Schaperow, Jason

From: Schaperow, Jason
Sent: Wednesday, March 30, 2011 8:33 AM
To: Lee, Richard
Subject: RE: COMMENTS on SUMMARY SLIDES
Attachments: UW Fukushima MCCI Summ rev3.ppt

Thanks for letting me know.

Has someone in RES reviewed the attached slides? Do we agree with them?

What is the context of the request from the NRC Team in Tokyo?

-----Original Message-----
From: Lee, Richard
Sent: Wednesday, March 30, 2011 8:01 AM
To: Salay, Michael; Esmaili, Hossein; Tinkler, Charles; Schaperow, Jason; Helton, Donald
Subject: FW: COMMENTS on SUMMARY SLIDES

FYI.

I will be forwarding this calculations to Op Center (since last week the NRC Team in Tokyo was asking for MCCI info. per Japanese request) to transmit to Tokyo NRC team.

Richard

-----Original Message-----
From: Farmer, Mitchell T. [mailto:farmer@anl.gov]
Sent: Tuesday, March 29, 2011 3:01 PM
To: Lee, Richard
Cc: 'Michael Corradini'; Basu, Sudhamay; Gavrilas, Mirela; Robb, Kevin Richard
Subject: FW: COMMENTS on SUMMARY SLIDES

Hi Richard,

I believe Mike has forwarded these corquench and melcor ex-vessel analyses on to you earlier. Would it be possible to forward these on to John Kelly? If possible, could you also cc Jeff Binder as John's email is being overwhelmed and Jeff is helping him on managing information. Jeff's email is: binderjl@ornl.gov

Thank you,
Mitch

-----Original Message-----
From: Kevin Robb [mailto:krrobb@wisc.edu]
Sent: Saturday, March 26, 2011 9:02 PM
To: Michael Corradini; Farmer, Mitchell T.
Subject: Re: COMMENTS on SUMMARY SLIDES

Hello,
Attached is updated calcs from me.

CORQUENCH predicts anchoring but there's uncertainty in that.

LLLL/151

Anchoring allowed - slide 15: 50-100% melts all do not quench in 5 days but ablation is very slow (<0.4 cm/hr), ablation on the order of 1m Anchoring not allowed - slide 16: 50-100% melts quenches in several to tens of hrs, ablation on the order of 0.5m 100's - 1500 kg of H2 is produced I'm not sure about the MELCORE predictions - higher ablation rate (2x), odd spikes in upward/downward heat transfer

I'll try some hand calcs tomorrow about steaming rate & non-condensable pressurization.

Kevin

On 03/26/11, Michael Corradini wrote:
>
>

Progression Results

- CORQUENCH
  - Crust anchoring is predicted to occur
    - **Continued slow basemat ablation (<0.4 cm/hr)** after 5 days of simulated contact time
    - A 100% melt generates 1410 kg H_2 in 5 days
  - IF crust anchoring is prohibited (model turned off)
    - **Melt quenches** in several to 10's of hours
    - A 100% melt generates 660 kg H_2 in 5 days
- MELCOR (crust cannot anchor)
  - **Continued axial ablation (2.6 cm/hr)** after 5 days of simulated contact time
  - Axial (vs radial) ablation dominates
  - More aggressive ablation than CORQUENCH

Fukushima Daiichi Unit 1
Ex-vessel Core Melt Simulation
Rev. 3
March 25, 2011

Kevin Robb

University of Wisconsin - Madison

Foreword

- These are initial calculations based on approximated and assumed initial conditions and boundary conditions
  - Parameters such as cavity geometry, melt and concrete composition, etc. can have a large impact on accident progression
- Refinement and review of the calculations are required

Setup Overview

- Codes
  - CORQUENCH v3.03
  - MELCOR (CORCON-MOD3) v1.8.6
- Initial Conditions
  - 100% melt relocation at 14 days after scram
    - Decay heat curve from El-Wakil (1981)
  - Fukushima core materials based on linear scaling with core thermal power with Point Beach
  - Water addition 1000 sec after melt relocation
    - Allow for melt/code initialization
  - 6m diameter cavity
  - SIL concrete (CORQUENCH default composition)
  - 5 days of simulation time (time after melt relocation)
  - Pressure constant at 1 bar
    - Initial concrete temperature = Tsat
    - Water temperature = Tsat
  - Concrete decomposition temperature = 1500 K

Setup Overview
CORQUENCH

- *'Best'* Phenomenological Models:
  - Water ingression - Epstein/Lister
  - Melt eruption model - ANL
  - Crust anchoring model
- Other modeling details
  - Quasi steady ablation model
    - A transient dryout model is available
  - Homogenous melt
  - 2-D right circular cylinder geometry
    - (uniform axial and radial ablation)

Setup Overview
MELCOR

- *'Best'* Phenomenological Models:
  - Advanced cavity profile tracking
    - Angle dependent heat transfer between melt/concrete
  - More rigorous chemical reactions
  - Melt pool layer segregation modeling (layered instead of homogenous)
- Other modeling details
  - Quasi steady ablation model
  - Slag film melt/concrete heat transfer model
  - No - Water ingression
  - No - melt eruptions
  - No - crust anchoring

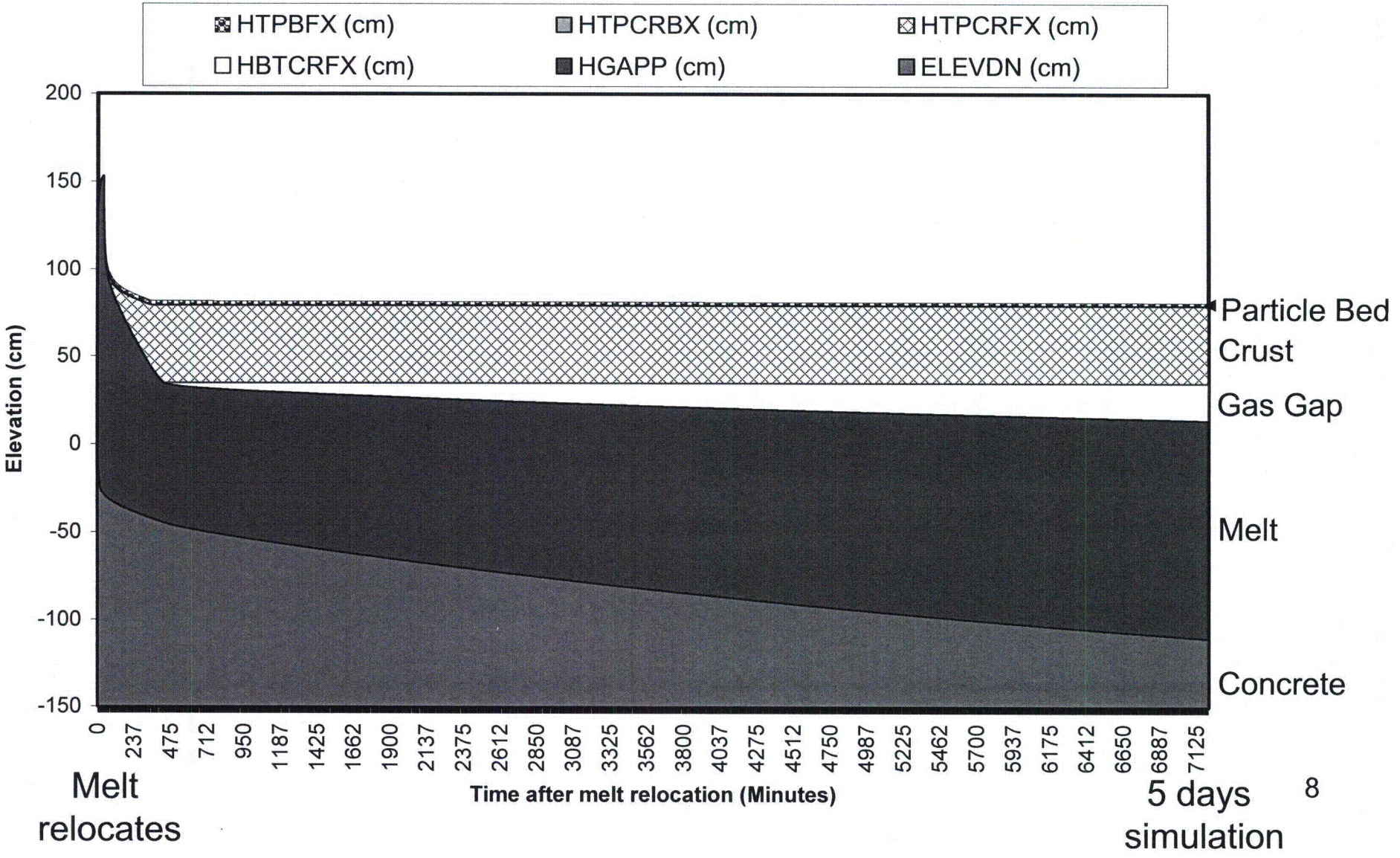
Core Melt Composition

- Assumed Melt Composition (100% melt):

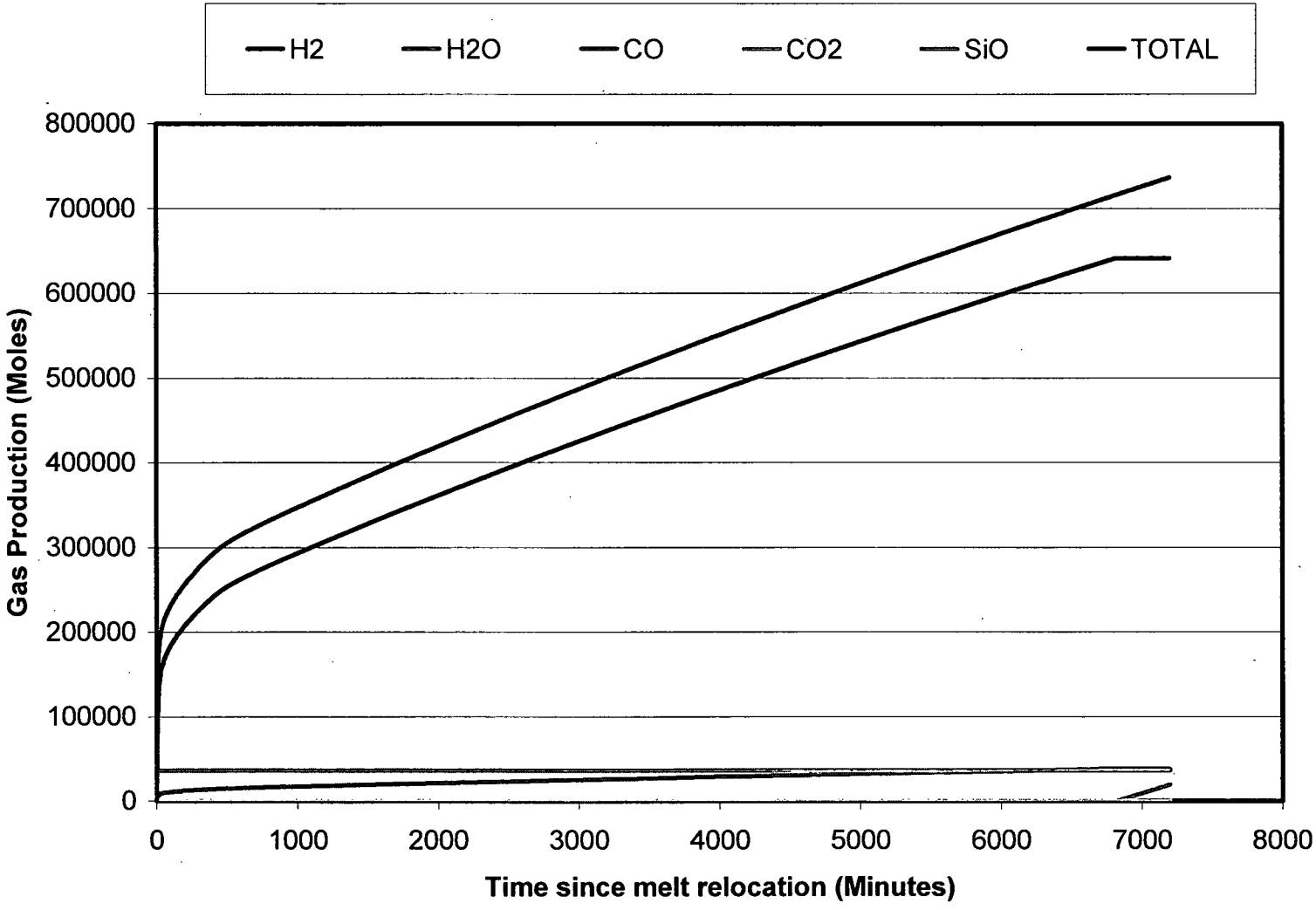
	Peach Bottom	Fukushima Daiichi Unit 1	Fukushima Daiichi Unit 2 & 3
Thermal Power [MW]	3514	1380	2381
UO2 [kg]	**168086**	**66010**	**113900**
Zr [kg]	**57874**	**22730**	**39210**
SS [kg] Fe (70%) Cr (20%) Ni (10%)	**151560**	**59520** 41660 11900 5952	**102700** 71890 20540 10270

- Assumed 90% of Zr is pre-oxidized

Progression Results (CORQUENCH)

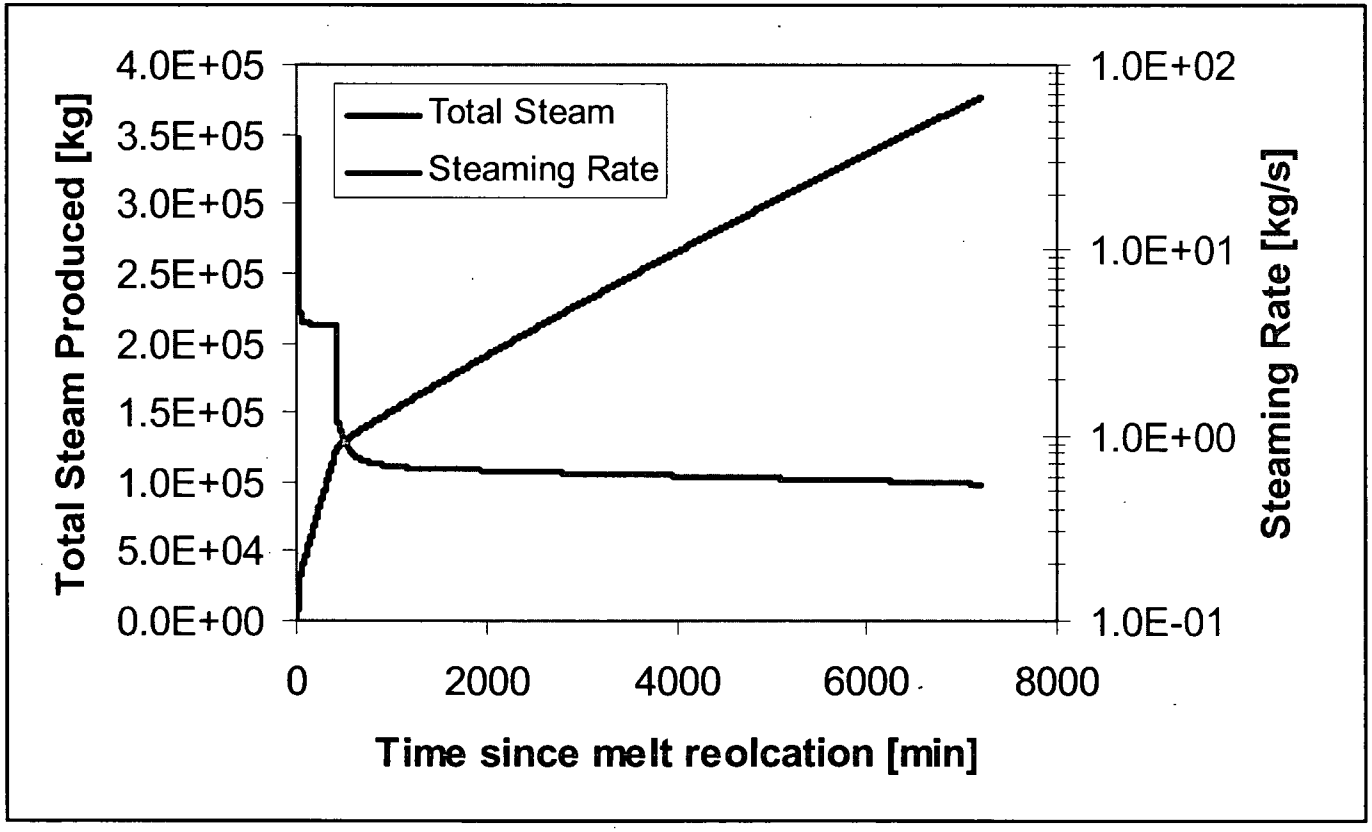


Gas Generation from Concrete Decomposition (CORQUENCH)



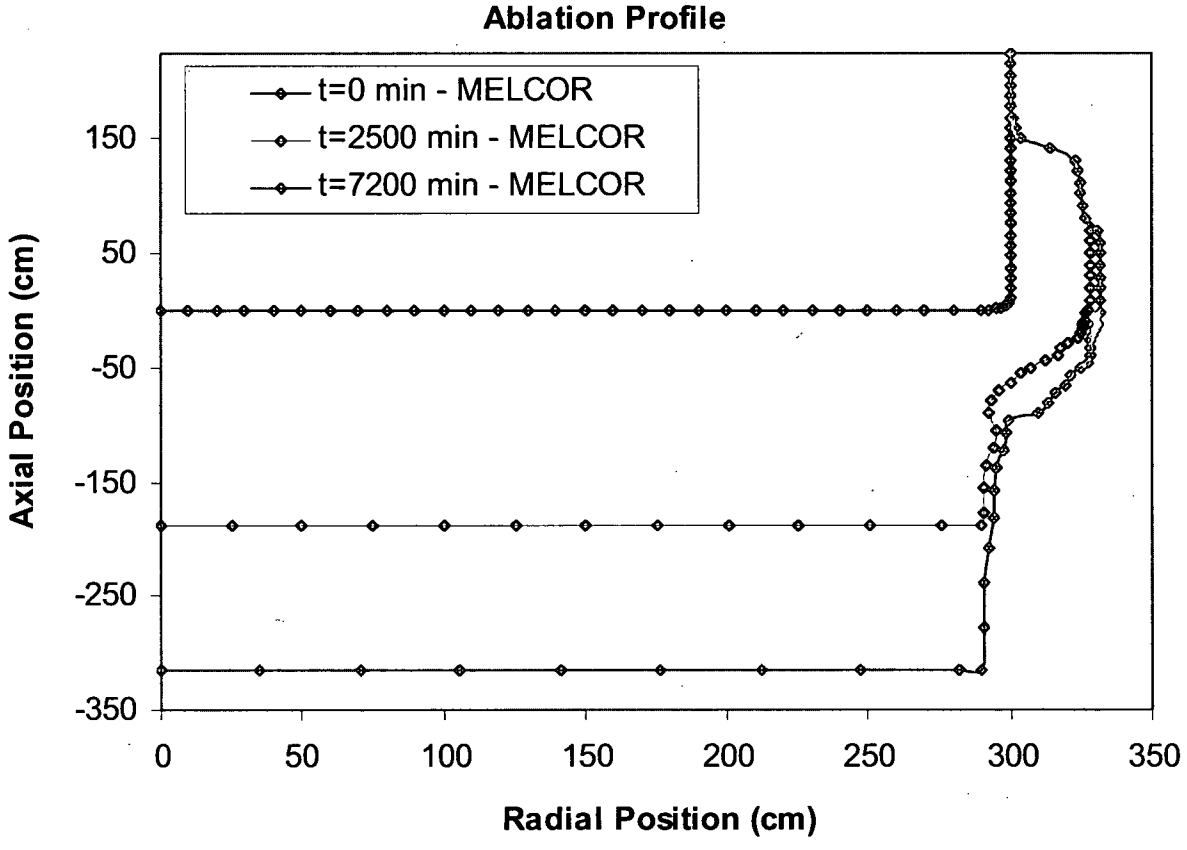
Steaming Rate (from upward heat transfer) (CORQUENCH)

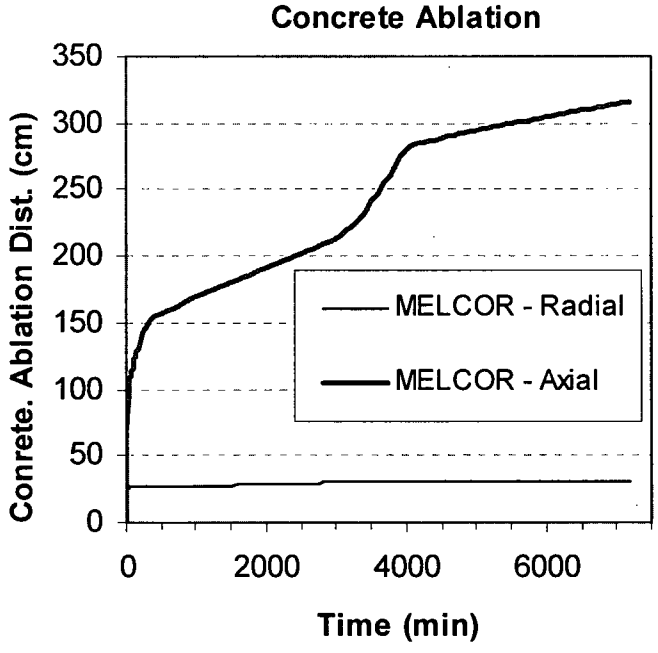
- For constant pressure of 1 bar



Progression Results (MELCOR)

- Continued axial ablation after 5 days simulated time
- Radial ablation stops early
- Calculation needs review





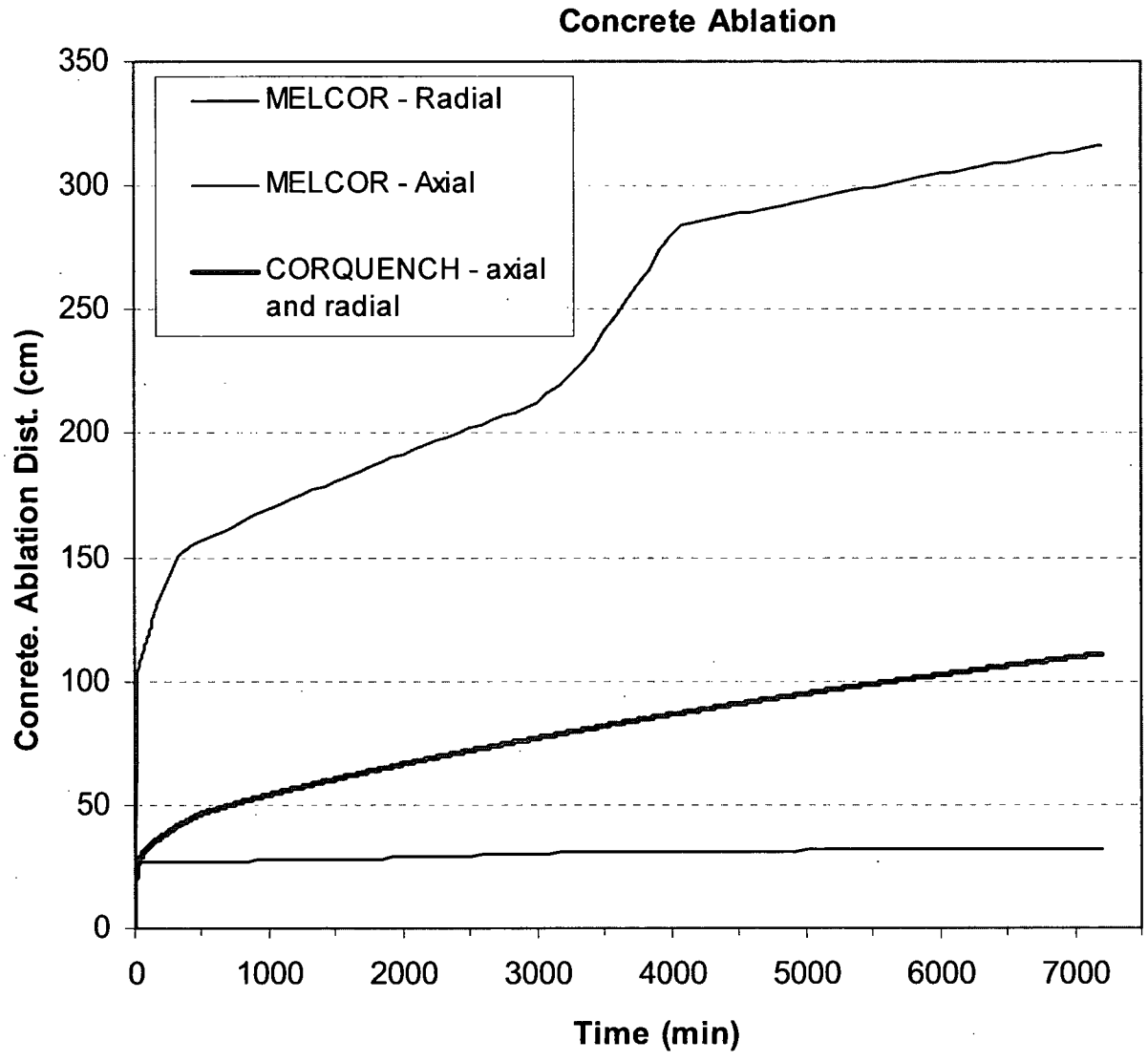
Axial basemat erosion depths and rates:

After 1hr: 111 cm, 12.2 cm/hr

After 1 day: 178 cm,11 1.37 cm/hr

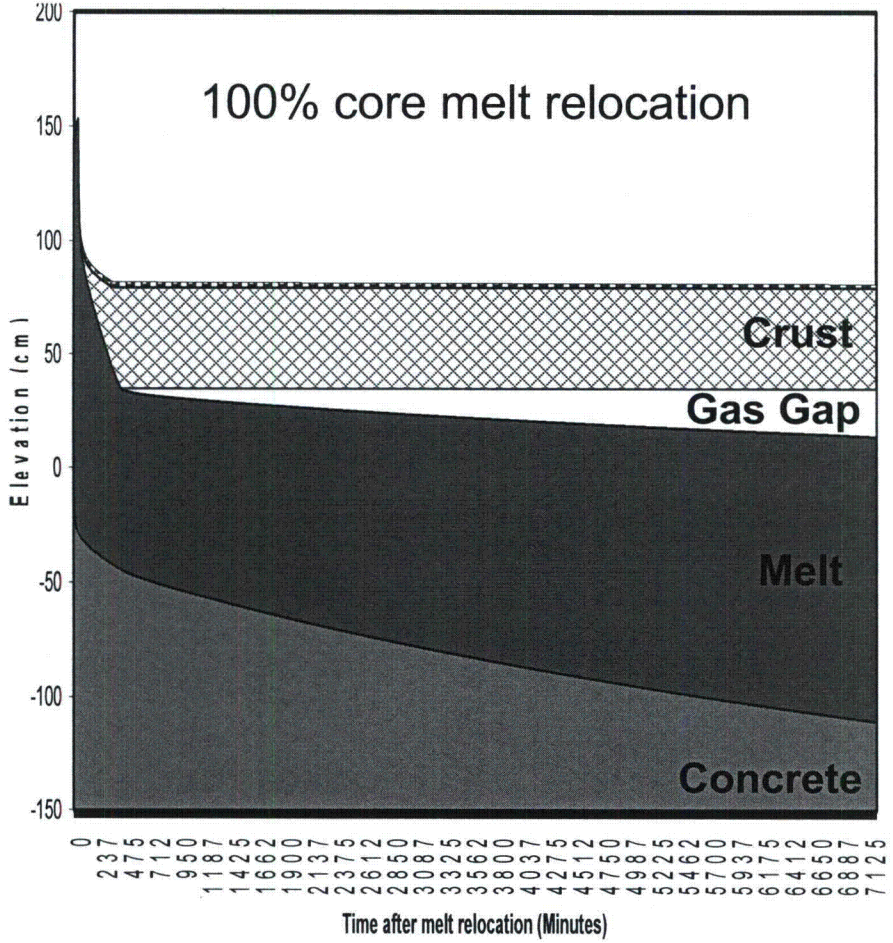
After 5 days: 316 cm 2.63

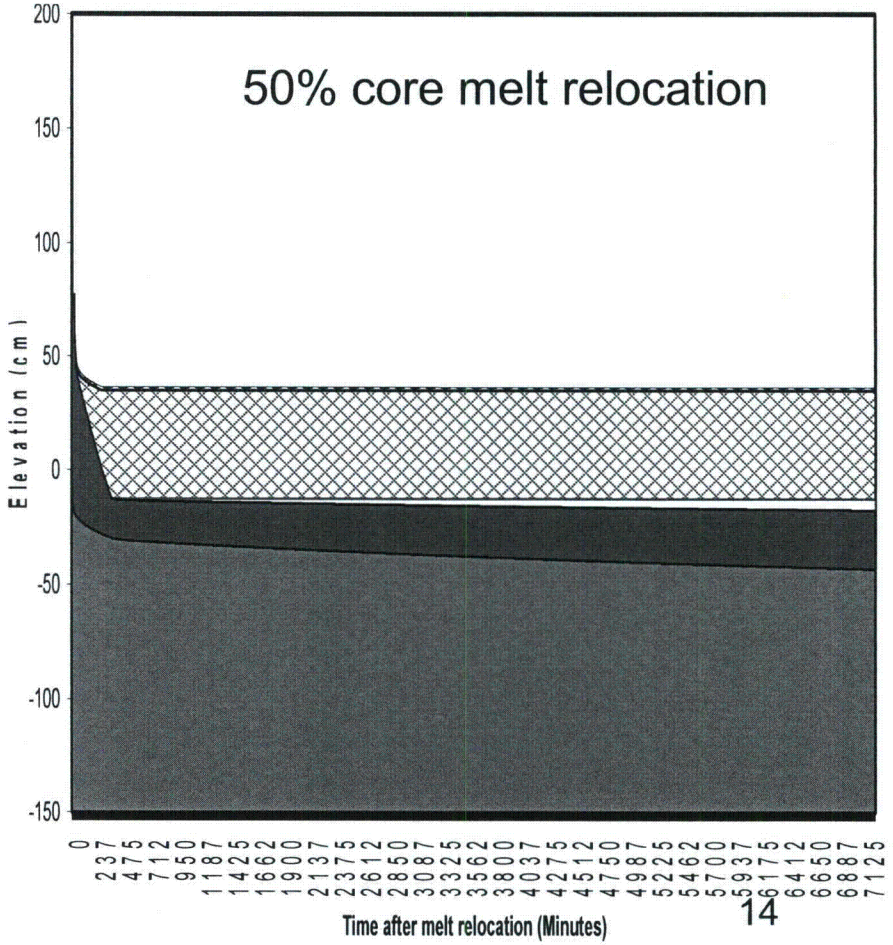
CQ vs MELCOR


Concrete Ablation
MELCOR - Radial
MELCOR - Axial
CORQUENCH - axial and radial
Conrete. Ablation Dist. (cm)
350
300
250
200
150
100
50
0
0
1000
2000
3000
4000
5000
6000
7000
Time (min)

INITIAL CONDITIONS VARIATIONS

Melt Mass (CORQUENCH)





Melt Mass
Crust Anchoring Allowed
(CORQUENCH)

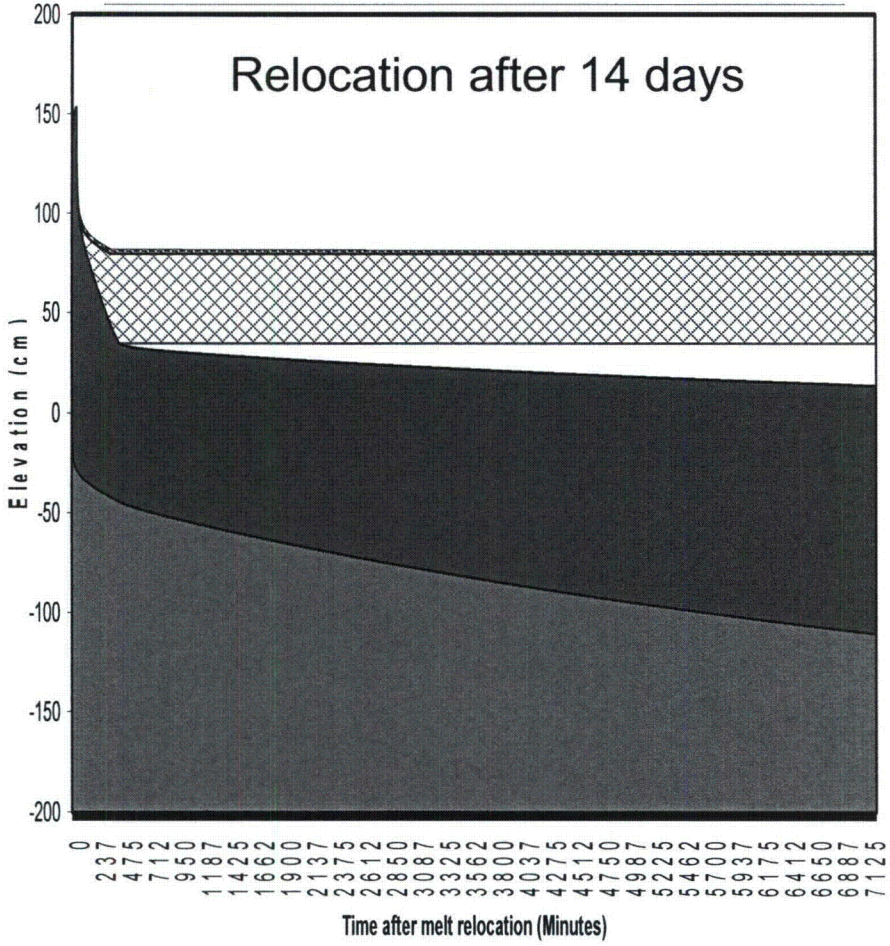
	Point In Simulation [days after melt relocation]					
	1 day		5 days		10 days	
Percent Core Melt Relocated	Ablation Rate [cm/hr]	Ablation Distance [cm]	Ablation Rate [cm/hr]	Ablation Distance [cm]	Ablation Rate [cm/hr]	Ablation Distance [cm]
100%	0.74	59.7	0.39	111		
75%	0.49	47.9	0.26	81.6		
50%	0.14	33.4	0.077	43.3	0.056	50.9

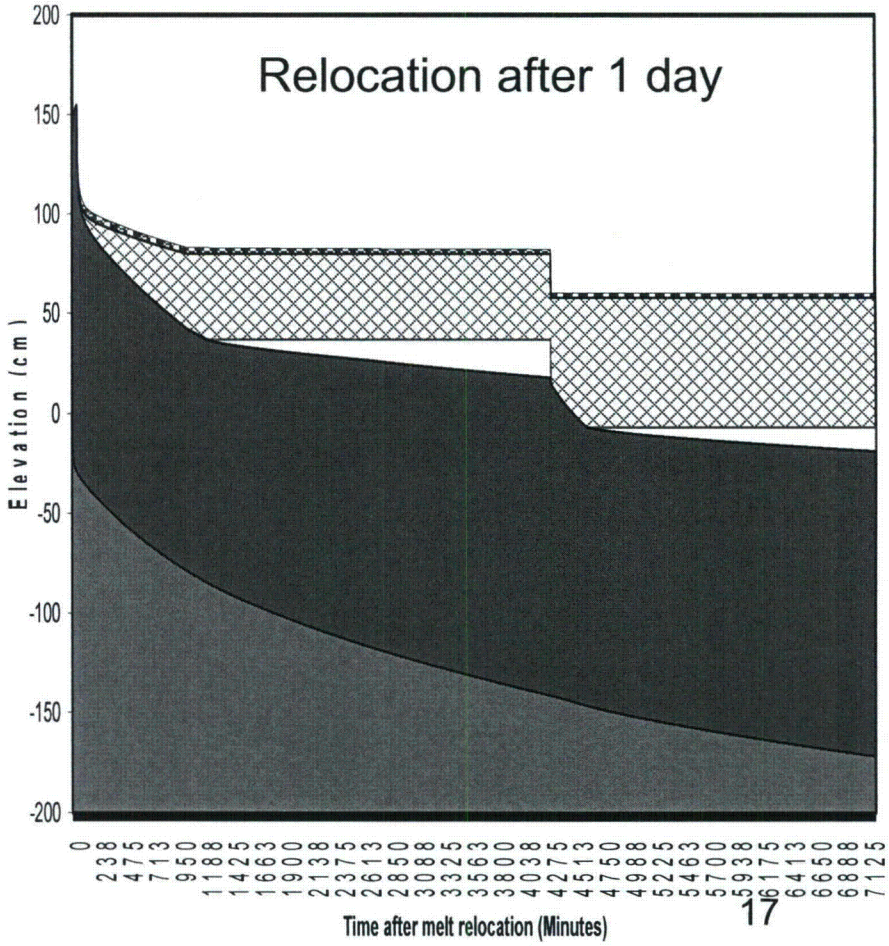
Melt Mass
Crust Anchoring Not Allowed
(CORQUENCH)

Percent Core Melt Relocated	Point In Simulation [days after melt relocation]					
	1 day		5 days		10 days	
	Ablation Rate [cm/hr]	Ablation Distance [cm]	Ablation Rate [cm/hr]	Ablation Distance [cm]	Ablation Rate [cm/hr]	Ablation Distance [cm]
100%	0.0	57.2	0.0	57.2	0.0	57.2
75%	0.0	44.2	0.0	44.2	0.0	44.2
50%	0.0	31.5	0.0	31.5	0.0	31.5

Percent Core Melt Relocated	Ablation Stops After [min]
100%	1148
75%	761
50%	459

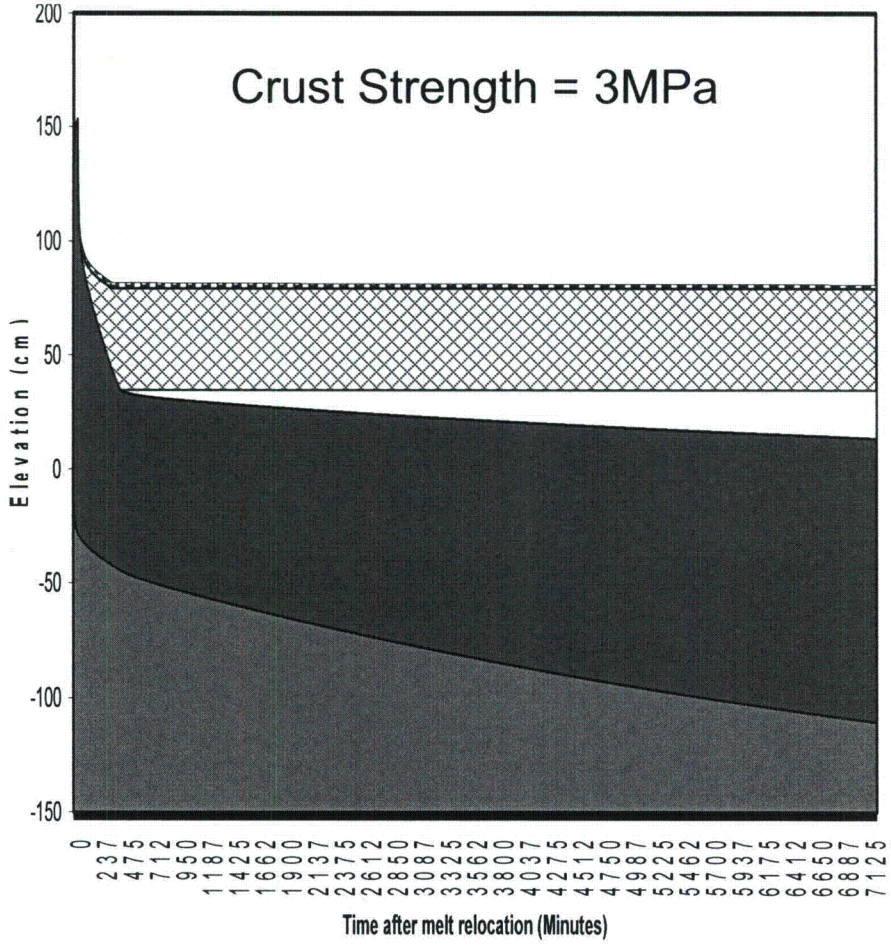
Melt Relocation Time (CORQUENCH)

