undertake configuration of a line for PCV hardened venting (a situation in which one action remained for an operation to open the outlet valve on the S/C side).** Even at Unit 3, it was decided to configure a line for PCV hardened venting similar to the other units in preparation should PCV pressure rise.
- **At Units 2, 3 and 4, configuration of the line in question was completed in 5~25 minutes through the operation of switches in the main control room. On the other hand, at Unit 1, because the solenoid valve for drive air control for the hardened venting line inlet valve (air-operated valve) lost power due to the impact of the tsunami, the opening operation could not be performed.** As a result, the power station countermeasures headquarters examined countermeasures (a method for connecting a small compressed-gas cylinder to the valve driver and a method for restoring the power source of the solenoid valve in question and performing the opening operation), and **taking into account the trend of the PCV pressure rise, it was determined that there was a margin of time until the completion of the preparations for hardened venting, and it was decided to restore the power source of the solenoid valve in question and perform the opening operation.** Beginning at 16:00 on March 12, confirmation was undertaken of the power source route and configuration of an electric circuit was completed. At 18:30, the

operation to open the hardened venting line inlet valve was performed. It was confirmed to be “open,” and **configuration of the PCV pressure venting line was completed.**

< Ensuring Reactor Heat Removal Capability >

・ At approximately 20:00 on March 11, the power station countermeasures headquarters gave instructions to confirm the soundness of equipment while giving sufficient consideration to safety, and the operators and the restoration team at the power station countermeasures headquarters commenced confirmation of the site. From the condition of equipment and the state of inundation of power sources, the power station countermeasures headquarters determined the target equipment to be prioritized for inspection and repair of seawater system facilities important for removing heat from the reactor at each unit.

・ **Temporary cable needed for restoration of the power supply was transported by helicopter from outside the power station.** Hurriedly, it was decided that the outside arena and baseball field would serve as the heliport. Early in the morning on March 12, preparations were put in place, including throughout the night, for receiving the load, such as removing the fence around the outside arena and positioning 20 of the employees’ vehicles to be used as guide lights for the helicopter to land. In addition, trucks even transported temporary cable with the roads in poor condition due to the impact of the earthquake.

・ In order to restore power to the necessary equipment, temporary cable was laid from the radwaste building (“RW building”) to the Hx/B for Units 1 and 2, and from the Hx/B for Unit 3 to the Hx/B for Units 2 and 4, and, moreover, from a high-voltage power supply vehicle through a power transformer temporarily set up at the entrance for large deliveries to the Unit 3 turbine building to the Hx/B for Units 1 and 4. The priority for restoration of the power supply was determined by assessing the condition of the plant from the change in D/W pressure and other parameters for each unit. The result was that although it was initially decided to respond by prioritizing Unit 2 and cable was started to be laid, subsequently, based on an assessment of changes in parameter movements, the order was changed to prioritize Unit 1.

Preparations for laying temporary cable (photo of work conditions at a later date)

・ **In laying the temporary cable, a team was formed which was a mix of approximately 40 personnel from each of the respective Distribution Departments assembled from station personnel and each of the company offices (station employees and contractors), and the team performed the work while aftershocks were still occurring and with**

debris scattered about due to the impact of the tsunami. There was also night work depending on the Unit, and the work was undertaken while depending on vehicle headlights due to the total darkness.

- The temporary cable having a thickness of 2~3 centimeters was wound into one strand of three cables, and a length of approximately 200 meters weighed over one ton. **From the RW building to the Hx/B, it was necessary to lay the distance with a maximum length of approximately 800 meters. The work of laying the cable, which ordinarily would use machinery and take a considerable number of days was undertaken at a rapid pace using human power, and the total length of approximately 9 kilometers of temporary cable to be laid was partially carried out on March 12 and the majority of the work done and completed on March 13.**
- **As for part of the seawater system facility important for conducting heat removal of the reactor at Unit 1, although the motor was cleaned, the insulation resistance was not restored, so a motor was brought from Mie Prefecture by a Self Defense Forces transport plane.** After the motor arrived at the power station, it was immediately mounted and a connection started with the temporary cable, and the work was finished by the evening of March 13.
- With regard to the motor for part of the seawater system facility important from conducting heat removal of the reactor at Unit 4, the insulation resistance was not restored, so the motor was disassembled and inspected and, along with this, preparations were made for its replacement. From the results of the disassembly and inspection, it was determined that the existing motor could not be used, so **it was decided to use a motor transported by land from the Kashiwazaki-Kariwa Nuclear Power Station. During transport of the motor, the door of the Unit 4 Hx/B did not open, so the work of delivering the motor was difficult with the door having to be destroyed along with other problems.**

