Fukushima Daiichi Nuclear Power Station
Response after the earthquake

This document is a summary of the latest information obtained through information and interviews with personnel concerned. We will continue investigation and announce when new facts and findings are obtained.

○Activities between occurrence of the Great East Japan Earthquake at 14:46, March 11 to the first tsunami hit the site at 15:27 on March 11.

【Evacuation and safety confirmation】

・ Personnel in the administration building evacuated to the parking lot in front of the building and called over the names. Emergency response personnel stationed in the Anti-Seismic Building (TSC Building) and started response. Everyone was familiar with evacuation route because emergency drill was done just a week before the earthquake.

【SCRAM Response】

<Main Control Room of Unit 1/2>

・ Operators started normal scram response after the shaking trailed off. Shift Supervisor confirmed scram of the units and supervised response in between the unit 1 and 2 control panels. Each operator was assigned to control panels and Chief Operator conducted monitoring and operation, also reported plant situation to Shift Supervisor.

・ At 14:52, operators confirmed automatic start up of the Isolation Condenser (IC) at Unit 1. Because reactor water stayed in normal level, operators decided to use HPCI when water level dropped and to control reactor pressure by IC.

・ At 15:03, reactor pressure of Unit 1 dropped so fast and the reactor coolant temperature decreased 55 C per hour, exceeding a criteria in the Tech.Spec. Then operators closed MO-3A and 3B, return isolation valves of IC. IC was in stand-by condition with other valves in the IC remained open. Operators judged that only one train of IC was sufficient to control the reactor pressure in 6 – 7 MPa. They decided to use Train A and started to control the pressure by operating MO-3A.

・ As for Unit 2, RCIC was started manually but tripped because of high reactor water level． After that, RCIC was started manually again.

<Main Control Room of Unit 3/4>

・ MCR became white as if laid a smoke screen by dust caused by the earthquake.

After the shaking was trailed off, operators started normal scram response. Shift Supervisor was reported plant scrams. Emergency Diesel Generator (DG) started up due to loss of off-site power. Emergency bus was confirmed to be charged by DG.

- At Unit 3, RCIC was manually started but tripped by high reactor water level.
- After the earthquake, safety of the operators was checked. Earthquake and Tsunami alert were paged to the plant workers.

<Main Control Room of Unit 5/6>

- Shift Supervisor were checking control panel at his desk and securing his safety until the shaking trailed off. Other operators also secured their safety at the same time paid attention to monitoring panels. After the shaking, operators checked alarms. Most of the alarms was sounding at that time.
- Since Paging and ITV were unavailable, PHS (Personal Handy phone System: like cell phone) was utilized to order evacuation for field workers. Shift operators returned to the MCR after gathered in anteroom.

○ Activities after Loss of all AC Power at 15:42 on March 11

【Situation at Main Control Room of Unit 1/2】

- Lighting and indicators in the MCR gradually fading due to loss of all AC power. Sound of alarm was lost, too. In Unit 1-side of MCR, only emergency lights remained. In Unit 2- side, all lighting was lost and it became completely dark. By command of Shift Supervisor, operators checked availability of equipment in MCR.
- For Unit1, IC and HPCI were operable by DC power. However, valve status of IC was not indicated on the control panel. Operators judged HPCI was not operable because indicators on the control panel were gradually faded. For Unit 2, operating status of RCIC became unknown.
- At 15:50, instrumentation power was lost and reactor water levels for Units 1 and 2 became unknown.
- Communication between MCR and the site emergency response headquarters was limited to a hot-line and fixed-line phone, it was not able to use PHS.

【Situation at Main Control Room of Unit 3/4】

- Due to loss of all AC power, lighting in MCR was emergency light only. Since Unit 4 was in refueling outage and completely defueled, parameters such as reactor water level was checked mainly focused at Unit 3. This was conducted with flashlights.
- Per operating procedure at the time of loss of AC power, unnecessary load was cut to extend battery life for RCIC and HPCI.

・ At 16:03, RCIC was manually started, parameters like discharge pressure and rotating speed were confirmed in MCR. Operating status was monitored and made HPCI start up ready.

【Situation at Main Control Room of Unit 5/6】

・ Two DGs at Unit 5 and two DGs at Unit 6 were stopped simultaneously by the tsunami. One remained DG at Unit 6 continued operation with adjusting frequency.

・ MCR at Unit 5 lost lighting and emergency lights put on, but these emergency lights faded gradually then MCR became dark. MCR at Unit 6 was same as normal.

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【Restoration of MCR Instrumentation】

・ The restoration team in the site emergency response headquarters prepared for necessary documents and drawings to restore power in MCRs. **Also they started to gather batteries and cables at offices of contractor's office in the site. The team carried batteries and cables which were collected in the site to MCR of Unit 1/2. Then confirming drawings, they started to connect the batteries to instrument panel in the MCR**. At the event of "ECCS was unavailable to inject water into the reactor", a top priority was to understand the status of water injection into the RPV. So restoration work was focused on connecting batteries to reactor water indicator which functions by DC power.

Temporary Batteries were used to supply power to instrumentation

Checking indicators with flashlight

・ Reactor water levels were become clear for Unit 1 at 21:19 and for Unit 2 at 21:50.

・ The restoration team of the emergency response headquarters installed a small generator to restore lighting in MCR. Temporary lights were installed in MCR of Unit 1/2 at 20:49 and Unit 3/4 at 21:58.

【Securing Power Supply, Starting Restoration Work】

＜Securing Power Supply Vehicle＞

・ Corporate Distribution Department ordered branch offices to secure high and low voltage power supply vehicles and confirm driving route to Fukushima Diichi NPS.

・ Although high and low voltage power supply vehicles headed to Fukushima Daiichi,

they were not able to drive up to the site fast enough because of **damages of roads and traffic jam**. It was considered to transport the power supply vehicles by choppers of the Self Defense Force, but it turned out that the weight of the vehicles were too heavy to carry. TEPCO requested Tohoku Electric Power Company to dispatch power supply vehicles to Fukushima Daiichi NPS.

<Soundness Check of Power Supply Equipment>

- As a result of equipment soundness check, **it turned out that breakers were dropped and not usable in the switchyard and off-site power would not be restored soon. Also DGs were not operable and difficult to be restored soon because they were submerged.** It was concluded that power restoration using power supply vehicles were necessary.
- Visual inspections for inundation status and damages on exterior and insulation resistance tests were conducted on the power panels (M/C and P/C) in the turbine buildings (part of them are not in the turbine building). It was confirmed that all of the M/C and P/C at Units 1 and 3 was inoperable, all of the M/C at Unit 2 was also inoperable, part of P/C at Unit 2 was operable. (later we confirmed 4 out of 7 P/Cs were operable.)

<Preparation for accepting power supply vehicles by station personnel>

- The site engines decided to connect power supply vehicles to the primary side of a power transformer (6.9kV/480V) in a P/C at Unit 2 to have 480 V to use SLC pumps.
- **Considering distance to the P/C of Unit 2 and workability for laying cables, the power supply vehicle was set at the side of the turbine building and cable was laid from the equipment hatch of the turbine building to the P/C in the north side of the first floor of the building. The distance was about 200 m.**
- The cable laid in the building was carried in by a 4-ton unic truck. This cable was stored by an on-site contractor for outage works.

＜Arrival of Power Supply Vehicles＞

- Power supply vehicles of Tohoku EPC and TEPCO arrived at the site during midnight of March 11 and early morning of March 12.
- In cable connection, TEPCO's power supply vehicles were given priority.

＜Cable Laying and Connection＞

- Cable in the building was **more than 10 cm diameter, about 200m long and weigh more than 1 ton.** Usually, laying this kind of cable takes considerable days using machine but **40 TEPCO personnel laid the cable in 4, 5 hours by hand**.

Sagging of Road

- It was very difficult to work steadily because of **extremely bad working condition such as dark place, water puddle by the tsunami, debris and lost manhole lids.** It was necessary and quite a challenge to look for cable penetration in the dark and make cable route by destroying doors. Also, cable work was suspended by **evacuation with continued Tsunami Alarm and many aftershocks.**
- Cable terminal connection to P/C was completed only a few engineers, usually this takes several hours.
- Though it was necessary to maintain communication between the field and the site emergency response headquarters, the communication was almost lost in the site and **had to walk to locations where communication was possible**, very time consuming for the emergency situation.
- **At 15:30, cable connection between the primary side of the P/C at Unit 2 and the high voltage power supply vehicle was completed. Power was supplied just short of the SLC pump.** However, at 15:36, Unit 1 exploded and **debris by the explosion hit and damaged the cable, then the high voltage power supply vehicle automatically stopped.** Field work was suspended and everyone evacuated to Anti-Seismic Building (TSC Building).

【Confirmation of Water Injection to RPV】

<Unit1, Confirmation of IC status, Operation>

- In MCR, operators found indication light of MO-3A and MO-2A after temporary restoration of DC power. The indicators showed the valves were closed. Then an operator opened the valves at 18:18 and confirmed the light indicated the valve status from close to open. Also steam generation was confirmed after the valve operation.
- At 18:25, the operator closed the return line isolation valve (MO-3A). At 21:30, the operator opened the MO-3A and confirmed that steam was generated.

<Unit 2, Confirmation of RCIC status, Operation>

- In the early morning of March 12, an operator confirmed operating status at the field(RCIC Room). **Equipped with Self air set, flashlight and high boot. It took about an hour to go to and back from the RCIC room. Usually this takes only 10 minutes but at that time, there were still concerns of aftershocks and tsunami and putting on/off the self air set took extra time.**
- In RCIC room, **there was a water puddle and it's depth was**

Self Air Set

about the height of the boots. Faint metallic sound was heard but the operator was not able to check the rotating part. He returned to the MCR but was not able to determine whether RCIC was operating or not. Since PHS was not functioning, he reported the situation after getting back to the MCR

- Then at 2:00, the operator went there again. **Water puddle increased and the operating status of RCIC was not able to see in the RCIC room.** The operator determined **RCIC was in operation** by checking reactor pressure and RCIC discharge pressure at the instrument rack of RCIC and **RCIC discharge pressure was high.** After he reported this after returning to the MCR then reported to the site emergency response headquarters at 2:55.