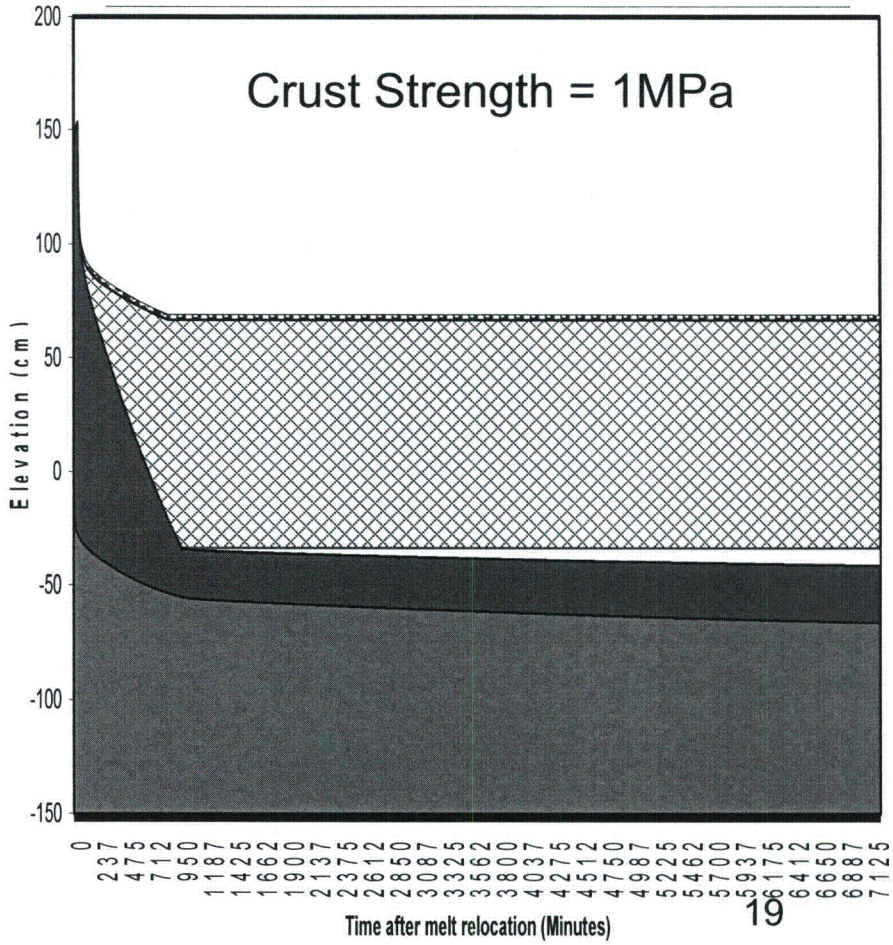




MODELING UNCERTAINTY

Crust Anchoring Uncertainty (CORQUENCH) also see previous slides





Crust Anchoring Uncertainty (CORQUENCH)

$$\delta_{t,\min} = \frac{\rho_{t,c} A_b g}{2 C_{geom} \hat{\sigma}_{t,f}} + \frac{1}{2}\sqrt{\left(\frac{\rho_{t,c} A_b g}{C_{geom} \hat{\sigma}_{t,f}}\right)^2 + \frac{4 g (m_{bed} + m_l)}{C_{geom} \hat{\sigma}_{t,f}}}$$

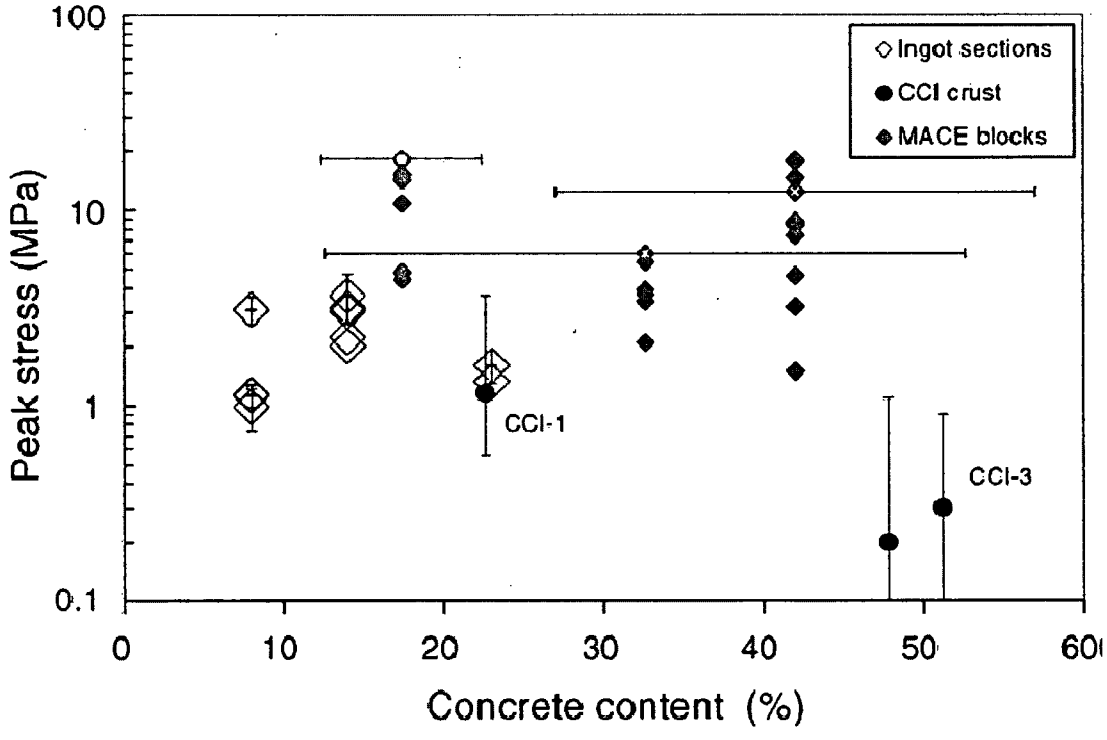
Crust thickness above which anchoring occurs

C_{geom} = 2.53 to 8.84 (Boundary and failure mode dependent)

m_l = weight of overlying water

$\sigma_{t,f}$ = Crust strength

A_b = Cavity area (diameter)



- Lomperski, Farmer, **NED**, Volume 239, Issue 11, November 2009, Pages 2551-2561
- Farmer, CORQUENCH manual, Eqn. 2.189

Water Ingression Modeling (CORQUENCH)

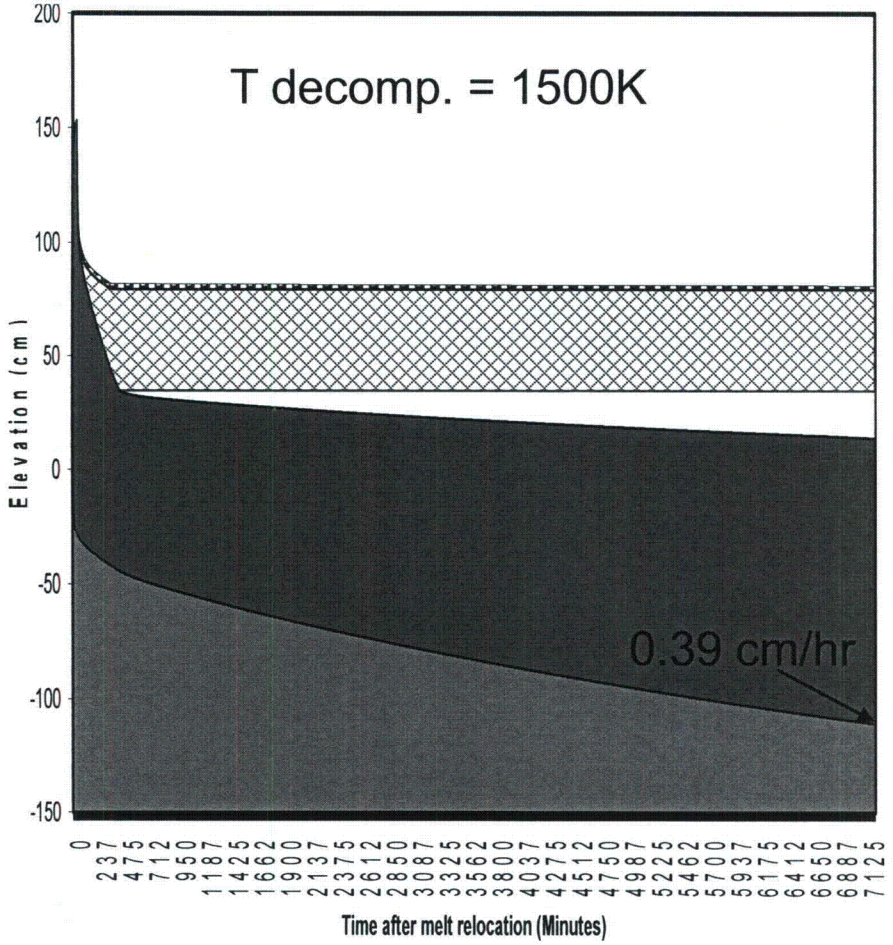
$$q''_{c,dry} = C_{dry}\left(\frac{\Delta e_{lv}(\rho_l - \rho_v)g}{\nu_v}\right)^{5/13}\left(\frac{Nk_{t,c}^2(\Delta e_{sat})^2}{c_{t,c}\Delta e_{crack}}\right)^{4/13}\left(\alpha_{c,\exp}\left[T_{t,frz} - \left(T_{sat} + \frac{\sigma_{t,f}}{\alpha_{t,ex}E_{t,y}}\right)\right]\right)^{15/13} \quad (2\text{-}186)$$

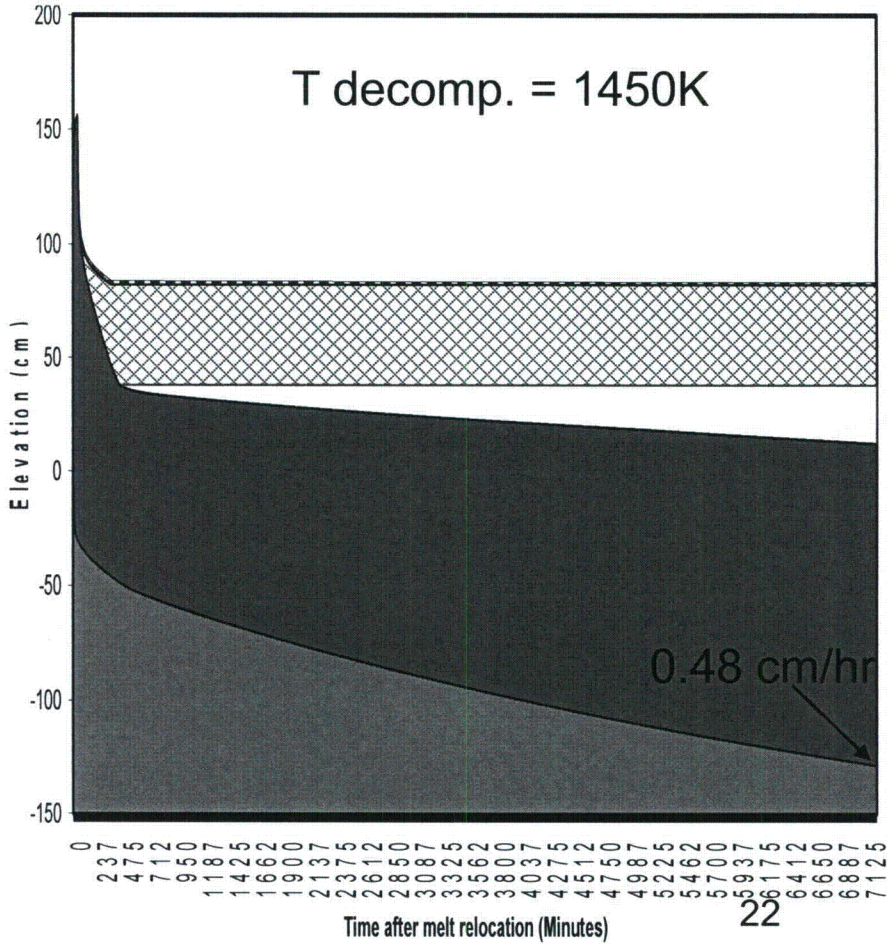
9.0 based on CCI tests (current default)
5.5 based on old SSWICS tests
New SSWICS tests suggest higher???

- Value of C_{dry} had very little impact
  - Crust anchoring dominates
- If crust was not allowed to anchor, C_{dry} would likely have a large impact (based on previous sensitivity studies)

Concrete Decomposition Temp. (CORQUENCH)

T solidus = 1403K
T liquidus= 1523K





From:	LIA07 Hoc
Sent:	Thursday, March 31, 2011 6:07 AM
To:	LIA07 Hoc; Borchardt, Bill; Bradford, Anna; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; ET07 Hoc; Flory, Shirley; Gibbs, Catina; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
Cc:	LIA07 Hoc
Subject:	Go Book Update - 0600 EDT, March 31, 2011
Attachments:	NRC Status Update 3.31.11--0430.pdf; TEPCO Press Release 225.pdf; TEPCO Press Release 226.pdf; TEPCO Press Release 227.pdf; TEPCO Press Release 228.pdf; TEPCO Press Release 229.pdf; TEPCO Press Release 230.pdf; TEPCO Press Release 224.pdf; ET Chronology 3-31-11 0600EDT.pdf

Attached, please find updated information for the "Go Books".

The updates include:

- The 0430 EDT, 03/31/11 Status Update
- The latest ET Chronology
- TEPCO Press Releases (224-230)

Please let me know if you have any questions or concerns.

-Jim

Jim Anderson
Office of Nuclear Security & Incident Response
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)
james.anderson@nrc.gov

LLLL/152

Search

Press Releases

Press Release (Mar 30,2011)
Plant Status of Fukushima Daini Nuclear Power Station (as of 9:00 pm March 30th)

[Updates are underlined]

Unit	Status
1	· Reactor cold shutdown, stable water level, offsite power is available. · No reactor coolant is leaked to the reactor containment vessel. · Maintain average water temperature below 100°C in the Pressure Suppression Chamber. · **At 2:30 pm on March 30th, the residual heat removal system(B) that is cooling the reactor of Unit 1 was also enabled to be energized by an emergency power source in addition to an offsite power. This means that all units secure backup power sources (emergency power sources) for the residual heat removal systems(B).**
2	· Reactor cold shutdown, stable water level, offsite power is available. · No reactor coolant is leaked to the reactor containment vessel. · Maintain average water temperature below 100°C in the Pressure Suppression Chamber.
3	· Reactor cold shutdown, stable water level, offsite power is available. · No reactor coolant is leaked to the reactor containment vessel. · Maintain average water temperature below 100°C in the Pressure Suppression Chamber.
4	· Reactor cold shutdown, stable water level, offsite power is available. · No reactor coolant is leaked to the reactor containment vessel. · Maintain average water temperature below 100°C in the Pressure Suppression Chamber.
Other	N.A.

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Press Releases

Press Release (Mar 30,2011)
Plant Status of Fukushima Daiichi Nuclear Power Station (as of 8:00 PM Mar 30th)

Updates are underlined

All 6 units of Fukushima Daiichi Nuclear Power Station have been shut down.

Unit 1(Shut down)
- Explosive sound and white smoke were confirmed after the big quake occurred at 3:36 pm Mar 12th. It was assumed to be hydrogen explosion.
- At approximately 2:30 am on March 23rd, seawater injection to the nuclear reactor through the feed water system was initiated.
- At approximately 10:50 am on March 24th, white fog-like steam arising from the roof part of the reactor building was observed.
- At approximately 11:30 am on March 24th, lights in the main control room was restored.
- We had been injecting seawater into the reactor, but from 3:37 pm on March 25th, we started injecting freshwater.
- At 8:20 am on March 29th, we switched injection of fresh water from using fire engine to temporary electrical pump.

Unit 2(Shut down)
- At approximately 6:00 am on March 15th, an abnormal noise began emanating from nearby Pressure Suppression Chamber and the pressure within the chamber decreased.
- At 6:20 pm on March 21st, white smoke was confirmed arising from the top of the reactor building. As of 7:11 am on March 22nd, smoke decreased to the level to nearly non-existent.
- We have been injecting seawater into the reactor, but from 10:10 am on March 26th, we started injecting fresh water (with boric acid).
- At approximately 4:46 pm on March 26th, the light in the main control room was restored.
- We had been injecting fresh water in to the reactor utilizing fire pump, however, we switched over to utilizing temporary electrical pump from 6:31 pm on March 27th.

Unit 3(Shut down)
- Explosive sound and white smoke were confirmed at 11:01am March 4th. It was assumed to be hydrogen explosion.
- At 8:30am on March 16th, fog like steam was confirmed arising from the reactor building.
- At approximately 6:15 am on March 17th the pressure of the Suppression Chamber has temporarily increased. We were preparing to implement measures to reduce the pressure of the reactor containment vessel (partial discharge of air containing radioactive material to outside) in order to fully secure safety. However, at present, it is not a situation to immediately implement measures and discharge air containing radioactive material to outside. We will continue to monitor the status of the pressure of the reactor containment vessel.
- At approximately 4:00 pm, March 21st, light gray smoke was confirmed arising from the floor roof of the Unit 3 building. On March 22nd, the color of smoke changed to somewhat white and it is slowly dissipating.
- At around 4:20 pm on March 23rd, our staff confirmed light black smoke belching from the Unit 3 building. At approximately 11:30 pm on March 23rd and 4:50 am on March 24th, our employee found no signs of smoke.
- We had been injecting sea water into the reactor pressure vessel, but from 6:02 pm on March 25th, we started injecting freshwater.
- We had been injecting fresh water in to the reactor utilizing fire pump, however, we switched over to utilizing temporary electrical pump from 8:30 pm on March 28th.

Unit 4 (outage due to regular inspection)
- At approximately 6 am on March 15th, we confirmed the explosive sound and the sustained damage around the 5th floor rooftop area of the Nuclear Reactor Building.
- On March 15th and 16th, we respectively confirmed the outbreak of fire

at the 4th floor of the northwestern part of the Nuclear Reactor Building. We immediately reported this matter to the fire department and the related authorities. TEPCO employees confirmed that each fire had already died down by itself.
- At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 5 (outage due to regular inspection)
- Sufficient level of reactor coolant to ensure safety is maintained.
- At 5 am, March 19th, we started the Residual Heat Removal System Pump (C) in order to cool the spent fuel pool.
- At 2:30 pm, March 20th, the reactor achieved reactor cold shutdown. At around 5:24 pm on March 23rd, when we switched the temporary Residual Heat Removal System Seawater Pump, it has stopped automatically. At around 4:14 pm, March 24th we replaced the pump, and restarted cooling of reactor at around 4:35 pm.
- At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 6 (outage due to regular inspection)
- Sufficient level of reactor coolant to ensure safety is maintained.
- We completed the repair work on the emergency diesel generator (A).
- At 10:14 pm, March 19th, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
- At 7:27 pm, March 20th, the reactor achieved reactor cold shutdown.
- In relation to the two seawater side pumps of the Residual Heat Removal System, we switched the power source from temporary to permanent at 3:38 PM and 3:42PM, Mar 25 respectively.
- At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Today's work for cooling the spent fuel pools
- From 9:25 am, freshwater injection to Unit 2 was conducted by a temporary motor driven pump. But, because of the malfunction of that pump at 9:45 am, we decided to switch to the fire fighting pump. At 0:30 pm, we switched to use the fire pump. Though the injection of the flesh water was stopped temporarily because we found the tear in a part of the hose at 0:47 pm and 1:10 pm, we restarted injection of the flesh water at 7:05 pm.
- From 2:04 pm to 6:33 pm, we conducted spray water to Unit 4 by a concrete pumping vehicle.
- We are considering further spraying subject to the conditions of spent fuel pools.

Draining water from underground floor of turbine buildings
- Unit 1 Draining water was started at around 5 pm on March 24th and it was stopped at around 7:30 am on March 29th, because we confirmed that the water level reached almost full capacity of a condenser. At present, we are preparing removal the water from a condensate storage tank to a suppression pool water surge-tank.
- Unit 2 We started to remove water from a condensate storage tank to a suppression pool water surge-tank from around 4:45 pm on March 29th.
- Unit 3 We started to remove water from a condensate storage tank to a suppression pool water surge-tank from around 5:40 pm on March 28th.
- Unit 4 The implementation of the work is under examination.

Casualties
- Presence of 2 TEPCO employees at the site is not confirmed on March 11th.
- On March 24th, it was confirmed that 3 workers from cooperative companies who were in charge of cable laying work in the 1st floor and the underground floor of turbine building were exposed to the radiation dose of more than 170 mSv. 2 of them were confirmed that their skins on legs were contaminated. After they were decontaminated, since there was a possibility of beta ray burn injury, they were transferred to Fukushima Medical University Hospital. The third worker was also transferred to Fukushima Medical University Hospital on March 25th. Later, the 3 workers were transferred to National Institute of Radiological Sciences in Chiba Prefecture. They all left the hospital on March 28th.
  Regarding this event, TEPCO has reported to the related government ministries and agencies on measures to be taken to assure appropriate radiation dose control and radiation exposure related operations.
  We will inform the related parties of countermeasures and continue to take all possible measures to future management.

Others
- We measured radioactive materials (iodine etc.) inside of the nuclear power station area (outdoor) by monitoring car and confirmed that radioactive materials level is getting higher than ordinary level. As listed below, we have determined that specific incidents stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) have occurred.
  - Determined at 4:17 pm Mar 12th (Around Monitoring Post 4)
  - Determined at 8:56 am Mar 13th (Around Monitoring Post 4)
  - Determined at 2:15 pm Mar 13th (Around Monitoring Post 4)
  - Determined at 3:50 am Mar 14th (Around Monitoring Post 6)

· Determined at 4:15 am Mar 14th (Around Monitoring Post 2)
· Determined at 9:27 am Mar 14th (Around Monitoring Post 3)
· Determined at 9:37 pm Mar 14th (Around main entrance)
· Determined at 6:51 am Mar 15th (Around main entrance)
· Determined at 8:11 am Mar 15th (Around main entrance)
· Determined at 4:17 pm Mar 15th (Around main entrance)
· Determined at 11:05 pm Mar 15th (Around main entrance)
· Determined at 8:58 am Mar 19th (Around MP5)

From now on, if the measured figure fluctuates and goes above and below 500 micro Sv/h, we deem that as the continuous same event and will not regard that as a new specific incidents stipulated in article 15, clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) has occurred. In the interim, if we measure a manifestly abnormal figure and it is evident that the event is not the continuous same event, we will determine and notify.

- The national government has instructed evacuation for those local residents within 20km radius of the periphery and evacuation to inside for those residents from 20km to 30km radius of the periphery, because it is possible that radioactive materials are discharged.
- At around 10:37 am March 21st, water spraying to common spent fuel pool and finished at 3:30 pm (conducted by TEPCO).
- At around 3:37 pm, March 24th, electricity supply to common spent fuel pool has started from external power source. At around 6:05 pm, fuel pool cooling pump was started to cool the pool.
- We found no signs of abnormal situation for the casks by visual observation during the patrol activity. A detailed inspection is under preparation.
- At Units 5 and 6, in order to prevent hydrogen gas from accumulating within the buildings, we have made three holes on the roof of the reactor building for each unit.
- In total 12 fire engines are lent for the water spraying to the spent fuel pools and water injection to the nuclear reactors by various regional fire departments* as well as Tokyo Fire Department. Also, instruction regarding the setting and operation of large scale decontamination system was provided by Niigata City Fire Headquarter and Hamamatsu City Fire Headquarter.

*: Koriyama Fire Department, Iwaki Fire Brigade Headquarters, Fire Headquarters of Sukagawa District Wide Area Fire-fighting Association, Yonezawa City Fire Headquarters, Utsunomiya City Fire Headquarters, Fire Headquarters of Aizu-Wakamatsu wide area municipal association, Saitama City Fire Bureau, and Niigata City Fire Bureau.

- By March 22nd, Units 1 through 6 were started to be energized from the external power source.
- At 3:30PM, March 27th, we found that there was water in the trenches of Units 1 to 3. The radioactive emission at the surface of the water was 0.4mSv/h for Unit 1 and over 1,000mSv/h for Unit 2. As for Unit 3, we couldn't have access to the surface because of debris. We will continue to monitor water in the trenches.
- On March 28th, a puddle of water was found at a centralizedc environmental facility process main building. As a result of a radioactivity analysis, on March 29th, we detected approximately 1.2 x 10Bq/cm^3 in a full dose at a radiation controlled area and 2.2 x 10Bq/cm^3 in a full dose at a non-controlled area.
- At 12:03 pm, March 29th, when taking off the flange of the pipe of the seawater piping of the Residual Heat Removal System, 3 workers from our subcontractor were soaked with water in the pipe. After wiping the water off, we confirmed that there was no radioactive contamination to their bodies.
- We will continue to take all measures to ensure the safety and to continue monitoring the surrounding environment around the Power Station.

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Press Releases

Press Release (Mar 31,2011)
Implementation Plan of Rolling Blackouts on and after April 1, 2011

Due to the tight power supply-demand balance, TEPCO has been implementing rolling blackouts since Monday, March 14. We sincerely regret causing anxiety and inconvenience to our customers and the society. We appreciate your cooperation in conserving electricity consumption.
For customers who will be subject to rolling blackouts, please be prepared for the announced blackout periods. Also, for the customers who are not subject to blackouts, we would appreciate your continuous cooperation in reducing electricity usage by turning off unnecessary lightings and electrical appliances.
We will inform the implementation plan of rolling blackouts on and after April 1, 2011 as follows:

o Implementation plan of rolling blackout on April 1 (Fri)

On April 1, Friday, no rolling blackout will be implemented in any time periods based on the today's power demand, the weather forecast tomorrow on April 1 and the trend of the power supply. Because of your cooperation in conserving electricity, we can avoid the rolling blackout for tomorrow on April 1. We appreciate your continuous cooperation

o Implementation plan of rolling blackouts on April 2 (Sat)- April 7 (Thu)

Please refer to the appendix for details.

- The actual blackout period for each Group is planned to be maximum about 3 hours during the relevant scheduled time period.
- Each blackout period for each Group differs every day and starting and ending time of blackout periods may slightly differ.
- Depending on the supply-demand balance of the day, planned blackouts may not be carried out. In case the electricity supply-demand balance becomes tighter than expected, we will reconsider the rolling blackout plan and inform you accordingly before we implement the revised plan.
- A blackout may occur in the adjacent areas where the planned blackouts are carried out.

[Others]
- In order to prevent fires, please make sure to switch off electric appliances such as hair driers when you leaving home.
- Please carefully pay attention to the traffic at the crossings in case the traffic lights are suddenly turned off.
- As for the buildings and apartments, please be aware that equipments and facilities such as elevators, automatic doors, automatic locks, and multilevel parking lots will not function. In particular, please avoid using elevators during the scheduled blackouts.

<Reference>
o Prediction of demand and supply on March 31
Estimated Demand 33,500 MW (18:00-19:00)
Supply Capacity 37,500 MW

o Prediction of demand and supply on April 1
Estimated Demand 33,500 MW (18:00-19:00)
Supply Capacity 37,500 MW

* Prediction of demand
According to the weather forecast, the temperature tomorrow on April 1 will be normal. We assume the estimated peak demand on April 1 will be 33,500MW, equal to the estimated demand today on March 31.
* Estimated demand and supply capacity may change depending on the situation of the day.

Appendix:Weekly Rolling Blackout Tentative Plan from Apr 1(Fri) to April 7(Thu)(PDF 60.2KB)

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Press Releases

Press Release (Mar 31,2011)
Plant Status of Fukushima Daini Nuclear Power Station (as of 9:00 am March 31st)

[No particular update from the previous release]

Unit	Status
1	· Reactor cold shutdown, stable water level, offsite power is available. · No reactor coolant is leaked to the reactor containment vessel. · Maintain average water temperature below 100°C in the Pressure Suppression Chamber.
2	· Reactor cold shutdown, stable water level, offsite power is available. · No reactor coolant is leaked to the reactor containment vessel. · Maintain average water temperature below 100°C in the Pressure Suppression Chamber.
3	· Reactor cold shutdown, stable water level, offsite power is available. · No reactor coolant is leaked to the reactor containment vessel. · Maintain average water temperature below 100°C in the Pressure Suppression Chamber.
4	· Reactor cold shutdown, stable water level, offsite power is available. · No reactor coolant is leaked to the reactor containment vessel. · Maintain average water temperature below 100°C in the Pressure Suppression Chamber.
Other	N.A.

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Press Releases

Press Release (Mar 30,2011)
Status of TEPCO's Facilities and its services after the Tohoku-Taiheiyou-Oki Earthquake(as of 10:00PM)

Due to the Tohoku-Taiheiyou-Oki Earthquake which occurred on March 11th 2011, TEPCO's facilities including our nuclear power stations have been severely damaged. We deeply apologize for the anxiety and inconvenience caused.

Below is the status of TEPCO's major facilities.
*new items are underlined

[Nuclear Power Station]
Fukushima Daiichi Nuclear Power Station:
Units 1 to 3: shutdown due to the earthquake
(Units 4 to 6: outage due to regular inspections)

* The national government has instructed the public to evacuate for those local residents within 20km radius of the site periphery and to evacuate voluntarily for those local residents between 20km and 30km radius of the site periphery.

* Off-site power was connected to Unit 1 to 6.

* Unit 1
- The explosive sound and white smoke was confirmed near Unit 1 when the big quake occurred at 3:36pm, March 12th.
- We started injection of sea water at 8:20 pm, March 12th, and then boric acid which absorbs neutron into the reactor afterwards.
- At approximately 2:30 am, March 23rd, we started the injection of sea water into the reactor from feed water system. After that, the injection of freshwater was started from 3:37 pm on March 25th (switched from the seawater injection). At 8:32 am, Mar 29th, transfer from the fire fighting pump to a temporary motor driven pump was made.
- At approximately 10:50 am on March 24th, white smoke was confirmed arising from the top of the reactor building.
- At approximately 11:30 am, March 24th, lights in the main control room were restored.
- At approximately 5:00 pm, March 24th, draining water from underground floor of turbine buildings into a condenser was started and it was paused at approximately 7:30 am, March 29th because we confirmed that the water level reached almost full capacity of a condenser. Water transfer from condensate reservoirs to suppression pool water surge-tanks is under review to enable water transfer from a condenser to condensate reservoirs.

* Unit 2
- At 1:25 pm, March 14th, since the Reactor Core Isolation Cooling System has failed, it was determined that a specific incident stipulated in Clause 1, Article 15 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred (failure of reactor cooling function). At 5:17 pm, March 14th, while the water level in the reactor reached the top of the fuel rod, we have restarted the water injection with the valve operation.
- At approximately 6:14 am, March 15th, the abnormal sound was confirmed near the suppression chamber and the pressure inside the chamber decreased afterwards. It was determined that there is a possibility that something happened in the suppression chamber. While sea water injection to the reactor continued, TEPCO employees and workers from other companies not in charge of injection work started tentative evacuation to a safe location.
Sea water injection to the reactor continued.
- On March 18th, power was delivered up to substation for backup power through offsite transmission line. We completed laying cable further to unit receiving facility in the building, and at 3:46 pm, March 20th the load-side power panel of the receiving facility started to be energized.
- From 3:05 pm to 5:20 pm on March 20th, about 40 tons of seawater was

injected into Unit 2 by TEPCO employees.
- At approximately 6:20 pm on March 21st, white smoke was confirmed arising from the top of the reactor building. As of 7:11 am on March 22nd, smoke decreased to the level where we could hardly confirm.
- From around 4 pm to 5 pm on March 22nd, approximately 18 tons of sea water was injected into the spent fuel pool by TEPCO employees.
- From 10:30 am on March 25th, seawater injection through Fuel Pool Cooling and Filtering System was initiated. The work was finished at 0:19 pm on March 25th. From 4:30 PM, March 29th, freshwater injection through Fuel Pool Cooling and Filtering System was initiated. (We switched from seawater to freshwater). The work was finished at 6:25 pm on March 29th.
- From 10:10 am on March 26th, freshwater (with boric acid) injection was initiated. (switched from the seawater injection) At 06:31pm, Mar 27th, transfer from the fire fighting pump to a temporary motor driven pump was made. At 9:25 am, March 30th, transfer from a temporary motor driven pump to the fire fighting pump was made due to pump trouble. At 1:10 pm, March 30th, freshwater injection was paused due to hose trouble. At 7:05 pm, March 30th, freshwater injection was resumed.
- At approximately 4:46 pm, March 26th, lights in the main control room were restored.
- At approximately 4:45 pm, March 29th, water transfer from condensate reservoirs to suppression pool water surge-tanks was initiated to enable water transfer from a condenser to condensate reservoirs in order to drain water from underground floor of turbine buildings into a condenser.

* Unit 3
- At 6:50 am, March 14th, while water injection to the reactor was under operation (injection of boric acid was done on Mar 13th), the pressure in the reactor containment vessel increased to 530 kPa. As a result, at 7:44 am, it was determined that a specific incident stipulated in article 15, clause 1 occurred (abnormal increase of the pressure of reactor containment vessel). Afterwards, the pressure gradually decreased (as of 9:05 am, 490 kPa).
- At approximately 11:01 am, March 14th, an explosion followed by white smoke occurred near Unit 3. 4 TEPCO employees and 3 workers from other companies (all of them were conscious) sustained injuries and were taken to the hospital by ambulances.
- As the temperature of water in the spent fuel pool rose, spraying water by helicopters with the support of the Self Defense Force was considered. However the operation on March 16th was cancelled.
- At 6:15 am, March 17th, the pressure of the Suppression Chamber temporarily increased, but currently it is stable within a certain range. On March 20th, we were preparing to implement measures to reduce the pressure of the reactor containment vessel (partial discharge of air containing radioactive material to outside) in order to fully secure safety. However, at present, it is not a situation to immediately implement measures and discharge air containing radioactive material to outside. We will continue to monitor the status of the pressure of the reactor containment vessel.
- In order to cool spent fuel pool, water was sprayed by helicopters on March 17th with the cooperation of Self-Defense Forces.
- At approximately past 7:00 pm, March 17th, Self-Defense Forces and the police started spraying water by water cannon trucks upon our request for the cooperation. At 8:09 pm, March 17th, they finished the operation.
- At 2:00 pm, March 18th, spraying water by fire engines was started with the cooperation of Self-Defense Forces and the United States Armed Forces. At 2:45 pm, March 18th, the operation was finished.
- At approximately 12:30 am, March 19th, spraying water was started with the cooperation of Fire Rescue Task Forces of Tokyo Fire Department. At approximately 1:10 am, March 19th, the operation was finished. They resumed spraying water at 2:10 pm and finished at approximately 3:40 am, March 20th.
- At approximately 9:30 pm, March 20th, spraying water was started with the cooperation of Fire Rescue Task Forces of Tokyo Fire Department. At approximately 3:58 am, March 21th, they the operation was finished.
- At approximately 3:55 pm, March 21st, light gray smoke was confirmed arising from the southeast side of the 5th floor roof of the Unit 3 building. The situation was reported to the fire department at approximately 4:21 pm. The parameters of reactor pressure vessel, reactor containment vessel, and monitored environmental data remained stable without significant change. However, employees working around Unit 3 evacuated to a safe location. On March 22nd, the color of smoke changed to somewhat white and it is slowly dissipating.
- At approximately 3:10 pm on March 22nd, spraying water to Unit 3 by Tokyo Fire Department's Hyper Rescue and Osaka City Fire Department was conducted, and completed at approximately 4:00 PM on the same day.
- At approximately 10:45 pm on March 22nd, lights in the main control room were restored.
- At 11:00 am on March 23rd, the injection of sea water to spent fuel pool was conducted, and finished approximately at 1:20 pm on the same day.
- At 4:20 pm on March 23rd, light gray smoke was observed belching from Unit 3 building. The situation was reported to the fire department at 4:25 pm on March 23rd. The parameters of the reactor, the reactor containment vessel of Unit 3, and monitored figures around the site's immediate surroundings remained stable without significant change. To be safe, workers in the main control room of Unit 3 and around Unit 3 evacuated to a safe location. At approximately 11:30 pm on March 23rd and

4:50 am on March 24th, TEPCO employees confirmed the smoke has disappeared. Accordingly, workers evacuation was lifted.
- From approximately 5:35 am on March 24th, sea water injection through Fuel Pool Cooling and Filtering System was initiated, and finished at approximately 4:05 pm on the same day.
- From 1:28 pm on March 25th, Hyper Rescue team started water spray. The work finished at 4:00 pm on March 25th.
- From 6:02 pm on March 25th, the injection of freshwater to the reactor was started (switched from the seawater injection). At 8:30 pm on March 28th, the injection of fresh water is switched to temporary electricity pumps from the fire engine pumps.
- At approximately 12:34pm March 27th , the injection of water by the concrete pump truck was started. At approximately 2:36 pm, March 27th, the operation was finished.
- At approximately 2:17pm March 29th, the injection of fresh water by the concrete pump truck was started. (Sea water had been injected so far and transfer from seawater to freshwater was made). The water injection was finished at 6:18 PM, March 29th.
- At approximately 5:40 pm, March 28th, water transfer from condensate reservoirs to suppression pool water surge-tanks was initiated to enable water transfer from a condenser to condensate reservoirs in order to drain water from underground floor of turbine buildings into a condenser.

* Unit 4
- At approximately 6:00 am, March 15th, an explosive sound was heard and the damage in the 5th floor roof of Unit 4 reactor building was confirmed. At 9:38 am, the fire near the north-west part of 4th floor of Unit 4 reactor building was confirmed. At approximately 11:00 am, TEPCO employees confirmed that the fire was out.
- At approximately 5:45 am on March 16th, a TEPCO employee discovered a fire at the northwest corner of the Nuclear Reactor Building. TEPCO immediately reported this incident to the fire department and the local government and proceeded with the extinction of fire. At approximately 6:15 am, TEPCO staff confirmed at the site that there are no signs of fire.
- At approximately 8:21 am on March 20th, spraying water by fire engines was started with the cooperation of Self-Defense Forces and they finished the operation at approximately 9:40 am. At approximately 6:45 pm spraying water was started by Self-Defenses' water cannon trucks and finished at approximately 7:45 pm.
- At approximately 6:30 am, March 21st, spraying water by fire engines was started with the cooperation of Self-Defense Forces and the United States Armed Forces. At approximately 8:40 am, March 21, they had finished the operation.
- On March 21st, cabling has been completed from temporary substation to the main power center.
- From approximately 5:20 pm on March 22nd, spraying water from the concrete pumping vehicle was conducted and ended at approximately 8:30 pm on the same day.
- From approximately 10:00 am on March 23rd, spraying water from the concrete pumping vehicle was conducted and ended at approximately 1:00 pm on the same day.
- From approximately 2:35 pm on March 24th, spraying water by the concrete pumping vehicle was conducted and ended at approximately 5:30 pm on the same day.
- From 6:05 am on March 25th, seawater injection through Fuel Pool Cooling and Filtering System was initiated and finished at approximately 10:20 am on the same day.
- From 7:05 pm on March 25th, water spray by the concrete pumping vehicle was started and finished at 10:07 pm on March 25th.
- From 4:55 pm on March 27th, water spray by the concrete pumping vehicle was started and finished at 7:25 pm on March 27th.
- At approximately 11:50 am on March 29th, lights in the main control room were restored.
- From 2:04 pm on March 30th, water spray by the concrete pumping vehicle was started and finished at 6:33 pm on March 30th.

* Unit 5 and 6
- At 5 am on March 19th, we started the Residual Heat Removal System Pump (C) of Unit 5 in order to cool the spent fuel pool. At 10:14 pm, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
- Unit 5 has been in reactor cold shutdown since 2:30 pm on March 20th. Unit 6 has been in reactor cold shutdown since 7:27 pm on March 20th.
- At Units 5 and 6, in order to prevent hydrogen gas from accumulating within the buildings, we have made three holes on the roof of the reactor building for each unit.
- At approximately 5:24 pm on March 23rd, the temporary Residual Heat Removal System Seawater Pump automatically stopped when its power source was switched. We restarted the pump at around 4:14 pm, March 24th, and resumed cooling of reactor at around 4:35 pm.

* On March 18th, regarding the spent fuel in the common spent fuel pool, we have confirmed that the water level of the pool is secured. At around 10:37 am March 21st, water spraying to common spent fuel pool and finished at 3:30 pm. At around 6:05 pm, fuel pool cooling pump was started to cool the pool.