Pump motor recovery work
(photo of work conditions at a later date)

- At Units 1, 2 and 4, the seawater system facilities important for removing heat from the reactor and for which restoration had been completed were started up in sequence, and then, the RHR pump, which was sound, was started up. With this, it was determined that a recovery had been made from the event in question pursuant to Article 10 of the ASMNE (loss of reactor heat removal capability).
- Furthermore, by using the recovered reactor heat removal capability to conduct S/C cooling,

the S/C temperature fell below 100℃, so it was determined that a recovery had been made from the conditions of the specific event (loss of pressure suppression capability) pursuant to the provision of Paragraph 1 of Article 15 of the ASMNE. Subsequently, coolant was injected into the reactor and the reactor water temperature fell below 100℃, so it was confirmed that cold shutdown had been achieved.

・ With regard to Unit 3, the reactor was cooled by means of the RHR which had been confirmed to be sound and not affected by the tsunami. On March 12, the reactor water temperature fell below 100℃, and cold shutdown was achieved.

End

Appendix

Voices of field workers

After the earthquake and massive tsunami struck the power plant on March 11, 2011, which resulted in the station black out, field workers were confronted with severe and difficult site conditions.

The severe and difficult conditions of field workers were revealed through the hearing and so forth conducted in the fact-finding survey. Voices of field workers regarding the condition at that time are listed below.

Those voices are direct opinions made by respondents etc. based on their memory and therefore may include opinions which are not true. They are listed nevertheless as helpful information to understand the disaster control situation.

[Condition of main control rooms and field inspection status by reactor operators]

○ At the time of tsunami arrival, **I saw the power panel lamps of Units 1 and 2 begin to flicker (Note: blinking) and then go out at once** right before my very eyes. DGs stopped and lamps went out one after another but I had no idea what had happened. **The lighting in the MCR (Note: main control room) was pitch black on the side of Unit 2 and the emergency lights (dim and slight illumination) lit up on the side of Unit 1**. All alarms stopped and the room went silent for a moment. Maybe, it went silent on the Unit 2 side first. **I could not believe what had happened**.

○ I do not remember what time it was, but I thought that seawater was flowing into the plant from the tsunami when **a reactor operator came back to the MCR shouting loudly, "We are in danger! Seawater is flowing into the plant."**

○ I heard this story on a later day from an auxiliary machine operator who went to the site to recover the MG set (Note: electric motor/generator set) of RPS (Note: reactor protection system). He left Unit 1 shortly because Unit 1 could not be activated. When Unit 2 was activated, **he heard an unusual roar from underground and he hurried upstairs. The seawater flowed into the S/B (Note: Service Building) through the entrance and he ran back soaked in water**.

○ I felt helpless rather than scared due to the loss of the power source. Young reactor operators seemed anxious. We were thrown into confusion over the question **"Is it worth us staying here helplessly, without being able to operate the facilities? Why are we staying here?"** (In response to the question about how things were brought under control) **I pleaded with them "to remain here." Subsequently, another shift supervisor bowed to them without**

○ When we were completely helpless, I instructed the operators, “You can do nothing but **fetch emergency water and hardtack and eat it,” so that they could regain their composure**.

○ Some people said that we could do nothing by staying here. Others may have felt the same but they did not say anything. **A man became sick and lay down. This man is still unable to come to work (Note: as of the time of the hearing survey)**.

○ Before the parameters became available, **I felt as if I had lost all my five senses**.