Time line sequence of major events following earthquake to May 12th (Sat) for Unit 1 at Fukushima Daiichi Nuclear Power Station

This report is based on various information as well as testimonies received from relevant people up to this point in time. Further announcements may be released upon the discovery of new information identified during the investigation.

March 11th, 2011

2:46 pm **The reactor was scrammed automatically after the Tohoku Chihou Taiheiyou Oki Earthquake occurred.** The third state of emergency was announced.

2:47 pm The main turbine was suspended automatically. Diesel generator for emergency started automatically.

2:52 pm The isolation condenser (hereafter referred as "IC") started automatically.

3:02 pm Subcritical state of reactor was confirmed.

Approx. 3:03 pm IC was suspended manually to control the reactor pressure. The control of the reactor pressure by IC was started.

3:06 pm Headquarter for major disaster countermeasures was established in the head office to grasp situations of damages and to restore the outage due to the earthquake.

3:27 pm The first tsunami hit the Muclear Power Station.

3:35 pm The second tsunami hit the Muclear Power Station.

3:37 pm All the alternating-current sources were stopped.

3:42 pm It was decided that a specific incident stipulated in Article 10, Clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness has occurred, and relevant governments were notified of the incident.

3:42 pm The first Level Emergency" was declared, and Emergency Response Headquarter was established (as Joint Headquarter with Headquarter for major disaster countermeasures mentioned above).

4:36 pm It was decided that a specific incident (impossibility of water injection by Emergency Core Cooling System) stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness has occurred, because the reactor water level and the status of water injection was not confirmed. The relevant governments were notified of the incident at 16:45.

4:36 pm "The second Level Emergency" was declared.

4:45 pm It was decided to cancel a specific incident (impossibility of water injection by

Emergency Core Cooling System) stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness, because the reactor water level was confirmed. The relevant governments were notified of the cancellation at 16:55.

5:07 pm It was decided that a specific incident (impossibility of water injection by Emergency Core Cooling System) stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness has occurred, because the reactor water level was not confirmed again. The relevant governments were notified of the cancellation at 17:12.

5:12 pm General Manager of Power station directed to start consideration of measure to injecting water to Reactor using the Fire Protection System which is installed as a measure for accident management and fire fighter.

5:30 pm Diesel-powered fire pump activated. (idle activity)

6:18 pm Operated to open IC return line of isolation valve (MO-3A) and IC steam line of isolation valve (MO-2A). Confirmed steam rising out.

6:25 pm Operated to close IC return line of isolation valve (MO-3A)

8:49 pm Temporary lighting was turned on in the main control room.

8:50 pm Government of Fukushima prefecture ordered to evacuate for the residents within 2km radius from Fukushima Daiichi Nuclear Power Station.

9:19 pm Water level in the reactor found out. Top of active fuel (hereinafter “TAF”) +200mm

9:23 pm The Prime Minister ordered the residents to evacuate within 3km radius from Fukushima Daiichi Nuclear Power Station, and ordered the residents to stay indoors within 3km to 10 km radius.

9:30 pm Operated to open IC return line of isolation valve (MO-3A). Confirmed steam rising out.

9:51 pm Prohibited entry into the reactor building as the radioactive dose increased.

10:00 pm Confirmed water level in the reactor was TAF+550 mm. Reported it to the authorities at 10:20 pm.

11:00 pm Reported to the authorities as a result of survey at 11:40 pm, an increase of radioactive dose in the turbine building (1.2mSv/h in front of the double doors in the North on the first floor of the turbine building, 0.5mSv/h in front of the double doors in the South on the first floor of the turbine building)

March 12th, 2011

0:06 am The General Manager of power station instructed to prepare to vent the Primary Containment Vessel (hereinafter “the Vent”) as the drywell (hereinafter “D/W”) pressure was likely to exceed 600kPa abs and there was a possibility to

implement the Vent.

0:30 am Government confirmed the completion of evacuation of the residents (3km radius of the periphery of Fukushima Daiichi Nuclear Power Station in Futaba Town and Okuma Town, reconfirmed at 1:45 am)

0:49 am As D/W pressure was likely to exceed 600kPa abs, it was judged to a specific incident (extraordinary increase of pressure in the Primary Containment Vessel) occurred, based on Article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness. Reported it to the authorities at 0:55 am

1:30 am Proposed and obtained agreement to implement the Vent at Unit1 and Unit2 to prime minister, minister of economy, trade and industry and Nuclear and Industrial Safety Agency.

1:48 am Confirmed that diesel-powered fire pump stopped because of defects. Started to consider connecting the water inlet of the Fire Protection Line with a fire engine.

2:47 am Reported to the authorities, D/W pressure reached 840 kPa abs at 2:30 am

3:06 am Press conference about the Vent implementation was held.

3:33 am Reported to the authorities, the result of evaluation of radioactive exposure in the case that the Vent was implemented.

4:55 am Confirmed the radioactive dose in the power station rised (0.069μSv /h (4:00) => 0.59μSv /h(4:23) around main gate) and reported it to the authorities.

5:14 am As the radioactive dose increased in the premise of the power plant and the D/W pressure tended to decrease, it was judged that “radioactive material leakage to the exterior” occurred. Reported it to the authorities.

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

5:46 am The fire engine started plain water injection into the reactor through the Fire Protection Line.

6:33 am Confirmed that consideration was being given to the evacuation from Okuma Town to an area located in Miyakoji.

6:50 am There was an order of The Minister of Economy, Trade and Industry to implement the Vent based on the laws and ordinances (manual Vent).

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

8:03 am The General Manager of the power station instructed to aim to implement the Vent at 9 am.

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

8:27 am Confirmed the information that part of the residents in Okuma Town have not been able to evacuate yet.

8:37 am Reported to the Fukushima Prefectural Government that we were preparing for the start of the Vent around 9 am. Coordination was done with Fukushima Prefectural government to implement vent operations subsequent to the evacuation.

9:03 am Confirmed that the evacuation of Okuma Town (Kuma area) residents had been completed.

9:04 am Person on duty left for the scene in order to implement the Vent.

9:05 am Announcement of implementation of the Vent.

Approx. 9:15 am Manually opened the vent valve (MO valve) of Primary Containment Vessel (hereinafter ”PCV”)

9:30 am An operation of the vent valve (A/O valve) of the suppression chamber (hereinafter “S/C”) was tried but given up due to high radioactive dose.

9:53 am Reported to the authorities, an evaluation result of exposure in the case that the Vent was implemented.

10:17 am S/C vent valve (AO valve) was opened in the central control room (with expectation of residual pressure of instrumentation air system).

10:40 am As the radioactive dose increased at the main gate and the monitoring post, it was judged that there was a high possibility that radioactive materials were released because of the Vent.

11:15 am Confirmed that there was a possibility that the Vent was not fully effective as the radioactive dose decreased.

11:39 am Reported to the authorities, that radioactive exposure of an employee of Tepco exceeded 100 mSv (106.30 mSv), who had entered into the reactor building for the Vent operation.

2:30 pm When setting up a makeshift air compressor around 2 pm in order to operate the S/C vent valve (AO valve), we confirmed that the D/W pressure decreased and judged that the “release of radioactive materials” occurred by the Vent. We reported this information to the authorities at 3:18 pm.

2:53 pm 80 tons (accumulated total) plain water had just been poured into the reactor by the fire engines.

2:54 pm The General Manager of the power plant instructed to implement an injection of seawater into the reactor.

3:18 pm Reported the following items to the authorities: recovery work of standby liquid control system was in progress, the standby liquid control pump was scheduled to be activated and boric-acid solution was scheduled to be injected into the reactor as soon as those were ready, furthermore, seawater was hereafter scheduled to

be injected into the reactor through the Fire Protection Line as soon as that was ready.

3:36 pm All the preparations were complete for the injection of boric-acid solution through the standby liquid control system, upon power restoration by use of a power supply car.

3:36 pm An explosion occurred in the reactor building. Power- supply facility for the standby liquid control system and pre-arranged hose for seawater injection were damaged and out of commission.

4:27 pm Measuring the dose exceeding 500μSv /h at the monitoring post (1,015μSv /h), judged as a specific incident occurred based on article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose increased abnormally at the boundary of the site). Reported this information to the authority.

6:05 pm The information was shared among the head office and the power station that there was an order of The Minister of Economy, Trade and Industry based on the laws and ordinances.

6:25 pm The Prime Minister ordered the residents within 20km radius from Fukushima Daiichi Nuclear Power Station to evacuate.

7:04 pm Seawater was started to be injected into the reactor by the fire engines through the Fire Protection Line.

8:45 pm Boric-acid solution was started to be mixed with seawater and injected into the reactor.

End

Fukushima Daiichi Nuclear Power Station Unit 1
Alternative Water Injection

This document is a summary of the latest information obtained through information and interviews with personnel concerned. We will continue investigation and announce when new facts and findings are obtained.

○Activities after Determination and Reporting of Loss of ECCS at 16:36 on March11.