*common spent fuel pool: a spent fuel pool for common use set in a separate building in a plant site in order to preserve spent fuel which are transferred from the spent fuel pool in each Unit building.

* On March 17th, we patrolled buildings for dry casks and found no signs of abnormal situation for the casks by visual observation. A detailed inspection is under preparation.
*dry cask: a measure to store spent fuel in a dry storage casks in storages. Fukushima Daiichi Nuclear Power Station started to utilize the measure from August 1995.

* In total 13 fire engines are lent for spraying water to the spent fuel pools and water injection to the nuclear reactors by various regional fire departments* as well as Tokyo Fire Department. Also, instruction regarding the setting and operation of large scale decontamination system was provided.

* On March 21st, 23rd to 29th, we detected technetium, cobalt, iodine, cesium, tellurium, barium, lanthanum and molybdenum from the seawater around discharge canal of Unit 1, 2, 3 and 4.

* On March 20th, 21st, 23rd to 29th, we detected iodine, cesium, tellurium and ruthenium in the air collected at the site of Fukushima Daiichi Nuclear Power Station.

* Plutonium has detected from the sample of soil at the site of Fukushima Daiichi Nuclear Power Station collected on 21st and 22nd of March, Concentration level of Plutonium detected was same as that of under usual environment and it is thought not to be harmful to human health. We will strengthen environmental monitoring of power station and surrounding environment.

* On March 28th, we detected radioactive materials contained in the puddles found in the turbine building of Unit 1 to 4.

* At approximately 3:30 pm, March 27th, we found water pooling in the vertical shaft of the trench outside of the turbine buildings for Units 1 to 3. The radiation dose at the surface of the water amounted 0.4 mSv/h in Unit 1 and over 1,000 mSv/h in Unit 2. We could not confirm the amount of the radiation dose in Unit 3. We will keep observing the condition of the water in the vertical shaft.
On March 29th, we detected niobium, tellurium, ruthenium, silver, tellurium, iodine, cesium, and ruthenium in the water collected at the trench of unit 1.

* On March 28th, a puddle of water was found at a centralized environmental facility process main building. As a result of a radioactivity analysis, on March 29th, we detected approximately 1.2 x $10Bq/cm^3$ in a full dose at a radiation controlled area and 2.2 x $10Bq/cm^3$ in a full dose at a non-controlled area.

* At 12:03 pm, March 29th, when taking off the flange of the pipe of the seawater piping of the Residual Heat Removal System, 3 workers from our subcontractor were soaked with water in the pipe. After wiping the water off, we confirmed that there was no radioactive contamination to their bodies.

* We will continuously endeavor to securing safety, and monitoring of the surrounding environment.

Fukushima Daini Nuclear Power Station:
Units 1 to 4: shutdown due to the earthquake

* The national government has instructed evacuation for those local residents within 10km radius of the periphery.

* In order to achieve cold shutdown, reactor cooling function was restored and cooling of reactors was conducted. As a result, all reactors achieved cold shutdown: Unit 1 at 5:00 pm, March 14th, Unit 2 at 6:00 pm, March 14th, Unit 3 at 0:15 pm, March 12th, Unit 4 at 7:15 am, March 16th.

* At 2:30 pm on March 30th, the residual heat removal system(B) that is cooling the reactor of Unit 1 was also enabled to be energized by an emergency power source in addition to an offsite power. This means that all the units secure backup power sources (emergency power sources) for the residual heat removal systems(B).

* (Unit 1)
As it is confirmed that the temperature of the Emergency Equipment Cooling Water System*1 has increased, at 3:20 pm, March 15th, we stopped the Residual Heat Removal System (B) for the inspection. Subsequently, failure was detected in the power supply facility associated with the pumps of the Emergency Equipment Cooling Water System. At 4:25 pm, March 15th, after replacing the power facility, the pumps and the Residual Heat Removal System (B) have been reactivated.

* (Unit 4)

As it is confirmed that the pressure at the outlet of the pumps of the Emergency Equipment Cooling Water System*1 has been decreased, at 8:05 pm, March 15th, we stopped the Residual Heat Removal System (B) for the inspection. Subsequently, failure was detected in the power supply facility associated with the pumps of the Emergency Equipment Cooling Water System. At 9:25 pm, March 15th, after replacing the relevant facility, the pumps and the Residual Heat Removal System (B) have been reactivated.

*1:emergency water system in which cooling water (pure water) circulates which exchanged the heat with sea water in order to cool down bearing pumps and/or heat exchangers.etc.

Kashiwazaki Kariwa Nuclear Power Station:
Units 1, 5, 6, 7: normal operation
(Units 2 to 4: outage due to regular inspection)

[Thermal Power Station]
- Hirono Thermal Power Station Units 2 and 4: shutdown due to the earthquake
- Hitachinaka Thermal Power Station Unit 1: shutdown due to the earthquake
- Kashima Thermal Power Station Units 2, 3, 5, 6: shutdown due to the earthquake

[Hydro Power Station]
- All the stations have been restored.
  (Facilities damaged by the earthquake are now being repaired in a timely manner.)

[Transmission System, etc.]
- All substation failed due to the earthquake have been restored.
  (Facilities damaged by the earthquake are now being repaired in a timely manner.)

[Power Supply to TEPCO's Service Areas]
- Except in case of planned rolling blackouts, we can supply electricity to our all service areas.

[Supply and Demand Status within TEPCO's Service Area to Secure Stable Power Supply]
- Considering the critical balance of our power supply capacity and expected power demand forward, in order to avoid unexpected blackout, TEPCO has been implementing rolling blackout (planned blackout alternates from one area to another) since Mar 14th. We will make our utmost to secure the stable power supply as early as possible. For customers who will be subject to rolling blackout, please be prepared for the announced blackout periods. Also for customers who are not subject to blackouts, TEPCO appreciates your continuous cooperation in reducing electricity usage by avoiding using unnecessary lighting and electrical equipment.

[Others]
- Please do NOT touch cut-off electric wires.
- In order to prevent fire, please make sure to switch off the electric appliances such as hair driers when you leave your house.
- For the customer who has in-house power generation, please secure fuel for generator.

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Press Releases

Press Release (Mar 31,2011)
The results of nuclide analyses of radioactive materials in the air at the site of Fukushima Daiichi Nuclear Power Station (10th release)

On March 22nd 2011, as part of monitoring activity of the surrounding environment, we conducted nuclide analysis of radioactive materials contained in the air which were collected at the site of Fukushima Daiichi Nuclear Power Station, which was damaged by Tohoku-Chihou-Taiheiyo-Oki Earthquake. As a result, radioactive materials were detected and therefore, we summarized the results and reported them to Nuclear and Industry Safety Agency as well as to the government of Fukushima Prefecture. (previously announced)

On March 30th, 2011, we conducted nuclide analysis of radioactive materials contained in the air which were collected on the same date at the site of Fukushima Daiichi Nuclear Power Station. As a result, radioactive materials were detected as shown in the attachment. Therefore, we summarized the results and reported them to Nuclear and Industry Safety Agency as well as to the government of Fukushima Prefecture today.

We are planning to conduct these surveys continuously.

attachment1:The result of the nuclide analysis of radioactive materials in the air at the site of Fukushima Daiichi Nuclear Power Station (PDF 35.7KB)
attachment2:The result of the nuclide analysis of radioactive materials in the air at the site of Fukushima Daini Nuclear Power Station (PDF 36.9KB)
attachment3:Nuclide analysis of radioactive materials in the air Fukushima Daiichi Nuclear Power Station (Western Gate)(PDF 31.1KB)
attachment4:Nuclide analysis of radioactive materials in the air Fukushima Daini Nuclear Power Station(PDF 36.3KB)

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Press Releases

Press Release (Mar 31,2011)
Status of TEPCO's Facilities and its services after the Tohoku-Taiheiyou-Oki Earthquake (as of 9:00AM)

Due to the Tohoku-Taiheiyou-Oki Earthquake which occurred on March 11th 2011, TEPCO's facilities including our nuclear power stations have been severely damaged. We deeply apologize for the anxiety and inconvenience caused.

Below is the status of TEPCO's major facilities.
*new items are underlined

[Nuclear Power Station]
Fukushima Daiichi Nuclear Power Station:
Units 1 to 3: shutdown due to the earthquake
(Units 4 to 6: outage due to regular inspections)

* The national government has instructed the public to evacuate for those local residents within 20km radius of the site periphery and to evacuate voluntarily for those local residents between 20km and 30km radius of the site periphery.

* Off-site power has been connected to Unit 1 to 6 by March 22, 2011.

* Unit 1
- The explosive sound and white smoke was confirmed near Unit 1 when the big quake occurred at 3:36pm, March 12th.
- We started injection of sea water at 8:20 pm, March 12th, and then boric acid which absorbs neutron into the reactor afterwards.
- At approximately 2:30 am, March 23rd, we started the injection of sea water into the reactor from feed water system. After that, the injection of freshwater was started from 3:37 pm on March 25th (switched from the seawater injection). At 8:32 am, Mar 29th, transfer from the fire fighting pump to a temporary motor driven pump was made.
- At approximately 10:50 am on March 24th, white smoke was confirmed arising from the top of the reactor building.
- At approximately 11:30 am, March 24th, lights in the main control room were restored.
- At approximately 5:00 pm, March 24th, draining water from underground floor of turbine buildings into a condenser was started and it was paused at approximately 7:30 am, March 29th because we confirmed that the water level reached almost full capacity of a condenser. Water transfer from condensate reservoirs to suppression pool water surge-tanks is under review to enable water transfer from a condenser to condensate reservoirs.

* Unit 2
- At 1:25 pm, March 14th, since the Reactor Core Isolation Cooling System has failed, it was determined that a specific incident stipulated in Clause 1, Article 15 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred (failure of reactor cooling function). At 5:17 pm, March 14th, while the water level in the reactor reached the top of the fuel rod, we have restarted the water injection with the valve operation.
- At approximately 6:14 am, March 15th, the abnormal sound was confirmed near the suppression chamber and the pressure inside the chamber decreased afterwards. It was determined that there is a possibility that something happened in the suppression chamber. While sea water injection to the reactor continued, TEPCO employees and workers from other companies not in charge of injection work started tentative evacuation to a safe location.
  Sea water injection to the reactor continued.
- On March 18th, power was delivered up to substation for backup power through offsite transmission line. We completed laying cable further to unit receiving facility in the building, and at 3:46 pm, March 20th the load-side power panel of the receiving facility started to be energized.
- From 3:05 pm to 5:20 pm on March 20th, about 40 tons of seawater was

injected into Unit 2 by TEPCO employees.
- At approximately 6:20 pm on March 21st, white smoke was confirmed arising from the top of the reactor building. As of 7:11 am on March 22nd, smoke decreased to the level where we could hardly confirm.
- From around 4:00 pm to 5:00 pm on March 22nd, approximately 18 tons of sea water was injected into the spent fuel pool by TEPCO employees.
- From 10:10 am on March 26th, freshwater (with boric acid) injection was initiated. (switched from the seawater injection) At 6:31pm, March 27th, transfer from the fire fighting pump to a temporary motor driven pump was made.
- From 10:30 am on March 25th, seawater injection through Fuel Pool Cooling and Filtering System was initiated. The work was finished at 12:19 pm, March 25th. From 4:30 pm, March 29th, freshwater injection through Fuel Pool Cooling and Filtering System was initiated. (We switched from seawater to freshwater). The work was finished at 6:25 pm on March 29th. At 9:25 am, March 30th, we started fresh water injection by a temporary motor driven pump, but we switched the pump to the fire fighting pump due to the pump trouble. At 1:10 pm, March 30th, freshwater injection was suspended, because we found the crack on a part of the hose. At 7:05 pm, March 30th, freshwater injection was resumed and finished at 11:50 pm, March 31.
- At approximately 4:46 pm, March 26th, lights in the main control room were restored.
- At approximately 4:45 pm, March 29th, the water in condensate reservoirs was being transferred to suppression pool water surge-tanks to prepare for water transfer from a condenser to condensate reservoirs in order to drain water on the underground floor of the turbine building into a condenser.

* Unit 3
- At 6:50 am, March 14th, while water injection to the reactor was under operation (injection of boric acid was done on Mar 13th), the pressure in the reactor containment vessel increased to 530 kPa. As a result, at 7:44 am, it was determined that a specific incident stipulated in the Article 15, the Clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred (abnormal increase of the pressure of reactor containment vessel). Afterwards, the pressure gradually decreased (as of 9:05 am, 490 kPa).
- At approximately 11:01 am, March 14th, an explosion followed by white smoke occurred near Unit 3. 4 TEPCO employees and 3 workers from other companies (all of them were conscious) sustained injuries and were taken to the hospital by ambulances.
- As the temperature of water in the spent fuel pool rose, spraying water by helicopters with the support of the Self Defense Force was considered. However the operation on March 16th was cancelled.
- At 6:15 am, March 17th, the pressure of the Suppression Chamber temporarily increased, but currently it is stable within a certain range. On March 20th, we were preparing to implement measures to reduce the pressure of the reactor containment vessel (partial discharge of air containing radioactive material to outside) in order to fully secure safety. However, at present, it is not a situation to immediately implement measures and discharge air containing radioactive material to outside. We will continue to monitor the status of the pressure of the reactor containment vessel.
- In order to cool spent fuel pool, water was sprayed by helicopters on March 17th with the cooperation of Self-Defense Forces.
- At approximately past 7:00 pm, March 17th, Self-Defense Forces and the police started spraying water by water cannon trucks upon our request for the cooperation. At 8:09 pm, March 17th, they finished the operation.
- At 2:00 pm, March 18th, spraying water by fire engines was started with the cooperation of Self-Defense Forces and the United States Armed Forces. At 2:45 pm, March 18th, the operation was finished.
- At approximately 12:30 am, March 19th, spraying water was started with the cooperation of Fire Rescue Task Forces of Tokyo Fire Department. At approximately 1:10 am, March 19th, the operation was finished. They resumed spraying water at 2:10 pm and finished at approximately 3:40 am, March 20th.
- At approximately 9:30 pm, March 20th, spraying water was started with the cooperation of Fire Rescue Task Forces of Tokyo Fire Department. At approximately 3:58 am, March 21th, they the operation was finished.
- At approximately 3:55 pm, March 21st, light gray smoke was confirmed arising from the southeast side of the 5th floor roof of the Unit 3 building. The situation was reported to the fire department at approximately 4:21 pm. The parameters of reactor pressure vessel, reactor containment vessel, and monitored environmental data remained stable without significant change. However, employees working around Unit 3 evacuated to a safe location. On March 22nd, the color of smoke changed to somewhat white and it is slowly dissipating.
- At approximately 3:10 pm on March 22nd, spraying water to Unit 3 by Tokyo Fire Department's Hyper Rescue and Osaka City Fire Department was conducted, and completed at approximately 4:00 PM on the same day.
- At approximately 10:45 pm on March 22nd, lights in the main control room were restored.
- At 11:00 am on March 23rd, the injection of sea water to spent fuel pool was conducted, and finished approximately at 1:20 pm on the same day.
- At 4:20 pm on March 23rd, light gray smoke was observed belching from Unit 3 building. The situation was reported to the fire department at

4:25 pm on March 23rd. The parameters of the reactor, the reactor containment vessel of Unit 3, and monitored figures around the site's immediate surroundings remained stable without significant change. To be safe, workers in the main control room of Unit 3 and around Unit 3 evacuated to a safe location. At approximately 11:30 pm on March 23rd and 4:50 am on March 24th, TEPCO employees confirmed the smoke has disappeared. Accordingly, workers evacuation was lifted.
- From approximately 5:35 am on March 24th, sea water injection through Fuel Pool Cooling and Filtering System was initiated, and finished at approximately 4:05 pm on the same day.
- From 1:28 pm on March 25th, Hyper Rescue team started water spray. The work finished at 4:00 pm on March 25th.
- From 6:02 pm on March 25th, the injection of freshwater to the reactor was started (switched from the seawater injection). At 8:30 pm on March 28th, the injection of fresh water is switched to temporary electricity pumps from the fire engine pumps.
- At approximately 12:34pm March 27th , the injection of water by the concrete pump truck was started. At approximately 2:36 pm, March 27th, the operation was finished.
- At approximately 2:17pm March 29th, the injection of fresh water by the concrete pump truck was started. (Sea water had been injected so far and transfer from seawater to freshwater was made). The water injection was finished at 6:18 PM, March 29th.
- At approximately 5:40 pm, March 28th, the water in condensate reservoirs was being transferred to suppression pool water surge-tanks to prepare for water transfer from a condenser to condensate reservoirs in order to drain water on the underground floor of the turbine building into a condenser.

* Unit 4
- At approximately 6:00 am, March 15th, an explosive sound was heard and the damage in the 5th floor roof of Unit 4 reactor building was confirmed. At 9:38 am, the fire near the north-west part of 4th floor of Unit 4 reactor building was confirmed. At approximately 11:00 am, TEPCO employees confirmed that the fire was out.
- At approximately 5:45 am on March 16th, a TEPCO employee discovered a fire at the northwest corner of the Nuclear Reactor Building. TEPCO immediately reported this incident to the fire department and the local government and proceeded with the extinction of fire. At approximately 6:15 am, TEPCO staff confirmed at the site that there are no signs of fire.
- At approximately 8:21 am on March 20th, spraying water by fire engines was started with the cooperation of Self-Defense Forces and they finished the operation at approximately 9:40 am. At approximately 6:45 pm spraying water was started by Self-Defenses' water cannon trucks and finished at approximately 7:45 pm.
- At approximately 6:30 am, March 21st, spraying water by fire engines was started with the cooperation of Self-Defense Forces and the United States Armed Forces. At approximately 8:40 am, March 21, they had finished the operation.
- On March 21st, cabling has been completed from temporary substation to the main power center.
- From approximately 5:20 pm on March 22nd, spraying water from the concrete pumping vehicle was conducted and ended at approximately 8:30 pm on the same day.
- From approximately 10:00 am on March 23rd, spraying water from the concrete pumping vehicle was conducted and ended at approximately 1:00 pm on the same day.
- From approximately 2:35 pm on March 24th, spraying water by the concrete pumping vehicle was conducted and ended at approximately 5:30 pm on the same day.
- From 6:05 am on March 25th, seawater injection through Fuel Pool Cooling and Filtering System was initiated and finished at approximately 10:20 am on the same day.
- From 7:05 pm on March 25th, water spray by the concrete pumping vehicle was started and finished at 10:07 pm on March 25th.
- From 4:55 pm on March 27th, water spray by the concrete pumping vehicle was started and finished at 7:25 pm on March 27th.
- At approximately 11:50 am on March 29th, lights in the main control room were restored.
- From 2:04 pm on March 30th, water spray by the concrete pumping vehicle was started and finished at 6:33 pm on March 30th.

* Unit 5 and 6
- At 5:00 am on March 19th, we started the Residual Heat Removal System Pump (C) of Unit 5 in order to cool the spent fuel pool. At 10:14 pm, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
- Unit 5 has been in reactor cold shutdown since 2:30 pm on March 20th. Unit 6 has been in reactor cold shutdown since 7:27 pm on March 20th.
- At Units 5 and 6, in order to prevent hydrogen gas from accumulating within the buildings, we have made three holes on the roof of the reactor building for each unit.
- At approximately 5:24 pm on March 23rd, the temporary Residual Heat Removal System Seawater Pump automatically stopped when its power source was switched. We restarted the pump at around 4:14 pm, March 24th, and resumed cooling of reactor at around 4:35 pm.

* On March 18th, regarding the spent fuel in the common spent fuel pool, we have confirmed that the water level of the pool is secured. At around 10:37 am March 21st, water spraying to common spent fuel pool and finished at 3:30 pm. At around 6:05 pm, fuel pool cooling pump was started to cool the pool.
  * common spent fuel pool: a spent fuel pool for common use set in a separate building in a plant site in order to preserve spent fuel which are transferred from the spent fuel pool in each Unit building.

* On March 17th, we patrolled buildings for dry casks and found no signs of abnormal situation for the casks by visual observation. A detailed inspection is under preparation.
  * dry cask: a measure to store spent fuel in a dry storage casks in storages. Fukushima Daiichi Nuclear Power Station started to utilize the measure from August 1995.

* In total 13 fire engines are lent for spraying water to the spent fuel pools and water injection to the nuclear reactors by various regional fire departments* as well as Tokyo Fire Department. Also, instruction regarding the setting and operation of large scale decontamination system was provided.

* On March 21st, 23rd to 29th, we detected technetium, cobalt, iodine, cesium, tellurium, barium, lanthanum and molybdenum from the seawater around discharge canal of Unit 1, 2, 3 and 4.

* On March 20th, 21st, 23rd to 29th, we detected iodine, cesium, tellurium and ruthenium in the air collected at the site of Fukushima Daiichi Nuclear Power Station.

* Plutonium has detected from the sample of soil at the site of Fukushima Daiichi Nuclear Power Station collected on 21st and 22nd of March, Concentration level of Plutonium detected was same as that of under usual environment and it is thought not to be harmful to human health. We will strengthen environmental monitoring of power station and surrounding environment.

* On March 28th, we detected radioactive materials contained in the puddles found in the turbine building of Unit 1 to 4.

* At approximately 3:30 pm, March 27th, we found water pooling in the vertical shaft of the trench outside of the turbine buildings for Units 1 to 3. The radiation dose at the surface of the water amounted 0.4 mSv/h in Unit 1 and over 1,000 mSv/h in Unit 2. We could not confirm the amount of the radiation dose in Unit 3. We will keep observing the condition of the water in the vertical shaft.
On March 29th, we detected niobium, tellurium, ruthenium, silver, tellurium, iodine, cesium, and ruthenium in the water collected at the trench of unit 1.

* We found a puddle of water at the main building of the centralized environmental facility process. We analyzed and detected approximately 1.2 x 10^1Bq/cm3 of radioactivity in full dose in the Controlled Area and 2.2 x 10^1Bq/cm3 in full dose in the Non-Controlled Area on March 29.

* At 12:03 pm, March 29th, when taking off the flange of the pipe of the seawater piping of the Residual Heat Removal System, 3 workers from our subcontractor were soaked with water in the pipe. After wiping the water off, we confirmed that there was no radioactive contamination to their bodies.

* We will continuously endeavor to securing safety, and monitoring of the surrounding environment.

Fukushima Daini Nuclear Power Station:
Units 1 to 4: shutdown due to the earthquake
* The national government has instructed evacuation for those local residents within 10km radius of the periphery.

* In order to achieve cold shutdown, reactor cooling function was restored and cooling of reactors was conducted. As a result, all reactors achieved cold shutdown: Unit 1 at 5:00 pm, March 14th, Unit 2 at 6:00 pm, March 14th, Unit 3 at 0:15 pm, March 12th, Unit 4 at 7:15 am, March 16th.

* At 2:30 pm on March 30th, the power source of the residual heat removal system(B) to cool the reactor of Unit 1 was secured from an emergency power source in addition to an offsite power. This means that all the units secure backup power sources (emergency power sources) for the residual heat removal systems(B).

* (Unit 1)
As it is confirmed that the temperature of the Emergency Equipment Cooling Water System *1 has increased, at 3:20 pm, March 15th, we stopped the Residual Heat Removal System (B) for the inspection. Subsequently, failure was detected in the power supply facility associated with the pumps of the

Emergency Equipment Cooling Water System. At 4:25 pm, March 15th, after replacing the power facility, the pumps and the Residual Heat Removal System (B) have been reactivated.

* (Unit 4)
As it is confirmed that the pressure at the outlet of the pumps of the Emergency Equipment Cooling Water System*1 has been decreased, at 8:05 pm, March 15th, we stopped the Residual Heat Removal System (B) for the inspection. Subsequently, failure was detected in the power supply facility associated with the pumps of the Emergency Equipment Cooling Water System. At 9:25 pm, March 15th, after replacing the relevant facility, the pumps and the Residual Heat Removal System (B) have been reactivated.

*1:emergency water system in which cooling water (pure water) circulates which exchanged the heat with sea water in order to cool down bearing pumps and/or heat exchangers etc.

Kashiwazaki Kariwa Nuclear Power Station:
Units 1, 5, 6, 7: normal operation
(Units 2 to 4: outage due to regular inspection)

[Thermal Power Station]
- Hirono Thermal Power Station Units 2 and 4: shutdown due to the earthquake
- Hitachinaka Thermal Power Station Unit 1: shutdown due to the earthquake
- Kashima Thermal Power Station Units 2, 3, 5, 6: shutdown due to the earthquake

[Hydro Power Station]
- All the stations have been restored.
  (Facilities damaged by the earthquake are now being repaired in a timely manner.)

[Transmission System, etc.]
- All substation failed due to the earthquake have been restored.
  (Facilities damaged by the earthquake are now being repaired in a timely manner.)

[Power Supply to TEPCO's Service Areas]
- Except in case of planned rolling blackouts, we can supply electricity to our all service areas.

[Supply and Demand Status within TEPCO's Service Area to Secure Stable Power Supply]
- Considering the critical balance of our power supply capacity and expected power demand forward, in order to avoid unexpected blackout, TEPCO has been implementing rolling blackout (planned blackout alternates from one area to another) since Mar 14th. We will make our utmost to secure the stable power supply as early as possible. For customers who will be subject to rolling blackout, please be prepared for the announced blackout periods. Also for customers who are not subject to blackouts, TEPCO appreciates your continuous cooperation in reducing electricity usage by avoiding using unnecessary lighting and electrical equipment.

[Others]
- Please do NOT touch cut-off electric wires.
- In order to prevent fire, please make sure to switch off the electric appliances such as hair driers when you leave your house.
- For the customer who has in-house power generation, please secure fuel for generator.

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Schaperow, Jason

From: Schaperow, Jason
Sent: Thursday, March 31, 2011 12:24 PM
To: Wucher, John
Cc: Greenwood, Carol
Subject: RE: Mailbox Size Increase Request - Jason Schaperow

Importance: High

Hi John,

I am incredibly busy today. The US Embassy in Tokyo wants us to estimate radiation doses in Japan, so they can decide whether to let U.S. citizens return to the area between 20 and 50 miles from the Fukushima Daiichi reactors.

Is there something you can do to fix this problem for me, so I don't have to do anything?

Also, neither of the black and white printers on my floor are working today. They were not working yesterday either.

Thanks,
Jason

From: RESHelpDesk Resource
Sent: Thursday, March 31, 2011 9:19 AM
To: Schaperow, Jason
Subject: FW: Mailbox Size Increase Request - Jason Schaperow
Importance: High

Is your Mailbox setup to archive? This will save your emails to your C:\ and reduce the amount of mail in your mailbox.

Call 301-415-1234 option 2 and ask them to setup auto archiving.

JOHN WUCHER
IT Specialist
(301) 251-7960
Mail stop: 06D20M
CSB 06D03

From: Greenwood, Carol
Sent: Thursday, March 31, 2011 8:41 AM
To: RESHelpDesk Resource
Subject: Mailbox Size Increase Request - Jason Schaperow
Importance: High

Per the below message, any chance his mailbox size can be increased?

Regards

LLLL/153

Carol Greenwood
Lead Administrative Assistant
RES/DSA
U.S. Nuclear Regulatory Commission
Phone: 301-251-7499

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

From: Schaperow, Jason
Sent: Thursday, March 31, 2011 8:25 AM
To: Greenwood, Carol
Subject: FW: Your mailbox is almost full.
Importance: High

Hi Carol,

Earlier today, I receive the email below. I can't just delete lots of emails, because I received 2 or 3 FOIA requests in the last few weeks. I don't really have time to deal with it, because I am working full time (plus overtime) to respond to the Fukushima accident. I could use some help and advice.
How can I quickly reduce the amount of mail in my mailbox without violating FOIA rules to not throw stuff away after receiving a FOIA?
Alternatively, how can I get my mailbox size increased?

Thanks,
Jason

From: Microsoft Exchange
Sent: Thursday, March 31, 2011 1:00 AM
To: Schaperow, Jason
Subject: Your mailbox is almost full.
Importance: High

Your mailbox is almost full.

815MB **900**MB

Please reduce your mailbox size. Delete any items you don't need from your mailbox and empty your Deleted Items folder.

Sent by Microsoft Exchange Server 2007

Schaperow, Jason

From: Schaperow, Jason
Sent: Thursday, March 31, 2011 2:21 PM
To: Bixler, Nathan E
Attachments: Unit 1 FP release.xlsx

Please check columns L, M, N on sheet 1. I will call you in a few minutes. Thanks.

LLLL/154

Unit 1	
MWe	460
MWt	1380

Isotopic group	Release percent	Release fraction	Release duration (hours)
Kr, Xe	30	0.3	0.5
I	1.1	0.011	0.5
Te, Sb	0.72	0.0072	0.5
Cs	1.8	0.018	24
Ba	1.6	0.016	0.5
Sr	1.6	0.016	0.5
Ce, Np	0.1	0.001	0.5
La, Y	0.005	0.00005	24
Ru	0.0006	0.000006	0.5
Mo		0.004	24

isotope	corinv (Ci/MWt)	corinv (Ci)	release fraction	release duration (hours)	release (Ci)	half-life (sec)	decay time (sec)	release corrected for decay (Ci)
Ba140	5.30E+04	7.31E+07	0.016	0.5	1.17E+06	1.11E+06	3024000	1.77E+05
Ce144	2.80E+04	3.86E+07	0.001	0.5	3.86E+04	2.46E+07	3024000	3.55E+04
Cs134	4.17E+03	5.75E+06	0.018	24	1.04E+05	6.50E+07	3024000	1.00E+05
Cs136	1.00E+03	1.38E+06	0.018	24	2.48E+04	1.13E+06	3024000	3.89E+03
Cs137	2.67E+03	3.68E+06	0.018	24	6.63E+04	9.51E+08	3024000	6.62E+04
I131	2.80E+04	3.86E+07	0.011	0.5	4.25E+05	6.95E+05	3024000	2.08E+04
I132	4.00E+04	5.52E+07	0.011	0.5	6.07E+05	8.24E+03	3024000	2.15E-105
I133	5.70E+04	7.87E+07	0.011	0.5	8.65E+05	7.49E+04	3024000	6.11E-07
I134	6.30E+04	8.69E+07	0.011	0.5	9.56E+05	3.16E+03	3024000	9.28E-283
I135	5.00E+04	6.90E+07	0.011	0.5	7.59E+05	2.37E+04	3024000	3.01E-33
Kr85	3.17E+02	4.37E+05	0.3	0.5	1.31E+05	3.38E+08	3024000	1.30E+05
Kr85m	8.00E+03	1.10E+07	0.3	0.5	3.31E+06	1.61E+04	3024000	9.79E-51
Kr87	1.60E+04	2.21E+07	0.3	0.5	6.62E+06	4.56E+03	3024000	1.71E-193
Kr88	2.30E+04	3.17E+07	0.3	0.5	9.52E+06	1.02E+04	3024000	5.64E-83
La140	5.30E+04	7.31E+07	0.00005	24	3.66E+03	1.45E+05	3024000	1.93E-03
Mo99	5.30E+04	7.31E+07	0.004	24	2.93E+05	2.38E+05	3024000	4.39E+01
Np239	5.50E+05	7.59E+08	0.001	0.5	7.59E+05	2.03E+05	3024000	2.49E+01
Ru103	3.70E+04	5.11E+07	0.000006	0.5	3.06E+02	3.40E+06	3024000	1.65E+02
Ru106	1.33E+04	1.84E+07	0.000006	0.5	1.10E+02	3.18E+07	3024000	1.03E+02
Sb127	2.00E+03	2.76E+06	0.0072	0.5	1.99E+04	3.28E+05	3024000	3.34E+01
Sb129	1.10E+04	1.52E+07	0.0072	0.5	1.09E+05	1.58E+04	3024000	2.73E-53
Sr89	3.10E+04	4.28E+07	0.016	0.5	6.84E+05	4.36E+06	3024000	4.23E+05
Sr90	2.00E+03	2.76E+06	0.016	0.5	4.42E+04	9.15E+08	3024000	4.41E+04
Sr91	3.70E+04	5.11E+07	0.016	0.5	8.17E+05	3.43E+04	3024000	2.39E-21
Te129m	1.80E+03	2.48E+06	0.0072	0.5	1.79E+04	2.89E+06	3024000	8.66E+03
Te131m	4.00E+03	5.52E+06	0.0072	0.5	3.97E+04	1.08E+05	3024000	1.49E-04
Te132	4.00E+04	5.52E+07	0.0072	0.5	3.97E+05	2.81E+05	3024000	2.29E+02
Xe131m	3.30E+02	4.55E+05	0.3	0.5	1.37E+05	1.00E+06	3024000	1.68E+04
Xe133	5.70E+04	7.87E+07	0.3	0.5	2.36E+07	4.54E+05	3024000	2.33E+05
Xe133m	2.00E+03	2.76E+06	0.3	0.5	8.28E+05	2.00E+05	3024000	2.33E+01
Xe135	1.10E+04	1.52E+07	0.3	0.5	4.55E+06	3.27E+04	3024000	6.70E-22
Xe138	5.70E+04	7.87E+07	0.3	0.5	2.36E+07	1.00E+03	3024000	0.00E+00
Y91	4.00E+04	5.52E+07	0.00005	24	2.76E+03	5.06E+06	3024000	1.82E+03

Releases are from unmitigated LTSBO in NUREG-1935, Rev. 2, 4/30/10
Assumes 70% core damage previously
Noble gas, I, Te releases from NUREG-1935 multiplied by 0.3
Cs release is from revaporization, Ba release is from CCI/oxidation
Ci/MWt is from RASCAL code manual, Table 1.1
Half-lives for Xe131m, Xe133m, Xe138 are from NUREG/CR-5106
Other half-lives are from NUREG/CR-4467
Decay time is 35 days (March 11 to April 15)

isotope	release fraction	release duration (hours)	release corrected for decay (Ci)
Ba140	0.016	0.5	1.77E+05
Ce144	0.001	0.5	3.55E+04
Cs134	0.018	24	1.00E+05
Cs136	0.018	24	3.89E+03
Cs137	0.018	24	6.62E+04
I131	0.011	0.5	2.08E+04
I132	0.011	0.5	2.15E-105
I133	0.011	0.5	6.11E-07
I134	0.011	0.5	9.28E-283
I135	0.011	0.5	3.01E-33
Kr85	0.3	0.5	1.30E+05
Kr85m	0.3	0.5	9.79E-51
Kr87	0.3	0.5	1.71E-193
Kr88	0.3	0.5	5.64E-83
La140	0.00005	24	1.93E-03
Mo99	0.004	24	4.39E+01
Np239	0.001	0.5	2.49E+01
Ru103	6E-06	0.5	1.65E+02
Ru106	6E-06	0.5	1.03E+02
Sb127	0.0072	0.5	3.34E+01
Sb129	0.0072	0.5	2.73E-53
Sr89	0.016	0.5	4.23E+05
Sr90	0.016	0.5	4.41E+04
Sr91	0.016	0.5	2.39E-21
Te129m	0.0072	0.5	8.66E+03
Te131m	0.0072	0.5	1.49E-04
Te132	0.0072	0.5	2.29E+02
Xe131m	0.3	0.5	1.68E+04
Xe133	0.3	0.5	2.33E+05
Xe133m	0.3	0.5	2.33E+01
Xe135	0.3	0.5	6.70E-22
Xe138	0.3	0.5	0.00E+00
Y91	0.00005	24	1.82E+03

Schaperow, Jason

From: Schaperow, Jason
Sent: Thursday, March 31, 2011 3:05 PM
To: 'kcw@dycoda.com'
Subject: RE: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

You can ignore my question. A 3 gpm leak integrated over 24 hours is only 4000 gal. I am guessing that such a small amount would not show up on your plots.

From: Schaperow, Jason
Sent: Thursday, March 31, 2011 3:03 PM
To: 'kcw@dycoda.com'
Subject: RE: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat
Importance: High

Thanks. Does the level decrease shown in you plots include a 3 gpm leak?

From: Casey Wagner [mailto:kcw@dycoda.com]
Sent: Thursday, March 31, 2011 2:57 PM
To: Tinkler, Charles; Schaperow, Jason
Subject: RE: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

In WORD format... The two plots are identical but flipped the units on the axes.

From: Casey Wagner [mailto:kcw@dycoda.com]
Sent: Thursday, March 31, 2011 12:32 PM
To: 'Tinkler, Charles'; 'Schaperow, Jason' (Jason.Schaperow@nrc.gov)
Subject: RE: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

Truncated to 24 hours and slight adjustment on the initial level.

From: Casey Wagner [mailto:kcw@dycoda.com]
Sent: Thursday, March 31, 2011 12:18 PM
To: 'Tinkler, Charles'; 'Schaperow, Jason' (Jason.Schaperow@nrc.gov)
Subject: RE: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

Hi Jason (and Charlie),

Sorry this took so long. It was much, much easy to start above the specified state, heat to Tsat, and then boil to the starting spot. Is 3 days enough time?

KC

From: Casey Wagner [mailto:kcw@dycoda.com]
Sent: Thursday, March 31, 2011 11:52 AM
To: 'Tinkler, Charles'; 'Schaperow, Jason' (Jason.Schaperow@nrc.gov)
Subject: RE: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

LLLL/155

Sorry. It is way too hard to specify the hundred or so conditions necessary to specify this initial condition. It just dawned on me to start a boil-off and we will translate time to the right conditions.

From: Tinkler, Charles [mailto:Charles.Tinkler@nrc.gov]
Sent: Thursday, March 31, 2011 11:38 AM
To: kcw@dycoda.com
Subject: RE: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

Please send new plot to Jason also

From: Casey Wagner [mailto:kcw@dycoda.com]
Sent: Thursday, March 31, 2011 12:59 PM
To: Tinkler, Charles
Subject: RE: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

I did not adjust for the hydrostatic pressure, so the pool was just slightly subcooled and no void at the start (i.e., the reason for no immediate drop). I will fix that and send a new plot.

From: Casey Wagner [mailto:kcw@dycoda.com]
Sent: Thursday, March 31, 2011 10:47 AM
To: Charles.Tinkler@nrc.gov
Subject: Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

Initial Conditions (ICs): Level = -2 ft, Temp = Tsat

Let me know if it is still confusing.

Wagner, Katie

From: Wagner, Katie
Sent: Thursday, March 31, 2011 5:03 PM
To: Lee, Richard
Subject: RE: Fukushima Dai Ichi Nuclear Power Plant containment integrity from Ki Sig Kang, IAEA

Richard,

I see you are in a telecom right now, is the following item "Pending" or "Complete"?

45	3/24/2011	Jason Petti of Sandia for IAEA	jppetti@sandia.gov	Richard Lee x7526 Charlie Tinkler x7496	FSTB/DSA	Request for Sandia staff help with questions relating to containment integrity and using sea water to cool systems. ***Update as of 3/30***: DE was asked to lead, also SNL asked B. Sheron for information.	Determine if Sandia should help answer IAEA's questions. ***Update as of 3/30***: DE was asked to lead, also SNL asked B. Sheron for information.	Pending

Thanks,

Katie

-----Original Message-----
From: Petti, Jason P [mailto:jppetti@sandia.gov]
Sent: Thursday, March 31, 2011 11:30 AM
To: Lee, Richard
Cc: Pickering, Susan Y; Wagner, Katie; Khalil, Imane
Subject: RE: Fukushima Dai Ichi Nuclear Power Plant containment integrity from Ki Sig Kang, IAEA

Richard

Thanks for getting back to me. I just wanted to clarify something. Are we allowed to add any thoughts/concerns to the staff's response when replying to the IAEA?

Jason

-----Original Message-----
From: Lee, Richard [mailto:Richard.Lee@nrc.gov]
Sent: Thursday, March 31, 2011 9:03 AM
To: Petti, Jason P
Cc: Pickering, Susan Y; Wagner, Katie
Subject: RE: Fukushima Dai Ichi Nuclear Power Plant containment integrity from Ki Sig Kang, IAEA

Hi, Jason:

The following is the response that I got from RES Division of Engineering staff who specialized in containment structure.
Please feel free to share it with IAEA. You do not need to do further evaluation on this.

"Two pressures are of interest when considering venting: leakage pressure and rupture pressure. According to NUREG/CR- 6920, the leakage pressure for the wetwell is around 0.8 MPa (116 psi) and for the drywell it is around 1.0 MPa (145 psi). The rupture pressure is about 1.0-1.2 MPa, which is consisted to 2.5-3x design

LLLL/156

pressure. Note that these pressures are also temperature dependent, but that dependency is weak until about 200 deg. C (400 deg. F).