○ Although we had received various training, we could not use what we had learned in the training in that situation. **We were watching limited available data in a situation in which our hands were tied**. After the hydrogen explosion, **some people became restless to varying degrees**.

○ In the MCR, I instructed the operators **to move from the Unit 1 side to the Unit 2 side and squat down to lower their dose exposure**. During the period from the evening of the 11th to the next morning, **even chief operators looked anxious**.

○ **After the explosion, three members lay down in bad shape and could not get up**.

○ **With no information obtained about the current condition of the plant, I felt like I would lose my mind if I stayed still. So I was always doing some job at the site, however small.** I think I could do it because I had no information.

○ I discovered water encroaching through the truck bay door. When I looked into the water immersion, I found water infiltrating from below the shutter. Immediately after that, **the shutter was blown away and the tsunami entered the building. I ran away with a colleague and escaped from the disaster but we were shivering with fright**.

○ When I tried to enter the common use building to inspect the operational condition of the 4B D/G, **I was confined at the entrance gate.** I tried to contact the security guard but the communication system was unavailable. **A few minutes later, the tsunami hit. Just when I thought I was going to die with water encroaching from below,** a senior employee in the same situation broke the glass of the gate and escaped, and then helped me out by breaking the glass on my side. **When I did escape from the confinement, water had inundated to the height of immediately below my jaw. I was really scared.**

○ When I went to the site, I removed my ring for fear that it might become contaminated with radiation and therefore unable to be taken out, **but I finally headed for the site with the ring on me so that I could be identified by it in the worst case scenario and also as a lucky charm**.

○ **It was dark both in the MCR and at the site, and I was full of anxiety about whether**

○ When the loads were reduced in the cable bolt room under conditions where neither PHS nor paging were usable due to the loss of the power source, we exchanged information by assigning operators to some positions from the MCR to the cable bolt room as a means of communication. Approximately five operators in total were assigned to the MCR entrance, dining hall, site anteroom, and cable bolt room. **Sometimes everyone travelled a distance of as much as 50 m in the turbine building many times**.

○ The explosion of Unit 1 resulted in a rapid increase in the radiation dose in the MCRs of Units 3 and 4. As I had recognized that what had exploded was hydrogen within the generator of Unit 1, I did not really understand why it had resulted in an outdoor radiation dose increase. **Because the means of communication had been limited to the hotline at the desk of the shift supervisor, I was very anxious about the lack of information on conditions outside the MCR**.

○ Under circumstances where Unit 3 could explode at anytime, I had to go to the MCR next by rotation. **As I really prepared to die, I asked my father at home "to take care of my wife and daughter if anything should happen to me."**

○ I conducted the operation of opening/closing the S/C spray valve, of opening/closing the reactor injection valve, and of opening the D/W spray valve in darkness without scaffolding. What was more terrible during the operation was **the realization that "leakage of this steam will result in my death." I was conscious of this when I felt the sound and vibration of the SRV being operated nearby in my body**.

○ When I returned to the MCR, it was completely dark. Only the lamps of HPCI and RCIC and the lamp of DC power source were lit within it. **It was surreal. Had it really happened? I did not actually feel like it had**.

○ When I could not leave the MCR as the radiation dose started to increase by 0.01 mSv per 3 seconds in the MCR, **I thought it was the end of my life**.

○ When I ate hardtack of preserved emergency food and drank potable mineral water, **I could not help removing the full face mask at the risk of being contaminated with radiation**.

○ **As I could not help but eat to stay alive (operation & surveillance)**, I was anxious about my health.

○ It was an improbable view from the changing room window. **I saw huge breakwaters falling like dominoes. A gantry crane had crashed into the SW pump, several cars were washed away... I heard the continual sound of vehicle horns from immediately below**.

○ A large amount of adrenalin might have been released in my body during the earthquake. I felt surprisingly calm with little sense of fear. I felt as if it was an incident in a dream... This

○ As the shaking grew gradually stronger, I saw the ANN window of Unit 6 scram lighting up in red at the front. Several seconds later I turned back expecting “Unit 5 will be scrammed soon," and the scram signal was transmitted from Unit 5. **Many fire alarms were sounded due to dust and it became dusty inside the MCR.** I had a blocked nose. I wanted to wear a mask.