【Planning for Alternative Injection】

- **Frequent evacuation and suspension of field work due to continued tsunami alerts and aftershocks. Working without lighting and communication measures and significant amount of debris and soil by the tsunami made the field operation very difficult**.
- At 17:12, the site emergency response headquarters **started to discuss using the alternative water injection which was put in place as an accident management measures (AM) and the fire protection tanks and fire engines deployed after Niigataken Chuetsuoki Earthquake**.
- Meanwhile, operators checked measures for alternative water injection with AM procedure in the MCR and **confirmed injection line to RPV** then started to use Diesel Driven Fire Pump (D/D FP).
- **Operators lined up alternative water injection** with D/D FP and Fire Protection line via Core Spray System , **opening valves in the Core Spray lines by hand in the dark reactor building.** After depressurize the RPV below 0.69 MPa, water injection through FP/CS became available.
- At 17:30, D/D FP started up but in stand-by.
- The restoration team of the site emergency response headquarters conducted **visual inspections for inundation status and damages on exterior and insulation resistance tests were conducted on the power panels (M/C and P/C)** and found power supply equipment in Unit 1 was unable to use but one of P/Cs in Unit 2 was operable. The team made plans to use SLC (Stand by Liquid Control) system to inject water in the RPV, since the SLC had high discharge pressure. **Power supply for the SLC was planed to be restored by power supply vehicle via P/C in Unit 2**.
- **Monitoring instruments in the MCR were unable to use because of power outage**. Then an operator **entered in the dark reactor building** and

confirmed the reactor pressure was 6.9 MPa as of 20:07. Later, water level indicator returned its function and indicated the level was 200 mm above TAF (Top of Active Fuel) at 21:19.

○Activities after Starting Consideration for Connecting Water Injection Line from Fire Engine to Fire Protection Line at 1:48 on March 12

【Diesel Driven Fire Pump (D/D FP)】

- At 1:48, an Operator found D/D FP was stopped which had been on stand by to inject water into the RPV. **In order to start the D/D FP again, diesel fuel was carried to the pump and fueled manually and batteries stored at an office of on-site contractor was carried and replaced** but the pump did not work.

【Preparation for Water Injection from Fire Engine】

- It was impossible to use filtered water as water source for RPV because fire hydrant was damaged and water was spewed. **To have sufficient amount of filtered water for the injection, valves were closed around the area**. Also **other water sources were looked for and the fire protection tank was confirmed to be available.**


Sagged Road in the Site

- One fire engine was made ready for injection to the RPV. Other two fire engines were unavailable, for one was failed by the tsunami and the other was not able to move from the area near Unit 5/6. Damages on the road and debris by the tsunami divided the access route between Units 1 – 4 side and Units 5,6 side.


Tank moved by Tsunami

- **There were a lot of obstacles to deploy the available fire engine close to Unit 1. Tank swept by the tsunami blocked a road in front of the old-administration building and the road was impassable. The gate at the physical protection headquarters lost power and did not open. The restoration team of the site emergency response headquarters looked for rout in the site, then got access for the fire engine by breaking a lock at the gate between Units 2 and 3.**
- As for the fire engine, measures were studied to inject water via Fire Protection line. Also additional fire engines and water transportation by the

SDF were considered.

- Reactor pressure was 0.8 MPa at 2:4.

【Restoration of SLC system】

- Power supply and pump in SLC system were not affected by the tsunami. Since the SLC has high-head pump, power supply was being restored by the power supply vehicle.

○**Activities after Starting Water Injection into the RPV at 5:46, on 3/12**

【Prepare/Continue Freshwater Injection】

- A fire engine in the garage moved to Unit 1. At first, **the fire engine pumped up water at the fire protection tank then drove close to the reactor building and injected water through FP line, this operation was repeated** because it was considered the elevation at the fire protection tank was too low and the discharge pressure of the pump in the fire engine was not enough. **It took significant amount of time to drive the fire engine carefully under the half-collapsed building**.
- **It took time to go back and forth the fire engine between the fire protection tank and the reactor building**, **after some trial and error**, continuous water injection started by using a horse equipped on the fire engine to directly connect the fire protection tank and the fire protection line to the RPV.
- Additional fire engine arrived to the site and this one was used to **transport freshwater** from the fire protection tank at Unit 3 to the fire protection tank at Unit 1 **repeatedly**. **The fire protection tank had room for only one horse, so water injection to the RPV had to be suspended when the second fire engine came to replenish the water in the tank**.

【Preparation for Seawater Injection and SLC】

- Because of the limitation of the amount of freshwater in the fire protection tanks, preparation for seawater injection was initiated.
- **Instead of taking seawater directly from the sea, the backwash pit where seawater was filled by the tsunami was selected as a supply souse taking the road conditions in the site**

Injection by Fire Engine

and distance from Unit 1 into consideration.

- At 14:53, 80,000 Litter of fresh water had been injected to the RPV.
- At 14:54, Site Vice President directed to prepare for seawater injection to the RPV. Since freshwater in the fire protection tank at Unit 1 was drying up, freshwater was transported from other fire protection tanks in a quick pace and preparation for seawater injection was moved ahead.
- Around 15:30, **cable connection between the primary side of P/C at Unit 2 and high-voltage power supply vehicle was completed. Power was supplied just short of the SLC pump.**
- Lining up of seawater injection was completed with three fire engines connected in series to have sufficient head. Seawater was taken from the backwash pit at Unit 3.

- At 15:36, **Unit 1 reactor building exploded.**
  - **Workers at the field evacuated, rescued and transported the injured.** (TEPCO: 3, Contractor: 2)
  - **To verify safety and see effect of the explosion, field survey and walk down were conducted.** (Status of fire engines, damages to the buildings and smoking etc.) Fire engines maintained their function though windshield was broken.

Explosion of Unit 1 Reactor Building

  - As for the SLC pump, **ballistic fragments by the explosion damaged cable damaged the cable and high-voltage power supply vehicle stopped automatically.**
  - **The hoses prepared for seawater injection was also damaged.**

- **It was impossible to resume restoration work until evacuation, confirmation of the safety of workers and the field were completed.**
- **Workers removed debris, collected hoses from outdoor fire hydrants and laid hoses again to seawater injection. Because the debris near Unit 1 had high radiation, all these activities were monitored by radioactive protection technicians.**
- At 19:04, seawater injection started using the fire protection line and fire engines.

Unit 1, Fukushima Daiichi Nuclear Power Station
The operation of the vent valve at the PCV

This summarizes the facts based on info and testimony available to date. We will continue the investigation. If new facts are confirmed at a later date, we will announce again.

○ **Activities after report "At 4:36 PM on March 11, Determination and Report of ECCS's inability to inject water"**

・ We were endeavoring to restore indicators in the Main Control Room. We did below works.

【Preparation work for opening the vent valve】

・ At the Main Control Room we submitted the accident management ("AM") operation procedure to the chief operator and confirmed the procedure. Also, **we began confirming the name and place of valves required for opening the vent valves ("Vent") using the checklist for valves.**

・ Generation team of Power station emergency response headquarters ("PSER") began reviewing the AM operation procedure and checking **the Vent procedures without electricity.**

・ Restoration team of PSER, **during aftershocks, went to the administration main building (entrance prohibited) to get drawings in order to check the model and structure of the S/C vent valve (AO valve) required for Vent and open manually**. At the same time, we inquired our subcontractors. From the drawings, we confirmed that there is a handle on the small valve of S/C vent valve (AO valve) and could be opened manually. We notified the Main Control Room accordingly.


The status of administration main building

【The dose at the work place began to increase】

・ 9:51 PM, **The dose at the R/B began to increase**. We **prohibited entry to R/B.**

・ 10:00 PM, PSER have been reported that the figures by APD went up to 0.8mSv during a very short period of time at the R/B.

・ 11:00 PM, because of the influence of increase of dose at R/B, **the radiation dose in the T/B increased.** (in front of the airlock, north side, 1FL, T/B: 1.2mSv/h, in front of the airlock, south side, 1FL, T/B: 0.5mSv/h)。

【D/W pressure began to increase】

・ 11:50PM, at the Main Control Room, Restoration team of PSER connected the battery for the reactor water level gauge to D/W pressure gauge to check the pressure. The pressure indicated was 600kPa abs. Reported that to PSER.

○ **Activities after "At 12:06 AM on March 12, D／W pressure may exceed 600kPa abs. Instruction from the Station Manager to proceed with the preparation"**

【began to confirm the actual Vent procedures】

・ At the Main Control Room we put together the piping and instrumentation diagrams, AM procedure manual, documents such as the drawings of valves and the whiteboard. We began confirming the actual procedures such as how to operate the valve and sequences.

・ At 1:30 AM, we asked for permission to do Vent to Prime Minister, Minister of METI and NISA and got approval. From Headquarters Task Force ("HTF"), we received instruction **"We would like you to do Vent by whatever ways to operate the MO valve and AO valve. At 3:00 AM, Minister of METI and we will announce doing Vent. After the announcement, please do Vent."**

【continue confirmation of Vent procedures】

・ 2:24 AM, PSER received the evaluation result of work time at the field site to do Vent. **If the atmospheric radiation is 300mSv/h, we have 17 minutes of work time under the radiation limit for emergency response (100mSv/h)** (the air in the self-contained breathing apparatus lasts 20 minutes. Need to take iodine tablets.)

・ 2:30 AM, D/W pressure reached 840kPa abs（the maximum operation pressure = 427kPa gauge※）

※528.3kPa abs（＝427kPa gage＋101.3kPa）

・ 3:45AM, HTF made the evaluation on exposure dose at the surrounding areas at the time of Vent and shared with the power station. At the power station, **in order to measure dose in the R/B, we opened the airlock. As we saw white gaseous substance, we instantaneously closed the airlock. We couldn't conduct dose measurement.**

・ At the Main Control Room, **in preparation for Vent, we repeatedly confirmed the sequence of operation of valves, location of valves in Torus Room, height of valves etc.** We collected **as many equipments as possible** required for the work. Those are fire fighting garments, self-contained breathing apparatus, APD, survey meter and flashlights.