While carbon steel is not highly vulnerable to cracking, the salt can increase the crevice/pitting corrosion so some degradation of the values listed above can be expected. The once you have the conditions for localized corrosion, the rate can be as high as 10 cm/year (4 in/year). The containment shell thickness for MK-Is varies from 0.75-1.75 in (1.9-4.5 cm) at various locations. NUREG/CR-6920 estimates that localized corrosion of up to 50% of the thickness reduces the leakage and rupture pressure by 10-20%."

Best regards,
Richard

-----Original Message-----
From: Petti, Jason P [mailto:jppetti@sandia.gov]
Sent: Thursday, March 24, 2011 3:14 PM
To: Lee, Richard
Cc: Pickering, Susan Y; Khalil, Imane; Gauntt, Randall O
Subject: FW: Fukushima Dai Ichi Nuclear Power Plant containment integrity from Ki Sig Kang, IAEA

Richard

The email Susan Pickering and I described to you on the phone from the IAEA is attached, and includes their requests for information/opinions.

Our potential plan would be to consult with Sandia staff members (Mike Hessheimer, Randy Gauntt) to provide a quick opinion based on past work on similarly designed US plants (2-3 hours of time).

Past/current work in structural response of containments has been performed for NRC/Research under Rosemary Hogan's branch with the PMs Herman Graves and Jose Pires.

Please let me know if you need more information.

Jason

Jason P. Petti, Ph.D
Structural & Thermal Analysis Department 6233 Sandia National Laboratories, Albuquerque, New Mexico
Phone: 505-284-8574
Email: jppetti@sandia.gov

-----Original Message-----
From: K-S.Kang@iaea.org [mailto:K-S.Kang@iaea.org]
Sent: Thursday, March 24, 2011 11:53 AM
To: Petti, Jason P
Subject: Fukushima Dai Ichi Nuclear Power Plant containment integrity from Ki Sig Kang, IAEA

Dear Dr. Jason Petti,

I got you name through Dr. Naus from ORNL. Can I ask your engineering judgement to Fukushima Dai Ichi nuclear power plant containment ?
I have very very urgent issues related to Fukushima Dai Ichi Npp containment. The thickness of reinforced concrete containment is from
1.2 to 1.6 M and containment has a carbon steel plate (6 mm). (see attached file)

Can I ask you the important questions ?
Containment design pressure of Fukushima Dai Ichi Npp unit 1 is 3.84 MPa and the Max. operation pressure is 4.27 MPa..
Due to reactor temperature high of unit 1, Japan released high steam from reactor pressure vessel to suppression pool and then containment pressure was increased from 3.2 to 3.8 Mpa.

My Questions are :
1. What are the major elements to keep the containment integrity ?
2. To keep containment integrity under design pressure, Japan should release pressure through venting system, but it is very difficult to release pressure to environment due to radiation material.
How can maintain or decrease pressure of containment in current situation without venting ?
3. What is the maximum operating pressure according to your judgement ?
4. If Japan insert sea water to dry well to cool down RPV and containment, is this good suggestion ?

Based on your knowledge and profession, please reply and if you have any reference documents, send them to me.

Thanks for your reply in advance.

Note : Thanks Dan for your recommendation.

Ki- Sig KANG

Technical Head (PLiM/LTO)

Nuclear Power Engineering Section
Division of Nuclear Power
International Atomic Energy Agency

Tel: +43 1 2600 22796
Fax: +43 1 2600 29598
E-mail: Ki-Sig.KANG@iaea.org

-----Original Message-----
From: nausdj@ornl.gov [mailto:nausdj@ornl.gov]
Sent: Thursday,24 March 2011 17:44
To: KANG, Ki-Sig
Subject: Re: Containment integrity from Ki Sig Kang, IAEA

Hi Ki-Sig,

Unfortunately I can not answer your questions because my background is materials and not structural analysis
You might contact Jason Petti
(jppetti@snl.gov) at Sandia as they have done the model tests of containment vessels for NRC and correlated analyses of the tests.

Use of seawater definitely makes steel corrosion an issue.

Best regards,

dan

On 3/24/11 11:27 AM, "K-S.Kang@iaea.org" <K-S.Kang@iaea.org> wrote:

Hello Naus,

Long time I do not have any communication with you. I have very very urgent issues related to Fukushima Dai Ichi Npp containment.
The thickness of reinforced concrete containment is from 1.2 to 1.6 M and containment has a carbon steel plate (6 mm).

Can I ask you the important questions ?

Containment design pressure of Fukushima Dai Ichi Npp unit 1 is 3.84 MPa and the Max. operation pressure is 4.27 MPa..
Due to reactor temperature high of unit 1, Japan released high steam from reactor pressure vessel to suppression pool and then containment pressure was increased from 3.2 to 3.8 Mpa.

My Questions are :
1. What are the major elements to keep the containment integrity ?

2. To keep containment integrity under design pressure, Japan should release pressure through venting system, but it is very difficult to release pressure to environment due to radiation material.
How can maintain or decrease pressure of containment in current situation without venting ?

3. What is the maximum operating pressure according to your judgement ?

4. If Japan insert sea water to dry well to cool down RPV and containment, is this good suggestion ?

Based on your knowledge and profession, please reply and if you have any reference documents, send them to me.

Thanks for your reply in advance.

[cid:3383815441_5634291]

Ki- Sig KANG

Technical Head (PLiM/LTO)
Nuclear Power Engineering Section
Division of Nuclear Power
International Atomic Energy Agency
Tel: +43 1 2600 22796
Fax: +43 1 2600 29598

E-mail: Ki-Sig.KANG@iaea.org

Greenwood, Carol

From: Gibson, Kathy
Sent: Friday, April 01, 2011 1:38 PM
To: Lee, Richard; Tinkler, Charles
Subject: Fw: CRS draft document on Japanese event - for your awareness
Attachments: CRS Report 110331 Japan reactor v2.pdf

From: Sheron, Brian
To: Case, Michael; Coe, Doug; Correia, Richard; Gibson, Kathy; Richards, Stuart; Scott, Michael; Uhle, Jennifer; Valentin, Andrea
Sent: Fri Apr 01 13:35:32 2011
Subject: FW: CRS draft document on Japanese event - for your awareness

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From: Jones, Cynthia
Sent: Friday, April 01, 2011 1:00 PM
To: Wiggins, Jim; Evans, Michele; Rothschild, Trip; Brenner, Eliot; Hayden, Elizabeth; Leeds, Eric; Boger, Bruce; Uhle, Jennifer; Sheron, Brian; Droggitis, Spiros; Merzke, Daniel; Virgilio, Martin; Weber, Michael; Burnell, Scott; McDermott, Brian; Morris, Scott
Subject: CRS draft document on Japanese event - for your awareness

FYI-

Last weekend amongst all the other requests, we (PMT and myself) were requested to review and assist the Congressional Research Service (CRS) on their draft document on the Japanese event. I just rec'd a copy from them, for your awareness.

The RST (Rx Safety Team) had no comments, but we had a lot, and I think it showed an improved production in this version. Please share with your staff (I already passed along to RST & PMT).

I expect that CRS will share with Congress shortly.

Cyndi

From: Jonathan Medalia [mailto:JMEDALIA@crs.loc.gov]
Sent: Friday, April 01, 2011 12:01 PM
To: Jones, Cynthia
Subject: RE: your phone message on CRS draft document

I'm updating the report to add an appendix with useful links, and of course have included a couple from NRC. Thanks again for your good work.
Jon

>>> "Jones, Cynthia" <Cynthia.Jones@nrc.gov> 4/1/2011 11:59 AM >>>
Thanks Jon

From: Jonathan Medalia [mailto:JMEDALIA@crs.loc.gov]
Sent: Thursday, March 31, 2011 6:31 PM
To: Jones, Cynthia

LLL-/157

Cc: Sun, Casper; LIA06 Hoc; Hoc, PMT12
Subject: Re: your phone message on CRS draft document

Hi Cyndi, Casper, et al.,
Thanks for your comments on my report, Cyndi. I have worked through them and now have the report in good shape. I'll be in touch if I have further questions, but for now I think I'm ok. I've attached the report. You will notice that I acknowledge assistance from NRC, which I greatly appreciate. I will update the report from time to time, so let me know if you have any thoughts, esp. things to add.
Best,
Jon

Jonathan Medalia, Ph.D.
Specialist in Nuclear Weapons Policy
Congressional Research Service
202-707-7632
jmedalia@crs.loc.gov

The Japanese Nuclear Incident: Technical Aspects

Jonathan Medalia
Specialist in Nuclear Weapons Policy

March 31, 2011

Congressional Research Service
7-5700
www.crs.gov
R41728

CRS Report for Congress
Prepared for Members and Committees of Congress

Summary

Japan's nuclear incident has engendered much public and congressional concern about the possible impact of radiation on the Japanese public, as well as possible fallout on U.S. citizens. This report provides information on technical aspects of the nuclear incident, with reference to human health.

While some radioactive material from the Japanese incident may reach the United States, it appears most unlikely that this material will result in harmful levels of radiation. In traveling thousands of miles between the two countries, some radioactive material will decay, rain will wash some out of the air, and its concentration will diminish as it disperses.

Many atoms are stable; they remain in their current form indefinitely. Other atoms are unstable, or radioactive. They "decay" or "disintegrate," emitting energy through various forms of radiation. Each form has its own characteristics and potential for human health effects.

Nuclear reactors use uranium or mixed oxides (uranium oxide and plutonium oxide, or MOX) for fuel. Uranium and plutonium atoms fission, or split, releasing neutrons that cause additional fissions in a chain reaction, and also releasing energy. A nuclear reactor's core consists of fuel rods made of uranium or MOX encased in zirconium, and neutron-absorbing control rods that are removed or inserted to start or stop the chain reaction. This assembly is placed underwater to carry off excess heat. The incident at the Fukushima Daiichi Nuclear Power Plant prevented water from circulating in the core of several reactors, causing water to evaporate and temperature to rise. High heat could melt the fuel rods and lead to a release of radioactive material into the air.

When uranium and plutonium fission, they split into smaller atoms that are highly radioactive and generate much heat; indeed, fuel rods that have just been removed from a reactor are much more radioactive, and hotter, than fuel rods before they have been inserted into a reactor. After fuel rods can no longer efficiently produce energy, they are considered "spent" and are placed in cooling pools of water for several years to keep them from overheating while the most radioactive materials decay. A concern about the spent fuel pool at reactor 4 is that it may have lost most or all of its water, yet it has more fuel rods than pools at the other five reactors, as it contains all the active fuel rods that were temporarily removed from the reactor core in November 2010 to permit plant maintenance in addition to spent fuel rods.

A nuclear reactor cannot explode like an atomic bomb because the concentration of the type of uranium or plutonium that fissions easily is too low to support a runaway chain reaction, and a nuclear weapon requires one of two configurations, neither of which is present in a reactor.

Some types of radiation have enough energy to knock electrons off atoms, creating "ions" that are electrically charged and highly reactive. Ionizing radiation is thus harmful to living cells. It strikes people constantly, but in doses low enough to have negligible effect. A concern about the reactor incident is that it will release radioactive materials that pose a danger to human health. For example, cesium-137 emits gamma rays powerful enough to penetrate the body and damage cells. Ingesting iodine-131 increases the risk of thyroid cancer. Potassium iodide tablets protect the thyroid, but there is no need to take them absent an expectation of ingesting iodine-131.

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Introduction

The Japanese earthquake and tsunami of March 2011 caused extensive damage to the Fukushima Daiichi Nuclear Power Plant (NPP). This damage has released some radioactive materials, and there are widespread fears about the health effects of current and possible future releases. These fears, and public concern about radiation in general, have attracted the world's attention. This report presents scientific and technical aspects of these issues in order to provide a basis for understanding the risks associated with this event.

Could Harmful Levels of Fallout Reach the United States?[1]

To monitor radiation in the United States, the Environmental Protection Agency (EPA) operates RadNet, which "is a national network of monitoring stations that regularly collect air, precipitation, drinking water, and milk samples for analysis of radioactivity. The RadNet network, which has stations in each state, has been used to track environmental releases of radioactivity from nuclear weapons tests and nuclear accidents."[2] EPA has an online map of these stations,[3] and provides updates on the results of its air monitoring as relates to the Japanese nuclear incident.[4]

Whether harmful levels of radioactive material from the incident reach the United States depends on many factors:

- Particle size: Tiny particles are more readily carried by the wind and can travel farther than large particles, which fall to Earth more rapidly.
- Wind patterns.
- Amount of material released: The more material released, the more likely some of it is to travel long distances.
- Melt vs. burn: If nuclear fuel rods (fresh or spent) melt and form a pool of very hot, highly radioactive liquid, that liquid might be contained by a containment structure. If it melts through that structure, it might contaminate groundwater. If the fuel rods burn, the fire would loft radioactive material into the air. The larger and hotter the fire, and the longer it burns, the more material would be injected into the air.
- Travel time: The longer radioactive material is in the air, the more of it will decay.
- Distance: The farther radioactive material travels, the greater the volume of air in which the material disperses, diluting it.

[1] This section was written by Jonathan Medalia, Specialist in Nuclear Weapons Policy, Foreign Affairs, Defense, and Trade Division.

[2] U.S. Environmental Protection Agency. "RadNet—Tracking Environmental Radiation Nationwide," http://www.epa.gov/narel/radnet/.

[3] U.S. Environmental Protection Agency. "RadNet Map View," https://cdxnode64.epa.gov/radnet-public/showMap.do.

[4] U.S. Environmental Protection Agency. "Japanese Nuclear Emergency: EPA's Radiation Air Monitoring," http://www.epa.gov/japan2011/.

- Rain and snow: Precipitation washes some particles out of the air.

The first four of these factors depend on circumstances; the other three would reduce the amount of material reaching the United States under any circumstances.

According to U.S. nuclear authorities, the reactor incident does not appear to pose an immediate threat to the United States. On March 13, the Nuclear Regulatory Commission (NRC) stated, "Given the thousands of miles between the two countries [United States and Japan], Hawaii, Alaska, the U.S. Territories and the U.S. West Coast are not expected to experience any harmful levels of radioactivity."[5] On March 18, EPA and the Department of Energy stated that a monitoring station in Sacramento "today ... detected minuscule quantities of iodine isotopes and other radioactive particles that pose no health concern at the detected levels," and that between March 16 and 17, a detector in Washington state detected "trace amounts of Xenon-133, which is a radioactive noble gas produced during nuclear fission that poses no concern at the detected level."[6] In a briefing to the Nuclear Regulatory Commission on March 21, Bill Borchardt, NRC Executive Director for Operations, said, "natural background from things like ... rocks, sun, buildings, is 100,000 times more than any level that has been detected to date. We feel confident in our conclusion that there is no reason for concern in the United States regarding radioactive releases from Japan."[7] A press report of March 22 stated that equipment in Charlottesville, VA, detected radiation from the reactor incident, but that "health experts said that the plume's radiation had been diluted enormously in its journey of thousands of miles and that—at least for now, with concentrations so low—its presence will have no health consequences in the United States."[8]

It is useful to put these doses in perspective. Using the figure that natural sources provide 100,000 times the dose recorded in California and Washington state, it is possible to calculate a rough approximation of the dose from the Japanese incident, using the improbable assumption that the dose persists at the detected rate for an entire year. As discussed later, a report estimates that the average American receives a dose of 310 millirem (mrem) per year from natural sources. (Units of radiation dose are discussed under "Health Effects of Ionizing Radiation.") NRC requires its licensees to "limit maximum radiation exposure to individual members of the public" to 100 mrem per year. One one hundred thousandth of 310 mrem per year is a dose of 0.00310 mrem per year. At that rate, it would take 32,258 years to accumulate a dose of 100 mrem; over a 70-year lifespan, the cumulative dose at this rate would amount to 0.22 mrem.

[5] U.S. Nuclear Regulatory Commission. "NRC Sees No Radiation at Harmful Levels Reaching U.S. from Damaged Japanese Nuclear Power Plants," press release no. 11-046, March 13, 2011, http://pbadupws.nrc.gov/docs/ML1107/ML110720002.pdf.

[6] U.S. Department of Energy and Environmental Protection Agency. "Joint EPA/DOE Statement: Radiation Monitors Confirm That No Radiation Levels of Concern Have Reached the United States," press release, March 18, 2011, http://www.energy.gov/news/10190.htm.

[7] U.S. Nuclear Regulatory Commission. "Briefing on NRC Response to Recent Nuclear Events in Japan," public meeting, March 21, 2011, p. 13, http://www.nrc.gov/reading-rm/doc-collections/commission/tr/2011/20110321.pdf.

[8] William Broad, "Radiation over U.S. Is Harmless, Officials Say," *New York Times*, March 22, 2011, p. 6.

What Is Radiation?[9]

Many atoms are stable: they will remain in their current form indefinitely. Some atoms are unstable, or radioactive. They "decay" or "disintegrate," often transforming into atoms of a different element, such as through emission of radiation, which permits the atom to reach a more stable state.[10] The most common types of radiation emitted in decay, and their characteristics, are:

- Alpha particles are two protons plus two neutrons. They are electrically charged and massive by subatomic standards, and travel relatively slowly, so they lose energy quickly in matter. They travel only an inch in air, and are stopped by a sheet of paper or the dead outer layers of skin.
- Beta particles (an electron or positron[11]) are electrically charged, so are readily absorbed by matter, but are much less massive than alpha particles or neutrons. Depending on their energy, some are stopped by outer layers of skin, while others can penetrate several millimeters. They can travel up to several feet in air.
- Neutrons are typically emitted by heavy atoms like uranium and plutonium. They have no electrical charge and may be highly penetrating, depending on their speed. They can travel tens of meters in air; energetic neutrons can penetrate the body. They can be slowed down by hydrogen-containing material like water.
- Gamma rays are photons released during radioactive decay. Photons may be thought of as packets of electromagnetic energy; radio waves, light, and x-rays are less-energetic photons. Gamma ray energies vary widely. Those of medium to high energies are highly penetrating and can travel hundreds of meters in air. Stopping them requires a thick layer of a dense material like lead.

Several measurements are useful in discussing radioactivity. Radioactivity is measured in units of curies (Ci), where 1 Ci = 3.7×10^{10} disintegrations per second, or becquerels (Bq), where 1 Bq = 1 disintegration per second. (The curie is widely used in the United States; the Becquerel is more widely used internationally.) Specific activity—curies per gram—measures how radioactive a material is. Half-life is the time for half the atoms in a mass of particular type of radioactive material to decay. Specific activity is inversely related to half-life. For example, radioactive iodine-131 is intensely radioactive. It has a specific activity of 124,000 curies per gram and a half-life of 8 days; in 10 half-lives (80 days), 99.9 percent of the iodine-131 created at a given time will have decayed. In contrast, uranium-235 has a specific activity of 0.000002 curies per gram and a half-life of 700 million years; it would take 7 billion years (10 half-lives) for 99.9 percent of it to decay.[12] According to Richard Firestone, staff scientist, Lawrence Berkeley

[9] This section was written by Jonathan Medalia, Specialist in Nuclear Weapons Policy, Foreign Affairs, Defense, and Trade Division.

[10] For descriptions of radiation, see Roger Eckhardt, "Ionizing Radiation—It's Everywhere," *Los Alamos Science*, no. 23, 1995, http://www.fas.org/sgp/othergov/doe/lanl/00326627.pdf, and U.S. Environmental Protection Agency, "Radiation: Ionizing and Non-Ionizing," http://www.epa.gov/radiation/understand/index.html.

[11] A positron is a positively-charged electron.

[12] For data on half-lives and other characteristics of radionuclides, see Lawrence Berkeley National Laboratory, "Exploring the Table of Isotopes," http://ie.lbl.gov/education/isotopes.htm, and U.S. Department of Energy. Office of Environmental Management. "Table B.1. Characteristics of important radionuclides," http://www.orau.org/ptp/PTP%20Library/library/DOE/Misc/Table%20B_1_%20Characteristics%20of%20Important%20Radionuclides.htm.

National Laboratory, uranium-235 emits so little radiation that "holding a piece in the hand would cause negligible radiation exposure."[13]

Energy released per decay is measured differently. A standard measure is the electron volt or, more commonly, thousands of electron volts (keV).[14] The penetrating power of gamma rays, and thus their threat to human health, increases as their energy increases.

Each radioactive atom, or "radionuclide," decays in a specific way. For example, when uranium-235 decays,[15] it emits gamma rays, most of which are of 186 keV (a low energy) or less, and alpha particles; cesium-137 emits gamma rays, virtually all of which are of 662 keV, a medium energy, and beta particles. Each radionuclide that emits gamma rays does so in a unique pattern, or "spectrum," of energies that is the primary characteristic used to identify many radionuclides.

Radioactivity and Nuclear Reactors[16,17]

Some heavy atoms, such as uranium-235 and plutonium-239, "fission" when struck by a neutron. In fission, an atom typically (1) splits into two lighter atoms, called "fission products"; (2) releases two or three neutrons; and (3) emits vast quantities of radiation. Fission products are often highly radioactive, such as cesium-137, iodine-131, and strontium-90.

Uranium-235 and plutonium-239 can support a nuclear chain reaction: to oversimplify, one neutron fissions one atom, which releases two neutrons that fission two atoms, releasing four neutrons that fission four atoms, and so on. Neutrons thus drive chain reactions; this is a key concept for understanding nuclear reactors. A supercritical mass supports an increasing rate of fission; fission diminishes in a subcritical mass; and fission proceeds at a constant rate in a critical mass. In an atomic bomb, a supercritical mass of uranium or plutonium supports a chain reaction that proceeds in a tiny fraction of a second, releasing vast quantities of energy. A nuclear reactor is designed to maintain a constant rate of fission. If fission proceeds too quickly, it gets out of control, in which case the fuel rods generate so much heat that they melt. When control rods are inserted into the reactor core, individual atoms continue to fission but the chain reaction stops. Control rods typically contain boron or cadmium because they are efficient neutron absorbers. (Because boron absorbs neutrons, it was added to cooling water in the Fukushima Daiichi NPP incident to prevent inadvertent criticality.) Fission that proceeds at the desired rate releases energy over several years from one load of fuel. The energy heats water to generate steam that spins turbines to generate electricity.

[13] Personal communication, March 30, 2011.

[14] "An electron volt is a measure of energy. An electron volt is the kinetic energy gained by an electron passing through a potential difference of one volt." Fermi National Accelerator Laboratory, "How Big Is an Electron Volt?," http://www-bd.fnal.gov/public/electronvolt.html.

[15] The number following the name of an element is the number of protons plus neutrons in the nucleus.

[16] This section was written by Jonathan Medalia, Specialist in Nuclear Weapons Policy, Foreign Affairs, Defense, and Trade Division, and Mark Holt, Specialist in Energy Policy, Resources, Science, and Industry Division. See also CRS Report R41694, *Fukushima Nuclear Crisis*, by Richard J. Campbell and Mark Holt.

[17] For the status of each reactor, see "Status of the Nuclear Reactors at the Fukushima Daiichi Power Plant," *New York Times*, http://www.nytimes.com/interactive/2011/03/16/world/asia/reactors-status.html., and Japan, Nuclear and Industrial Safety Agency, http://www.nisa.meti.go.jp/english/.

A nuclear reactor cannot explode like an atomic bomb because the fuels and configurations differ. In nature, uranium is 99.3 percent uranium-238 and 0.7 percent uranium-235. Only the latter is "fissile," that is, it will fission when struck by neutrons moving at relatively slow speeds. To make fuel for a bomb or a reactor, the fraction of uranium-235 must be increased through "enrichment."[18] An atomic bomb uses uranium enriched to about 90 percent uranium-235 ("highly enriched uranium," HEU), while nuclear reactor fuel is typically enriched to less than 5 percent ("low enriched uranium," LEU). LEU does not have enough uranium-235 to support a chain reaction of the sort found in an atomic bomb. In addition, a bomb must be configured in one of two ways to create a large enough mass to support a runaway chain reaction; reactors are arranged in an entirely different configuration.

A nuclear reactor uses pellets of LEU or mixed oxides (MOX, i.e., uranium oxide and plutonium oxide) for fuel. Fuel rods—thin zirconium tubes typically between 12 and 15 feet long—hold the fuel. According to one report,

> Zirconium is the metal of choice in this application because it absorbs relatively few of the neutrons produced in a fission reaction and because the metal is highly resistant to both heat and chemical corrosion.
>
> Low neutron absorption is vital to any structural material used in a nuclear reactor because large numbers of neutrons produced by the reaction must be free to interact simultaneously with all the nuclear fuel confined inside hundreds of fuel rods. This interaction sustains the necessary chain reaction throughout the reactor's core.[19]

Even with control rods fully inserted to halt the nuclear chain reaction, the radioactive decay of the fuel rods (primarily from fission products) generates heat, which must be dissipated. At the Fukushima Daiichi NPP, cooling was done by pumping cool water into the reactor. If the heat is not dissipated, the rods become so hot that they melt or burn. A fire would loft particles of radioactive material into the air. If fuel rods become too hot, their zirconium cladding may also react with water and produce hydrogen. The Fukushima Daiichi NPP primary containments used inert nitrogen gas to preclude hydrogen ignition. However, the operators had to vent the primary containment to relieve pressure, introducing hydrogen into the secondary containment, which is believed to have caused the explosions at reactor units 1-3.[20] This explains the urgency of the efforts to keep the fuel rods cool, and why the reactors suffered major damage when backup cooling systems failed.

In order to cool the fuel rods, personnel have been spraying huge amounts of seawater into the reactors and spent fuel pools. However, when seawater boils away from the heat of the fuel rods, it leaves behind large quantities of salt.

> The big question is how much of that salt is still mixed with water, and how much now forms a crust on the reactors' uranium fuel rods. Chemical crusts on uranium fuel rods have been a problem for years at nuclear plants.

---

[18] For information on the enrichment process, see U.S. Nuclear Regulatory Commission. "Fact Sheet on Uranium Enrichment," May 15, 2009, http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/enrichment.html.

[19] "Zirconium: Covering for Fuel Rods," *New York Times*, June 9, 1995, http://www.nytimes.com/1995/06/09/nyregion/zirconium-covering-for-fuel-rods.html.

[20] Information provided by Nuclear Regulatory Commission, personal communication, March 25, 2011.

> Crusts insulate the rods from the water and allow them to heat up. If the crusts are thick enough, they can block water from circulating between the fuel rods. As the rods heat up, their zirconium cladding can ignite, which may cause the uranium inside to melt and release radioactive material.[21]

To alleviate this problem, workers have begun using fresh water instead of seawater.[22]

As the fuel fissions in a reactor, the fraction of fission products in fuel rods increases. When the ratio of fission products to fissile material rises to the point at which a fuel rod can no longer efficiently maintain a chain reaction, it is referred to as spent fuel. "Spent" seems to imply that the fuel has been used up, and is therefore less dangerous, than fresh uranium fuel, but this is not necessarily the case. When fuel rods are first removed from a nuclear reactor, they have a high level of short-lived radionuclides, unlike new fuel rods, so they are intensely radioactive. This radioactivity generates intense heat, so spent fuel rods are placed in pools of water to cool them, typically for several years, until most of the short-lived radionuclides decay. The water also provides shielding against any radioactive release into the air, and the spent fuel pools have no hardened containment structure that would protect against radiation release. If a pool is drained, the fuel rods would heat up, melt, and perhaps burn. This possibility led to concern about the spent fuel rods at Fukushima Daiichi NPP reactor 4:

> The spent fuel pools can be even more dangerous than the active fuel rods, as they are not contained in thick steel containers like the reactor core. As they are exposed to air, the zirconium metal cladding on the rods can catch fire, and a deadly mix of radioactive elements can spew into the atmosphere. ...
>
> According to Tokyo Electric [Power Company]'s data, the spent fuel pool at the No. 4 reactor contains 548 fuel assemblies that were in use at the reactor until last November, when they were moved to the storage pool on the site. That means that the fuel rods were only recently taken out of active use and that their potential to burn and release radioactivity is higher than spent fuel in storage for a longer period.[23]

Another danger comes from the potential release of plutonium from the MOX fuel used at reactor 3. Even very small amounts of plutonium, if inhaled, can potentially cause lung cancer. This explains the concern about that reactor, as it is the only one that uses MOX fuel, although irradiation of uranium fuel also creates plutonium. Water is being pumped into the spent fuel pools at the Fukushima Daiichi NPP reactors as well to cool the fuel rods and prevent additional radiation release.

[21] Keith Bradsher, "New Problems at Japanese Plant Subdue Optimism and Present a Risky Agenda," *New York Times*, March 24, 2011, p. 11.

[22] David Nakamura and Steven Mufson, "Japan Urges More to Evacuate," *Washington Post*, March 26, 2011, p. 1, and "Nuclear Energy—Crisis in Japan," *New York Times*, update of March 30, 2011.

[23] David Sanger, Matthew Wald, and Hiroko Tabuchi, "U.S. Sees 'Extremely High' Radiation Level at Plant, Focusing on Spent Fuel's Impact," *New York Times*, March 17, 2011, p. 13.

Health Effects of Ionizing Radiation[24]

Humans are continuously exposed to significant amounts of ionizing radiation from various naturally occurring and manmade sources. Because of its relatively high energy level, ionizing radiation is capable of producing significant biological change. Ionizing radiation gets its name from the fact that it causes ionization—ejection of electrons—when it interacts with atoms in the molecules that constitute cells and tissue. This process creates charged, often unstable, and highly reactive entities. The ensuing reactions may result in permanent molecular damage. Radiation disrupts cell division, which is why the most sensitive tissues are those in which cells frequently divide, such as skin, hair, bone marrow (where precursor cells give rise to new blood cells), and the cells that line the stomach and small intestine. Ionizing radiation may also damage DNA in chromosomes, resulting in mutations that are responsible for long-term effects such as the development of cancer.

Sources of Radiation Exposure

Naturally occurring sources of ionizing radiation to which all humans are exposed include cosmic radiation from outer space and terrestrial radiation from radioactive materials in rock deposits and soil. The Earth's atmosphere acts as a shield against cosmic radiation, so exposure levels increase with altitude (especially when flying). The most important source of terrestrial exposure is the inhalation of radon, which is produced by the radioactive decay of naturally occurring uranium.

In the United States, radiation exposure as a result of medical practice has increased significantly over the past 25 years as a result of the growing use of CT scans and nuclear medicine procedures to diagnose and treatment disease. Other manmade sources of radiation account for a relatively small fraction of the U.S. population's total exposure. Those sources include consumer products (e.g., cigarettes, building materials, appliances); industrial, security, educational, and research activities, including nuclear power generation; and various types of occupational exposure.

Measuring Exposure: Absorbed Dose v. Equivalent Dose

Human exposure is measured by the amount of energy that ionizing radiation deposits in a unit mass of tissue. This is called the *absorbed dose*. The international unit for the absorbed dose is the gray (Gy), which replaced an earlier unit of dose, the rad (short for "radiation absorbed dose"). One gray equals 100 rad. The biological impact of ionizing radiation, however, depends not just on the absorbed dose (i.e., the amount of energy absorbed) but on the type of radiation. For example, an alpha particle is more damaging to biological tissue than a beta particle or gamma radiation because of its mass, electrical charge, and slow speed. Alpha particles lose their energy much more densely along the relatively short path they travel though biological tissue. Thus, 1 Gy of alpha radiation is more harmful than 1 Gy of beta or gamma radiation.

Radiation scientists use another quantity, called *equivalent dose*, which allows them to measure all types of exposure on an equal basis. Equivalent dose is equal to the absorbed dose multiplied by a factor that takes into account the relative effectiveness of each type of radiation to cause harm. For beta particles and gamma radiation, the factor is set at 1; that is, the absorbed dose

[24] This section was written by Jonathan Medalia, Specialist in Nuclear Weapons Policy, Foreign Affairs, Defense, and Trade Division, and C. Stephen Redhead, Specialist in Health Policy, Domestic Social Policy Division.

equals the equivalent dose. For alpha particles the factor is set at 20, which means that the equivalent dose is 20 times the absorbed dose. This reflects the fact that alpha radiation is more harmful than beta and gamma radiation. The international unit for the equivalent dose is the sievert (Sv). So, 1 Sv of alpha radiation to the lung would create the same risk of lung cancer as 1 Sv of beta radiation. The sievert is a large unit relative to common exposures, so the more common unit is the millisievert (mSv), which is one-thousandth of a sievert. The sievert replaced an earlier unit of equivalent dose, the rem, which is still widely used in the United States. One sievert = 100 rem; 1 mSv = 100 millirem (mrem).

The National Council on Radiation Protection and Measurement (NCRP) estimates that the *average annual equivalent dose* to an individual in the United States is 6.2 mSv (620 mrem).[25] Of that amount, 3.1 mSv (310 mrem) is from natural background sources, primarily inhalation of radon and its decay products, and 3.0 mSv (300 mrem) is from diagnostic and therapeutic medical procedures. The remaining 0.1 mSv (10 mrem) is from consumer products, industrial activities, and occupational exposure, among other sources. For comparison, the radiation dose from a jet airplane flight is 0.5 millirems (mrem) per hour in the air; from a chest x-ray, 6 mrem; and from living at an altitude of one mile, about 50 mrem/year.[26] **Table 1** shows various doses and their health consequences or regulatory limits.

[25] National Council on Radiation Protection and Measurement, "Ionizing Radiation Exposure of the Population of the United States," report no. 160, 2009.

[26] American Nuclear Society, "Radiation Dose Chart," http://www.ans.org/pi/resources/dosechart/. This interactive chart permits the user to adjust values to find an approximation of his or her total annual dose.

Table 1. Radiation Dose Levels

Dose, mSv	Dose, rem	Source	Comments
1/yr	0.1/yr	(2)	NRC requires its licensees to "limit maximum radiation exposure to individual members of the public" to this level.
6.2/yr	0.62/yr	(1)	Average U.S. individual's total effective radiation dose in 2006; half is from natural background and half is from medical uses and other human activities.
20	2	(7)	Federal Emergency Management Agency and Environmental Protection Agency recommend relocating the public from an area if the expected dose in the first year after a radiological incident is above this level.
50/yr	5/yr	(2)	NRC requires its licensees to "limit occupational radiation exposure to adults working with radioactive materials" to this level.
100	10	(6)	A National Research Council committee defines "low dose" of certain types of ionizing radiation, such as gamma rays, as this level or below.
0-250	0-25	(3)	For an "acute" (i.e., received over a short time) whole-body external dose of ionizing radiation, "No detectable clinical effects; small increase in risk of delayed cancer and genetic effects."
250	25	(4)	Japan raised the permitted dose for emergency workers at the Fukushima Daiichi NPP from 100 mSv/10 rem to this level.
500	50	(5)	For an acute whole-body external dose of ionizing radiation, "blood count changes."
1,000-2,000	100-200	(3)	For an acute whole-body external dose of ionizing radiation, "Minimal symptoms; nausea and fatigue with possible vomiting; reduction in [certain white blood cells], with delayed recovery."
2,000-3,000	200-300	(3)	For an acute whole-body external dose of ionizing radiation, "Nausea and vomiting on first day; following latent period of up to 2 weeks, symptoms (loss of appetite and general malaise) appear but are not severe; recovery likely in about 3 months unless complicated by previous poor health."
3,200-3,600	320-360	(5)	Half the population exposed to an acute whole-body external dose of ionizing radiation will die within 60 days despite receiving minimal supportive care.
3,500-5,000	350-500	(2)	NRC believes that half the population receiving this dose in a few hours or less would die within 30 days.
8,000	800	(5)	100% mortality, despite best available treatment, for people receiving this external dose of whole-body ionizing radiation.

Sources: (1) National Council on Radiation Protection and Measurement, "Ionizing Radiation Exposure of the Population of the United States," report no. 160, 2009, p. 11. (2) U.S. Nuclear Regulatory Commission. "Fact Sheet on Biological Effects of Radiation," January 2011, http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/bio-effects-radiation.html, and 10 CFR 20. (3) Dade Moeller, *Environmental Health*, revised edition, Cambridge, Harvard University Press, 1997, p. 250. (4) Keith Bradsher and Hiroko Tabuchi, "50 Workers Bravely Stay at Troubled Japan Reactors," *New York Times*, March 16, 2011. (5) Princeton University, Environmental Health and Safety. "Open Source Radiation Safety Training, Module 3: Biological Effects," http://web.princeton.edu/sites/ehs/osradtraining/biologicaleffects/page.htm, adapted from National Council on Radiation Protection and Measurements, Report No. 98, "Guidance on Radiation Received in Space Activities," Bethesda, MD, 1989. (6) National Research Council, Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation, "Health Risks from Exposure to Low Levels of Ionizing Radiation," BEIR [Biological Effects of Ionizing Radiation] VII Phase 2, p. 2, http://www.nap.edu/openbook.php?record_id=11340&page=1 and click on PDF Summary. (7) U.S. Environmental Protection Agency. Office of Radiation Programs. *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*, revised 1991 (second printing, May 1992), p. 4-4, http://www.epa.gov/radiation/docs/er/400-r-92-001.pdf, and Federal Emergency Management Agency, "Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents," 73 *Federal Register* 45034, August 1, 2008.

External v. Internal Exposure: Effective Dose

The health risks of ionizing radiation can occur as a result of both external and internal exposure. External exposure is almost exclusively from radioactive material that emits gamma radiation, which is very penetrating and, at higher energies, can only be stopped by a thick layer of lead or concrete. External sources of gamma radiation produce a whole-body exposure. Importantly, the level of exposure to gamma radiation falls off sharply with distance from the source. Cesium-137 (^{137}Cs), which has a half-life of 30 years, is the most common source of gamma radiation from nuclear weapons tests and reactor accidents.

Alpha and beta particles outside the body are typically not a source of external exposure. Alpha particles travel only a few centimeters through the air and cannot penetrate clothing or the outermost dead layer of skin. Beta particles, composed of electrons or positrons, can travel at most several feet through the air and penetrate to the live layer of skin causing burns (as happened to workers at Chernobyl). But they too are blocked by radiation suits.

Internal radiation exposure occurs through the inhalation of airborne radioactive material or the ingestion of contaminated food and drink. The potential for harm depends on the type and quantities of radioactive material taken in and the length of time they remain in the body. As already noted, isotopes that emit alpha particles present a greater hazard than those that emit beta particles and gamma radiation. In addition, the fate of the radioactive material depends on its chemical identity. For example, Strontium-90 (^{90}Sr), which is chemically similar to calcium and emits beta particles, accumulates in bone and can cause leukemia and bone cancer.

Iodine-131 (^{131}I), another beta emitter, tends to accumulate in the thyroid gland, where it is used in the synthesis of thyroid hormones. Beta radiation from iodine-131 damages the surrounding cells and increase the risk of non-malignant thyroid disease and thyroid cancer. Iodine-131 from radioactive fallout accumulates on grass and leafy crops and becomes concentrated in the milk of cows and goats that feed on the contaminated vegetation. Children who drink the contaminated milk are especially at risk because they are still growing and their thyroid glands are very active. However, iodine-131 has a half-life of only 8 days, so it decays relatively quickly on the ground, in the food chain, and in the body.

Iodine-131 posed the most important health risk following the incident at the Chernobyl nuclear power plant in 1986. According to the International Atomic Energy Agency:

> The main consequence of the Chernobyl accident is thyroid cancer in children, some of whom were not yet born at the time of the accident. Following the vapour [sic] explosion and fire at the Chernobyl reactor, radioactive iodine was released and spread in the surrounding area. Despite measures taken, children in southern Belarus and northern Ukraine, were exposed to radiation in the weeks following the accident, particularly by consuming milk from pastured cows and leafy vegetables that had been contaminated with radioactive iodine.[27]

Unlike whole-body external exposures, the exposure from ingested or inhaled radioactive material is often limited to certain parts of the body or even specific organs. Radiation scientists

[27] International Atomic Energy Agency, "Thyroid Cancer Effects in Children," staff report, August 2005, http://www.iaea.org/newscenter/features/chernobyl-15/thyroid.shtml.

are able to calculate a whole-body equivalent dose, or *effective dose*, for partial-body exposures. These amounts can be summed with external exposure to calculate a total dose.