○ While checking parameters, **I heard a loud thud.** Everyone looked startled. **Soon after that, all the D/Gs of Unit 5 tripped. All lights went out except for the emergency incandescent lamps in the Unit 5 MCR.**

[Voices from restoration workers (vent)]

○ I called for staff who could go to the vent. **Even relatively young operators raised their hands. I was moved to tears.** I organized teams with shift supervisors assigned to each. **As the members had to go to a place with a high dose under unknown conditions in full equipment, I did not include young operators in the teams.**

○ I organized up to three teams **in consideration of the high dose, the members' physical strength, and the possibility of their returning because of aftershock. As we might not be able to rescue members in an emergency if all the teams started at once,** I instructed the teams to go one by one.

○ I felt like going by myself even though I was a shift supervisor. I volunteered but my colleagues said to me, “**You should give direction and see it through to completion!" I admired them greatly. I could not even speak. I felt so sorry.**

○ **As we could not exchange information among teams if all teams started at once, the teams were expected to go one by one**. We entered the building from the south side double door. It was very hazy in the building and I wondered why it was in such a condition. I had an image that it is normally dry inside. I went down the northwest stairs to the middle basement from the south side through the rear of HCU (Note: hydraulic control unit). At first I checked the radiation dose with a dosimeter. But soon after I entered the torus room, I found it impossible to continue measurement and ran back.

○ The Restoration Team tried to enter the torus to keep the containment vessel vent valve open by engaging a jig to it, but could not enter the torus **due to the extraordinary noise of the steam flowing from the SRV (Note: safety relief valve) to the S/C (Note: suppression chamber) and excessive heat**. Eventually, the team returned to the MCR without being able to conduct the operation.

○ **In the darkness, bubbling-up steam was loudly released from the SRV. My shoes melted in the heat in an upper part of the S/C**.

○ I was instructed to confirm that ●● valve was open. When I went to the S/C, my shoes melted. I could not confirm the openness by visual inspection. **As the valve was located topmost, I stepped onto the torus to check the heat. My shoes melted immediately**. I judged that I should stop the operation.

○ At the site, I opened the ●● valve for reactor coolant injection, and conducted the operation of opening and closing the S/C spray valve at 5:08 on March 13. **My boots melted when I went to the D/W spray to stop the S/P spray**. **The S/C valve was too hot to handle.**

[Voices from restoration workers (coolant injection, restoration of SRV/instruments, restoration of power supply)]

(Coolant injection)

○ There was an employee from a partner company who had been told by the president of his company to return to his office. **He was moved by our efforts to protect the power plant by all means and decided to remain with us, saying with tears "I cannot return to the office."** He directly told his president that he would return after remaining here for the time being.

(SRV, restoration of instruments)

○ Cable cutting for the SRV (Note: The work of processing the cable for connecting batteries necessary to open the SRV) was hard work too. It was difficult to conduct terminal treatment for a considerably long wire (core wire stripping) without even a wire stripper to connect 10 batteries in series taking care not to damage the wire. It was even more difficult because of the darkness in the MCR. It was also hard to connect a wire to a battery with a plastic tape in rubber gloves because the tape stuck to the rubber gloves.

○ **Batteries sputtered terribly when connected together to a DC voltage of approximately 120V. Even at as low as 24V, when my hand slipped and a large spark was emitted, the battery terminal melted with the spark**.

(Restoration of power supply)

○ As we could not attend the site due to warnings of aftershock and tsunami, and we were not informed of restoration of the power supply from the shift supervisor in the anti-earthquake building, **operators of TL (Note: team leader) and chief classes volunteered for site inspection for the T/B (Note: turbine building) and the S/B (Note: Service Building)**.

○ Manhole covers had been opened here and there by the water force, and we moved forward on a path covered with scattered rubble step by step making sure that there was no opening

○ **Cable laying work usually takes one to two months. We did it at an unprecedented high pace of several hours**. We needed to find a penetration hole for cable laying and conduct terminal treatment in the darkness. The terminal treatment of high-voltage cables requires special skills and needs to be performed carefully. The terminal treatment alone usually takes about four to five hours. Worse still, cables are usually laid using a machine but it was done manually this time. A single cable consists of three cables of about 15 cm in diameter and hence it is very heavy.