・ At 4:30 AM, **because of the risk of tsunami by aftershocks, PSER instructed the**

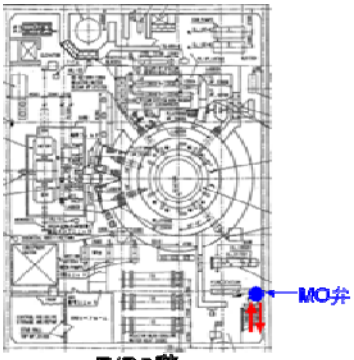
Main Control Room to prohibit operation at the field site.

- At 4:45 AM, PSER delivered APDs (set at 100mSv) and full face masks to the Main Control Room. At 4:50 AM, as the worker returned to the main anti-earthquake building was contaminated, we decided to equip, **from the entrance of the main anti-earthquake building, "full face mask + charcoal filter + B garment, C garment or coverall" when we go to the field site**. After that, at 5:00 AM, Main Control Room was instructed to **equip similarly "full face mask + charcoal filter + B garment.**
- At the Main Control Room as the dose increased, the Chief shift operator instructed shift operators to move to Unit 2 side with relatively lower dose.
- At 6:33 AM, as to the status of evacuation at surrounding areas, we confirmed that residents are planning to move from Okuma town to Miyakoji.
- 8:03 AM, Station Chief instructed to target 9 AM to do Vent for Unit 1.
- At the Main Control Room, **we formed three teams, two persons for each (Chief shift operator and deputy chief shift operator) because of the following reasons: (i) it is impossible to work by one person because of complete darkness (ii) the high anticipated dose and (iii) may need to return because of the aftershock.**
- We confirmed the status of evacuation by residents. At 8:27 AM, TEPCO employees dispatched to Okuma town office reported to PSER that **part of Okuma town hadn't yet evacuated.**
- At 8:37, we notified Fukushima prefecture that we are preparing for the commencement of Vent from 9:00 AM. **We coordinated to Vent after evacuation is over.**
- At 9:03 AM, we confirmed that Kuma area, Okuma town finished evacuation. We notified Fukushima prefecture that we will make announcement to the media and do Vent at 9:05 AM.

○ **Activities after "At 9:04 AM on March 12, shift operators departed to the field site to do Vent"**

【Open PCV vent valve (MO valve)】

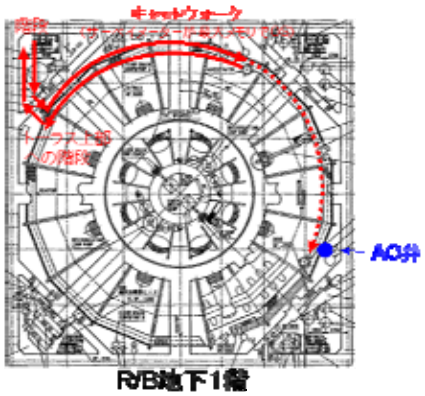
- At 9:04, in order to open PCV vent valve, two shift operators went to the field site. They were equipped with **fire fighting garment, self-contained breathing apparatus and APD.** As the electricity was lost, the field sites in R/B and T/B were **in complete darkness.** They



R/B2階

departed with flashlights. As there was **no communication channel with the field site, we decided to dispatch teams to the field site one by one. After one team returned to the Main Control Room, the next team departed.**

- The first team departed the Main Control Room to the field site to open the PCV vent valve (MO valve). At 9:15 AM, opened to 25% per the operation procedure and returned to the Main Control Room. The exposure dose was 25mSv.



【open the S/C vent valve (AO valve) - small】

- At 9:24 AM, in order to open the S/C vent valve (AO valve) – small, team 2 departed the Main Control Room to Torus Room. During the way, **dose increased** and as there was a risk to exceed the dose limit, 100mSv, at 9:30 AM, team returned to the Main Control Room.
- As the dose was high, we gave up the work by team 3. We reported to the PSER.

【Considered measures to open S/C vent valve (AO valve) -large】

- As we could not open the S/C vent valve (AO valve) – small at the field site, the PSER began considering the location to connect the temporary air compressor (to 11:00 AM). Also, PSER instructed the Main Control Room to open the S/C vent valve (AO valve) – small by remote operation hoping for the residual air pressure in the I&C compressed air line.

【remote opening of the vent valve (AO valve) – small (hoping for the residual air pressure in the I&C compressed air line), reading at monitoring posts ("MP") became higher】

- At 10:17 AM, did the first remote opening, uncertain whether the valve opened.
- At 10:23 AM, did the second remote opening, uncertain whether the valve opened.
- At 10:24 AM, did the third remote opening, uncertain whether the valve opened.
- At 10:40 AM, as we confirmed that the dose at the main gate and MP became higher, PSER determined that it was highly likely that radioactive substances were released by Vent. At 11:15 AM, as the dose became lower, PSER suspected that the Vent was insufficient.

【Opening the S/C vent valve (AO valve) -large】

- The restoration team of PSER looked for the temporary compressor, received info that the there was one at the subcontractor's office and decided to go and search at there. In order to connect the temporary compressor, we needed the adaptor. By using the piping and instrumentation diagrams, we decided the place to connect. At

the field site, we took photos of that place and returned to PSER.

- At 12:30 PM, we looked for the adaptor. We found the temporary compressor at our subcontractor's office and transferred that by a crane truck. As the dose was high, we located the compressor at the outside of large equipments carry-in opening. At 2:00 PM, we started the temporary compressor.
- **At 2:30 PM, we confirmed that D/W pressure went down and determined this as "release of radioactive substances" by Vent.**

  D/W pressure 0.75MPa→0.58MPa(2:50 PM)

Time line sequence of major events following earthquake to May 15th (Tue) for Unit 2 at Fukushima Daiichi Nuclear Power Station

This report is based on various information as well as testimonies received from relevant people up to this point in time. Further announcements may be released upon the discovery of new information identified during the investigation.

Friday March 11, 2011

2:46 pm **Touhoku-Pacific earthquake occurred.** The 3rd emergency attitude was automatically issued.

2:47 pm **Automatic Reactor scram**, Stopped automatically Main Turbine, Started Emergency generator automatically.

2:50 pm Manually started up Reactor Core Isolation Cooling System (hereinafter RCIC).

2:51 pm Shut down RCIC (High Reactor water level).

3:01 pm Confirmed uncritical on Reactor.

3:02 pm Manually started RCIC.

3:06 pm Set up an Emergency Center at headquarter.(To figure out the situation by damage caused by earthquake, recovering from blackout etc)

3:27 pm 1st wave of Tsunami arrived.

3:28 pm RCIC shut down (High Reactor water level).

3:35 pm **2nd wave of Tsunami arrived.**

3:39 pm **Manually started up RCIC.**

3:41 pm Lost all AC power sources.

3:42 pm **Judged that specific issue (lost all AC power sources) based on the article 10, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred and reported to authority etc.**

3:42 pm The 1st emergency attitude was issued. Set headquarter for Emergency Headquarters (Combined headquarter with headquarters for major disaster countermeasures).

4:36 pm **Judged that the specific issue (Enable to inject water by Emergency Core Cooling System) based on the article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred because of enable to confirm Reactor water level and situation of injecting water. Reported it to authority etc. at 4:45 pm.**

4:36 pm 2nd emergency attitude was issued.

5:12 pm **General Manager of Power station directed to start consideration of measure to injecting water to Reactor using the Fire Protection System which is installed as a measure for accident management and fire fighter.**

8:49 pm Temporary lighting was turned on in the main control room.

8:50 pm Government of Fukushima prefecture ordered to evacuate for the residents within 2km radius from Fukushima Daiichi Nuclear Power Station.

9:02 pm **Reported the risk that the water level may reach to Top of Active fuel (hereinafter TAF) because of uncertain Reactor water level and enable to check the condition of injecting water by RCIC to the Reactor.**

9:13 pm Estimated the TAF reaching time at 9:40 pm, report it to authority.

9:23 pm Prime minister ordered to evacuate for the residents in 3km radius from Fukushima Daiichi Nuclear Power Station, and to shelter indoors for the residents in 3km to 10 km radius.

10:00 pm **As Reactor water level was turned out to be at TAF+3400mm, estimated to take more time to reach TAF and reported authority at 22:10 and 22:20.**

Saturday, March 12, 2011

12:30 am Confirmed evacuating measure of residents by national government has been completed (Confirmed the evacuation inside 3km radius in Futaba town and Okuma town has been completed, reconfirmed at 1:45)

Approx.

1:30 am Proposed and obtained agreement to implement vent at Unit1 and Unit2 to prime minister, minister of economy, trade and industry and Nuclear and Industrial Safety Agency.

2:55 am **Confirmed RCIC is under operation.**

3:06 am Press conference about vent implementation was held.

3:33 am Reported the result of evaluation exposure dose in the case of vent was implemented to authorities.

4:55 am Confirmed the radiation dose in the power station raised (0.069μSv /h (4:00) => 0.59μSv /h(4:23) around main gate) and reported it to authority.

5:44 am Prime minister ordered to the residents in 10km radius from Fukushima Daiichi Nuclear Power Station to evacuate.

6:50 am The order to implement vent based on the law by minister of economy, trade and industry (manually vent).

7:11 am Prime minister arrived at Fukushima Daiichi Nuclear Power Station.

8:04 am Prime minister departed from Fukushima Daiichi Nuclear Power Station.

4:27 pm Measuring the dose exceeding 500μSv /h by monitoring post (1,015μSv /h), judged as specific event based on article 15,clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred (Radiation dose raised abnormally at boundary of the site) and reported it to the authority.

5:30 pm General Manager of the power station ordered to prepare the operation of vent.

6:25 pm Prime minister ordered the residents in 20km radius from Fukushima Daiichi Nuclear Power Station to evacuate.