Acute Health Effects v. Long-Term Cancer Risk

The health effects of ionizing radiation exposure depend on the total dose and dose rate. Radiation health experts distinguish between (1) acute, or short-term, effects such as radiation sickness that are associated with relatively high doses over a short period; and (2) long-term effects such as increased lifetime cancer risk that result from chronic exposure to low-levels of radiation. Short-term health effects are typically seen in workers and others in close proximity to nuclear weapons tests and accidents, while the long-term cancer risks apply to the general population. Scientists calculate the cancer risk from radiation exposure using data from epidemiological and other studies, such as those following the health outcomes of the Japanese atomic bomb survivors. According to the International Commission on Radiological Protection (ICRP), the lifetime risk of contracting a fatal cancer from chronic exposure to low-level radiation exposure is 0.05 per sievert, or 1 in 20 per sievert (i.e., 1 in 2,000 per rem). The ICRP and NCRP both recommend an annual exposure limit of 1 mSv (100 mrem) for members of the general population. An individual that received that much annual exposure over a 70-year lifetime (a total of 70 mSv, or 7 rem) would, as a result, have an increased risk of cancer death of approximately 1 in 300.

Table 1 summarizes the health effects of exposure to various acute doses of ionizing radiation. For comparison, the table also includes the current exposure standards for the general public and workers, and the average background radiation exposure in the United States.

Potassium Iodide

There is considerable interest in potassium iodide (also referred to by its chemical formula, KI) tablets to protect against thyroid cancer. These tablets contain non-radioactive iodine-127, the same type used in iodized table salt, to saturate the thyroid with iodine. Once the thyroid is saturated, it cannot absorb more of any isotope of iodine, including iodine-131. As a result, potassium iodide tablets, taken shortly *before* exposure to iodine-131, offer protection from thyroid cancer. The protection is of limited duration, however, and potassium iodide protects only the thyroid only against radioactive iodine. It does not protect against any other radioactive material or against radiation in general. Nor is there value in taking potassium iodide as a precautionary measure unless iodine-131 is expected to be present. As the next section of this report discusses, the amount of radioactive material that has reached the United States from the Japanese nuclear reactor incident is minuscule. Accordingly, the website of the Centers for Disease Control and Prevention, accessed on March 22, said, "At this time, CDC does not recommend that people in the United States take KI or iodine supplements in response to the nuclear power plant explosions in Japan. You should only take KI on the advice of emergency management officials, public health officials, or your doctor. There are health risks associated with taking KI."[28] Further, "Some general side effects caused by KI may include intestinal upset, allergic reactions (possibly severe), rashes, and inflammation of the salivary glands."[29]

[28] U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. "Emergency Preparedness and Response: Radiation and Potassium Iodide (KI)," http://www.bt.cdc.gov/radiation/japan/ki.asp.

[29] U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. "Emergency (continued...)

The Japanese Situation

Understanding dose and its health effects casts light on the Japanese situation. The (U.S.) Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation of the National Research Council reported on the health risks from a certain type of radiation that includes gamma rays and x-rays. It considered doses below about 100 mSv (10 rem) to be low doses. The committee found that many factors "make it difficult to characterize the effects of ionizing radiation at low levels," and that "at doses less than 40 times the average yearly background exposure (100 mSv), statistical limitations make it difficult to evaluate cancer risk in humans." To develop an estimate of risk, the committee constructed a "lifetime risk model [that] predicts that approximately 1 person in 100 would be expected to develop cancer (solid cancer or leukemia) from a dose of 0.1 Sv [10 rem] above background." For comparison, about 42 percent of the population will be diagnosed with cancer in their lifetimes.[30] At Fukushima Daiichi NPP,

> The workers are being asked to make escalating—and perhaps existential—sacrifices that so far are being only implicitly acknowledged: Japan's Health Ministry said Tuesday that it was raising the legal limit on the amount of radiation exposure to which each worker could be exposed, to 250 millisieverts from 100 millisieverts, five times the maximum exposure permitted for nuclear plant workers in the United States.
>
> The change means that workers can now remain on site longer, the ministry said. "It would be unthinkable to raise it further than that, considering the health of the workers," the health minister, Yoko Komiyama, said at a news conference. [31]

An acute dose of 250 mSv (25 rem) is the upper threshold at which dose is unlikely to cause noticeable health effects, but it increases the risk of cancer. Based on the National Research Council report, 25 of 1,000 people would be expected to develop solid cancers or leukemia as a result of receiving this dose. Workers exposed to this dose will probably not be allowed to be exposed to additional radiation above background for at least a year to give their bodies time to repair cell damage.

Beyond the Fukushima Daiichi NPP, the external doses reported fall far below the low-dose threshold of the U.S. Nuclear Regulatory Commission (NRC). Japan's Ministry of Education, Culture, Sports, Science and Technology reported dose readings from 80 monitoring stations between 25 and 60 km from the Fukushima Daiichi NPP.[32] On March 20, almost all the readings were less than 15 microsieverts per hour. (One millisievert = 1,000 microsieverts; 1 microsievert = 0.1 millirem.) At a rate of 15 microsieverts per hour, it would take 278 days to accumulate a dose of 10 rem. At the highest rate reported, 110 microsieverts per hour, it would take 38 days to accumulate that dose. Staying inside an uncontaminated building would reduce exposure

(...continued)

Preparedness and Response: Potassium Iodide (KI)," http://emergency.cdc.gov/radiation/ki.asp#med.

[30] National Research Council. Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation. *Health Risks from Exposure to Low Levels of Ionizing Radiation,* Washington, National Academies Press, 2006, pp. 1, 2, 7, 8, http://www.nap.edu/openbook.php?record_id=11340&page=1, and click on "pdf summary."

[31] Keith Bradsher and Hiroko Tabuchi, "50 Workers Bravely Stay at Troubled Japan Reactors," *New York Times,* March 16, 2011.

[32] Japan. Ministry of Education, Sports, Culture, Science and Technology (MEXT), "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP [Nuclear Power Plant]," news release, as of 19:00 March 20, 2011, http://www.mext.go.jp/component/english/__icsFiles/afieldfile/2011/03/20/1303972_2019.pdf.

considerably, and short-lived radionuclides like iodine-131 (half-life, 8 days) would decay significantly during a month or more, sharply reducing the dose they produce. On the other hand, a larger release of radionuclides would be expected to increase dose, and cesium-137 (half-life, 30 years) decays much more slowly than iodine-131, so it would contribute to dose for many decades.

Given the increase in thyroid cancer as a result of the Chernobyl disaster, a major concern in Japan is minimizing the risk of thyroid cancer. This is especially important for children. At Chernobyl, as noted earlier, ingestion of radioactive iodine-131 resulted mainly from drinking milk from cows that ate contaminated feed, and from eating leafy greens. Accordingly, Japanese authorities have tested spinach, other vegetables, and milk for iodine-131, and found elevated levels. In response, on March 23 Prime Minister Naoto Kan restricted the distribution and consumption of spinach, cabbage, broccoli, and other vegetables in Fukushima Prefecture, and restricted the distribution of fresh raw milk and parsley produced in Ibaraki Prefecture.[33] In addition, authorities have reportedly found traces of radioactive iodine in drinking water in Tokyo. On March 23,

> Ei Yoshida, head of water purification for the Tokyo water department, said ... that infants in Tokyo and surrounding areas should not drink tap water. He said iodine-131 had been detected in water samples at a level of 210 becquerels per liter, about a quart. The recommended limit for infants is 100 becquerels per liter. For adults, the recommended limit is 300 becquerels. ... The Health Ministry said in a statement that it was unlikely that there would be negative consequences to infants who did drink the water, but that it should be avoided if possible and not be used to make infant formula.[34]

However, by March 24 the level was reported to be 79 becquerels per liter, and by March 27 had diminished to the point where two readings showed no radiation and one showed 27 becquerels per liter.[35]

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[33] Japan. Policy Planning and Communication Division. Inspection and Safety Division. Department of Food Safety. "Restriction of Distribution and/or Consumption of Foods Concerned in Fukushima and Ibaraki Prefectures (in Relation to the Accident at Fukushima Nuclear Power Plant)," March 23, 2011, http://www.mhlw.go.jp/stf/houdou/2r98520000015wun-att/2r98520000015xym.pdf.

[34] David Jolly and Denise Grady, "Tokyo Says Radiation in Water Puts Infants at Risk," *New York Times*, March 23, 2010.

[35] David Jolly, "Radiation in Tokyo's Water Has Dropped, Japan Says," *New York Times*, March 24, 2011, and David Jolly, Hiroko Tabuchi, and Keith Bradsher, "High Radiation Found in Water at Japan Plant," *New York Times*, March 28, 2011, p. 11.

Acknowledgments

The Nuclear Regulatory Commission provided technical comments on this report.

Schaperow, Jason

From: Schaperow, Jason
Sent: Friday, April 01, 2011 2:37 PM
To: Chang, Richard
Subject: FW:
Attachments: one page on Fukushima.doc

From: Tinkler, Charles
Sent: Friday, March 11, 2011 5:35 PM
To: 'mtl@dycoda.com'; Gauntt, Randall O; Schaperow, Jason
Subject:

I added a sentence to clarify that in the mitigated case we could have vented after roughly 18 hrs.

Charles Tinkler
Charles.Tinkler@nrc.gov

LLL4/158

As part of the SOARCA project we have performed analysis for a severe accident scenario for a boiling water reactor (BWR) plant which may (or may not) bear on the event taking place at the Fukushima plant. For the Peach Bottom plant, a BWR4 Mark I plant we performed accident progression and offsite consequence analyses for a long term station blackout. This scenario involved the loss of offsite power and the immediate loss of the emergency diesel generators. Emergency batteries were available for this scenario and were used to initate and control the reactor core isolation cooling (RCIC) system. For our analysis batteries were assumed to fail after 4 hrs. In our calculation the water source for RCIC was the condensate storage tank (an alternative may be the torus). Other key assumptions included 1) the assumption that operators would open 1 SRV to begin a controlled depressurization according to emergency procedures (to avoid excessive cycles on the SRV) and 2) operators take manual control of RCIC to reduce and stabilize coolant flow from the RCIC pump.
The major timeline events for this calculated scenario are

- Station blackout at t=0. hrs
- RCIC initation at t=10 minutes
- Operators depressurize reactor by opening SRV at t= 1.0 hr
- Batteries deplete at 4 hrs
- RCIC fails due to steam line flooding at 5.2 hrs
- SRV sticks open at 8.2 hrs
- Water level at top of active fuel 8.4 hrs
- First fuel failure at 9.1 hrs
- First core collapse at 9.8 hrs
- Lower head dries out at 13.3 hrs
- Lower head failure at 19.7 hrs
- Containment (drywell shell) failure at 20 hrs

In our LTSBO analysis there was no containment venting since battery depletion would prevent actuation of the solenoid on the air operated isolation valves. Containment pressure did not exceed design pressure until roughly 15 hrs and did not reach ultimate capacity of the containment prior to drywell shell failure. If venting were possible it would not have been undertaken until roughly 10 hrs due to emergency procedures and or the limitation of the rupture disc in the hardened vent line.

The radiological release predicted for this scenario included near complete release of noble gases (98%) but much smaller release of important radionuclides; roughly 1% release of cesium, 2 % release of iodine and 1% release of barium. There was no early fatality risk. Individual latent cancer fatality risk in the emergency phase period (first week) was extremely small, risk was controlled by the risk associated with the return of the population following the event

In another calculation which examined longer operation of RCIC, containment venting would not have been needed to remain below design pressure for at least 24 hrs. Venting may be undertaken at a lower pressure (30 psig) via the hardened vent in our calculations after roughly 18 hrs. Containment pressure was lower in this case than the case described above because there was no core damage in this case and hydrogen generation due to core metal-water reaction did not take place. Hydrogen generation is a large contributor to containment pressure for a severe accident in a BWR Mark I design. Venting may be undertaken based on specific procedures at lower pressure depending on SRV operation or other considerations. If the Fukushima plant were using the torus as the water source for RCIC, containment pressure would rise somewhat more quickly.

Schaperow, Jason

From: Schaperow, Jason
Sent: Friday, April 01, 2011 2:35 PM
To: Chang, Richard
Subject: FW: new and improved Q&A's
Attachments: Q&A SBO.doc

From: Tinkler, Charles
Sent: Tuesday, March 29, 2011 2:50 PM
To: Gibson, Kathy; Armstrong, Kenneth
Cc: Schaperow, Jason
Subject: new and improved Q&A's

New version (also included reference to Op-Ed)

Charles Tinkler
Charles.Tinkler@nrc.gov

LLLL/159

SOARCA Insights

- Probabilistic risk assessments and severe accident research and studies over the last 20 yrs have evaluated US plant response to an event generally similar to the event which occurered at Fukushima (not including similar Tsunami)

- In many respects the Japanese event resembles a severe accident scenario which is known as a long term station blackout, an event in which offsite AC power and emergency onsite AC power is lost. The plant is able to respond safely through the use of turbine driven equipment controlled by emergency DC power (station batteries)

- Recent severe accident studies (SOARCA) for a long term station blackout (seismically initiated) at a US BWR Mark I plant indicate that US plants can safely shutdown during such an event through the use of new, additional equipment, put in place (and inspected) following the terrorist attack of 9/11
    - Comprehensive security assessments focused on implementing plant changes to enhance plants ability to respond to accidents

- The new, additional equipment (B.5.b) includes both portable generators (with inverters) and an independent portable diesel driven pump. Addtionally procedures have been developed for manual start of turbine driven pump (RCIC).

- These measures combined with existing infrastructure and coordination within the nuclear industry indicate that US plants have capability to successfully respond to a staion blackout.

- Also, as a result of our post 9/11 security assessment addtional equipment has been added to improve spent fuel pool cooling.
    - Measures have been added to provide water spray capability to the spent fuel pools by a diesel driven pump.
    - Further, another enhancement has been made to spent fuel pools to enhance coolability of the fuel by distributing fuel within the pool (by locating higher decay power assemblies amongst lower decay power assemblies).
    - These items were also identified by the National Academy of Sciences. [Note an Op-Ed was written which erroneously stated that these measures were not implemented – a retraction was printed in the Washington Post]

From: LIA07 Hoc
Sent: Friday, April 01, 2011 6:03 AM
To: LIA07 Hoc; Borchardt, Bill; Bradford, Anna; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; ET07 Hoc; Flory, Shirley; Gibbs, Catina; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
Subject: Go Book Update - 0600 EDT, April 1, 2011
Attachments: NRC Status Update 4.01.11--0430.pdf; ET Chronology 4-1-11 0600EDT.pdf; TEPCO Press Release 242.pdf; TEPCO Press Release 243.pdf; TEPCO Press Release 239.pdf; TEPCO Press Release 240.pdf; TEPCO Press Release 241.pdf

Attached, please find updated information for the "Go Books".

The updates include:

- The 0430 EDT, 04/01/11 Status Update
- The latest ET Chronology
- TEPCO Press Releases (239-243)

Please let me know if you have any questions or concerns.

-Jim

Jim Anderson
Office of Nuclear Security & Incident Response
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)
james.anderson@nrc.gov

LLL4/160

Press Releases

Press Release (Mar 31,2011)
Plant Status of Fukushima Daiichi Nuclear Power Station (as of 9:00 PM Mar 31st)

*Updates are underlined

All 6 units of Fukushima Daiichi Nuclear Power Station have been shut down.

Unit 1 (Shut down)
- Explosive sound and white smoke were confirmed after the big quake occurred at 3:36 pm Mar 12th. It was assumed to be hydrogen explosion.
- At approximately 2:30 am on March 23rd, seawater injection to the nuclear reactor through the feed water system was initiated.
- At approximately 10:50 am on March 24th, white fog-like steam arising from the roof part of the reactor building was observed.
- We had been injecting seawater into the reactor, but from 3:37 pm on March 25th, we started injecting freshwater.
- We had been injecting fresh water to the reactor using fire engines; however we switched over utilizing temporary electrical pump at 8:32 am on March 29th.

Unit 2 (Shut down)
- At approximately 6:00 am on March 15th, an abnormal noise began emanating from nearby Pressure Suppression Chamber and the pressure within the chamber decreased.
- At 6:20 pm on March 21st, white smoke was confirmed arising from the top of the reactor building. As of 7:11 am on March 22nd, smoke decreased to the level to nearly non-existent.
- We have been injecting seawater into the reactor, but from 10:10 am on March 26th, we started injecting fresh water (with boric acid).
- We had been injecting fresh water in to the reactor utilizing fire pump, however, we switched over to utilizing temporary electrical pump from 6:31 pm on March 27th.

Unit 3 (Shut down)
- Explosive sound and white smoke were confirmed at 11:01am March 4th. It was assumed to be hydrogen explosion.
- At 8:30am on March 16th, fog like steam was confirmed arising from the reactor building.
- At approximately 6:15 am on March 17th the pressure of the Suppression Chamber has temporarily increased. We were preparing to implement measures to reduce the pressure of the reactor containment vessel (partial discharge of air containing radioactive material to outside) in order to fully secure safety. However, at present, it is not a situation to immediately implement measures and discharge air containing radioactive material to outside. We will continue to monitor the status of the pressure of the reactor containment vessel.
- At approximately 4:00 pm, March 21st, light gray smoke was confirmed arising from the floor roof of the Unit 3 building. On March 22nd, the color of smoke changed to somewhat white and it is slowly dissipating.
- At around 4:20 pm on March 23rd, our staff confirmed light black smoke belching from the Unit 3 building. At approximately 11:30 pm on March 23rd and 4:50 am on March 24th, our employee found no signs of smoke.
- We had been injecting sea water into the reactor pressure vessel, but from 6:02 pm on March 25th, we started injecting freshwater.
- We had been injecting fresh water in to the reactor utilizing fire pump, however, we switched over to utilizing temporary electrical pump from 8:30 pm on March 28th.

Unit 4 (outage due to regular inspection)
- At approximately 6 am on March 15th, we confirmed the explosive sound and the sustained damage around the 5th floor rooftop area of the Nuclear Reactor Building.
- On March 15th and 16th, we respectively confirmed the outbreak of fire at the 4th floor of the northwestern part of the Nuclear Reactor Building. We immediately reported this matter to the fire department and the related authorities. TEPCO employees confirmed that each fire

had already died down by itself.
- At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 5 (outage due to regular inspection)
- Sufficient level of reactor coolant to ensure safety is maintained.
- At 5 am, March 19th, we started the Residual Heat Removal System Pump (C) in order to cool the spent fuel pool.
- At 2:30 pm, March 20th, the reactor achieved reactor cold shutdown. At around 5:24 pm on March 23rd, when we switched the temporary Residual Heat Removal System Seawater Pump, it has stopped automatically. At around 4:14 pm, March 24th we replaced the pump, and restarted cooling of reactor at around 4:35 pm.
- At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 6 (outage due to regular inspection)
- Sufficient level of reactor coolant to ensure safety is maintained.
- We completed the repair work on the emergency diesel generator (A).
- At 10:14 pm, March 19th, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
- At 7:27 pm, March 20th, the reactor achieved reactor cold shutdown.
- In relation to the two seawater side pumps of the Residual Heat Removal System, we switched the power source from temporary to permanent at 3:38 PM and 3:42PM, Mar 25 respectively.
- At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Today's work for cooling the spent fuel pools
- From 9:25 am 30th March, freshwater injection to Unit 2 was conducted by a temporary motor driven pump. But, because of the malfunction of that pump at 9:45 am, we decided to switch to the fire fighting pump. At 0:30 pm, we switched to use the fire pump. Though the injection of the flesh water was stopped temporarily because we found the tear in a part of the hose at 0:47 pm and 1:10 pm, we restarted injection of the flesh water at 7:05 pm, and finished at 11:50 pm.
- Water spraying by the concrete pump truck to Unit 1 was conducted from 1:03 pm to 4:04 pm.
- Water spraying by the concrete pump truck to Unit 3 was conducted from 4:30 pm to 7:33 pm.
- We are considering further spraying subject to the conditions of spent fuel pools.

Draining water from underground floor of turbine buildings
- In regard with transferring water from a condensate storage tank to a suppression pool water surge-tank in unit 3, work was implemented from 5:40 pm 28th March, and finished at 8:40 am today.
- In regard with transferring water from a condensate storage tank to a suppression pool water surge-tank in unit 1, work began at 0:00 pm today.
- In regard with transferring water from the vertical shaft of unit 1 to the centralized environmental facility storage tank, work was implemented from 9:20 am today and finished at 11:25 am today.

Casualties
- Presence of 2 TEPCO employees at the site is not confirmed on March 11th.
- On March 24th, it was confirmed that 3 workers from cooperative companies who were in charge of cable laying work in the 1st floor and the underground floor of turbine building were exposed to the radiation dose of more than 170 mSv. 2 of them were confirmed that their skins on legs were contaminated. After they were decontaminated, since there was a possibility of beta ray burn injury, they were transferred to Fukushima Medical University Hospital. The third worker was also transferred to Fukushima Medical University Hospital on March 25th. Later, the 3 workers were transferred to National Institute of Radiological Sciences in Chiba Prefecture. They all left the hospital on March 28th.
  Regarding this event, TEPCO has reported to the related government ministries and agencies on measures to be taken to assure appropriate radiation dose control and radiation exposure related operations.
  We will inform the related parties of countermeasures and continue to take all possible measures to future management.

Others
- We measured radioactive materials (iodine etc.) inside of the nuclear power station area (outdoor) by monitoring car and confirmed that radioactive materials level is getting higher than ordinary level. As listed below, we have determined that specific incidents stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) have occurred.
  - Determined at 4:17 pm Mar 12th (Around Monitoring Post 4)
  - Determined at 8:56 am Mar 13th (Around Monitoring Post 4)
  - Determined at 2:15 pm Mar 13th (Around Monitoring Post 4)
  - Determined at 3:50 am Mar 14th (Around Monitoring Post 6)
  - Determined at 4:15 am Mar 14th (Around Monitoring Post 2)
  - Determined at 9:27 am Mar 14th (Around Monitoring Post 3)
  - Determined at 9:37 pm Mar 14th (Around main entrance)
  - Determined at 6:51 am Mar 15th (Around main entrance)

· Determined at 8:11 am Mar 15th (Around main entrance)
· Determined at 4:17 pm Mar 15th (Around main entrance)
· Determined at 11:05 pm Mar 15th (Around main entrance)
· Determined at 8:58 am Mar 19th (Around MP5)
From now on, if the measured figure fluctuates and goes above and below 500 micro Sv/h, we deem that as the continuous same event and will not regard that as a new specific incidents stipulated in article 15, clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) has occurred. In the interim, if we measure a manifestly abnormal figure and it is evident that the event is not the continuous same event, we will determine and notify.

- The national government has instructed evacuation for those local residents within 20km radius of the periphery and evacuation to inside for those residents from 20km to 30km radius of the periphery, because it is possible that radioactive materials are discharged.
- At around 10:37 am March 21st, water spraying to common spent fuel pool and finished at 3:30 pm (conducted by TEPCO).
- At around 3:37 pm, March 24th, electricity supply to common spent fuel pool has started from external power source. At around 6:05 pm, fuel pool cooling pump was started to cool the pool.
- We found no signs of abnormal situation for the casks by visual observation during the patrol activity. A detailed inspection is under preparation.
- At Units 5 and 6, in order to prevent hydrogen gas from accumulating within the buildings, we have made three holes on the roof of the reactor building for each unit.
- In total 12 fire engines are lent for the water spraying to the spent fuel pools and water injection to the nuclear reactors by various regional fire departments* as well as Tokyo Fire Department. Also, instruction regarding the setting and operation of large scale decontamination system was provided by Niigata City Fire Headquarter and Hamamatsu City Fire Headquarter.
*: Koriyama Fire Department, Iwaki Fire Brigade Headquarters, Fire Headquarters of Sukagawa District Wide Area Fire-fighting Association, Yonezawa City Fire Headquarters, Utsunomiya City Fire Headquarters, Fire Headquarters of Aizu-Wakamatsu wide area municipal association, Saitama City Fire Bureau, and Niigata City Fire Bureau.
- By March 22nd, Units 1 through 6 were started to be energized from the external power source.
- At 3:30PM, March 27th, we found that there was water in the trenches of Units 1 to 3. The radioactive emission at the surface of the water was 0.4mSv/h for Unit 1 and over 1,000mSv/h for Unit 2. As for Unit 3, we couldn't have access to the surface because of debris. We will continue to monitor water in the trenches.
- On March 28th, a puddle of water was found at a centralized environmental facility process main building. As a result of a radioactivity analysis, on March 29th, we detected approximately 1.2 x 10Bq/cm3 in a full dose at a radiation controlled area and 2.2 x 10Bq/cm3 in a full dose at a non-controlled area.
- At 12:03 pm, March 29th, when taking off the flange of the pipe of the seawater piping of the Residual Heat Removal System, 3 workers from our subcontractor were soaked with water in the pipe. After wiping the water off, we confirmed that there was no radioactive contamination to their bodies.
- At 12:21 31st March, campaigner's sound truck (1 driver) tried to enter the site form the site's main gate, however it left after it was stopped to enter. We reported this incident to Fukushima Prefecture Police Department.
- A barge of the U.S. Forces with fresh water to be used to cool down reactors etc. was towed by a ship of Maritime Self-Defense Force and at 3:42 pm on March 31st 2011, came alongside the pier. As soon as the supply of water is ready, we will replenish the fresh water with filtrate tanks.
- We will continue to take all measures to ensure the safety and to continue monitoring the surrounding environment around the Power Station.

Back to page top

From: Hoc, PMT12
Sent: Friday, April 01, 2011 11:57 AM
To: PMT01 Hoc; PMT09 Hoc
Subject: FW: 0430 EDT (April 1, 2011) USNRC Earthquake/Tsunami Status Update
Attachments: NRC Status Update 4.01.11--0430.pdf

From: LIA07 Hoc
Sent: Friday, April 01, 2011 11:56 AM
To: Hoc, PMT12; OST01 HOC
Subject: FW: 0430 EDT (April 1, 2011) USNRC Earthquake/Tsunami Status Update

Please follow up.

From: McIntosh, Angela
Sent: Friday, April 01, 2011 11:40 AM
To: LIA07 Hoc
Cc: Lewis, Robert
Subject: Re: 0430 EDT (April 1, 2011) USNRC Earthquake/Tsunami Status Update

Good morning: I have received feedback that the downwind rad level reported as 4430 R/hr at Unit 1 appears to be in error. Please verify.

Thanks.

Angela R. McIntosh
Regional Coordinator
Office of Federal and State Materials
and Environmental Management Programs
U.S. Nuclear Regulatory Commission
Mail Stop T8-E24
Angela.McIntosh@nrc.gov
(301) 415-5030

From: LIA07 Hoc
Sent: Friday, April 01, 2011 4:44 AM
To: LIA07 Hoc
Subject: 0430 EDT (April 1, 2011) USNRC Earthquake/Tsunami Status Update

Attached, please find a 0430 EDT, April 1, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

Please note that this information is "~~Official Use Only~~" and is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Jim

Jim Anderson

LLLL/161

Executive Briefing Team Coordinator
Office of Nuclear Security and Incident Response
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)
james.anderson@nrc.gov

Wagner, Katie

From: Wagner, Katie
Sent: Friday, April 01, 2011 3:34 PM
To: Lee, Richard
Cc: Burnell, Scott; Gibson, Kathy
Subject: FW: Media - Yale Environment 360-Question

Richard,

Please see Scott's question below.

Thanks,
Katie

From: Burnell, Scott
Sent: Friday, April 01, 2011 3:24 PM
To: Wagner, Katie
Cc: Gibson, Kathy
Subject: FW: Media - Yale Environment 360-Question

Katie;

Would Bob or another person in RES have any relevant info for the reporter's request? Thanks.

Scott

From: Garry, Steven
Sent: Friday, April 01, 2011 3:23 PM
To: Burnell, Scott
Subject: RE: Media - Yale Environment 360-Question

Scott,

I suggest calling research, maybe Bob Ott.

Steve

From: Burnell, Scott
Sent: Friday, April 01, 2011 3:22 PM
To: Garry, Steven; Nash, Harriet; Milligan, Patricia
Cc: Nelson, Robert
Subject: FW: Media - Yale Environment 360-Question
Importance: High

Folks;

This reporter's trying to find information, studies, etc on how contamination would behave in a marine environment – she's made it clear she wants to understand the topic as opposed to ask us about Fukushima directly. I don't know if our environmental monitoring requirements would cover this in any way. The reporter's on a Monday deadline. Thoughts? Thanks.

Scott

LLLL/162

Elizabeth Grossman
Yale Environment 360
503-704-5637
lizziegrossman@mac.com
Re: Science on how radiation behaves in the water from Japan

Schaperow, Jason

From: Schaperow, Jason
Sent: Friday, April 01, 2011 2:14 PM
To: Bixler, Nathan E
Subject: Thanks

Hi Nate,

Thanks for helping us out yesterday and for working on the MACCS consequence/source term analysis today. I look forward to receiving your results by email. I will work with Ray Jun (instead of you) as needed next week.

There is an outside chance I may need to contact you next week. If so, I would likely try to contact you via email, with the understanding that it may take a day (or so) for you to get back to me.

Thanks again,
Jason

LLLL/163

From: HOO Hoc
Sent: Friday, April 01, 2011 6:34 AM
To: ET07 Hoc
Attachments: ACTION: Support Coordinator Monthly Review of IR Call List(s) 11 and 564 on 03/19/11; ACTION: SIOC/SGT Monthly Review of IR Call List(s) 31, 540, 541, and 542 on 03/19/11; ACTION: RST/FCST Coordinator Monthly Review of IR Call List(s) 3, 530, 531 and 580 on 03/19/11; ACTION: PMT Coordinator Monthly Review of IR Call List(s) 550, 551, 552, 553, 554 and 555 on 03/19/11; ACTION: LIA Coordinator Monthly Review of IR Call List(s) 570 on 03/19/11; ACTION: HQDM/ET/EST/EBT Monthly Review of IR Call List(s) 36, 50, 55, 56, 57, 58, 59, 60, 520, 521 and 522 on 03/19/11; ACTION: FED/INTL Coordinator Monthly Review of IR Call List(s) 20 and 21 on 03/19/11; ACTION: DDIR Coordinator Monthly Review of IR Call List(s) 7, 9, 10, 521, 561, 562 and 563 on 03/19/11

As requested.

Howie

Headquarters Operations Officer
U.S. Nuclear Regulatory Commission
Phone: 301-816-5100
Fax: 301-816-5151
Secure e-mail: hoo1@nrc.sgov.gov
e-mail: hoo.hoc@nrc.gov

LLLL/164

From: RST01 Hoc
Sent: Friday, April 01, 2011 8:40 AM
To: RST06 Hoc
Subject: FW: 0430 EDT (April 1, 2011) USNRC Earthquake/Tsunami Status Update
Attachments: NRC Status Update 4.01.11--0430.pdf

This morning's SITREP

From: LIA07 Hoc
Sent: Friday, April 01, 2011 4:44 AM
To: LIA07 Hoc
Subject: 0430 EDT (April 1, 2011) USNRC Earthquake/Tsunami Status Update

Attached, please find a 0430 EDT, April 1, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

Please note that this information is "~~Official Use Only~~" and is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Jim

Jim Anderson
Executive Briefing Team Coordinator
Office of Nuclear Security and Incident Response
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)
james.anderson@nrc.gov

LLLL/165

From: LIA07 Hoc
Sent: Friday, April 01, 2011 6:00 PM
Subject: 1800 EDT (April 1, 2011) USNRC Earthquake/Tsunami Status Update
Attachments: USNRC Earthquake-Tsunami Update.040111.1800EDT.pdf

Attached, please find a 1800 EDT, April 1, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

Please note that this information is ~~"Official Use Only"~~ and is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Sara

Sara K. Mroz
Executive Briefing Team Coordinator
Office of Nuclear Security and Incident Response
US Nuclear Regulatory Commission
Sara.Mroz@nrc.gov
LIA07.HOC@nrc.gov (Operations Center)

LLLL/166

From: Google Alerts
To: Burnell, Scott
Subject: Google Alert - "Nuclear Regulatory Commission"
Date: Sunday, April 10, 2011 7:13:24 AM

News **1** new result for **"Nuclear Regulatory Commission"**

Improvisation, frustration mark Japan's nuclear crisis at 4 weeks
CNN
Japan's government is consulting with experts from the US **Nuclear Regulatory Commission** and the French nuclear fuel company Areva, said Hidehiko Nishiyama, deputy director-general of Japan's Nuclear and Industrial Safety Agency and the agency's chief **...**
See all stories on this topic »

Tip: Use a plus sign (+) to match a term in your query exactly as is. Learn more.

Remove this alert.
Create another alert.
Manage your alerts.

LLLL/167

From: OST01 HOC
Sent: Friday, April 01, 2011 12:57 AM
To: RST01 Hoc
Cc: FOIA Response.hoc Resource
Subject: FW: Fax from 81355105111
Attachments: File1.PDF

-----Original Message-----
From: HOO Hoc
Sent: Friday, April 01, 2011 12:55 AM
To: LIA07 Hoc; OST01 HOC; OST02 HOC; OST03 HOC
Subject: FW: Fax from 81355105111

Headquarters Operations Officer
U.S. Nuclear Regulatory Commission
Phone: 301-816-5100
Fax: 301-816-5151
Secure e-mail: hoo1@nrc.sgov.gov
e-mail: hoo.hoc@nrc.gov

-----Original Message-----
From: hoo1 [mailto:hoo1.hoc@nrc.gov]
Sent: Friday, April 01, 2011 12:42 AM
To: HOO Hoc
Subject: Fax from 81355105111

RECEIVE NOTIFICATION FOR JOB 00018058

Notice for: HOO1

Remote ID: 81355105111

Received at: 04/01/2011 00:40

Pages: 18

Routed by:

Routed at: 04/01/2011 00:40

LLLL/168

FROM JACK GIBSON

TO RST

4/1 @ 1200 LOCAL

福島第一原子力発電所　プラント関連パラメータ

4月1日　6:00現在

※1：計器不良
※2：データ採取対象外

号機	1u	2u	3u	4u	5u	6u
注水状況	給水ラインを用いた淡水注入中。 流量 13l/min (3/29 8:32)　仮設計器	消火系ラインを用いた淡水注入中。 流量　15l/min (3/30 14:00)　仮設計器	消火系ラインを用いた淡水注入中。 流量 11l/min (3/29 14:39)　仮設計器	停止中	停止中	停止中
原子炉水位	燃料域A：−1600mm 燃料域B：−1600mm (4/1 6:00現在)	燃料域A：−1500mm (4/1 6:00現在)	燃料域A：−1900mm 燃料域B：−2250mm (4/1 5:45現在)	※2	停止域 1912mm (4/1 6:00現在)	停止域 1699mm (4/1 6:00現在)
原子炉圧力	0.283MPa g (A) 0.495MPa g (B) (4/1 6:00現在)	−0.014MPa g (A) −0.016MPa g (B) (4/1 6:00現在)	0.018MPa g (A) −0.086MPa g (C) (4/1 5:45現在)	※2	0.007MPa g (4/1 6:00現在)	0.003MPa g (4/1 6:00現在)
原子炉水温度	(系統流量がないため採取不可)			※2	29.8℃ (4/1 6:00現在)	44.1℃ (4/1 6:00現在)
原子炉圧力容器温度	給水ノズル温度：255.2℃ 圧力容器下部温度：119.7℃ (4/1 6:00現在)	給水ノズル温度：163.6℃ 圧力容器下部温度 ※1 (4/1 6:00現在)	給水ノズル温度：92.6℃(調査中) 圧力容器下部温度：116.3℃ (4/1 5:45現在)	4u:原子炉内に発熱体（燃料）なし 5,6u:原子炉水温度にて監視中		
D/W・S/C圧力	D/W　0.170MPa abs S/C　0.170MPa abs (4/1 6:00現在)	D/W　0.110MPa abs S/C　ダウンスケール (調査中) (4/1 6:00現在)	D/W　0.1071MPa abs S/C　0.1755MPa abs (4/1 5:45現在)	※2		
CAMS	D/W　4.43×10¹Sv/h S/C　1.74×10¹Sv/h (4/1 6:00現在)	D/W　3.72×10¹Sv/h S/C　1.11×10⁰Sv/h (4/1 6:00現在)	D/W　2.45×10¹Sv/h S/C　1.00×10⁰Sv/h (4/1 5:45現在)	※2		
D/W設計使用圧力	0.384MPa g (0.485MPa abs)	0.384MPa g (0.485MPa abs)	0.384MPa g (0.485MPa abs)	※2		
D/W最高使用圧力	0.427MPa g (0.528MPa abs)	0.427MPa g (0.528MPa abs)	0.427MPa g (0.528MPa abs)			
使用済燃料プール	※1	48.0℃ (4/1 6:00現在)	※1	※1	36.6℃ (4/1 6:00現在)	22.0℃ (4/1 6:00現在)
FPCスキマーサージタンクレベル	4500mm (4/1 6:00現在)	5100mm (4/1 6:00現在)	※1	5150mm (4/1 5:45現在)	※2	
電源	外部電源受電中 (P/C2C)		外部電源受電中 (P/C4D)		外部電源受電中	
その他情報	・3号機　原子炉圧力容器温度について、データ採取を行い、状況推移を継続調査中。 ・2号機　S/C圧力について、状況推移を継続調査中。			共用プール： 32℃程度 (3/31 08:10)	5u：SHCモード (3/31 10:36～)	6u：非熱モード (3/31 19:51～)

圧力換算　ゲージ圧(MPa g) ＝ 絶対圧(MPa abs) − 大気圧(標準大気圧 0.1013 MPa)
絶対圧(MPa abs) ＝ ゲージ圧(MPa g) ＋ 大気圧(標準大気圧 0.1013 MPa)

本店情報班(9144855)
1F情報班(9632507)

福島第一原子力発電所1，2，3号機の主要パラメータ

RPV

	1F1	1F2	1F3
水位A(mm)	-1600 (4/1 6:00)	-1500 (4/1 6:00)	-1900 (4/1 5:45)
水位B(mm)	-1600 (4/1 6:00)	-	-2250 (4/1 5:45)
圧力AorC(MPag)	0.283 (4/1 6:00)	-0.014 (4/1 6:00)	-0.086 (4/1 5:45)
圧力BorA(MPag)	0.495 (4/1 6:00)	-0.016 (4/1 6:00)	0.018 (4/1 5:45)
炉水温度(℃)	-	-	-

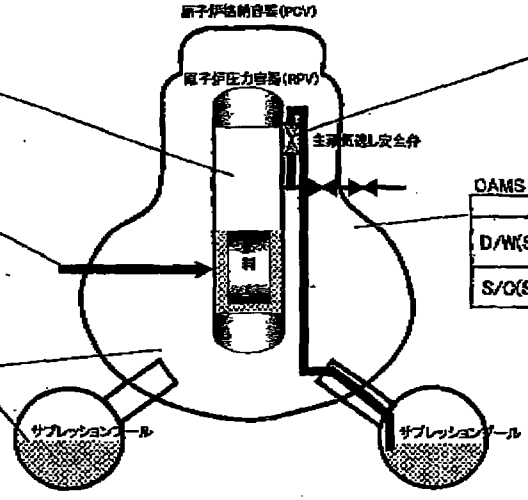
注水状況

1F1	1F2	1F3
給水系ラインを用いた淡水注入中	消火系ラインを用いた淡水注入中	消火系ラインを用いた淡水注入中

D/W, S/C

	1F1	1F2	1F3
D/W圧力(MPaabs	0.170 (4/1 6:00)	0.110 (4/1 6:00)	0.1071 (4/1 5:45)
S/C圧力(MPaabs	0.170 (4/1 6:00)	D/S* (4/1 6:00)	0.1755 (4/1 5:45)
S/C温度(℃)	-	-	54.6 (4/1 5:45)