○ The greatest impact was given by aftershocks. We were forced to return soon after we had moved forward. At every aftershock, we also took time to confirm safety. When a considerably large aftershock occurred, we desperately ran back. After returning, we had to wait for about two hours before restarting.

○ **The electric equipment room was inundated. It was not energized but there was the possibility of electric shock. We conducted the operation in long boots for fear of being electrocuted.**

○ We performed the operation cheek by jowl with death. During the operation in the unaccustomed full face mask, we ran away every time an aftershock and tsunami occurred. We repeated this process many times.

○ There was a weir full of water in the place where P/C (Note: low pressure power panel) was located. We could not reach the P/C without wearing long boots. **We could not even put down tools during the operation and needed an assistant to light the site and carry tools**.

○ **Some of us had family members who had died in the earthquake and others worked at the company crying all the time**. All of us had no means of knowing whether our family and friends were alive or not because telephone lines were out of service.

[Explosion status]

(When Unit 1 exploded)

○ **Windows of fire trucks were shattered by the bomb blast and then I was showered with rubble**. I thought hydrogen had leaked from the cylinder. The air was probably impregnated with hydrogen gas. **Things looked distorted to me for a moment. Then I felt as if I was floating at the same time as a tremendous roaring sound was emitted**. At the same time, I was showered with rubble from in front like a rocket.

○ **The whole main control room shook vertically out of the blue with a roaring noise. The entire room became full of white dust.** All of us put on our masks according to the command, “Full face mask!" Someone fell off his chair.

- ○ I was beside the backwash valve pit on the Unit 1 side. I was surprised by the excessive impact. **When I looked up, rubble was falling and scattering from the sky. So I ran away with a colleague.** We might have been hit by the rubble. As too much rubble was falling while we were running away, I pushed my colleague away and took action to avoid the rubble along the wall of a tank located by the turbine building. After a while, **when we tried to escape, we found another operator who had stayed beside a truck unable to stand up. So we returned and picked him up together then walked away**. I walked back to the site shouting "Explosion" over the wireless handset.
- ○ When Unit 1 exploded, I was near the entrance of the Anti-Earthquake Building, but I could not enter it and ran around it. I ran to a nearby fire truck.

(When Unit 3 exploded)

- ○ **When I entered the S/B, I felt an impact to the rear of me. I do not remember the sound well; it was like a wind pressure**. Then I went to the MCR to get information. All of us, six persons, tried to go home by car but there were heaps of debris on the roads. While traveling on a road on the R/W side, the roads became increasingly impassable. Then we discovered the damage of Unit 4. **As we could not go forward due to debris, we left the car and ran from the mountain side of the Unit 4 R/B**. We left the car unattended because roads were impassable and left the plant from Gate No. 7.
- ○ There was no wind pressure but I heard a banging noise like the bursting of a balloon. **The air suddenly became white. After a while, I heard a loud clang and guessed that it was the sound of falling concrete.** I tried to take shelter in an arcade that had collapsed in the tsunami. But it was useless because I could see the sky and there was nothing to shelter from the falling rubbles. **I hid in the shade of nearby piping though the place was in full view from above. I thought I would die.** The air went white with a banging noise, and I waited until things cleared. The roads between Unit 2 and Unit 3 were full of heaps of rubble. As roads were impassable for cars, I walked over the rubble with colleagues. The rubble accumulation was particularly marked between Unit 2 and Unit 3.
- ○ We laid cables after the Unit 1 hydrogen explosion, and then the hydrogen explosion occurred in Unit 3. Members ran back to the Technical Support Center. The operators were in a panic.
- ○ When Unit 3 exploded, I was in the corridor of Unit 2. **The air became white with dust simultaneously with a tremendous explosion sound. We were very much scared to see that the vehicle of a partner company, which we drove in to come to the plant, had been blown away by the explosion.**

End