Sunday, March 13, 2011/06/21

8:10 am Primary Containment Vessel (hereinafter PCV) Vent valve “OPEN”.

8:56 am As radioactive dose exceeding 500μSv /h(882μSv /h) was measured by monitoring post, it was judged to specific issue based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities.

10:15 am General Manager of Power Station ordered to start Vent operation.

11:00 am Vent line composition was completed except for rupture disc.

11:00 am Prime minister ordered sheltering indoors to the residents in the area of over 20km to 30km radius from Fukushima Daiichi Nuclear Power Station.

11:20 am Announcement of implementation of the Vent.

12:05 pm General Manager of Power Station ordered to prepare to use sea water.

2:15 pm As radioactive dose exceeding 500μSv /h(905μSv /h) was measured by monitoring post, it was judged to specific issue (radioactive dose at boundary abnormally raise) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 2:23.

3:18 pm Reported evaluation result of dose exposure in case of implementation of Vent to authorities.

Monday, March 14, 2011

2:20 am As radioactive dose exceeding 500μSv /h(751μSv /h) was measured around main gate, it was judged to specific issue(radioactive dose at

boundary abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 4:24.

2:40 am As radioactive dose exceeding 500μSv /h(650μSv /h) was measured by monitoring post, it was judged to specific issue(radioactive dose at boundary abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 5:37.

4:00 am As radioactive dose exceeding 500μSv /h(820μSv /h) was measured by monitoring post, it was judged to specific issue (radioactive dose at boundary abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 8:00.

9:12 am As radioactive dose exceeding 500μSv /h(518.7μSv /h) was measured by monitoring post, it was judged to specific issue (radioactive dose at boundary abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 9:34.

11:01 am The large valve of suppression chamber became (hereinafter "S/C") "Close" because of the explosion of building of Unit 3. Incapable of "Open" was confirmed. Prepared water injection line was not available because of breakage of the fire engine and the hose.

1:05 pm Recommencement of composing line of injecting seawater including fire engine.

1:18 pm As Reactor water level was downward trend , reported to start preparation work such as injecting seawater to the Reactor immediately to the authorities.

1:25 pm As Reactor water level is decreasing, the RCIC function seems to be lost, judged Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred (Lost Reactor Cooling Function) , and reported to the authorities at 1:38 pm.

3:26 pm Evaluated TAF reaching time is 4:30 pm, reported it to the authorities.

4:30 pm Activated fire engine for injecting seawater to the Reactor.

4:34 pm Started operation for reducing Reactor pressure, and reported to start injecting seawater using fire protection system to authorities.

5:17 pm Reactor water level reached TAF. Reported it to the authorities at 5:25 pm.

Approx.

6:00 pm Started Reactor depressurization (Reactor pressure 5.4MPa=>7:03 pm 0.63 MPa).

6:22 pm Reactor water level reached TAF-3,700mm. Judge the fuel was exposed to air. Reported to the authorities at 7:32pm.

7:20 pm Confirmed the fire engine for injecting seawater to the Reactor stopped due to out of fuel.

7:54 pm Started injecting seawater to the Reactor from Fire Protection System by fire engine (started up at 7:54 pm and 7:57)

Approx.

9:00 pm Operated to open the small valve of S/C vent valve(AO valve). The vent line composition was completed except for rupture disc.

9:20 pm Opened 2 Safety Release Valves (hereinafter SRV) and confirmed recovering of water level. Reported it to the authorities at 9:34 pm (as of 9:30 pm Reactor water level=TAF-3,000mm).

9:35 pm As radioactive dose exceeding 500 μSv/h was measured by monitoring car(760μSv/h), it was judged to specific issue (radioactive dose at boundary abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 10:35 pm.

10:50 pm As Dry Well (hereinafter D/W) pressure exceeded maximum usage pressure 427kPa gage, it was judged to specific issue (RPV pressure abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 11:39 pm.

Approx.

11:35 pm As the pressure at S/C side was lower than working pressure of the rupture disk and the pressure at D/W side was raising, decided measure of vent operation with opening small valve of D/W vent.

Tuesday, March 15, 2011

12:02 am Operated to open the small valve of D/W vent valve (AO valve). Vent line composition except for rupture disc was completed (confirmed the valve was closed few minutes later).

3:00 am As D/W pressure exceeded designed maximum usage pressure, tried to operate to reduce pressure and injecting water to the Reactor. But the

situation was not depressurized sufficiently. Reported it to the authorities at 4:17 am.

Approx.

6:00-6:10 am A large impulsive sound occurred around suppression chamber.

6:50 am As radioactive dose exceeding 500μSv/h(518.7μSv /h) was measured at around main gate, it was judged to specific issue (radioactive dose at boundary abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 7:00 am.

7:00 am Report to authorities on evacuation to Fukushima Daini except for the needed personnel such as monitoring and work.

8:11 am As radioactive dose exceeding 500μSv/h(807μSv /h) was measured by monitoring post, it was judged to specific issue (radioactive materials abnormally released due to fire disaster and explosion) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 8:36am. At 8:25 am, confirmed white smoke (seems steam) rising out from the wall around 5th floor of Reactor Building, reported to the authorities at 9:18pm.

4:00 pm As radioactive dose exceeding 500μSv/h(531.6μSv /h) was measured at main gate, it was judged to specific issue (radioactive dose at boundary abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 4:22 pm.

11:05 pm As radioactive dose exceeding 500μSv/h(4548μSv /h) was measured at around main gate, it was judged to specific issue (radioactive dose at boundary abnormally raised) based on Article15, clause1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred, and reported to the authorities at 11:20 pm.

END

Fukushima Daiichi Nuclear Power Station Unit 2
Alternative Water Injection

This report is summary of the fact information and verbal evidence currently we have. When we found new facts through the continuous investigation, we will update fact in this report.

○Activities after Determination and Reporting of Loss of ECCS at 16:36 on March11.

【Planning for Alternative Injection】

- At 17:12, start examination of **using alternative method of water injection (Fire Protection System("FP"), Feed Water Make-up System and Containment Vessel Cooling System), which are installed under Accident Management Plan("AP) and using fire engine with water from fire protection pool which was installed as a lesson of Chuetu-Oki Earthquake.**
- In the Main Control Room, to secure alternative method of water injection, prepare AM manual on the Chief Unit Operator's desk and conduct **confirmation of water injection line into the reactor**.
- Taking the radiation level of Unit 1 into consideration, before the radiation getting higher, **in order to establish water injection line for alternative method** by way of Residual Heat Reduction System, **open the valves of Residual Heat Removal System manually in the turbine and reactor building, in the darkness,** and secure the situation where water injection is possible after decompression of reactor (below 0.69MPa).
- Restoration Team of Power Station Emergency Response Team has **confirmed status of submergence and damage of Power Panel (High Voltage Clad Switch Gear, Power Center) and as a result of insulation resistance test, confirmed one of the power center was alive** and start examination of water injection by using Control Rod Drive System("CRD") and Standby Liquid Control System("SLC"), where high pressure water injection is possible, **after power restoration to power center by power supply vehicle.**
- At 22:00, water level gauge of the reactor has turned out and as its reading was Top of Active Fuel("TAF") +3400mm, confirmed not reaching TAF.

【Restoration of power for alternative water injection】

As power panel and pumps of CRD and SLC was not damaged by sea water, and high pressure water injection was possible, restoration of power by power supply vehicle to the power center was carried out.

- At around 15:30, though cable was connected to the primary side of the P/C of Unit 2 and, in parallel, connection was made between high voltage power supple vehicle, at 15:36 explosion occurred at Unit 1. Installed cables were damaged by explosion litter and high voltage poser supply vehicle was tripped. All the workers stopped their work and evacuated to the Main Anti-Earthquake Building.
- On the next day, tried restart of power supply vehicle, which was connected to power center of unit 2, however, current surge relay was operated and failed to supply power.

○Activities after 「3/13 12:05 Direction by Station Manager to prepare to use sea water」

【Start preparation of sea water injection】

- In preparation of RCIC out of service, in order to secure switching of sea water injection, proceed establishment of water line of back wash valve pit of Unit 3 as water source, and installed hose pipe of fore engines.

【Reestablishment of sea water injection pipe line after explosion of Unit 3】

- **At 3/14 11:01, due to the explosion of reactor building of Unit 3, to secure safety all the workers evacuated from site.** Hose piping was ready to use but were **unavailable to use due to the damage of fire engines and hose pipe.**
- **In the afternoon, immediately dashed off to the site and confirmed status of the site and, according to the scattered situation of rubble, decided to precede injecting water sourcing not from the back wash valve pit of Unit 3 but directly from the shallow draft quay. In the high radiation environment surrounded by scattered rubble, proceed preparing new water injection line by using useable fire engines and hose pipe.**
- At 13:18, water level of reactor was in the down trend, at 13:25, determined lose of RCIC function. Estimated from the current situation, reaching TAF will be at around 16:30. Continuously prepare for sea water injection and at

14:43connected to FP by fire engine.

- From after 15PM to after 16PM, **due to the aftershocks centered in offshore of Fukushima Prefecture, work was conducted with difficulties of suspension of work and evacuation.**
- At around 16:30started fire engine and **prepared for the readiness to start water injection when decompression of reactor.**

【Decompression of Reactor】

- In order to inject water from fire engine, **decompression of reactor by opening Safety and Relief Valve ("SR") was necessary**, however, as **temperature and pressure of Suppression Chamber ("S/C") was so high** (3/14 12:30 S/C Temperature was 149.3℃ and S/C pressure was 486Pa) that, **even if the SR valve was opened, there was a possibility of pressure reduction difficulty as the steam will not be condensed,** decided **after conducting Containment Vessel Vent ("Vent"), then open the SR valve and water injection will be started.**
- At around 16:00 頃, as it was foreseeable taking time until opening vent valve, changed priority on decompression of reactor by opening SR valve. Station manger also directed to conduct opening vent valve in parallel.
- Under the lack of power, battery was necessary to open the SR valve. **Gathered batteries out from the cars and carried to main control room and connected to the electricity cable, however, as the power voltage was lacking, add batteries, try operating several SR valves,** continue efforts to decompressing reactor and at around 18:00 start decompression of the reactor.
- Time was consumed as the temperature and pressure of S/C was high and difficult condition for condensation.