＊状況推移を調査中



SRV開閉状態

1F1	1F2	1F3
不明	不明	不明

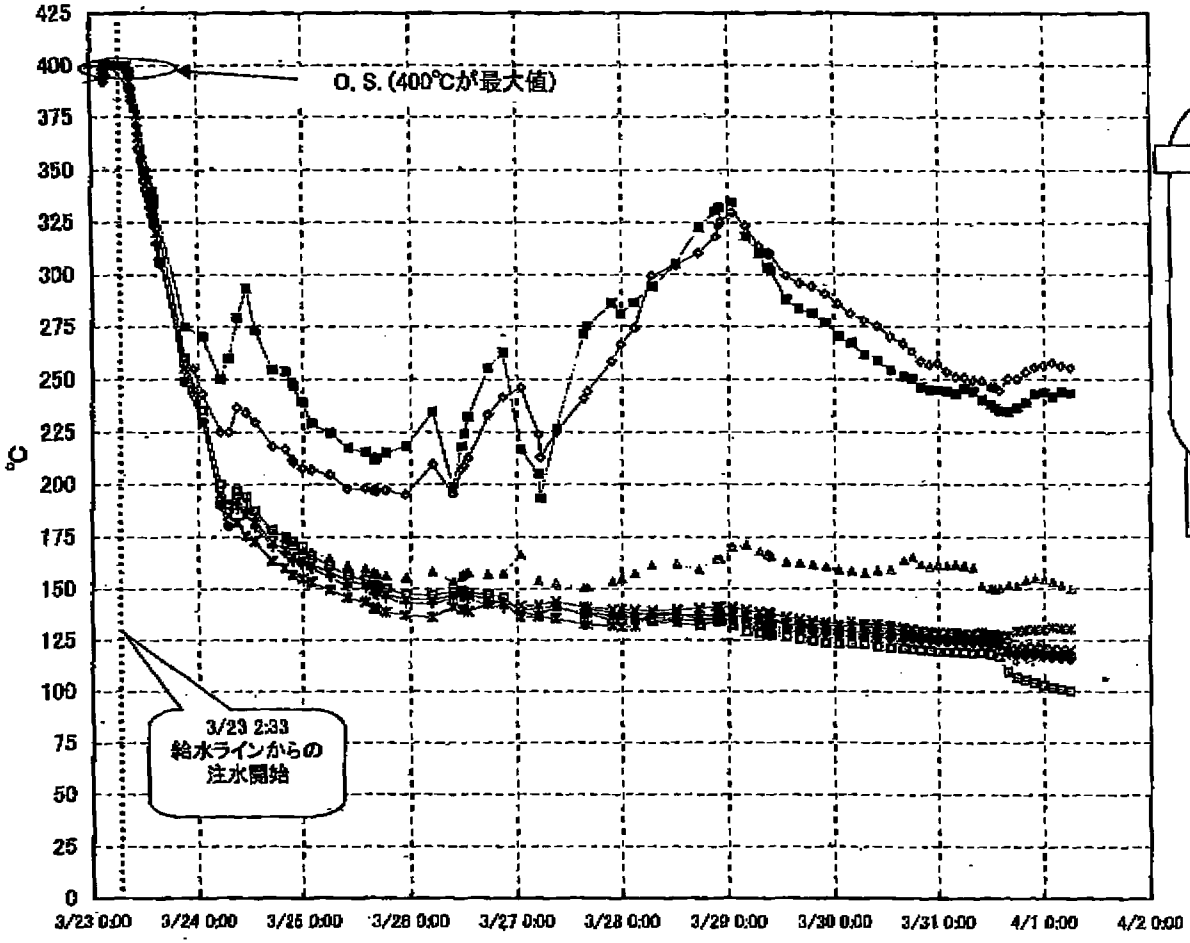
状況の確認ができない状態。

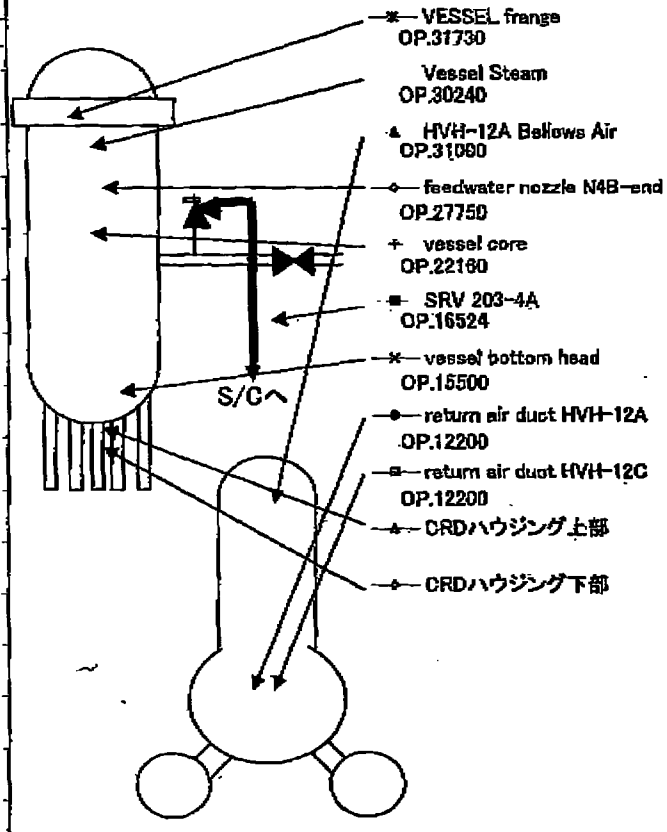
OAMS

	1F1	1F2	1F3
D/W(Sv/h)	44.3 (4/1 6:00)	37.2 (4/1 6:00)	24.5 (4/1 5:45)
S/C(Sv/h)	17.4 (4/1 6:00)	1.11 (4/1 6:00)	1.00 (4/1 5:45)

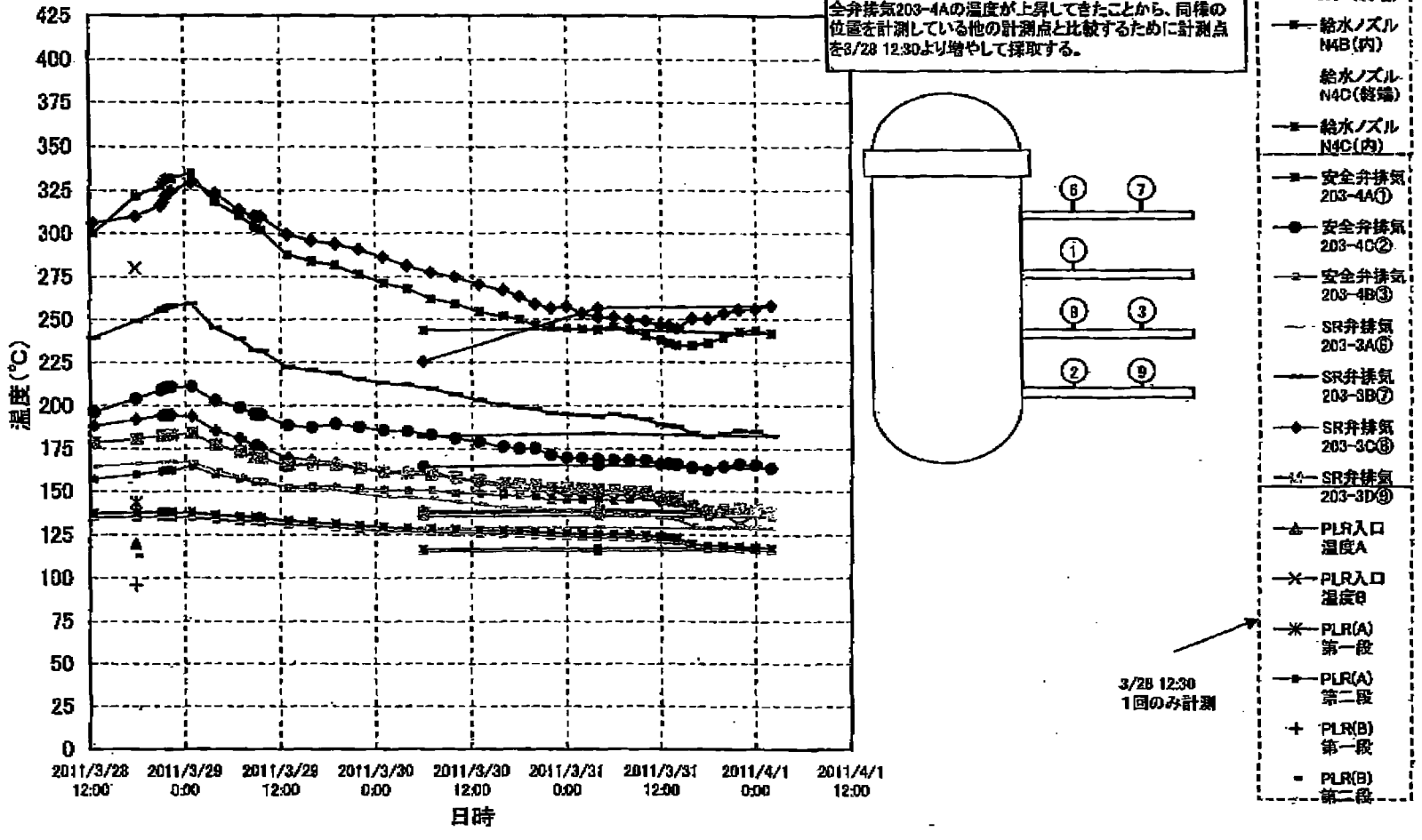
主要パラメータの測定点

1F-1RPV・PCV温度(4/1 6:00)

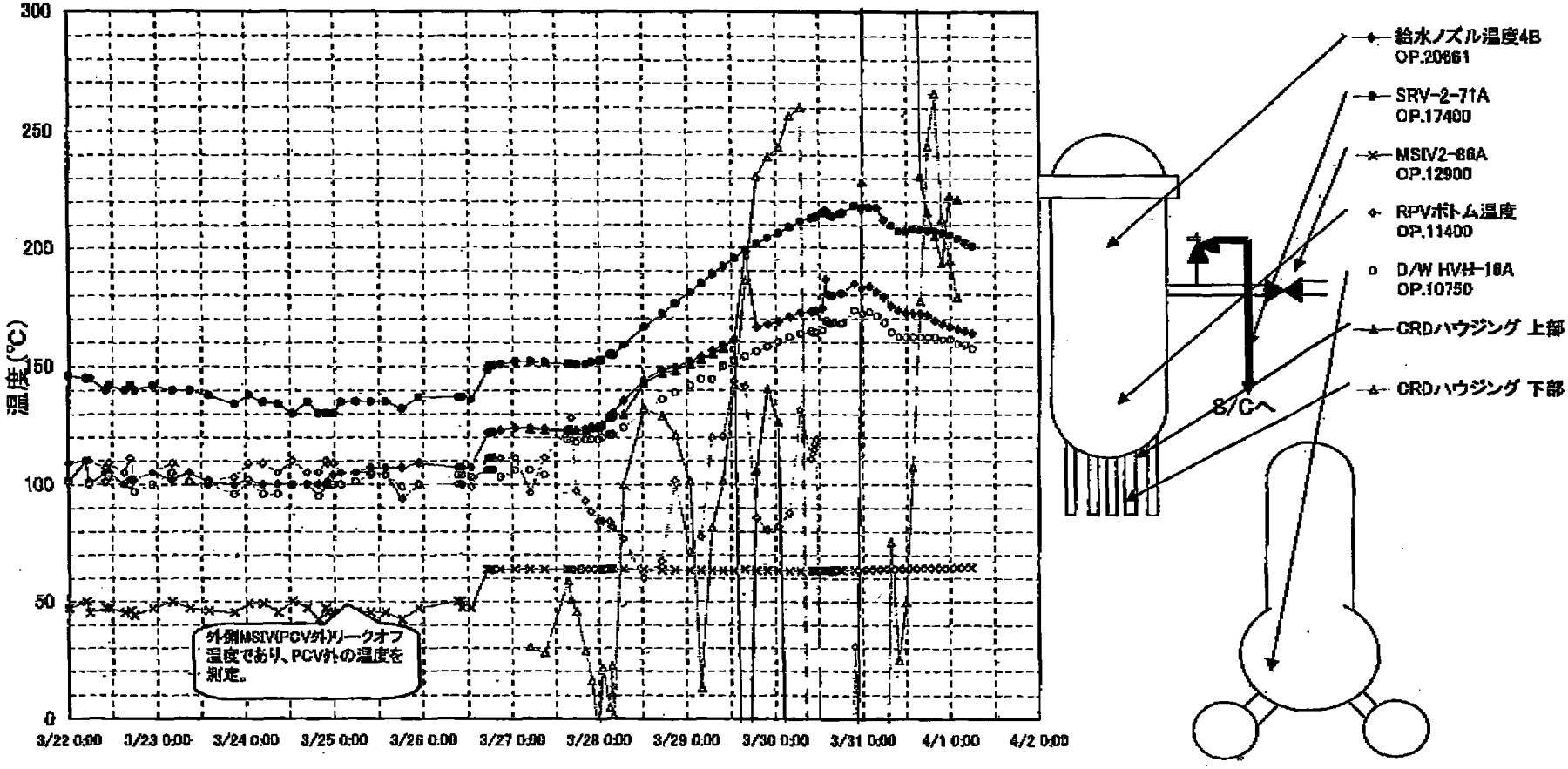




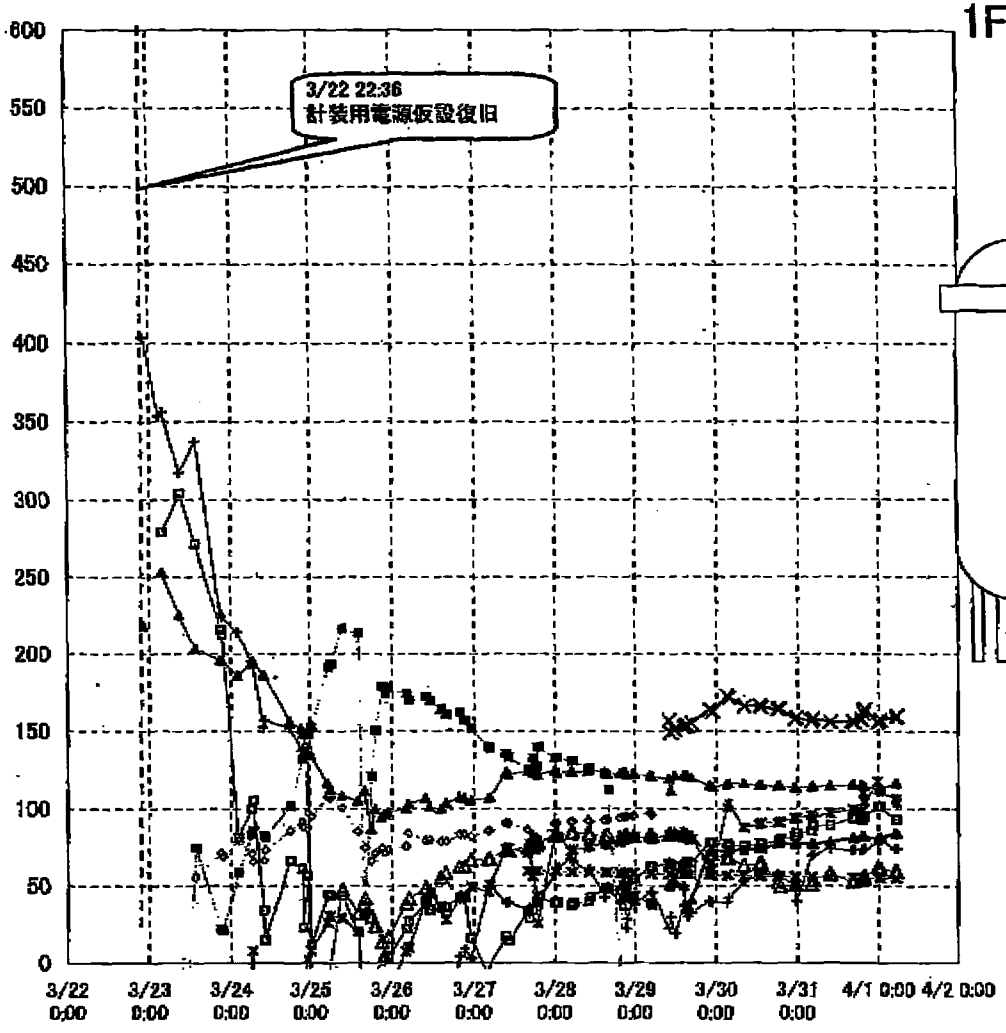
1F-1 給水ノズル温度および安全弁排気温度比較 (4月1日 6:00)

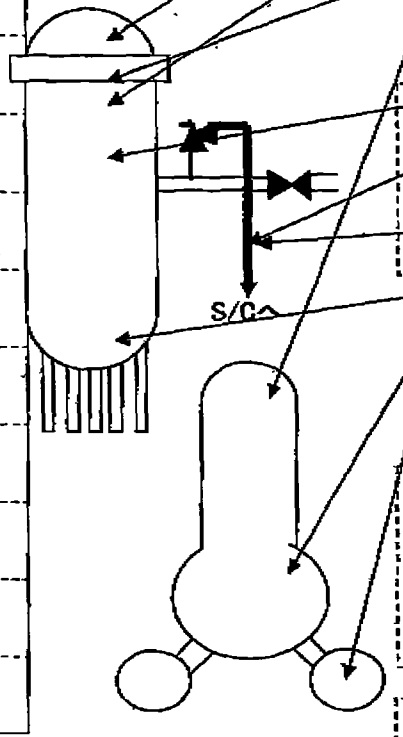


1F-2 RPV・PCV温度(4/1 6:00)



1F-3 RPV／PCV温度(4/1 5:45)





原子炉圧力容器フランジ温度 (TR-2-3-90)
1. RPV スタッドボルト温度

原子炉圧力容器フランジ温度 (TR-2-3-90)
2. RPV 胴フランジ下部温度

RPV 温度 (TRS-2-3-89) OP.32568
12. RPV 胴フランジ

格納容器内温度 (TR-16-115) OP.31853
11. L原子炉ベローシール部 TE-16-114L

RPV 温度 (TRS-2-3-89) OP.28601
1. RPV 給水ノズル N4B

安全弁漏洩温度 (TRS-2-166) OP.16298
7. 逃し安全弁 2-71D 漏洩 TE-2-113D

安全弁漏洩温度 (TRS-2-166) OP.16298
9. 逃し安全弁 2-71F 漏洩 TE-2-113F

RPV 温度 (TRS-2-3-89) OP.14770
13. RPV 下鏡ヘッド温度

格納容器内温度 (TR-16-115) OP.10700
1. A D/W HVH戻り空気 A号機 TE-16-114A

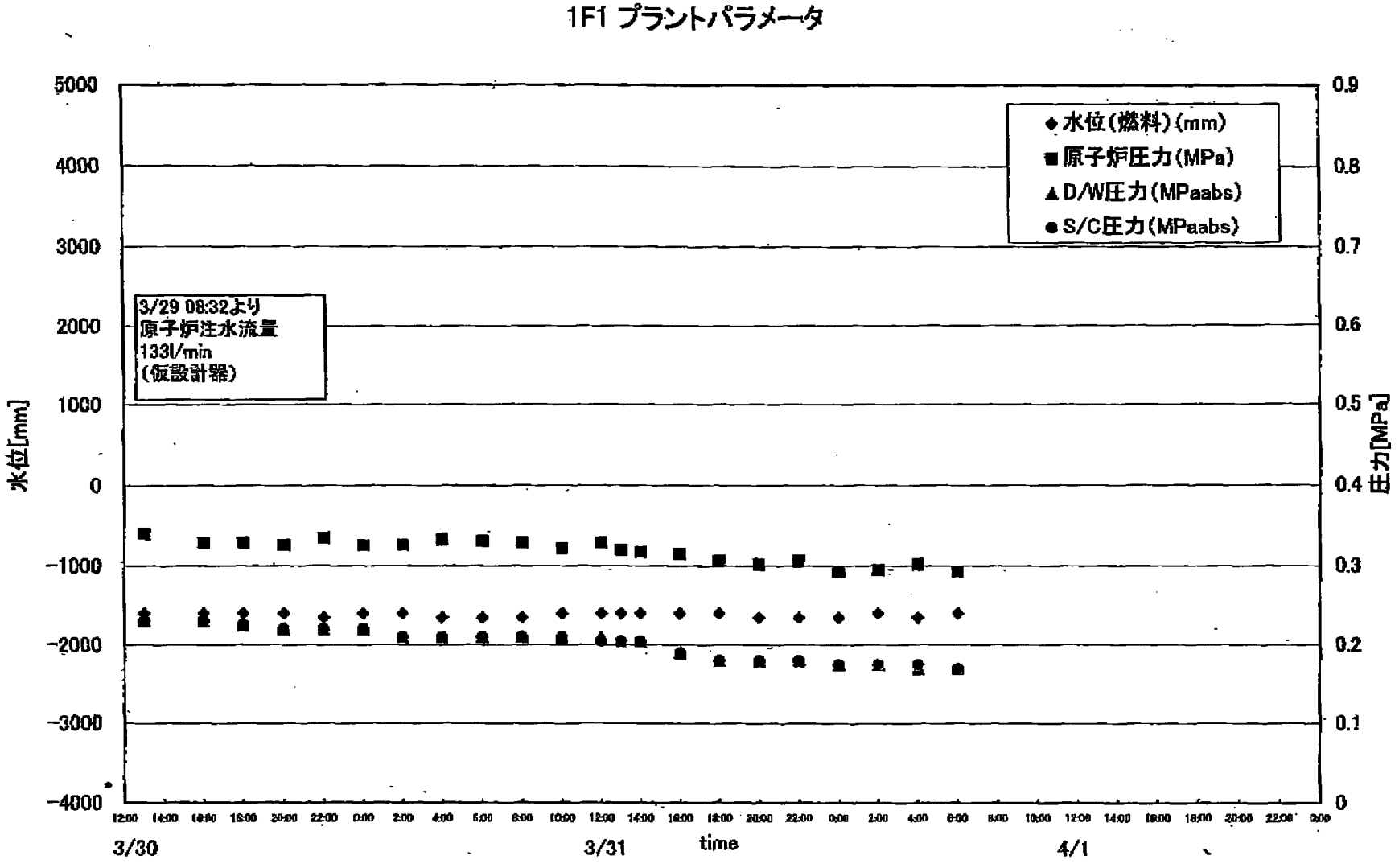
S/C温度
(ESS-I⑨)

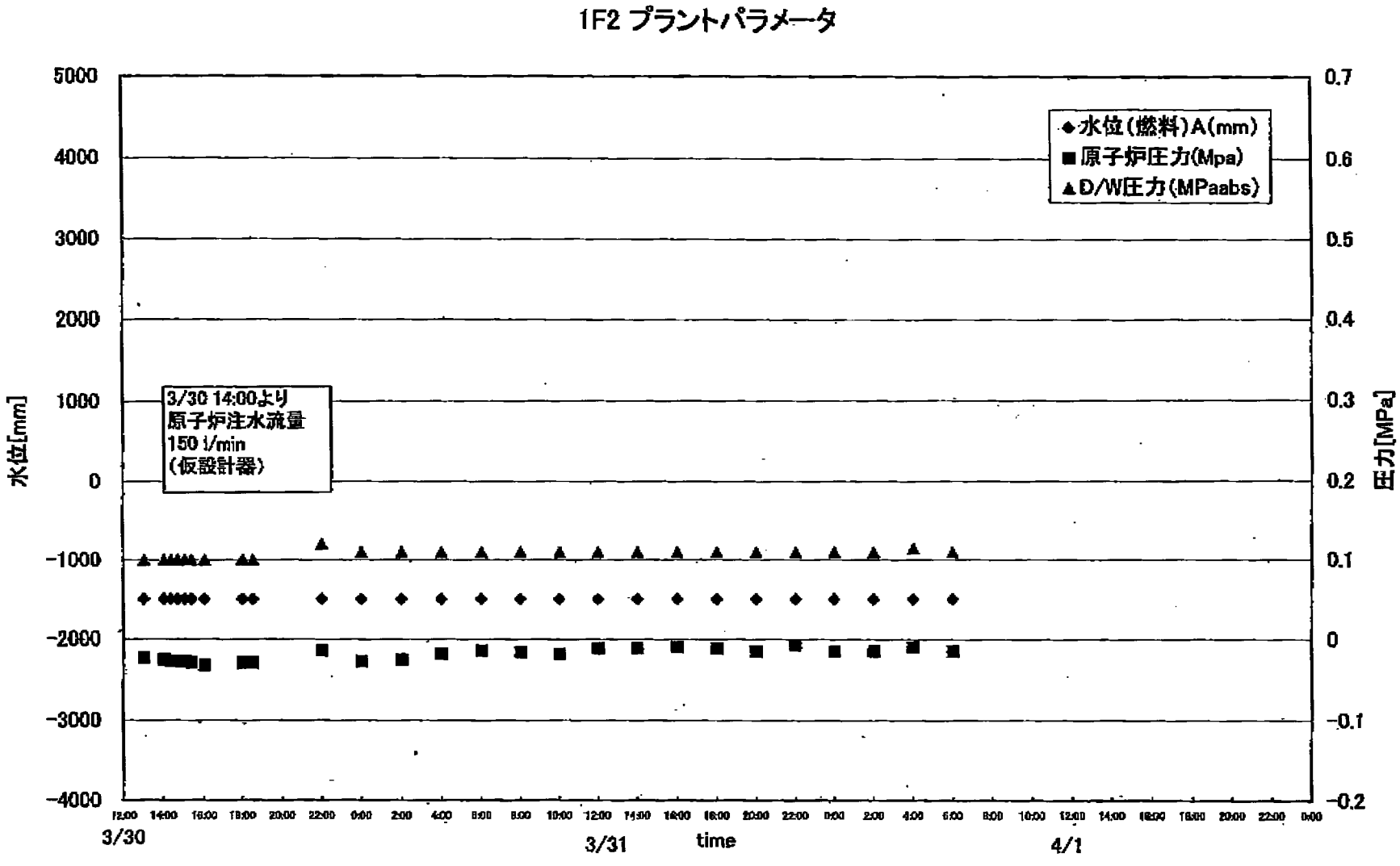
RPV 温度 (TRS-2-3-89)
3. RPV 給水ノズル N4D

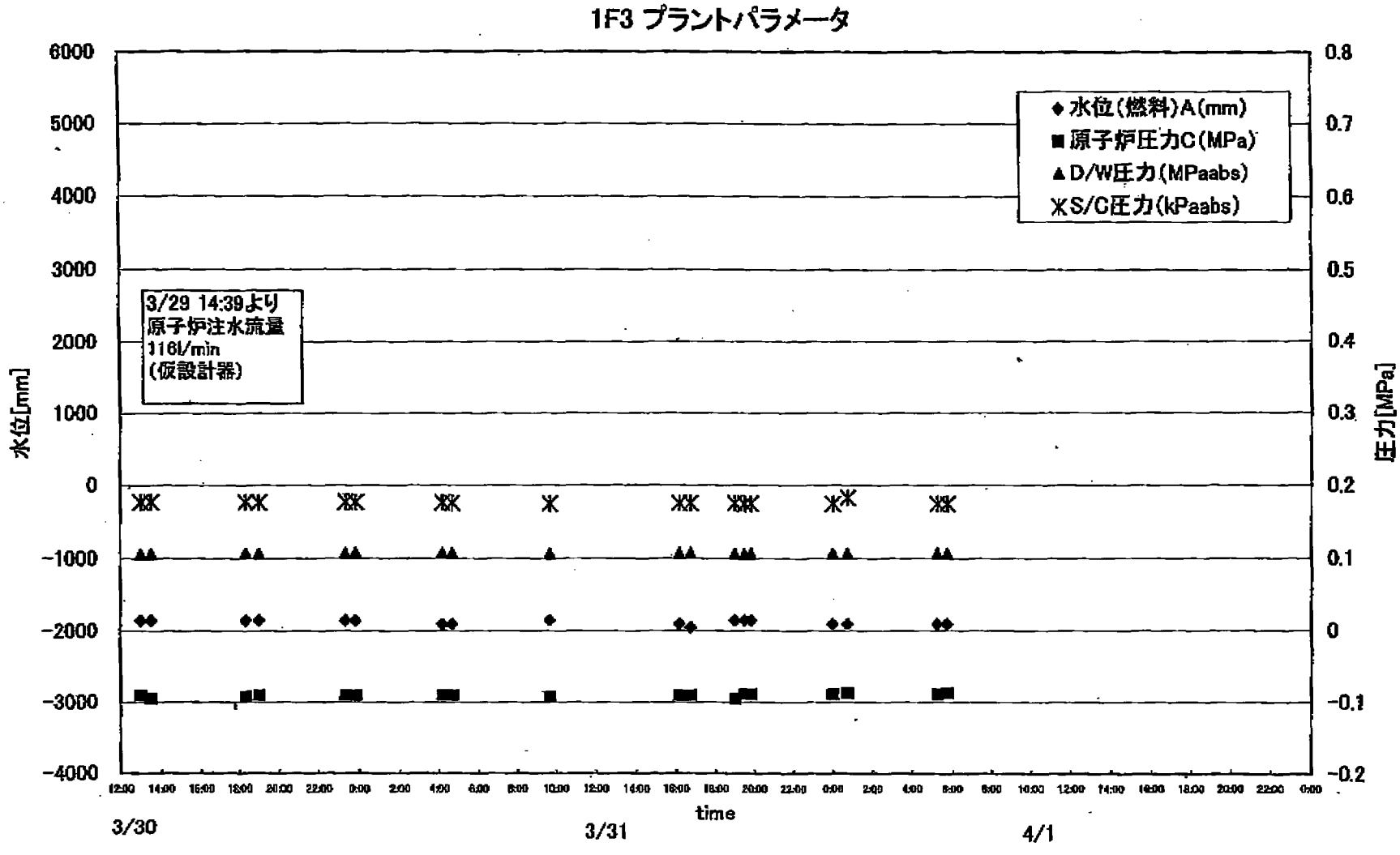
安全弁漏洩温度 (TRS-2-166)
10. 逃し安全弁 2-71G 漏洩 TE-2-113G

安全弁漏洩温度 (TRS-2-166)
16. 主蒸気隔離弁 2-86A リークオフ温度 TE-2-405A

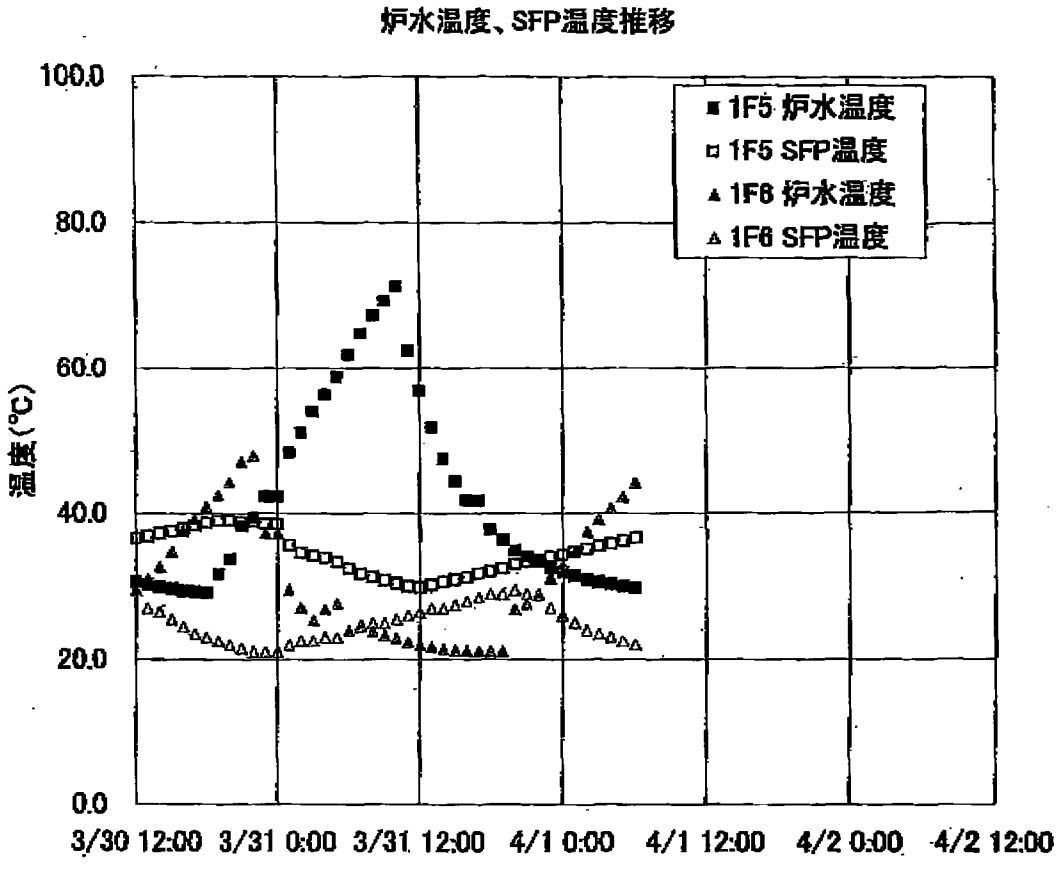
・矢印により測定位置を模式図上に示しているものが、現在測定中のデータ点
・一部測定点を変更しており、点線枠は測定を記載を中止した点。中止したデータは前記載版の表には載っています。


1F1 プラントパラメータ
水位[mm]
圧力[MPa]
◆水位(燃料)(mm)
■原子炉圧力(MPa)
▲D/W圧力(MPaabs)
●S/C圧力(MPaabs)
3/29 08:32より
原子炉注水流量
133l/min
(仮設計器)
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/30
3/31
4/1
time


1F2 プラントパラメータ
◆水位(燃料)A(mm)
■原子炉圧力(Mpa)
▲D/W圧力(MPaabs)
3/30 14:00より
原子炉注水流量
150 l/min
(仮設計器)
水位[mm]
圧力[MPa]
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
3/30
3/31
time
4/1


1F3 プラントパラメータ
◆水位(燃料)A(mm)
■原子炉圧力C(MPa)
▲D/W圧力(MPaabs)
✕S/C圧力(kPaabs)
3/29 14:39より
原子炉注水流量
116l/min
(仮設計器)
水位[mm]
圧力[MPa]
6000
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
time
3/30
3/31
4/1

	1F5		1F6	
	炉水温度	SFP温度	炉水温度	SFP温度
2011/3/31 9:00	69.4	30.8	23.3	25.0
2011/3/31 10:00	71.4	30.4	22.9	25.5
2011/3/31 11:00	62.4	30.0	22.3	26.0
2011/3/31 12:00	56.8	29.9	22.0	26.5
2011/3/31 13:00	51.8	30.2	21.7	27.0
2011/3/31 14:00	47.4	30.6	21.4	27.0
2011/3/31 15:00	44.4	30.9	21.3	27.5
2011/3/31 16:00	41.8	31.2	21.2	28.0
2011/3/31 17:00	41.7	31.7	21.1	28.5
2011/3/31 18:00	37.7	32.0	21.1	29.0
2011/3/31 19:00	36.3	32.4	21.1	29.0
2011/3/31 20:00	34.9	33.0	26.9	29.5
2011/3/31 21:00	34.0	33.3	27.6	29.0
2011/3/31 22:00	33.3	33.6	28.8	29.0
2011/3/31 23:00	32.4	34.0	31.1	27.0
2011/4/1 0:00	31.9	34.3	32.7	26.0
2011/4/1 1:00	31.4	34.7	34.8	25.0
2011/4/1 2:00	30.9	35.1	37.4	24.0
2011/4/1 3:00	30.6	35.5	39.1	23.5
2011/4/1 4:00	30.3	35.8	40.6	23.0
2011/4/1 5:00	30.0	36.2	42.2	22.5
2011/4/1 6:00	29.8	36.6	44.1	22.0



1F-1プラント関連パラメータ

1uプラントデータ(可能な限りの更新)

	3/31 4:00	3/31 6:00	3/31 8:00	3/31 10:00	3/31 12:00	3/31 13:00	3/31 14:00	3/31 16:00	3/31 18:00	3/31 20:00	3/31 22:00	2011/4/1 4/1 0:00	4/1 2:00	4/1 4:00	4/1 6:00
	4:00	6:00	8:00	10:00	12:00	13:00	14:00	16:00	18:00	20:00	22:00	0:00	2:00	4:00	6:00
水位(燃料上(cm)	-1650	-1650	-1650	-1600	-1600	-1600	-1600	-1600	-1600	-1650	-1650	-1650	-1600	-1650	-
原子炉圧力(MPa)	0.333	0.331	0.329	0.322	0.329	0.320	0.317	0.315	0.306	0.302	0.306	0.293	0.295	0.302	0.293
D/W圧力(MPa abs)	0.210	0.210	0.210	0.210	0.210	0.205	0.205	0.190	0.180	0.180	0.180	0.175	0.175	0.170	0.170
S/C圧力(MPa abs)	0.210	0.210	0.210	0.210	0.205	0.205	0.205	0.190	0.180	0.180	0.180	0.175	0.175	0.175	0.170
原子炉ウェル内の計器による水位	0.511	0.511	0.495	0.509	0.506	0.497	0.497	0.497	0.493	0.484	0.491	0.482	0.491	0.502	0.
CAMS-D/W	41.7	38.2	34.2	42.3	41.2	41.2	34.4	43.5	41.0	42.5	42.9	43.9	38.7	42.4	
CAMS-S/C	18.2	18.1	18.0	18.0	17.2	17.2	17.6	17.7	17.7	17.8	17.6	17.5	17.5	17.4	
水位(ゼロ一方の計器によるもの)	-1650	-1650	-1650	-1600	-1650	-1550	-1550	-1550	-1600	-1650	-1650	-1650	-1600	-1600	

1F-2プラント関連パラメータ

<続き>2uプラントデータ(可能な限りの更新)

	3/31 4:00	3/31 6:00	3/31 8:00	3/31 10:00	3/31 12:00	3/31 14:00	3/31 16:00	3/31 18:00	3/31 20:00	3/31 22:00	2011/4/1 4/1 0:00	4/1 2:00	4/1 4:00	4/1 6:
	4:00	6:00	8:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00	0:00	2:00	4:00	6:
水位(燃料プール)(mm)	-1500	-1500	-1500	-1500	-1500	-1500	-1500	-1500	-1500	-1500	-1500	-1500	-1500	-150
原子炉圧力(MPa)	-0.018	-0.014	-0.016	-0.018	-0.011	-0.011	-0.009	-0.011	-0.014	-0.007	-0.014	-0.014	-0.009	-0.0
D/W圧力(MPaabs)	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.115	0.110
S/C圧力(MPaabs)	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS
CAMS:D/W	38.7	38.6	38.5	38.4	37.9	38.0	37.9	37.8	37.8	37.7	37.6	37.5	37.3	37.
CAMS:S/C	1.19	1.19	1.17	1.17	1.16	1.16	1.16	1.15	1.15	1.14	1.14	1.14	1.13	1.1
申請線量(mSv/h)	0.10	0.11	0.12	0.13	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.09	0.1

[redacted]

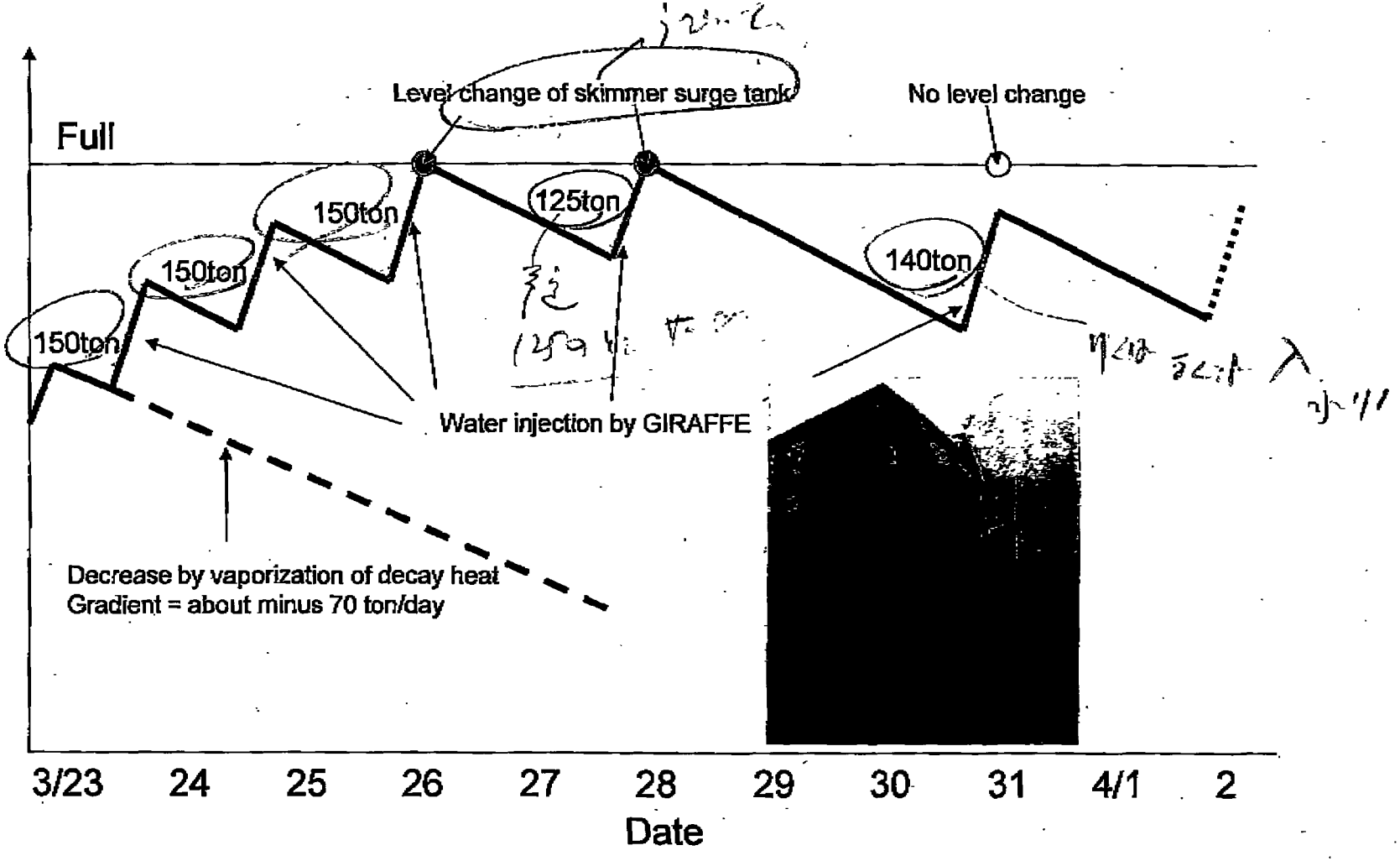
備考

1F-3プラント関連パラメータ

3uプラントデータ(可能な限りの更新)　2011/3/31

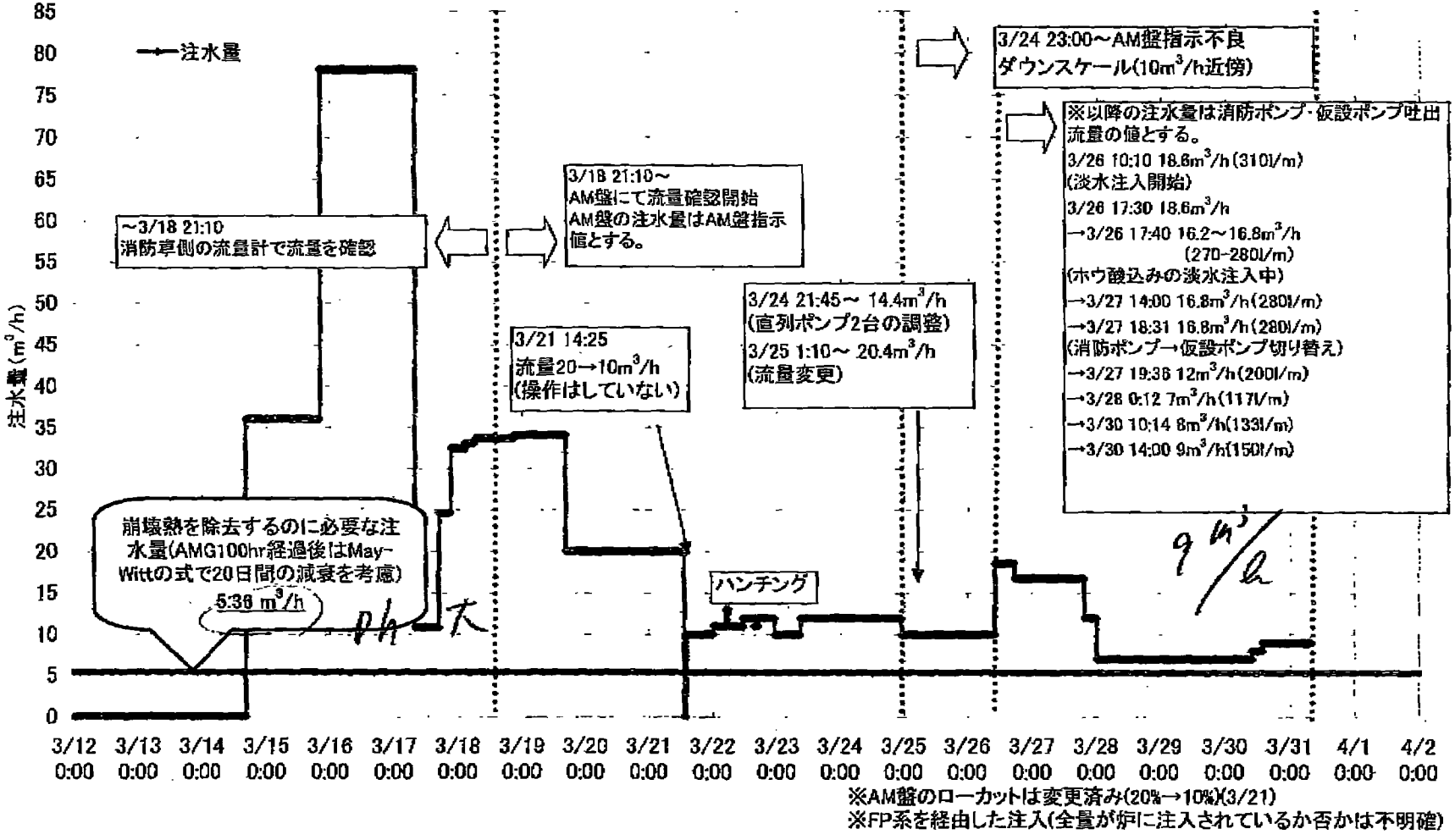
	3/31 4:10	3/31 4:40	3/31 9:40	3/31 16:10	3/31 16:45	3/31 19:00	3/31 19:30	3/31 19:50	2011/4/1 0:00	4/1 0:45	4/1 5:15	4/1 5:45
	4:10	4:40	9:40	16:10	16:45	19:00	19:30	19:50	0:00	0:45	5:15	5:45
水位(燃料域A)(mm)	-1900	-1900	-1850	-1900	-1950	-1850	-1850	-1850	-1900	-1900	-1900	-190
水位(燃料域B)(mm)	-2300	-2300	-2250	-2250	-2250	-2250	-2250	-2250	-2250	-2250	-2250	-2250
原子炉圧力(MPa)	-0.090	-0.090	-0.092	-0.090	-0.090	-0.095	-0.088	-0.088	-0.088	-0.086	-0.088	-0.086
原子炉圧力Bor(MPa)	0.020	0.020	0.016	0.016	0.018	0.011	0.020	0.023	0.016	0.016	0.018	0.01
D/W圧力(MPaabs)	0.1075	0.1073	0.1066	0.1071	0.1071	0.1069	0.1064	0.1068	0.1068	0.1073	0.1071	0.107
S/C圧力(kPaabs)	176.8	176.4	175.5	176.1	176.1	176.1	175.4	175.9	175.5	183.8	175.5	175.
予備 S/C圧力(MPaabs)	0.1768	0.1764	0.1755	0.1761	0.1761	0.1761	0.1754	0.1759	0.1755	0.1838	0.1755	0.175
CAMS-D/W(A)	26.0	25.7	25.4	25.1	25.9	24.8	25.4	24.8	24.0	24.0	24.7	24.
CAMS-D/W(B)	19.3	19.2	19.0	18.7	18.7	18.6	18.6	18.6	18.0	18.0	18.2	18.
CAMS-S/C(A)	1.05	1.05	1.04	1.02	1.02	1.02	1.02	1.02	1.00	1.00	1.00	1.0
CAMS-S/C(B)	0.98	0.98	0.97	0.98	0.95	0.95	0.95	0.95	0.93	0.93	0.93	0.92
S/C温度(℃)	55.4	55.3	55.2	55.0	55.0	54.9	54.9	54.9	54.7	54.7	54.6	54.6
中操線量(mSv/h)	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12
	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし	注水量計器不良のため測定データなし

Water volume estimation of 1F4 Spent Fuel Pool



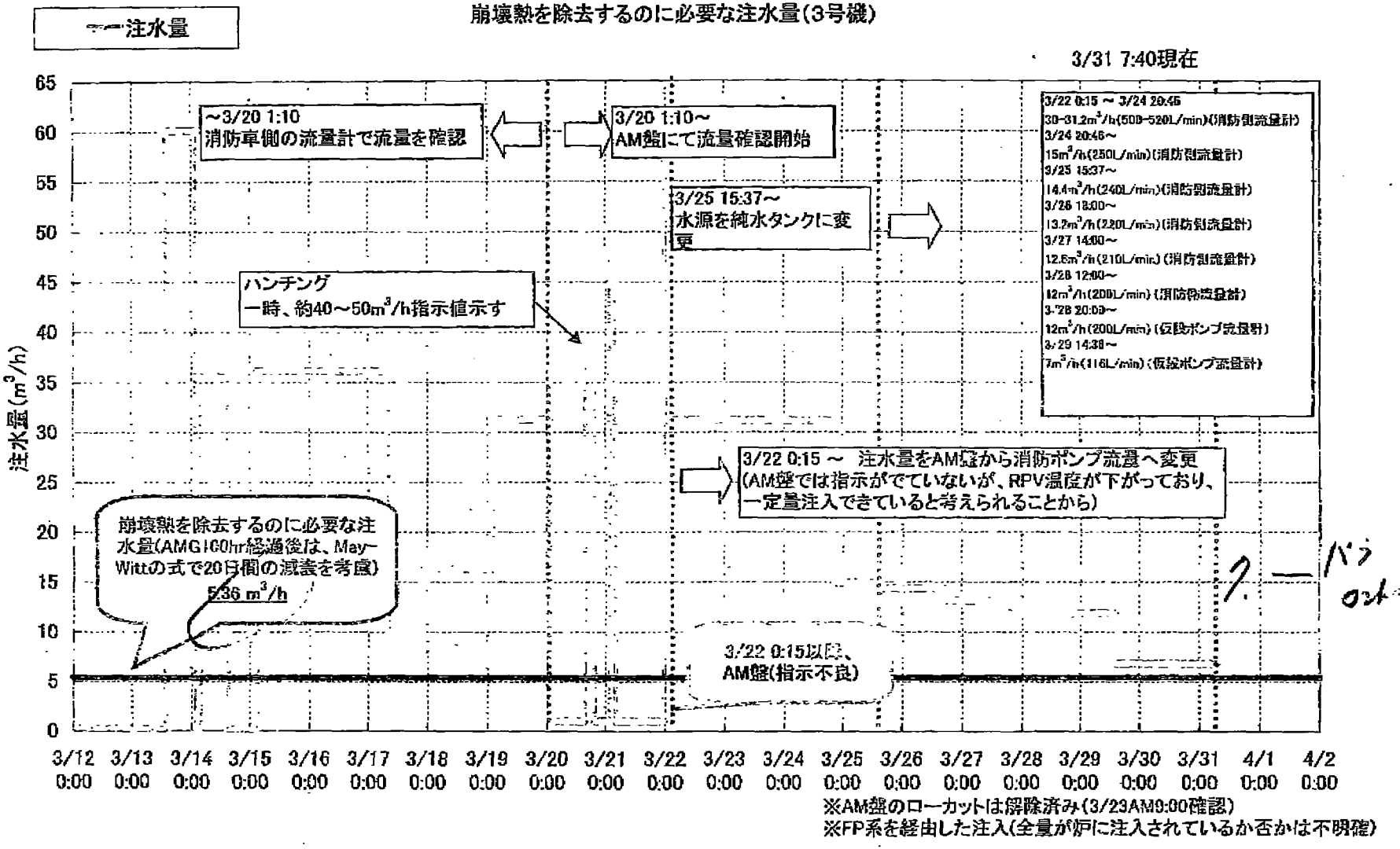
崩壊熱を除去するのに必要な注水量(2号機)

3/31 7:40現在

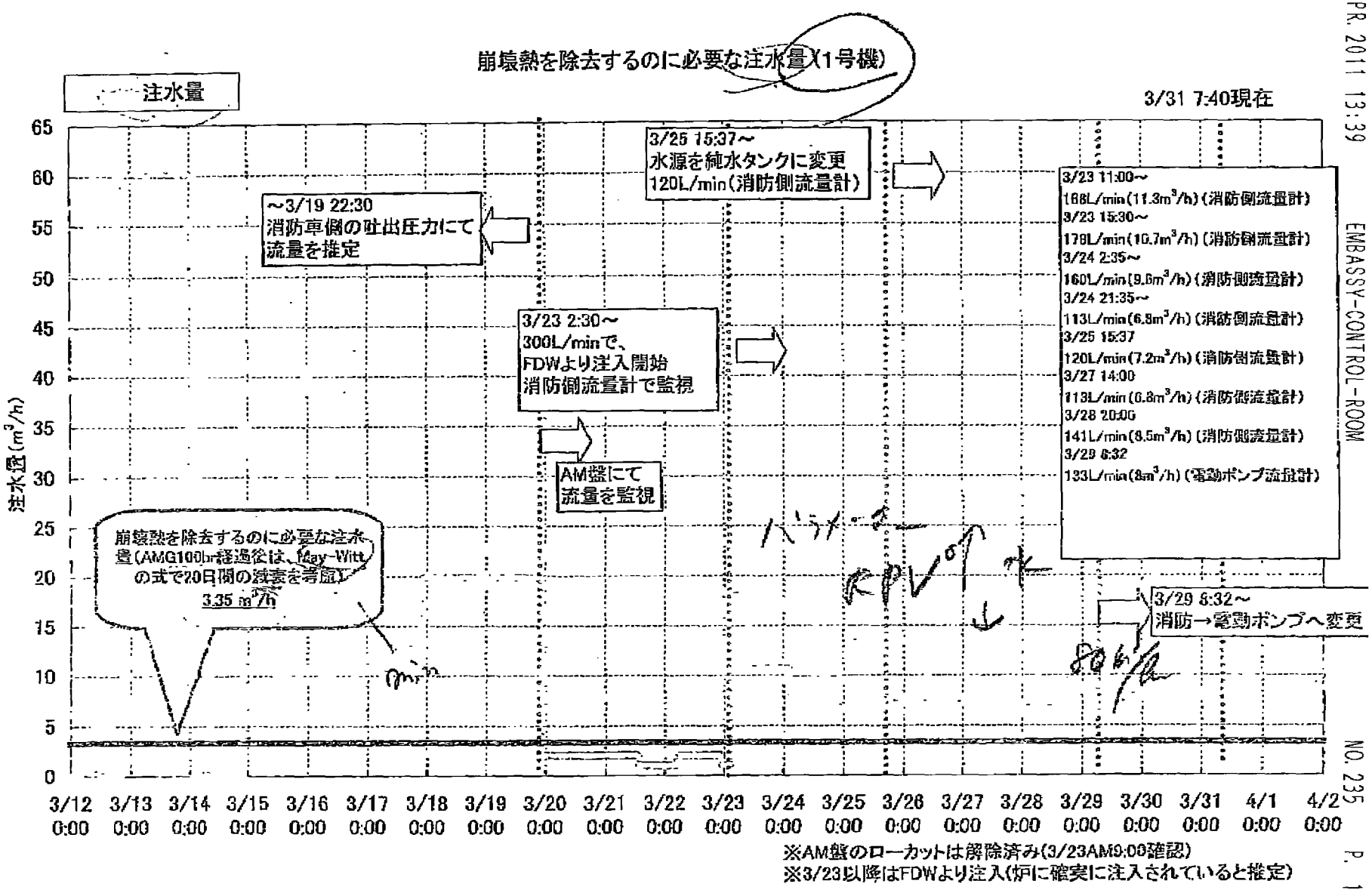


※AM盤のローカットは変更済み(20%→10%)(3/21)
※FP系を経由した注入(全量が炉に注入されているか否かは不明確)

崩壊熱を除去するのに必要な注水量(3号機)



※AM盤のローカットは解除済み(3/23AM9:00確認)
※FP系を経由した注入(全量が炉に注入されているか否かは不明確)



※AM盤のローカットは解除済み(3/23AM9:00確認)
※3/23以降はFDWより注入(炉に確実に注入されていると推定)

From: LIA07 Hoc
Sent: Saturday, April 02, 2011 5:24 AM
To: LIA07 Hoc
Subject: 0430 EDT (April 2, 2011) USNRC Earthquake/Tsunami Status Update
Attachments: NRC Status Update 4.2.11--0430.pdf

Attached, please find a 0430 EDT, April 2, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

Please note that this information is ~~"Official Use Only" and~~ is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Jim

Jim Anderson
Executive Briefing Team Coordinator
Office of Nuclear Security and Incident Response
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)
james.anderson@nrc.gov

LLL4/169

Bano, Mahmooda

From: Hochevar, Albert R. (INPO) [HochevarAR@INPO.org]
Sent: Sunday, April 03, 2011 7:44 AM
To: Scott, Michael; Giessner, John; Blamey, Alan
Subject: FW: April 3 briefing notes and Radiation Survey Map of the site
Attachments: 20110403 Roger's speaking note[1].pdf

For your situational awareness.
Al

From: Spinnato, Roger E (WANO)
Sent: Sunday, April 03, 2011 8:31 PM
To: INPO EmergencyResponseCtr (INPO); INPOERCTech
Cc: Gambone, Robert L (INPO); Hochevar, Albert R. (INPO); Farr, David M (WANO); Shirayanagi TC; Tsuchihashi; fujii@wano-tc.or.jp; felgate@wanocc.org; hopkinson@wanocc.org; igancio.araluce@wanopc.org; jan.bens@wanopc.org; Maddox, James E. (INPO); Garchow, David F.(INPO)
Subject: RE: April 3 briefing notes and Radiation Survey Map of the site

I appologize to everyone I forgot to attach my briefing notes. Sorry for the delay.

From: Spinnato, Roger E (WANO)
Sent: Sunday, April 03, 2011 5:23 AM
To: INPO EmergencyResponseCtr (INPO); INPOERCTech
Cc: Gambone, Robert L (INPO); Hochevar, Albert R. (INPO); Farr, David M (WANO); Shirayanagi TC; Tsuchihashi; fujii@wano-tc.or.jp; felgate@wanocc.org; hopkinson@wanocc.org; igancio.araluce@wanopc.org; jan.bens@wanopc.org; Maddox, James E. (INPO); Garchow, David F.(INPO)
Subject: April 3 briefing notes and Radiation Survey Map of the site

I have attached the survey map of the reactor building and our briefing notes. Please note that there is no update to the excel spreadsheet today.

Roger Spinnato

LLLL/170

FUKUSHIMA DAIICHI

Status as of 6pm (JST) April 3, 2011- TC Briefing. (All times JST)

All Information in this report may be shared:

It is with sadness that we have to report that the bodies of the two missing TEPCO operators were found ~~yesterday~~ in the basement of the Unit 4 turbine building. We in the Tokyo Center join TECPO in offering our deepest sympathy and condolence to the families of these young men, Kazuhiko Kokubo age 24 and Yoshiki Terashima age 21.

The priorities are as follows:

- Ensuring fresh water injection and cooling capabilities to the reactors and spent fuel pools.
- Restoration of the nitrogen purge system so that the rector pressure vessel and the drywell can be depressurized and eliminate the risk of a hydrogen explosion.
- Draining water from the turbine buildings to reduce the radiation levels so that work can continue and to contain the spread of radioactive materials.

Highlights for today include the following:

- Trails of white vapor are intermittently being seen coming out of the units 1, 2, 3, and 4 reactor buildings.
- Disposal of radioactive water and radiation levels of water in the turbine building basements continues to delay work to restore cooling functions. We do not have an update on the status on transferring water from the hotwells to the condensate storage tanks.
- Site personnel have been attempting to seal that crack in the side of a concrete pit near the intake facility. Two attempts to seal the crack with concrete were unsuccessful. Experts in sealing water leaks in concrete have been brought to the site and are making repairs. As we stated yesterday, NISA has directed TEPCO to conduct isotopic analysis of the seawater, perform extent of condition inspections and strengthen monitoring of sea water near the pit that is leaking. We have not received an update on the status of completing these actions.
- Injection flow of freshwater has been reduced on units 1 and 2.

Unit Status

- In Unit 1, non-borated fresh water injection continues into the main feedwater line. The injection flow rate is 6 cubic meters/hr (goal is to reduce flow to 4 cubic meters/hr, which is equivalent to the decay heat rate 14 days after shutdown.) Reactor pressure indicators A and B are diverged and are higher than yesterday. A has increased to .290 MPa, (42.06 psia) but B has increased to .542 MPa (78.61 psia). Feedwater nozzle temperature has decreased and is at 256.7 degrees centigrade or (494 degrees Fahrenheit) and reactor vessel lower temperature has decreased slightly to 117.2 degrees Centigrade or (243 degrees Fahrenheit.) Drywell and torus pressure have decreased to .155 or

(22.48 psi) and .160 MPa or (23.21 psi) respectively. Dose rates in the U1 Drywell have decreased significantly and are reading 31.8 Sv/Hr or (3,180 Rem/hr) and dose rates in the Torus continue to drop and are at 15.3 Sv/Hr (1,530 Rem/hr.)

- In Unit 2, injection of non-borated fresh water using the low pressure coolant injection line continues. The injection flow rate is at 8 cubic meters/hr, (goal is to reduce flow to 7 cubic meters/hr, which is equivalent to the decay heat rate 14 days after shutdown.) Unit 2 reactor and drywell pressure are relatively stable and feedwater nozzle temperature continues to decrease and is at 153.4 degrees centigrade or (308 degrees Fahrenheit) and reactor vessel lower temperature is not indicating. Dose rates in the U2 Drywell and Torus continue to decrease. The drywell dose rates are at 35 or Sv/hr (3,500 Rem/hr) and the dose rate in the Torus have decreased to .947 Sv/hr or (94.7 Rem/hr.)

- Power has been restored to the Unit 2 spent fuel pool skimmer surge tank level indicator and the level in the surge tank is indicating 5,350 millimeters or (17.55 feet) The temperature in the spent fuel pool has decreased slightly 70 degrees centigrade or (158 degree Fahrenheit)

- In Unit 3, injection of non-borated fresh water injection using the low pressure coolant injection line continues. The injection flow rate of 7 cubic meters/hr (= to the goal) is equivalent to the decay heat rate 14 days after shutdown. Unit 3 reactor, drywell pressure and torus pressures are relatively stable and Unit 3 feedwater nozzle temperature indicator is relatively stable and is currently reading 90.6 degrees Centigrade or (195 degrees Fahrenheit). The accuracy of this indication remains in doubt. Reactor vessel lower temperature has decrease slightly and is at 115.9 degrees Centigrade (241 degrees Fahrenheit.) Dose rates in the U3 Drywell and Torus continue to drop. The drywell is at 22.2 Sv/hr (2,220 Rem/hr) and the dose rate in the Torus is .911 Sv/hr or (91.1 Rem/hr.)

- Spraying of water into the spent fuel pools is being conducted as necessary. The Unit 3 Spent Fuel Pool was sprayed yesterday.

Dose Rates

- Overall site dose rates are decreasing. Several hot spots remain, primarily around Units 1 and 3 reactor buildings. The last reading reported at the main gate was 124 µSv /hr or (12.4 millirem/hour). Other readings around the site indicate that the dose rates on the side of the administration building facing the units is at .78 mSv/hr or 78 mrem/hr and the dose rate at the west gate is reported to be 78.4 µSv /hr or (7.84 millirem/hour). I have attached a survey map of the units to our briefing notes.

- The total number of Fukushima Daiichi NPS workers that have received more than 100 mSv (10 rem) of exposure is now 21.

Questions:

- In response to a question we posed on the significance of the detected levels of iodine being found near the plant. It was stated that it would be of more value to understand how far out from the plant discharge you have to go before the samples are below the limit. We have not as yet found how far you have to go from the plant before the values are below the legal limit. However, the government has found that 79.4 Becquerel's per liter Iodine-131 or twice the legal limit was found as far away as 40 kilometers from the station.

Bano, Mahmooda

From: nei-hisanori@meti.go.jp Rel
Sent: Sunday, April 03, 2011 12:41 AM
To: Scott, Michael
Cc: Blamey, Alan; Casto, Chuck; Collins, Elmo; HochevarAR@INPO.org; Giessner, John; Monninger, John; Taylor, Robert; RST01 Hoc; oshima-toshiyuki@meti.go.jp; bannai-toshihiro@meti.go.jp; koyama-masaomi@meti.go.jp; sakuma-yasuhiro@meti.go.jp Release
Subject: Re: Supplemental Information on Venting Hisanori Nei

Dear Mr. Scott

Thank you for your e-mail to share the supplemental infomation on Venting.

I already sent to Sato-san and my colleagues in Integrated Headquarters at TEPCO.

We will discuss on this matter tomorrow 1100 meeting.

However, it include beneficial to consider necessity of additional venting at 1F1 , therefore I ask my colleague to take a look carefully and take into account for there decision making.

See you tomorrow and thank you again for your cooperation.

Regards,

Hisanori Nei

LLLL/171

Wagner, Katie

From: Wagner, Katie
Sent: Monday, April 04, 2011 4:18 PM
To: Fuhrmann, Mark
Cc: Ott, William; Lee, Richard
Subject: RE: Media - Yale Environment 360-Question

Hello Mark,

DSA is tracking requests and the request from Scott Burnell is one of them. Is this item (description below) complete now or still pending?

69	4/1/2011	Scott Burnell	301-415-8204	Bill Ott x7407 Mark Fuhrmann x7472	DRA/ETB	Identify a staff member to contact a reporter trying to find information, studies, etc on how contamination would behave in a marine environment.	Identify a staff member to contact a reporter trying to find information, studies, etc on how contamination would behave in a marine environment.	Pending

Thanks,

Katie Wagner
DSA POC for Japan-Related Requests

From: Burnell, Scott
Sent: Friday, April 01, 2011 4:28 PM
To: Fuhrmann, Mark
Cc: Wagner, Katie
Subject: RE: Media - Yale Environment 360-Question

Mark;

What's your usual departure time? I can try and conference her in – given where the conversation might go I should be on the call.

Scott

From: Fuhrmann, Mark
Sent: Friday, April 01, 2011 4:22 PM
To: Burnell, Scott
Subject: RE: Media - Yale Environment 360-Question

Hi Scott
I will not be here on Monday. I can give her a call now. That is not a problem. I have her number. Let me know if that is OK.
Mark

Mark Fuhrmann, Ph.D.
Geochemist
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Mail Stop CSB 2C-07m

LLLL/172

11555 Rockville Pike
Rockville, MD 20852-2738

mark.fuhrmann@nrc.gov
Phone: 301-251-7472
Fax: 301-251-7410

From: Burnell, Scott
Sent: Friday, April 01, 2011 4:20 PM
To: Fuhrmann, Mark; Ott, William
Cc: Wagner, Katie
Subject: RE: Media - Yale Environment 360-Question

Hi Mark;

It's obviously a bit too late to try to do this today – what's your schedule Monday? Thanks.

Scott

From: Fuhrmann, Mark
Sent: Friday, April 01, 2011 4:11 PM
To: Ott, William; Burnell, Scott
Subject: RE: Media - Yale Environment 360-Question

Hi Scott;
Sure I can talk to this person....if it is appropriate that you moderate the conversation, that is fine and maybe for the better. My phone number is below.
Mark

Mark Fuhrmann, Ph.D.
Geochemist
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Mail Stop CSB 2C-07m
11555 Rockville Pike
Rockville, MD 20852-2738

mark.fuhrmann@nrc.gov
Phone: 301-251-7472
Fax: 301-251-7410

From: Ott, William
Sent: Friday, April 01, 2011 4:08 PM
To: Burnell, Scott
Cc: Fuhrmann, Mark
Subject: RE: Media - Yale Environment 360-Question

I have passed on your message to Mark.

From: Burnell, Scott
Sent: Friday, April 01, 2011 4:02 PM
To: Ott, William; Gibson, Kathy; Wagner, Katie

Cc: Garry, Steven
Subject: RE: Media - Yale Environment 360-Question

Hi Bill;

Would Dr. Fuhrmann be willing to talk to the reporter? I can certainly "moderate" the interview if he'd like.

Scott

From: Ott, William
Sent: Friday, April 01, 2011 4:00 PM
To: Gibson, Kathy; Burnell, Scott; Wagner, Katie
Cc: Garry, Steven
Subject: RE: Media - Yale Environment 360-Question

Dr. Mark Fuhrmann of my staff has considerable experience on the evaluation of ocean dumping from his years at Brookhaven National Laboratory where he served on at least one international committee on the subject. He is a geochemist by training but has spent most of his career applying that training to looking at radioactive materials in various environmental systems including marine systems.

From: Gibson, Kathy
Sent: Friday, April 01, 2011 3:41 PM
To: Burnell, Scott; Wagner, Katie; Ott, William
Subject: Re: Media - Yale Environment 360-Question

Its Bill Ott

From: Burnell, Scott
To: Wagner, Katie
Cc: Gibson, Kathy
Sent: Fri Apr 01 15:24:09 2011
Subject: FW: Media - Yale Environment 360-Question

Katie;

Would Bob or another person in RES have any relevant info for the reporter's request? Thanks.

Scott

From: Garry, Steven
Sent: Friday, April 01, 2011 3:23 PM
To: Burnell, Scott
Subject: RE: Media - Yale Environment 360-Question

Scott,

I suggest calling research, maybe Bob Ott.

Steve

From: Burnell, Scott
Sent: Friday, April 01, 2011 3:22 PM
To: Garry, Steven; Nash, Harriet; Milligan, Patricia

Cc: Nelson, Robert
Subject: FW: Media - Yale Environment 360-Question
Importance: High

Folks;

This reporter's trying to find information, studies, etc on how contamination would behave in a marine environment – she's made it clear she wants to understand the topic as opposed to ask us about Fukushima directly. I don't know if our environmental monitoring requirements would cover this in any way. The reporter's on a Monday deadline. Thoughts? Thanks.

Scott

Elizabeth Grossman
Yale Environment 360
503-704-5637
lizziegrossman@mac.com
Re: Science on how radiation behave in the water from Japan

Schaperow, Jason

From: Schaperow, Jason
Sent: Monday, April 04, 2011 8:35 AM
To: 'Gauntt, Randall O'
Subject: FW: analysis
Attachments: source term.doc

From: Schaperow, Jason
Sent: Friday, April 01, 2011 2:21 PM
To: 'Gauntt, Randall O'; 'mtl@dycoda.com'
Cc: Tinkler, Charles
Subject: FW: analysis

Sorry I didn't include you on cc originally.

We provided the attached analysis and source term to the NRC Operations Center yesterday. It was developed by Charlie, KC, Nate, and me on March 30 and 31. If you have any questions on this, please send them to me. (Not sure what Charlie's schedule is next week.)

Thanks,
Jason

From: Schaperow, Jason
Sent: Thursday, March 31, 2011 3:27 PM
To: Bixler, Nathan E; 'kcw@dycoda.com'
Subject: analysis

Attached is what we are sending to the NRC Ops Center in a few minutes.

Thanks for your help in preparing this.

Jason

LLLL/173

The following information is provided by RES in response to a PMT request of 3/30/11 to provide a realistic, up-to-date estimation of source terms for dose projections to address future potential radiological releases from the Fukushima Unit 1 reactor and the Unit 4 spent fuel pool. The source terms herein provided are based on MELCOR analyses that have been performed for a similar but not identical severe accident event for a BWR Mark I reactor and spent fuel pool. The spent fuel pool analysis did consider the Fukushima Unit 4 spent fuel pool decay heat and water volume. The reactor analyses results and radiological releases attached reflect the Fukushima Unit 1 reactor core inventories adjusted for decay since the time of the accident until April 15, 2011 (as requested by the PMT).

The premise of the calculation based on discussions with the PMT, as we understand the background, is that a hypothetical event may potentially occur at the Unit 1 reactor requiring abandonment for some 24 hours, during which water injection to the Unit 1 reactor and Unit 4 spent fuel pool is interrupted (ceased). The question then is posed, "What would the radiological release be for the next 24 hours?" After 24 hrs, injection is assumed to be resumed.

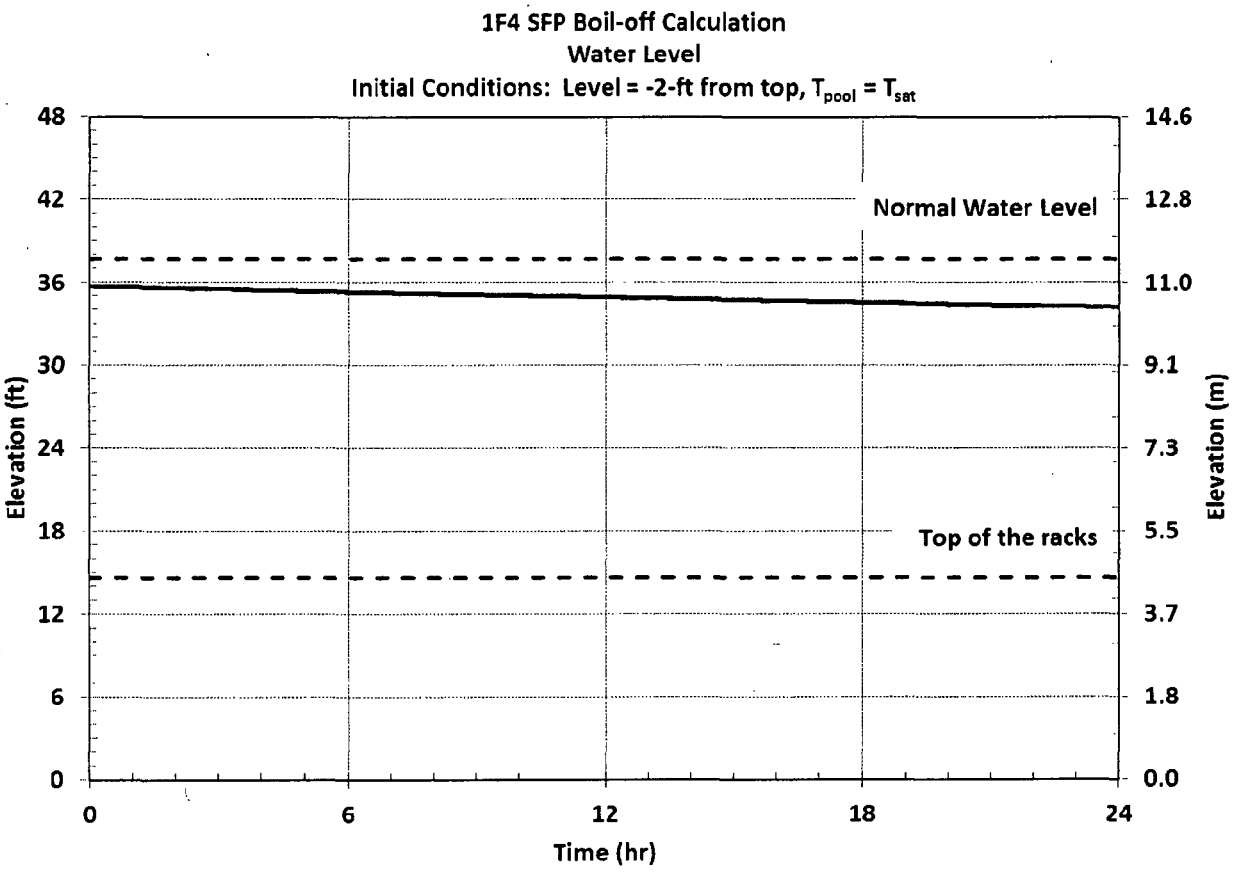
For the reactor analysis, we have conservatively assumed that core damage begins promptly; the radiolgical release begins at the start of the 24 hour period. We have also assumed that the initial heatup (on or about March 11th and 12th, 2011) of the Unit 1 reactor core already resulted in severe damage to 70% of the core. Certain radionuclides have already been scrubbed in the suppression pool and are no longer available for the release. The attached table provides the detailed radiological release.

For the spent fuel pool, recent information from the RST (3/30/11) indicates that the Unit 4 spent fuel pool is nearly full (2 ft from the top) and is at saturated conditions (~100 C). Leakage from the pool is estimated at 3 gpm. Our analyses indicate that neglect of the pool for 24 hours will not lower the water level sufficiently to cause any heatup of the spent fuel in the pool. This estimate has large available margins. Therefore, we recommend that no spent fuel pool radiolgical release be assumed for the event being considered. A plot of pool boil-off is attached.