Reactor pressure 6.998MPa(16:34)→6.075MPa(18:03)→0.63MPa(19:03)

【Restart of Fire Engines】

- Radiation at site was high and confirmation of operating status of fire engines was forced in rotation, at 19:20, confirmed fire engine which was used for water injection was stopped due to the shortage of fuel. After fueling, **started water injection into the reactor by using FP line by fire engine(at 19:54, 19:57 started respectively).**

End

Unit 2, Fukushima Daiichi Nuclear Power Station
The operation of the vent valve at the PCV

This summarizes the facts based on info and testimony available to date. We will continue the investigation. If new facts are confirmed at a later date, we will announce again.

○ Activities after report "At 4:36 PM on March 11, Determination and Report of ECCS's inability to inject water"

・ As a result of restoration work of instruments, at 9:50 PM, we could confirm the Reactor water level (Top of Active Fuel +3400mm). At 11:25 PM, we could confirm the D/W pressure (0.141MPa abs). At 2:55 AM, on March 12, **we could confirm operation of RCIC. We decided to prioritize opening the vent valve ("Vent") for Unit 1**. We proceeded with Vent of Unit 1. At the same time, we continued monitoring parameters of Unit 2.

○ Activities after "At 5:30 PM on March 12, Instruction from the Station Manager to proceed with the preparation of Vent"

【Preparation work for Vent】

・ **Water injection to the Reactor by RCIC continued.** D/W pressure was stable at 200～300kPaabs. As we expected that sooner or later we have to do Vent, we began preparation for the venting line-up together with Unit 3. As the dose at the field site was low, we decided to open valves for Vent, other than the rupture disk.

・ At 12:06 AM on March 12, we confirmed that D/W pressure for Unit 1 may have exceeded 600kPa abs. We started the actual work for Vent. At that time, as for Unit 2, **we checked from the drawings of valves whether we could manually open valves required for Vent and whether we could attach the jig and force the valve open.** Based on the result, the piping and instrumentation diagram, AM operation procedure and the Vent procedure for Unit 1, we confirmed the operation procedure of valves for Vent (PCV vent valve (MO valve) can be opened manually S/C vent valve (AO valve) cannot be opened manually) and prepared the Vent procedure. We also checked the places of valves for Vent using the valve check sheet.

（From here, March 13）

【Open PCV vent valve (MO valve) and S/C vent valve (AO valve)-large】

・ In order to manually open PCV vent valve (MO valve), **shift operators wore**

necessary equipments such as the self-contained breathing apparatus, brought the flashlight and departed for R/B.

- **At 8:10 AM, opened PCV vent valve (MO valve) by 25% per the operation procedure.**
- At 11:00 AM, we excited the solenoid for S/C vent valve (AO valve)-large by a small generator for the temporary lighting at the Main Control Room and opened S/C vent valve (AO valve)-large. We made up the vent line other than the rupture disk.
  （D/W pressure was lower than the working pressure of the rupture disk (427kPa gauge), so Vent hadn't yet occurred. We kept the vent valves open and continued monitoring D/W pressure.）

○ Activities after "At 11:01 AM on March 14, R/B of Unit 3 exploded. The water injection line prepared was out of order because of damage to the fire engine and hose."

【Impact of the explosion】

- **Because of the explosion, the excitation of the solenoid for S/C vent valve (AO valve)-large turned off and the S/C vent valve closed.** We had to do the venting line-up again.
- **After the explosion, workers other than shift operators at the Main Control Room suspended all works and evacuated to the main anti-earthquake building. As we had to confirm the workers' safety and the status of the field site, we couldn't resume work for a while.**
- D/W pressure was around 450kPa abs, stable below the Vent pressure.

【Open S/C vent valve (AO valve)-small】

- After the instruction for evacuation was lifted, at 4:00 PM, we tried to open S/C vent valve (AO valve)-large. At 4:20 PM, as the air pressure from the compressor was insufficient, we couldn't open.
- As there was no change on D/W pressure, at 6:35 PM, we tried to open not only S/C vent valve (AO valve)-large but also S/C vent valve (AO valve)-small to restore the vent line. We presumed that we couldn't open S/C vent valve (AO valve)-large because of malfunction of solenoid.
- At 9:00 PM, we could slightly open S/C vent valve (AO valve)-small. We established the venting line-up other than the rupture disk.
  （D/W pressure was lower than the working pressure of the rupture disk (427kPa gauge), so Vent hadn't yet occurred. We kept the vent valves open and continued monitoring D/W pressure.）

【**open D/W vent valve -small**】

- At 10:50 PM, D/W pressure increased. As the pressure exceeded the maximum operating pressure (427kPa gauge), we determined that specific incident stipulated in article 15 of Act on Special Measures Concerning Nuclear Emergency Preparedness"D/W pressure excessively high" occurred.
- D/W pressure was in upward trend whereas S/C pressure was stable around 300～400kPa abs. **The pressure was not unified.** As S/C pressure was lower than the working pressure of the rupture disk and D/W pressure increased, we decided to open D/W vent valve (AO valve)-small to do Vent.
- At 12:02 AM on March 15, we finished preparation of the venting line-up other than the rupture disk. A few minutes later, we confirmed that the rupture disk was closed.

（D/W pressure did not go down from 750kPa abs. After that, D/W pressure was stable but high.）

○ Activities after "At 6:00～6:10 AM on March 15, a big boom occurred around the suppression chamber"

- At 6:00～6:10, a big boom occurred around the S/C. The measured S/C pressure went down to 0MPaabs.
- Other than TEPCO employees and workers required for plant supervision and temporary restoration work, we temporarily evacuated to Fukushima Daini.
  - 650 persons moved to Fukushima Daini. 70 persons stayed at the power station headquarters.
- Shift operators periodically went to the Main Control Room to log D/W pressure etc.
  - At 11:25 AM, we confirmed decrease in D/W pressure (730kPa abs(7:20)→155kPa abs(11:25))

End

Time line sequence of major events following earthquake to May 15th (Tue) for Unit 3 at Fukushima Daiichi Nuclear Power Station

This report is based on various information as well as testimonies received from relevant people up to this point in time. Further announcements may be released upon the discovery of new information identified during the investigation.

Friday, March 11, 2011

2:46 pm Great East Japan Earthquake occurred. 3rd emergency attitude was automatically announced.

2:47 pm Reactor scram occurred automatically, main turbine tripped manually.

Around 2:48 pm Emergency diesel generators activated automatically

2:54 pm It was confirmed that the reactor was subcritical

3:05 pm Reactor Core Isolation Cooling System (hereinafter called “RCIC”) activated manually

3:06 pm Emergency Center was established at the main office (in order to figure out the damage situation caused by the earthquake and to restore the blackouts)

3:25 pm RCIC tripped (as the reactor water level was high)

3:27 pm 1st wave of the seismic sea wave arrived

3:35 pm 2nd wave of the seismic sea wave arrived

3:38 pm All AC electric power supply was lost

3:42 pm It was determined that a specific incident stipulated in article 10, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (loss of all AC electric supply) occurred and it was informed to the government offices etc.

3:42 pm 1st emergency attitude was announced. Contingency Planning Center was established (and combined with Emergency Center)

4:03 pm RCIC activated manually

4:36 pm 2nd emergency attitude was announced

8:50 pm Fukushima prefecture ordered the residents within 2km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate

9:23 pm Prime Minister ordered the residents within 3km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate, and the residents within 3km to 10km radius of the periphery to evacuate indoors

9:58 pm Temporary lights in the main control room were turned on.

Saturday, March 12, 2011

0:30 am Government confirmed the completion of evacuation of the residents (3km radius of the periphery of Fukushima Daiichi Nuclear Power Station in Futaba Town and Okuma Town, reconfirmed at 1:45 am)

4:55 am Increase of the radiation dose was confirmed (Near the main gate, 0.069μSv/h, 4:00 am to → 0.59μSv/h, 4:23 am), and it was informed to the government offices etc.

5:44 am Prime Minister ordered the residents 10km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate.

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

8:04 am Prime Minister departed from Fukushima Daiichi Nuclear Power Station

11:36 am RCIC tripped

0:35 pm High Pressure Core Injection System (hereinafter called "HPCI") activated automatically (as the reactor water level was low)

5:30 pm Plant manager ordered to prepare for the vent of primary containment vessel (hereinafter called "vent")

6:25 pm Prime Minister ordered the residents 20km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate

Sunday, March 13, 2011

2:42 am HPCI stopped

5:10 am It was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (loss of reactor cooling function) occurred as the injection of water by RCIC was impossible, and it was informed to the government offices etc. at 5:58 am

5:15 am Plant manager ordered to complete the lineup of the vent except for the rupture disk

5:50 am Press release of implementation of the vent

6:19 am As it was determined that the water level reached to the top of active fuel (hereinafter called "TAF") at 4:15 am, it was informed to the government offices etc.

7:35 am The result of the evaluation exposure dose by vent was informed to the government offices etc.

7:39 am Spray inside the primary containment vessel started, and it was informed to the government offices etc. at 7:56 am

8:35 am Primary containment vessel (hereinafter called "PCV") vent valve (MO valve) was

opened

8:41 am By opening the large valve of the vent valve (AO valve) of the suppression chamber (hereinafter called "S/C"), the configuration of the vent line was completed except for the rupture disk. It was informed to the government offices etc. at 8:46 am

8:56 am As the radiation dose over 500μSv/h was measured at the monitoring post, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 9:01 am

Around 9:08 am A rapid depressurization of the reactor pressure by safety relief valve was implemented. It was informed to the government offices at 9:20 am that injection of water to the reactor through fire extinction system will be implemented hereafter

9:25 am Injection of fresh water (with boric acid) into the reactor by fire truck through fire extinction system was started

9:36 am Drop of drywell (hereinafter called "D/W") pressure caused by vent operation was confirmed. It was informed to the government offices that injection of water to the reactor through fire extinction system started

10:30 am Plant Manager ordered to intend an injection of sea water

11:00 am Prime minister ordered the residents 20km to 30km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate indoors

11:17 am The close of large valve of S/C vent valve (AO valve) was confirmed (as the pressure of the air tank for the actuation dropped)

12:20 am Injection of fresh water terminated

12:30 am The large valve of S/C vent valve (AO valve) was opened (as the air tank for the actuation was exchanged)

1:12 pm Injection of sea water into the reactor through the fire extinction system started

2:15 pm As the radiation dose over 500μSv/h was measured at the monitoring post (905μSv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 2:23 pm

Monday, March 14, 2011

1:10 am As there were little sea water left to inject into the reactor, a fire truck was arranged

to supply sea water into the reversing valve pit

2:20 am As the radiation dose over 500μSv/h was measured near the main gate (751μSv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 4:24 am

2:40 am As the radiation dose over 500μSv/h was measured at the monitoring post (650μSv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 5:37 am

3:20 am Injection of sea water by fire truck restarted

4:00 am As the radiation dose over 500μSv/h was measured at the monitoring post (820μSv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 8:00 am

5:20 am The operation of the small valve of the S/C vent valve (AO valve) started

6:10 am It was confirmed that the small valve of the S/C valve (AO valve) was opened

9:12 am As the radiation dose over 500μSv/h was measured at the monitoring post (518.7Sv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 9:34 am

9:20 am The injection of sea water from the shallow draft quay into the reversing valve pit was started

11:01 am An explosion occurred in the reactor building. Injection of sea water stooped as the fire truck and hose were damaged

Around 4:30 pm New injection line into the reactor was constructed by exchanging the fire truck and horse, and the injection of sea water restarted

9:35 pm As the radiation dose over 500μSv/h was measured by the monitoring car (760Sv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 10:35 pm

Tuesday, March 15, 2011

6:50 am As the radiation dose over 500μSv/h was measured near the main gate (583.7Sv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 7:00 am

7:00 am It was informed to the government offices etc. that the employees except for the needed personnel for the monitoring and the operation would evacuate temporally to the Fukushima Daini Nuclear Power Station

7:55 am Steam floating at the upper side of the reactor building was confirmed, and it was informed to the government offices etc.

8:11 am As the radiation dose over 500μSv/h was measured near the main gate (807Sv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (extraordinary emission of radioactive material result from fire and explosion etc.) occurred and it was reported to the government offices etc. at 8:36 am

4:00 pm As the radiation dose over 500μSv/h was measured at the main gate (531.6Sv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 4:22 pm

11:05 pm As the radiation dose over 500μSv/h was measured near the main gate (4,548Sv/h), it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (radiation dose at the border of the site increased extraordinary) occurred and it was reported to the government offices etc. at 11:20 pm

Fukushima Daiichi Nuclear Power Station Unit 3
Alternative Water Injection

This document is a summary of the latest information obtained through information and interviews with personnel concerned. We will continue investigation and announce when new facts and findings are obtained.

Activities after "the stoppage of RCIC at 11:36 am on March 12"

【Water Injection by Fire Engines】

- Fire engines in the site were called but could not arrive, because they were all being used for water injection to Unit 1.
- Since tsunami occurred, the traffic between Unit 3 and Unit 5/6 had been disrupted due to the damage of the road and rubbles caused by tsunami. However, as restoration work such as road leveling with sandbags and removal of rubbles progressed, the restored traffic between Unit 3 and Unit 5/6 allowed us to bring the fire engines from Unit 5/6. Also, a fire engine prepared as a backup facility for the emergency of Fukushima Daini moved to Fukushima Daiichi. Fire engines for water injection were lined up, sourcing freshwater from fire cistern.
- In order to inject water by fire engines, it was necessary to decrease the reactor pressure by operating Safety Relief Valve (S/R Valve), but S/R Valve was not able to be operated because batteries had run out. Since batteries in the site were already collected for the restoration of indicators, Unit 1 and 2, there were no extra batteries in the site. Therefore, we removed and gathered batteries from employees' car and connected them to indicators of Main Control Room. At approximately 9:08 am we opened S/R Valve and conducted rapid decrease of the reactor pressure.
- Through that operation the reactor pressure went below the fire engines' jet force, which allowed us to start alternative water injection by fire engines at 9:25 am.

【Restoration of existing cooling facilities】

- We tried to restart water injection by existing cooling facilities, but could not.
  - We tried water injection by diesel powered fire-extinguishing pumps, but could not because the reactor pressure was as high as approximately 4MPa.
  - We tried to reboot HPCI, but could not due to the lack of batteries.

- We tried water injection through RCIC by confirming the situation in RCIC operation room, but could not reboot it.

【Restoration of High Pressure Core Injection System】

- Since the previous day we continued power restoration work via Power Center in order to restore Boric Acid Injection System that was capable of high pressure water injection, but the work was not successfully progressed due to the interruption of the work and evacuation caused by earthquakes from time to time and bad work environment (dark place, obstacles scattered and manhole covers lost). As a result, the restoration was not completed.

Activities after Plant Manager's order "we will move by taking into account seawater injection," at 10:30 am on March 13.

【Switching to seawater】

- Since freshwater of near fire cisterns ran out at 12:20 pm, we started to change the water supply line in order to use seawater in the vertical shaft of reversing valve. We had been well prepared for quick switching, but we were forced to suspend the work by the evacuation order caused by aftershocks. The work was completed as soon as it was resumed, and seawater injection started at 1:12 pm.
- Concurrently, we prepared additional freshwater.

【Supply of seawater to the vertical shaft of reversing valve】

- We had been requesting several offices for the support of fire engines, but it was not impossible for such fire engines to directly approach the power station due to radioactivity and contamination in the site and bad condition of the road to the station. It took longer time for fire engines to arrive at the station because the drivers needed to be changed to the plant operators at Off-site Center or J-Village.
- We tried to take seawater accumulated at the basement of the turbine, Unit 4 by breaking the entrance shutters of truck bay doors of the turbine building and moving fire engines to the place, but could not. Additionally, we examined the possibility of taking water from the discharge channel of Unit 4 or the skill training center's pool, but that was not implemented.
- Since the remaining amount of seawater in the vertical shaft of revering valve became little at 1:10 am on March 14, we stopped the operation of fire engines in order to supply seawater to the vertical shaft. With regard to seawater injection to Unit 3, we were able to resume injection at 3:20 am

since we could take seawater by putting fire engines close to the vertical shaft of reversing valve and placing the nozzle of the hose at deeper spot.

- Additional fire engines arrived at the station early in the morning. In order to directly take seawater and supply it to the vertical shaft of reversing valve, we placed 2 fire engines at around Shallow Draft Quay and arranged the line for water supply. We started supplying seawater from Shallow Draft Quay to the vertical shaft of reversing valve at 9:20 am.
- 7 Water Supply Vehicles (each 5 tons) of Self Defense Force that were requested as the source of freshwater arrived at the station. We decided to use them to supply water to the vertical shaft of reversing valve and placed them at the shaft at 10:53 am. We started water supply, but stopped due to the explosion of the reactor building.

○Activities after “Explosion occurred at the reactor building at 11:01 am on March 14. Seawater injection was stopped since fire engines and hoses got damaged.”

【Damage】

External View of Unit 3 after explosion

- Workers except for operators in Main Control Room interrupted their work and evacuated to Main Anti-Earthquake Building. We could not resume restoration work for a while since it took time for us to confirm workers’ safety and the situation of the site. 4 TEPCO employees, 3 workers of partner companies and 4 persons of Self Defense Force got injured.
- Rubbles with high level of radioactivity were scattered around by the explosion. Seawater injection was stopped since fire engines and hoses got damaged. Due to the rubbles the vertical shaft of reversing valve became unusable.

【Restart of water injection to the reactor】

- Since the vertical shaft of reversing valve was not available, we placed good fire engines around Shallow Draft Quay and re-arranged hoses in order to take seawater directly from sea and inject it to the reactor. By connecting 2 fire engines in series, we formed the water supply line toward both Unit 2 and 3. At approximately 4:30 pm, we restarted seawater injection by fire engines.

End

Unit 3, Fukushima Daiichi Nuclear Power Station
The operation of the vent valve at the PCV

This summarizes the facts based on info and testimony available to date. We will continue the investigation. If new facts are confirmed at a later date, we will announce again.

○ **Activities after "At 5:30 PM on March 12, Instruction from the Station Manager to proceed with the preparation of opening the vent valve ("Vent")"**

【Preparation work for Vent】

- At the Main Control Room, **at 9:00 PM, we started considering Vent procedures. We checked the sequence and places of valves and wrote on the whiteboard.**
- The generation team of the power station emergency response headquarters (" PSER ") completed the Vent procedure manual for Unit 1. Based on that Vent procedure manual for Unit 1 and the accident management procedure manual for Unit 3, generation team considered the Vent procedure manual for Unit 3 together with the restoration team. We notified the Vent procedure manual to the Main Control Room.

（From here, March 13）

- At 4:50 AM, in order to open S/C vent valve (AO valve)-large, we excited the solenoid using a small generator for the temporary lighting at the Main Control Room. The shift operator checked the indicator of the valve at the Torus Room. As the indicator showed "closed", we determined that the valve was completely closed. Inside the **Torus Room was very hot** because of the Reactor steam flow from the safety relief valve to S/C (S/C is below the Torus Room). **There was no lighting i.e. complete darkness.** It was a tough working environment.

【finish the venting line-up】

- At 5:15 AM, Station Manager instructed to complete the venting line-up other than the rupture disk and prepare for the press release.
- At 5:23 AM, as the solenoid for S/C vent valve (AO valve)-large was excited but the S/C vent valve was closed, we determined that we had to change the air tank. After that, we changed the air tank and opened the S/C vent valve.
- At 5:50 AM, we made the press release regarding Vent.
- At 8:35 AM, we manually opened the vent valve (MO valve) to 15% per the procedure.

○ **Activities after "At 8:41 AM on March 13, with the opening of S/C vent valve (AO valve)-large, we finished the venting line-up other than the rupture disk"**

【maintained the venting line-up】

- At 8:41AM, we finished the venting line-up. The pending was rupture of the rupture disk.
- At 9:24 AM, as D/W pressure went down 0.637 MPa abs (9:10 AM) to 0.540 MPa abs (9:24 AM), PSER determined that Vent was done around 9:20 AM.
- At 9:28 AM, as the air tank's pressure at S/C vent valve (AO valve) was in downward trend, we went to the field site to tighten the connecting parts. We confirmed air leakage and repaired.
- At 11:17 AM, we confirmed closing of S/C vent valve (AO valve)-large due to loss of air pressure. We replaced the air tank and opened. At 12:30 PM, we confirmed that S/C vent valve (AO valve)-large was open.
- In order to open and lock S/C vent valve (AO valve)-large S/C at open position, we went to the Torus Room. As the temperature was high and there was vibration due to the operation of the safety relief valve, we could not open and lock.

【dose at the field site increased】

- At 2:31 PM, we observed **over 300mSv/h at the north side airlock, R/B (there was white gaseous substance inside) and 100mSv/h at the south side airlock.** At 3:28 PM, the dose at the **Main Control Room of Unit 3 side went up to 12mSv/h.** Shift operators **evacuated to Unit 4 side.**
- At 5:52 PM, we finished charging the temporary compressor. As dose was high, the restoration team of PSER brought the temporary compressor to the large equipments carry-in opening by a crane truck and connected to IA line.
- At 8:10 PM, we determined that S/C vent valve (AO valve)-large opened from the reduction of D/W pressure.
- After this, because of loss of air pressure for S/C vent valve (AO valve)-large and loss of excitation of the solenoid at the air supply line, we couldn't maintain the S/C vent valve open. Several times we operated the valve to open.
  - 3/15 4:00 PM confirmed close ／ 3/15 4:05 PM operated to open
  - 3/17 9:00 PM confirmed close ／ 3/17 9:30 PM operated to open
  - 3/18 5:30 AM confirmed close ／ 3/18 5:30 AM operated to open
  - 3/19 11:30 AM confirmed close ／ 3/20 11:25 AM operated to open
  - 4/8 6:30 PM confirmed close

（From here, March 14）

【add the vent line】

- From 2:00 AM, D/W pressure was in upward trend※. We decided to open S/C vent valve (AO valve)-small. At 3:40 AM, we excited the solenoid.

  ※0.265MPa abs（2:00 AM）→0.315MPa abs（3:00 AM）
- At 5:20 AM, we started operation to open S/C vent valve (AO valve)-small. At 6:10 AM, we confirmed that the valve was open.
- After this, because of loss of air pressure for S/C vent valve (AO valve)-small and loss of excitation of the solenoid at the air supply line, we couldn't maintain the S/C vent valve open. Several times we operated the valve to open.
  - 3/15 4:00 PM confirmed close／3/16 1:55 AM operated to open
  - 4/8 6:30 PM confirmed close

End

Time line sequence of major events following earthquake to May 15th (Tue) for Unit 4 to 6 at Fukushima Daiichi Nuclear Power Station

This report is based on various information as well as testimonies received from relevant people up to this point in time. Further announcements may be released upon the discovery of new information identified during the investigation.

［Reference：Status of Unit 4 to 6 at the occurrence of the earthquake］

- Unit 4 had been shut down since November 30th, 2010 due to regular inspection. All the fuels had been transferred from reactor to spent fuel pool because shroud work had been conducted.
- Unit 5 had been shut down since January 3rd, 2011 due to regular inspection. When the earthquake occurred, fuel was installed and pressure leakage test for reactor pressure vessel was being conducted.
- Unit 6 had been shut down since August 14th, 2010 due to regular inspection. The period of shutdown had been extended due to a defect found in combustible gas density control system. When the earthquake occurred, fuel was installed in the reactor which was in cold shutdown.

Friday, March 11, 2011

2:46 pm Great East Japan Earthquake occurred. 3rd emergency attitude was automatically announced.

2:47 pm Emergency diesel generator (hereinafter called “DG”) activated automatically in Unit 5

3 DG activated automatically at Unit 6

3:06 pm Emergency Center was established at the head office (Recognizing the degree of damages caused by the earthquake, restoring blackouts)

3:27 pm 1st seismic sea wave arrived

3:35 pm 2nd seismic sea wave arrived

3:36 pm 2 DG in Unit 6 tripped

3:38 pm All AC electric power supply was lost in Unit 4

3:40 pm All AC electric power supply was lost in Unit 5

3:42 pm It was determined that a specific incident stipulated in article 10,clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (loss of all AC electric supply) occurred in Unit 1※, 2※, 3※, 4※ and 5※ and it was reported to the government offices etc.

※ On April 24th, it was corrected to Unit 1, 2 and 3.

3:42 pm 1st emergency attitude was announced. Contingency Planning Center was established (Later, incorporated with Emergency center)

4:36 pm 2nd emergency attitude was announced

8:50 pm Fukushima prefecture ordered the residents within 2km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate

9:23 pm Prime Minister ordered the residents within 3km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate, and the residents within 3km to 10km radius of the periphery to evacuate indoors

Saturday, March 12, 2011

12:30 am Government confirmed the completion of evacuation of the residents (3km radius of the periphery of Fukushima Daiichi Nuclear Power Station in Futaba Town and Okuma Town, reconfirmed at 1:45 am)

4:55 am Increase of the radiation dose was confirmed and it was informed to the government offices etc.

5:44 am Prime Minister ordered the residents 10km radius of the periphery of Fukushima Daiichi Nuclear Power Station.

6:06 am Pressure in reactor pressure vessel was reduced by opening a valve on the top in Unit 5.

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

8:04 am Prime Minister departed from Fukushima Daiichi Nuclear Power Station

8:13 am Power became available from DG in Unit 5 and 6

4:27 pm As the radiation dose exceeded 500μSv/h (1,015μSv/h) at the monitoring post, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc.

6:25 pm Prime Minister ordered the residents 20km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate.

Sunday, March 13, 2011

8:56 am As the radiation dose exceeded 500μSv/h (882μSv/h) at the monitoring post, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 9:01 am.

11:00 am Prime Minister ordered the residents 20km to 30km radius of the periphery of Fukushima Daiichi Nuclear Power Station to evacuate.

1:20 pm Water injection by condenser pump powered by DG was initiated in Unit6 (continued intermittently)

2:15 pm As the radiation dose exceeded 500μSv/h (905μSv/h) at the monitoring post, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 2:23 pm.

6:29 pm Water injection by condenser pump powered by DG was initiated in Unit5 (continued intermittently)

Monday, March 14, 2011

2:20 am As the radiation dose exceeded 500μSv/h (751μSv/h) around the main gate, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 4:24 am.

2:40 am As the radiation dose exceeded 500μSv/h (650μSv/h) at the monitoring post, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 5:37 am.

4:00 am As the radiation dose exceeded 500μSv/h (820μSv/h) at the monitoring post, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 8:00 am.

4:08 am Temperature in spent fuel pool of Unit 4 was confirmed to be ８４℃

9:12 am As the radiation dose exceeded 500μSv/h (518.7μSv/h) at the monitoring post, it

was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 9:34 am.

9:35 pm As the radiation dose exceeded 500μSv/h (760μSv/h) when measured by the monitoring car, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 10:35 pm.

Tuesday, March 15, 2011

Approx.6:00～6:10 am

Explosive sound was confirmed. Later, damage to the roof of reactor building's 5th floor in Unit 4 was confirmed

6:50 am As the radiation dose exceeded 500μSv/h (583.7μSv/h) around the main gate, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 7:00 am.

7:55 am Damage to the roof of reactor building's 5th floor in Unit 4 was reported to government's offices etc.

8:11 am Damage to reactor building in Unit 4 was confirmed. Also, as the radiation dose exceeded 500μSv/h (807μSv/h) around the main gate, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary release of radiation materials caused by fire explosion) occurred and it was reported to the government offices etc. at 8:36 am.

9:38 am Fire was confirmed around north west part of 3rd floor in reactor building of Unit 4. It was reported to the government offices etc. at 9:38 am.

Approx. 11:00 am

TEPCO staff confirmed that the fire at reactor building of Unit 4 was off. It was reported to government offices etc. at 11:45 am.

4:00 pm As the radiation dose exceeded 500μSv/h (531.6μSv/h) at the main gate, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported

to the government offices etc. at 4:22 pm.

11:05 pm As the radiation dose exceeded 500μSv/h (4548μSv/h) around the main gate, it was determined that a specific incident stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Extraordinary increase in radiation dose at the border of the site) occurred and it was reported to the government offices etc. at 11:20 pm.

End