Charles Tinkler
Jason Schaperow
March 31, 2011

Detailed radiological release for Fukushima Unit 1 reactor.

isotope	release fraction	release duration (hours)	release corrected for decay (Ci)
Ba140	0.016	0.5	1.77E+05
Ce144	0.001	0.5	3.55E+04
Cs134	0.018	24	1.00E+05
Cs136	0.018	24	3.89E+03
Cs137	0.018	24	6.62E+04
I131	0.011	0.5	2.08E+04
I132	0.011	0.5	2.15E-105
I133	0.011	0.5	6.11E-07
I134	0.011	0.5	9.28E-283
I135	0.011	0.5	3.01E-33
Kr85	0.3	0.5	1.30E+05
Kr85m	0.3	0.5	9.79E-51
Kr87	0.3	0.5	1.71E-193
Kr88	0.3	0.5	5.64E-83
La140	0.00005	24	1.93E-03
Mo99	0.004	24	4.39E+01
Np239	0.001	0.5	2.49E+01
Ru103	6E-06	0.5	1.65E+02
Ru106	6E-06	0.5	1.03E+02
Sb127	0.0072	0.5	3.34E+01
Sb129	0.0072	0.5	2.73E-53
Sr89	0.016	0.5	4.23E+05
Sr90	0.016	0.5	4.41E+04
Sr91	0.016	0.5	2.39E-21
Te129m	0.0072	0.5	8.66E+03
Te131m	0.0072	0.5	1.49E-04
Te132	0.0072	0.5	2.29E+02
Xe131m	0.3	0.5	1.68E+04
Xe133	0.3	0.5	2.33E+05
Xe133m	0.3	0.5	2.33E+01
Xe135	0.3	0.5	6.70E-22
Xe138	0.3	0.5	0.00E+00
Y91	0.00005	24	1.82E+03


1F4 SFP Boil-off Calculation
Water Level
Initial Conditions: Level = -2-ft from top, $T_{pool} = T_{sat}$
Normal Water Level
Top of the racks
Elevation (ft)
Elevation (m)
Time (hr)
48
42
36
30
24
18
12
6
0
14.6
12.8
11.0
9.1
7.3
5.5
3.7
1.8
0.0
0
6
12
18
24

Schaperow, Jason

From: Schaperow, Jason
Sent: Monday, April 04, 2011 8:39 AM
To: 'Gauntt, Randall O'
Subject: supporting spreadsheet
Attachments: Unit 1 FP release.xlsx

LLLL/174

Unit 1
MWe 460
MWt 1380

Isotopic group	Release percent	Release fraction	Release duration (hours)
Kr, Xe	30	0.3	0.5
I	1.1	0.011	0.5
Te, Sb	0.72	0.0072	0.5
Cs	1.8	0.018	24
Ba	1.6	0.016	0.5
Sr	1.6	0.016	0.5
Ce, Np	0.1	0.001	0.5
La, Y	0.005	0.00005	24
Ru	0.0006	0.000006	0.5
Mo	0.4	0.004	24

isotope	corinv (Ci/MWt)	corinv (Ci)	release fraction	release duration (hours)	release (Ci)	half-life (sec)	decay time (sec)	release corrected for decay (Ci)
Ba140	5.30E+04	7.31E+07	0.016	0.5	1.17E+06	1.11E+06	3024000	1.77E+05
Ce144	2.80E+04	3.86E+07	0.001	0.5	3.86E+04	2.46E+07	3024000	3.55E+04
Cs134	4.17E+03	5.75E+06	0.018	24	1.04E+05	6.50E+07	3024000	1.00E+05
Cs136	1.00E+03	1.38E+06	0.018	24	2.48E+04	1.13E+06	3024000	3.89E+03
Cs137	2.67E+03	3.68E+06	0.018	24	6.63E+04	9.51E+08	3024000	6.62E+04
I131	2.80E+04	3.86E+07	0.011	0.5	4.25E+05	6.95E+05	3024000	2.08E+04
I132	4.00E+04	5.52E+07	0.011	0.5	6.07E+05	8.24E+03	3024000	2.15E-105
I133	5.70E+04	7.87E+07	0.011	0.5	8.65E+05	7.49E+04	3024000	6.11E-07
I134	6.30E+04	8.69E+07	0.011	0.5	9.56E+05	3.16E+03	3024000	9.28E-283
I135	5.00E+04	6.90E+07	0.011	0.5	7.59E+05	2.37E+04	3024000	3.01E-33
Kr85	3.17E+02	4.37E+05	0.3	0.5	1.31E+05	3.38E+08	3024000	1.30E+05
Kr85m	8.00E+03	1.10E+07	0.3	0.5	3.31E+06	1.61E+04	3024000	9.79E-51
Kr87	1.60E+04	2.21E+07	0.3	0.5	6.62E+06	4.56E+03	3024000	1.71E-193
Kr88	2.30E+04	3.17E+07	0.3	0.5	9.52E+06	1.02E+04	3024000	5.64E-83
La140	5.30E+04	7.31E+07	0.00005	24	3.66E+03	1.45E+05	3024000	1.93E-03
Mo99	5.30E+04	7.31E+07	0.004	24	2.93E+05	2.38E+05	3024000	4.39E+01
Np239	5.50E+05	7.59E+08	0.001	0.5	7.59E+05	2.03E+05	3024000	2.49E+01
Ru103	3.70E+04	5.11E+07	0.000006	0.5	3.06E+02	3.40E+06	3024000	1.65E+02
Ru106	1.33E+04	1.84E+07	0.000006	0.5	1.10E+02	3.18E+07	3024000	1.03E+02
Sb127	2.00E+03	2.76E+06	0.0072	0.5	1.99E+04	3.28E+05	3024000	3.34E+01
Sb129	1.10E+04	1.52E+07	0.0072	0.5	1.09E+05	1.58E+04	3024000	2.73E-53
Sr89	3.10E+04	4.28E+07	0.016	0.5	6.84E+05	4.36E+06	3024000	4.23E+05
Sr90	2.00E+03	2.76E+06	0.016	0.5	4.42E+04	9.15E+08	3024000	4.41E+04
Sr91	3.70E+04	5.11E+07	0.016	0.5	8.17E+05	3.43E+04	3024000	2.39E-21
Te129m	1.80E+03	2.48E+06	0.0072	0.5	1.79E+04	2.89E+06	3024000	8.66E+03
Te131m	4.00E+03	5.52E+06	0.0072	0.5	3.97E+04	1.08E+05	3024000	1.49E-04
Te132	4.00E+04	5.52E+07	0.0072	0.5	3.97E+05	2.81E+05	3024000	2.29E+02
Xe131m	3.30E+02	4.55E+05	0.3	0.5	1.37E+05	1.00E+06	3024000	1.68E+04
Xe133	5.70E+04	7.87E+07	0.3	0.5	2.36E+07	4.54E+05	3024000	2.33E+05
Xe133m	2.00E+03	2.76E+06	0.3	0.5	8.28E+05	2.00E+05	3024000	2.33E+01
Xe135	1.10E+04	1.52E+07	0.3	0.5	4.55E+06	3.27E+04	3024000	6.70E-22
Xe138	5.70E+04	7.87E+07	0.3	0.5	2.36E+07	1.00E+03	3024000	0.00E+00
Y91	4.00E+04	5.52E+07	0.00005	24	2.76E+03	5.06E+06	3024000	1.82E+03

Releases are from unmitigated LTSBO in NUREG-1935, Rev. 2, 4/30/10
Assumes 70% core damage previously
Noble gas, I, Te releases from NUREG-1935 multiplied by 0.3
Cs release is from revaporization, Ba release is from CCI/oxidation
Ci/MWt is from RASCAL code manual, Table 1.1
Half-lives for Xe131m, Xe133m, Xe138 are from NUREG/CR-5106
Other half-lives are from NUREG/CR-4467
Decay time is 35 days (March 11 to April 15)

isotope	release fraction	release duration (hours)	release corrected for decay (Ci)
Ba140	0.016	0.5	1.77E+05
Ce144	0.001	0.5	3.55E+04
Cs134	0.018	24	1.00E+05
Cs136	0.018	24	3.89E+03
Cs137	0.018	24	6.62E+04
I131	0.011	0.5	2.08E+04
I132	0.011	0.5	2.15E-105
I133	0.011	0.5	6.11E-07
I134	0.011	0.5	9.28E-283
I135	0.011	0.5	3.01E-33
Kr85	0.3	0.5	1.30E+05
Kr85m	0.3	0.5	9.79E-51
Kr87	0.3	0.5	1.71E-193
Kr88	0.3	0.5	5.64E-83
La140	0.00005	24	1.93E-03
Mo99	0.004	24	4.39E+01
Np239	0.001	0.5	2.49E+01
Ru103	6E-06	0.5	1.65E+02
Ru106	6E-06	0.5	1.03E+02
Sb127	0.0072	0.5	3.34E+01
Sb129	0.0072	0.5	2.73E-53
Sr89	0.016	0.5	4.23E+05
Sr90	0.016	0.5	4.41E+04
Sr91	0.016	0.5	2.39E-21
Te129m	0.0072	0.5	8.66E+03
Te131m	0.0072	0.5	1.49E-04
Te132	0.0072	0.5	2.29E+02
Xe131m	0.3	0.5	1.68E+04
Xe133	0.3	0.5	2.33E+05
Xe133m	0.3	0.5	2.33E+01
Xe135	0.3	0.5	6.70E-22
Xe138	0.3	0.5	0.00E+00
Y91	0.00005	24	1.82E+03

From: ET01 Hoc
Sent: Wednesday, April 27, 2011 3:41 PM
To: ET02 Hoc
Subject: FW: DOE - NRC Coordination

From: Correia, Richard
Sent: Wednesday, April 27, 2011 3:40:47 PM
To: ET01 Hoc
Subject: Fw: DOE - NRC Coordination
Auto forwarded by a Rule

Richard Correia, Director
Division of Risk Analysis
RES

Sent from a Blackberry

From: Skeen, David
To: Kokajko, Lawrence; Correia, Richard
Sent: Wed Apr 27 14:50:18 2011
Subject: FW: DOE - NRC Coordination

FYI

From: Skeen, David
Sent: Wednesday, April 27, 2011 1:00 PM
To: Peko, Damian
Cc: RST01 Hoc; Casto, Chuck; Virgilio, Martin; Hiland, Patrick; Holian, Brian; Reynolds, Steven
Subject: DOE - NRC Coordination

Damian,

Per our conversation this morning, I just wanted to remind you that NRC might be able to support DOE on two of the 3 questions that were discussed at the cabinet-level meeting this week. Specifically, we may be able to help with (1) long term passive cooling and (2) the waste water issues.

Please let me know if you need any support in those areas, and we can discuss further.

Thanks!

David Skeen
Reactor Safety Team Director
USNRC

LLL4/175

Wagner, Katie

From: Wagner, Katie
Sent: Monday, April 04, 2011 4:08 PM
To: Schaperow, Jason
Cc: Lee, Richard
Subject: FW: Research Look into Worse Case, what if ...

Jason,
This is one of the two items I said I would find and forward to you. It corresponds to the following Sharepoint item:

63	3/31/2011	Ops Center (RST)	Email: RST01 Hoc	Jason Schaperow (x7452) Charlie Tinkler (x7496)	SPB/DSA	Answer the following question: Make determinations (time and measures) that would result in an energetic release no longer being a realistic possibility. How long until decay heat is not a factor?	Answer the following question: Make determinations (time and measures) that would result in an energetic release no longer being a realistic possibility. How long until decay heat is not a factor?		Pending

Thanks,
Katie

From: Lee, Richard
Sent: Thursday, March 31, 2011 3:05 PM
To: Tinkler, Charles; Schaperow, Jason
Cc: Wagner, Katie
Subject: FW: Research Look into Worse Case, what if ...

Gentlemen:

Your view on this is sought.

Thanks, Richard

From: RST01 Hoc
Sent: Thursday, March 31, 2011 2:48 PM
To: Gibson, Kathy; Lee, Richard
Subject: Research Look into Worse Case, what if ...

Please take a look at this first cut by RST and Please Add To or Refine as necessary to answer the following (RST Task # 3491):

Make determinations (time and measures) that would result in an energetic release no longer being a realistic possibility. How long until decay heat is not a factor?

Thank you,
RST Coordinator

LLLL/176

From: LIA07 Hoc
Sent: Tuesday, April 05, 2011 6:01 PM
To: Batkin, Joshua; Borchardt, Bill; Bradford, Anna; Coggins, Angela; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; ET07 Hoc; Flory, Shirley; Gibbs, Catina; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
Subject: Go Book Update - 1800 EDT, April 5, 2011
Attachments: TEPCO Press Release 274.pdf; TEPCO Press Release 270.pdf; TEPCO Press Release 271.pdf; TEPCO Press Release 272.pdf; TEPCO Press Release 273.pdf; ET Chronology 4-05-11 1800EDT.PDF; USNRC Earthquake-Tsunami Update.040511.1800EDT.pdf; April 5 1500 EDT Brief one pager .pdf

Attached, please find updated information for the "Go Books".

The updates include:

- The 1800 EDT, 04/05/11 Status Update
- The latest ET Chronology
- The latest "One Pager" (1500 EDT, 04/05/11)
- TEPCO Press Releases (270-274)

Please let me know if you have any questions or concerns.

-Sara

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Press Releases

Press Release (Apr 05,2011)
The results of nuclide analyses of radioactive materials in the air at the site of Fukushima Daiichi Nuclear Power Station (11th release)

On March 22nd 2011, as part of monitoring activity of the surrounding environment, we conducted nuclide analysis of radioactive materials contained in the air which were collected at the site of Fukushima Daiichi Nuclear Power Station, which was damaged by Tohoku-Chihou-Taiheiyo-Oki Earthquake. As a result, radioactive materials were detected and therefore, we summarized the results and reported them to Nuclear and Industry Safety Agency as well as to the government of Fukushima Prefecture.

(previously announced)

From March 31st to April 4th 2011, we conducted nuclide analysis of radioactive materials contained in the air which were collected on the same date at the site of Fukushima Daiichi Nuclear Power Station. As a result, radioactive materials were detected as shown in the attachment. Therefore, we summarized the results and reported them to Nuclear and Industry Safety Agency as well as to the government of Fukushima Prefecture today.

Three nuclides (Iodine-131, Cesium-134 and Cesium-137) are released as fixed figures. Other nuclides figures are to be released as soon as identified under instruction of NISA.

We are planning to conduct these surveys continuously.

Appendices:
The result of the nuclide analysis of radioactive materials in the air at the site of Fukushima Daiichi Nuclear Power Station
- Appendix1:March 31st(PDF 12.5KB)
- Appendix2:April 1st(PDF 12.6KB)
- Appendix3:April 2nd(PDF 12.5KB)
- Appendix4:April 3rd(PDF 12.6KB)
- Appendix5:April 4th(PDF 12.5KB)

The result of the nuclide analysis of radioactive materials in the air at the site of Fukushima Daini Nuclear Power Station
- reference1:March 31st(PDF 12.6KB)
- reference2:April 1st(PDF 12.1KB)
- reference3:April 2nd(PDF 12.1KB)
- reference4:April 3rd(PDF 12.2KB)
- reference5:April 4th(PDF 12.1KB)
- reference6:Nuclide analysis of radioactive materials in the air Fukushima Daiichi Nuclear Power Atation(PDF 12.6KB)
- reference7:Nuclide analysis of radioactive materials in the air Fukushima Daini Nuclear Power Station(PDF 12.6KB)

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Press Releases

Press Release (Apr 05,2011)
Detection of radioactive materials from the seawater near Fukushima Daiichi Nuclear Power Station(13th release)

On March 21st 2011, radioactive materials were detected from the seawater around the discharge canal (south) of Fukushima Daiichi Nuclear Power Station which was damaged by the 2011 off the Pacific coast of Tohoku earthquake as a result of the sampling survey of radioactive materials in the seawater which was implemented as a part of monitoring of surrounding environment. We had informed the result to Nuclear and Industrial Safety Agency (NISA) and Fukushima prefecture.

(We already informed.)

We also informed the seawater sampling survey result which is implemented at three points within 15km area of the Fukushima Daiichi Nuclear Power Plant from April 2nd.

Three nuclides (Iodine-131, Cesium-134 and Cesium-137) are fixed figures. Other nuclides figures are to be reinvestigated by improved measures under NISA instruction on April 1st.

(We already informed)

On April 4th, 2011, we conducted the seawater sampling survey to evaluate the dispersion of radioactive substances found at Fukushima Daiichi Nuclear Power Station. As we detected radioactive substances attached as appendix, we reported to NISA and Fukushima prefecture today.

We are intending to conduct the same sampling investigation.

attachment1: The result of the nuclide analysis of the seawater (Around the discharge canal (north) of Unit 5 and 6 Fukushima Daiichi Nuclear Power Station) (PDF 14.4KB)
attachment2: The result of the nuclide analysis of the seawater (Around the discharge canal (south) of Fukushima Daiichi Nuclear Power Station) (PDF 16.1KB)
attachment3: The result of the nuclide analysis of the seawater (Around the north water discharge canal of Fukushima Daini Nuclear Power Station) (PDF 10.3KB)
attachment4: The result of the nuclide analysis of the seawater (Around Iwasawa shore at Fukushima Daini Nuclear Power Station) (PDF 10.3KB)
attachment5: The result of the nuclide analysis of the seawater (Around 15km off shore of Fukushima Daiichi Nuclear Power Station) (PDF 10.2KB)
attachment6: The result of the nuclide analysis of the seawater (Around 15km off shore of Fukushima Daini Nuclear Power Station) (PDF 10.2KB)
attachment7: The result of the nuclide analysis of the seawater (Around 15km off shore of Iwasawa Sea Shore) (PDF 10.1KB)
attachment8: Radioactivity Density of Seawater (PDF 27.6KB)

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Press Releases

Press Release (Apr 05,2011)
Plant Status of Fukushima Daiichi Nuclear Power Station (as of 7:00 PM, April 5)

*Updates are underlined

All 6 units of Fukushima Daiichi Nuclear Power Station have been shut down.

Unit 1 (Shut down)
-Explosive sound and white smoke were confirmed after the big quake occurred at 3:36 pm on March 12th. It was assumed to be hydrogen explosion.
-At approximately 2:30 am on March 23rd, seawater injection to the nuclear reactor through the feed water system was initiated.
-At approximately 10:50 am on March 24th, white fog-like steam arising from the roof part of the reactor building was observed.
-We had been injecting seawater into the reactor, but from 3:37 pm on March 25th, we started injecting freshwater.
-We had been injecting fresh water to the reactor using fire engines; however we switched over utilizing temporary electrical pump at 8:32 am on March 29th.
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:42am to 11:52am on April 3rd we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.

Unit 2(Shut down)
-At approximately 6:00 am on March 15th, an abnormal noise began emanating from nearby Pressure Suppression Chamber and the pressure within the chamber decreased.
-We have been injecting seawater into the reactor, but from 10:10 am on March 26th, we started injecting freshwater (with boric acid).
-We had been injecting fresh water in to the reactor utilizing fire pump, however, we switched over to utilizing temporary electrical pump from 6:31 pm on March 27th.
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:22am to 0:06pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.

Unit 3(Shut down)
-Explosive sound and white smoke were confirmed at 11:01am March 14th. It was assumed to be hydrogen explosion.
-We had been injecting seawater into the reactor pressure vessel, but from 6:02 pm on March 25th, we started injecting freshwater.
-We had been injecting fresh water in to the reactor utilizing fire pump, however, we switched over to utilizing temporary electrical pump from 8:30 pm on March 28th.
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:03am to 0:16pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.

Unit 4 (outage due to regular inspection)
-At approximately 6 am on March 15th, we confirmed the explosive sound and the sustained damage around the 5th floor rooftop area of the Nuclear Reactor Building.
-Some of turbine building lights were turned on March 31st .
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 5 (outage due to regular inspection)
-Sufficient level of reactor coolant to ensure safety is maintained.
-At 5 am, March 19th, we started the Residual Heat Removal System Pump (C) in order to cool the spent fuel pool.
-At 2:30 pm, March 20th, the reactor achieved reactor cold shutdown. At around 5:24 pm on March 23rd, when we switched the temporary Residual Heat Removal System Seawater Pump, it has stopped automatically. At around 4:14 pm, March 24th we replaced the pump, and restarted cooling of reactor at around 4:35 pm.
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 6 (outage due to regular inspection)
-Sufficient level of reactor coolant to ensure safety is maintained.
-At 10:14 pm, March 19th, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
-At 7:27 pm, March 20th, the reactor achieved reactor cold shutdown.
-In relation to the two seawater side pumps of the Residual Heat Removal System, we switched the power source from temporary to permanent at 3:38 PM and 3:42PM, Mar 25 respectively.
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

·Operation for cooling the spent fuel pools
-Water spray by the concrete pump truck to Unit 4 was conducted from 5:35 pm to 6:22 pm on April 5th.
-We will conduct further water spray depending on the conditions of spent fuel pools.

·Draining water from underground floor of turbine buildings
-At 1:55 pm April 3rd, in Unit 1, water transfer from a condensate storage tank to a suppression pool water surge-tank was initiated.
-At 5:10 pm, April 2nd, in Unit 2, water transfer from a condensate storage tank was to a suppression pool water surge-tank was initiated.

Others
-We measured radioactive materials (iodine etc.) inside of the nuclear power station area (outdoor) by monitoring car and confirmed that radioactive materials level is getting higher than ordinary level. As listed below, we have determined that specific incidents stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) have occurred.
· Determined at 4:17 pm Mar 12th (Around Monitoring Post 4)
· Determined at 8:56 am Mar 13th (Around Monitoring Post 4)
· Determined at 2:15 pm Mar 13th (Around Monitoring Post 4)
· Determined at 3:50 am Mar 14th (Around Monitoring Post 6)
· Determined at 4:15 am Mar 14th (Around Monitoring Post 2)
· Determined at 9:27 am Mar 14th (Around Monitoring Post 3)
· Determined at 9:37 pm Mar 14th (Around main entrance)
· Determined at 6:51 am Mar 15th (Around main entrance)
· Determined at 8:11 am Mar 15th (Around main entrance)
· Determined at 4:17 pm Mar 15th (Around main entrance)
· Determined at 11:05 pm Mar 15th (Around main entrance)
· Determined at 8:58 am Mar 19th (Around MP5)
From now on, if the measured figure fluctuates and goes above and below 500 micro Sv/h, we deem that as the continuous same event and will not regard that as a new specific incidents stipulated in article 15, clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) has occurred. In the interim, if we measure a manifestly abnormal figure and it is evident that the event is not the continuous same event, we will determine and notify.

-The national government has instructed evacuation for those local residents within 20km radius of the periphery and evacuation to inside for those residents from 20km to 30km radius of the periphery, because it is possible that radioactive materials are discharged.
-In total 12 fire engines are lent for the water spraying to the spent fuel pools and water injection to the nuclear reactors by various regional fire departments* as well as Tokyo Fire Department. Also, instruction regarding the setting and operation of large scale decontamination system was provided by Niigata City Fire Headquarter and Hamamatsu City Fire Headquarter.
*: Koriyama Fire Department, Iwaki Fire Brigade Headquarters, Fire Headquarters of Sukagawa District Wide Area Fire-fighting Association, Yonezawa City Fire Headquarters, Utsunomiya City Fire Headquarters, Fire Headquarters of Aizu-Wakamatsu wide area municipal association, Saitama City Fire Bureau, and Niigata City Fire Bureau.
-By March 22nd, Units 1 through 6 started to be energized from the external power source.
-At around 11:35 am April 1st, a worker fell into the sea when he got into a barge of the U.S. Forces to repair a hose of the ship. The worker was rescued immediately, and was not injured and not contaminated. The worker will be checked using the whole-body counter to ensure his health.
-From April 4th, we began to transfer the radioactive water we collected from the building of Radioactive Waste Treatment Facilities to the Unit

4 turbine building. On April 4th, water level of the pit in the trench of Unit 3 increased by 15cm from previous day. Pathway of water flow is unknown. We can not deny the possibility that water in the turbine building of Unit 4 flows into the trench of Unit 3. So, we stopped transferring water to the Unit 4 turbine building to make assurance. Present water level of the pit in the trench of Unit 3 is not changed from the time we stopped transferring, and is being stable.

-At around 9:30 am, April 2nd, we detected water containing radiation dose over 1,000 mSv/h in the pit* where supply cables are stored near the intake channel of Unit 2. Furthermore, there was a crack about 20 cm on the concrete lateral of the pit, from where the water in the pit was out flowing into the sea. (previously announced).

-We also injected fresh concrete to the pit, but we could not observe a reduction in the amount of water spilling from the pit to the sea. Therefore, we started to inject the polymer (April 3rd).

-From 7:08 am to 7:11 am on April 4th, we put the tracer into the pit and began an investigation of water flows. Additional tracer was put through the two new holes drilled near the pit. At 2:15 pm, April 5th, it was observed the water with tracer came out from the crack on the concrete lateral of the pit. At 3:7 pm, April 5th, injection of coagulant from the holes was initiated.

-There is plenty of radioactive wastewater in the turbine buildings. Especially, Unit 2's wastewater is very highly radioactive. To store this stably, it was decided that this needed to be transferred to the Central Radioactive Waste Disposal Facility. However, within that facility, we are storing ten thousand tons of low level radioactive wastewater. In order to transfer more wastewater, we need to discharge the low level radioactive wastewater. In addition, as low radioactive subsurface water is piling up in sub-drain pits of Units 5 and 6 and a part of subsurface water is running into buildings. We are concerned that important equipment to secure the safety of reactors may be submerged. Based on the Section 1 of the Article 64 of the Nuclear Reactor Regulation Law, we have decided to discharge to the sea approximately ten thousand tons of the accumulated low level radioactive water and a total of fifteen hundred tons of the low level radioactive subsurface water stored in the sub drain pits of Unit 5 and 6 as soon as we get ready.

-We evaluate the impact on the discharge of the low radioactive wastewater to the sea as approximately 0.6 mSv per year per an adult if an adult eats adjacent fish and seaweeds everyday. The amount (0.6 mSv of effective radioactive doses per year) is one-forth of annual radioactive dose to which the general public is exposed from nature.

-At 7:03 pm, April 4th, discharge of low radioactive wastewater (approximately 10,000 ton in total) from Central Radioactive Waste Disposal Facility to the sea was initiated.

-At 9:00 pm, April 4th, discharge of low radioactive subsurface water (1,500 ton in total) from sub-drain pits of Units 5 and 6 to the sea was initiated.

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Press Releases

Press Release (Apr 05,2011)
Status of TEPCO's Facilities and its services after the Tohoku-Taiheiyou-Oki Earthquake (as of 16:00PM)

Due to the Tohoku-Taiheiyou-Oki Earthquake which occurred on March 11th 2011, TEPCO's facilities including our nuclear power stations have been severely damaged. We deeply apologize for the anxiety and inconvenience caused.

Below is the status of TEPCO's major facilities.
*new items are underlined

[Nuclear Power Station]
Fukushima Daiichi Nuclear Power Station:
Units 1 to 3: shutdown due to the earthquake
(Units 4 to 6: outage due to regular inspections)

* The national government has instructed the public to evacuate for those local residents within 20km radius of the site periphery and to evacuate voluntarily for those local residents between 20km and 30km radius of the site periphery.

* Off-site power has been connected to Unit 1 to 6 by March 22, 2011.

* Unit 1
- The explosive sound and white smoke was confirmed near Unit 1 when the big quake occurred at 3:36 pm, March 12th.
- We started injection of sea water at 8:20 pm, March 12th, and then boric acid which absorbs neutron into the reactor afterwards.
- At approximately 2:30 am, March 23rd, we started the injection of sea water into the reactor from feed water system. After that, the injection of freshwater was started from 3:37 pm on March 25th (switched from the seawater injection). At 8:32 am, Mar 29th, transfer from the fire fighting pump to a temporary motor driven pump was made. From 10:42am to 11:52am on April 3rd we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.
- At approximately 10:50 am on March 24th, white smoke was confirmed arising from the top of the reactor building.
- At approximately 11:30 am, March 24th, lights in the main control room were restored.
- At approximately 5:00 pm, March 24th, draining water from underground floor of turbine buildings into a condenser was started and it was paused at approximately 7:30 am, March 29th because we confirmed that the water level reached almost full capacity of a condenser. In order to move the water in the condenser into a condensate storage tank, water transfer from the condensate storage tank to suppression pool's water surge-tanks was conducted from around 0:00 pm, March 31st to 3:26 pm, April 2nd.
- From 1:03 pm, March 31st, the water spray by the concrete pumping vehicle was started, and finished at 4:04 pm.
- In order to confirm the position of water spray to the spent fuel pool by the concrete pumping vehicle, the water spray was conducted from 5:16 pm to 5:19 pm.
- Some of turbine building lights were turned on April 2nd.
- The water transfer from the condenser to the condensate storage tank has been implemented since 1:55 pm, April 3rd.

*Unit 2
- At 1:25 pm, March 14th, since the Reactor Core Isolation Cooling System has failed, it was determined that a specific incident stipulated in Clause 1, Article 15 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred (failure of reactor cooling function). At 5:17 pm, March 14th, while the water level in the reactor reached the top of the fuel rod, we have restarted the water injection with the valve operation.

- At approximately 6:14 am, March 15th, the abnormal sound was confirmed near the suppression chamber and the pressure inside the chamber decreased afterwards. It was determined that there was a possibility that something happened in the suppression chamber. While sea water injection to the reactor continued, TEPCO employees and workers from other companies not in charge of injection work started tentative evacuation to a safe location.
  Sea water injection to the reactor continued.
- On March 18th, power was delivered up to substation for backup power through offsite transmission line. We completed laying cable further to unit receiving facility in the building, and at 3:46 pm, March 20th the load-side power panel of the receiving facility started to be energized.
- From 3:05 pm to 5:20 pm on March 20th, about 40 tons of seawater was injected into Unit 2 by TEPCO employees.
- At approximately 6:20 pm on March 21st, white smoke was confirmed arising from the top of the reactor building. As of 7:11 am on March 22nd, smoke decreased to the level where we could hardly confirm.
- From around 4:00 pm to 5:00 pm on March 22nd, approximately 18 tons of sea water was injected into the spent fuel pool by TEPCO employees.
- From 10:10 am on March 26th, freshwater (with boric acid) injection was initiated. (switched from the seawater injection) At 6:31pm, March 27th, transfer from the fire fighting pump to a temporary motor driven pump was made. From 10:22am to 0:06pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.
- From 10:30 am on March 25th, seawater injection through Fuel Pool Cooling and Filtering System was initiated. The work was finished at 12:19 pm, March 25th. From 4:30 pm, March 29th, freshwater injection through Fuel Pool Cooling and Filtering System was initiated. (We switched from seawater to freshwater). The work was finished at 6:25 pm on March 29th. At 9:25 am, March 30th, we started fresh water injection by a temporary motor driven pump, but we switched the pump to the fire fighting pump due to the pump trouble. At 1:10 pm, March 30th, freshwater injection was suspended, because we found the crack on a part of the hose. At 7:05 pm, March 30th, freshwater injection was resumed and finished at 11:50 pm, March 31.
- At approximately 4:46 pm, March 26th, lights in the main control room were restored.
- At approximately 4:45 pm, March 29th, the water in a condensate storage tank was being transferred to suppression pool water surge-tanks to prepare for water transfer from a condenser to a condensate storage tank in order to drain water on the underground floor of the turbine building into a condenser. At 11:50 am, April 1st, transfer was completed.
- At 2:56 pm, April 1st, water injection into spent fuel pool in Unit 2 by temporary motor driven pump was initiated. At 5:05 pm on April 1st, the water injection was finished.
- The water transfer from the condenser to the condensate storage tank has been implemented since 5:10 pm, April 2nd.
- Some of turbine building lights were turned on April 2nd.
- At 11:05 am, April 4th, water injection into spent fuel pool in Unit 2 by a temporary motor driven pump was initiated. At 1:37 pm, April 4th, the water injection was finished.

*Unit 3
- At 6:50 am, March 14th, while water injection to the reactor was under operation (injection of boric acid was done on Mar 13th), the pressure in the reactor containment vessel increased to 530 kPa. As a result, at 7:44 am, it was determined that a specific incident stipulated in the Article 15, the Clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred (abnormal increase of the pressure of reactor containment vessel). Afterwards, the pressure gradually decreased (as of 9:05 am, 490 kPa).
- At approximately 11:01 am, March 14th, an explosion followed by white smoke occurred near Unit 3. 4 TEPCO employees and 3 workers from other companies (all of them were conscious) sustained injuries and were taken to the hospital by ambulances.
- As the temperature of water in the spent fuel pool rose, spraying water by helicopters with the support of the Self Defense Force was considered. However the operation on March 16th was cancelled.
- At 6:15 am, March 17th, the pressure of the Suppression Chamber temporarily increased, but currently it is stable within a certain range. On March 20th, we were preparing to implement measures to reduce the pressure of the reactor containment vessel (partial discharge of air containing radioactive material to outside) in order to fully secure safety. However, at present, it was not a situation to immediately implement measures and discharge air containing radioactive material to outside. We will continue to monitor the status of the pressure of the reactor containment vessel.
- In order to cool spent fuel pool, water was sprayed by helicopters on March 17th with the cooperation of Self-Defense Forces.
- At approximately past 7:00 pm, March 17th, Self-Defense Forces and the police started spraying water by water cannon trucks upon our request for the cooperation. At 8:09 pm, March 17th, they finished the operation.
- Before 2:00 pm, March 18th, spraying water by fire engines was started with the cooperation of Self-Defense Forces and the United States Armed Forces. At 2:45 pm, March 18th, the operation was finished.

- At approximately 12:30 am, March 19th, spraying water was started with the cooperation of Fire Rescue Task Forces of Tokyo Fire Department. At approximately 1:10 am, March 19th, the operation was finished. They resumed spraying water at 2:10 pm and finished at approximately 3:40 am, March 20th.
- At approximately 9:30 pm, March 20th, spraying water was started with the cooperation of Fire Rescue Task Forces of Tokyo Fire Department. At approximately 3:58 am, March 21th, they the operation was finished.
- At approximately 3:55 pm, March 21st, light gray smoke was confirmed arising from the southeast side of the 5th floor roof of the Unit 3 building. The situation was reported to the fire department at approximately 4:21 pm. The parameters of reactor pressure vessel, reactor containment vessel, and monitored environmental data remained stable without significant change. However, employees working around Unit 3 evacuated to a safe location. On March 22nd, the color of smoke changed to somewhat white and it was slowly dissipating.
- At approximately 3:10 pm on March 22nd, spraying water to Unit 3 by Tokyo Fire Department's Hyper Rescue and Osaka City Fire Department was conducted, and completed at approximately 4:00 pm on the same day.
- At approximately 10:45 pm on March 22nd, lights in the main control room were restored.
- At approximately 11:00 am on March 23rd, the injection of sea water to spent fuel pool was conducted, and finished approximately at 1:20 pm on the same day.
- At 4:20 pm on March 23rd, light gray smoke was observed belching from Unit 3 building. The situation was reported to the fire department at 4:25 pm on March 23rd. The parameters of the reactor, the reactor containment vessel of Unit 3, and monitored figures around the site's immediate surroundings remained stable without significant change. To be safe, workers in the main control room of Unit 3 and around Unit 3 evacuated to a safe location. At approximately 11:30 pm on March 23rd and 4:50 am on March 24th, TEPCO employees confirmed the smoke has disappeared. Accordingly, workers evacuation was lifted.
- From approximately 5:35 am on March 24th, sea water injection through Fuel Pool Cooling and Filtering System was initiated, and finished at approximately 4:05 pm on the same day.
- From 1:28 pm on March 25th, Hyper Rescue team started water spray. The work finished at 4:00 pm on March 25th.
- From 6:02 pm on March 25th, the injection of freshwater to the reactor was started (switched from the seawater injection). At 8:30 pm on March 28th, the injection of fresh water was switched to temporary electricity pumps from the fire engine pumps. From 10:03am to 0:16pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.
- At approximately 12:34pm March 27th, the injection of water by the concrete pump truck was started. At approximately 2:36 pm, March 27th, the operation was finished.
- At approximately 2:17pm March 29th, the injection of fresh water by the concrete pump truck was started. (Sea water had been injected so far and transfer from seawater to freshwater was made). The water injection was finished at 6:18 PM, March 29th.
- At approximately 5:40 pm, March 28th, the water in a condensate storage tank was being transferred to suppression pool water surge-tanks to prepare for water transfer from a condenser to a condensate storage tank in order to drain water on the underground floor of the turbine building into a condenser. We finished the transfer work at approximately 8:40 am, March 31st.
- From 4:30 pm, March 31st, the water spray by the concrete pumping vehicle was started, and finished at 7:33 pm.
- From 9:52 am, April 2nd, the water spray by the concrete pumping vehicle was started, and finished at 0:54 pm.
- Some of turbine building lights were turned on April 2nd.
- From 5:03 am, April 4th, the water spray by the concrete pumping vehicle was started, and finished at 07:19 pm.

* Unit 4
- At approximately 6:00 am, March 15th, an explosive sound was heard and the damage in the 5th floor roof of Unit 4 reactor building was confirmed. At 9:38 am, the fire near the north-west part of 4th floor of Unit 4 reactor building was confirmed. At approximately 11:00 am, TEPCO employees confirmed that the fire was out.
- At approximately 5:45 am on March 16th, a TEPCO employee discovered a fire at the northwest corner of the Nuclear Reactor Building. TEPCO immediately reported this incident to the fire department and the local government and proceeded with the extinction of fire. At approximately 6:15 am, TEPCO staff confirmed at the site that there were no signs of fire.
- At approximately 8:21 am on March 20th, spraying water by fire engines was started with the cooperation of Self-Defense Forces and they finished the operation at approximately 9:40 am. At approximately 6:45 pm spraying water was started by Self-Defenses' water cannon trucks and finished at approximately 7:45 pm.
- At approximately 6:30 am, March 21st, spraying water by fire engines was started with the cooperation of Self-Defense Forces and the United States Armed Forces. At approximately 8:40 am, March 21, they had

finished the operation.
- On March 21st, cabling has been completed from temporary substation to the main power center.
- From approximately 5:20 pm on March 22nd, spraying water from the concrete pumping vehicle was conducted and ended at approximately 8:30 pm on the same day.
- From approximately 10:00 am on March 23rd, spraying water from the concrete pumping vehicle was conducted and ended at approximately 1:00 pm on the same day.
- From approximately 2:35 pm on March 24th, spraying water by the concrete pumping vehicle was conducted and ended at approximately 5:30 pm on the same day.
- From 6:05 am on March 25th, seawater injection through Fuel Pool Cooling and Filtering System was initiated and finished at approximately 10:20 am on the same day.
- From 7:05 pm on March 25th, water spray by the concrete pumping vehicle was started and finished at 10:07 pm on March 25th.
- From 4:55 pm on March 27th, water spray by the concrete pumping vehicle was started and finished at 7:25 pm on March 27th.
- At approximately 11:50 am on March 29th, lights in the main control room were restored.
- From 2:04 pm on March 30th, water spray by the concrete pumping vehicle was started and finished at 6:33 pm on March 30th.
- Some of turbine building lights were turned on March 31st.
- From 8:28 am, April 1st, the water spray by the concrete pumping vehicle was started. At 2:14 pm, the water spray finished.
- From 5:14 pm, April 3rd, the water spray by the concrete pumping vehicle was started. At 10:16 pm, the water spray finished.

*Unit 5 and 6
- At 5:00 am on March 19th, we started the Residual Heat Removal System Pump (C) of Unit 5 in order to cool the spent fuel pool. At 10:14 pm, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
- Unit 5 has been in reactor cold shutdown since 2:30 pm on March 20th. Unit 6 has been in reactor cold shutdown since 7:27 pm on March 20th.
- At Units 5 and 6, in order to prevent hydrogen gas from accumulating within the buildings, we have made three holes on the roof of the reactor building for each unit.
- At approximately 5:24 pm on March 23rd, the temporary Residual Heat Removal System Seawater Pump automatically stopped when its power source was switched. We restarted the pump at around 4:14 pm, March 24th, and resumed cooling of reactor at around 4:35 pm.

* On March 18th, regarding the spent fuel in the common spent fuel pool, we have confirmed that the water level of the pool was secured. At around 10:37 am March 21st, water spraying to common spent fuel pool and finished at 3:30 pm. At around 6:05 pm, fuel pool cooling pump was started to cool the pool.
*common spent fuel pool: a spent fuel pool for common use set in a separate building in a plant site in order to preserve spent fuel which are transferred from the spent fuel pool in each Unit building.

* On March 17th, we patrolled buildings for dry casks and found no signs of abnormal situation for the casks by visual observation. A detailed inspection was under preparation.
*dry cask: a measure to store spent fuel in a dry storage casks in storages. Fukushima Daiichi Nuclear Power Station started to utilize the measure from August 1995.

* On March 21st, 23rd to April 4th we detected technetium, cobalt, iodine, cesium, tellurium, barium, lanthanum and molybdenum from the seawater around the discharge canal of the station. (We are reevaluating)

* On March 20th, 21st, 23rd to 30th, we detected iodine, cesium, tellurium and ruthenium in the air collected at the site of Fukushima Daiichi Nuclear Power Station. (We are reevaluating)

* Plutonium has been detected from the sample of soil at the site of Fukushima Daiichi Nuclear Power Station collected on 21st and 22nd of March, Concentration level of Plutonium detected was same as that of under usual environment and it was thought not to be harmful to human health. We will strengthen environmental monitoring of power station and surrounding environment.

* We detected radioactive materials contained in the puddles found in the turbine building of Unit 1 to 4.

* At approximately 3:30 pm, March 27th, we found water pooling in the vertical shaft of the trench outside of the turbine buildings for Units 1 to 3. The radiation dose at the surface of the water amounted 0.4 mSv/h in Unit 1 and over 1,000 mSv/h in Unit 2. We could not confirm the amount of the radiation dose in Unit 3. We will keep observing the condition of the water in the vertical shaft.
On March 29th, we detected niobium, tellurium, ruthenium, silver, tellurium, iodine, cesium, and ruthenium in the water collected at the trench of unit 1.

On March 30th, we took samples from the water in the trench of Unit 2 and 3, and conducted nuclide analysis on them. We are now confirming the results of the analysis.

*At approximately 9:30 am, April 2nd, we found that there was water in the shaft for storing power cable (concrete product) near the intake of water for Unit 2, the radioactive air dose was over 1,000mSv/h and the water spilled into the sea from the crack (approximately 20 cm) on the side of the shaft. We injected fresh concrete to the shaft twice, however, we could not observe a change in the amount of water flowing into the sea. Therefore, we considered that a new method of stopping the water and determined to use the polymer. Necessary equipment and experts of water shutoff will be dispatched to the site and after checking the condition, we began to stop water shutoff and were injecting polymer on April 3rd. On April 4th, we injected the tracer from the vertical shaft of the trench to start to examine the water current. We did not observe reduction of flow or change of color or water leaking. We checked the diagram and confirmed the route. At the same time, we checked the situation of the pit in detail and considered the possibility that the water was not from the pit, rather, from the joint between the piping upstream of the pit and the duct, then the water seeped through a layer of gravel below the piping. In order to stop that seepage from the layer of gravel, we decided to conduct the water sealing to the bedrock around the piping. We arranged for the specialist and gathered equipments. On April 5th, liquid glass was injected to the bedrock. Tracer was put through the two new holes drilled near the pit to investigate the water flow. At 2:15 pm, April 5th, it was observed the water with tracer came out from the crack on the concrete lateral of the pit. At 3:7 pm, April 5th, injection of coagulant from the holes was initiated. Additional countermeasure to prevent discharge of radioactive material from the pit will be implemented. Iodine and Cesium were detected from the water sampled in the pit and in the sea near the water discharge. Additional nuclide analysis will be implemented.
In addition, from April 2nd, we will implement sampling at 15km offshore Fukushima Daiichi and Fukushima Daini Nuclear Power Stations and will evaluate these samples comprehensively.

* Since approximately 9:20 am, March 31st, the water transfer from the vertical shaft of Unit 1 to the reservoir of the centralized environmental facility was conducted. We finished the task around 11:25 am of the same day.

* We found a puddle of water at the main building of the centralized environmental facility process. We analyzed and detected approximately 1.2×10^{1}Bq/cm^3 of radioactivity in full dose in the Controlled Area and 2.2×10^{1}Bq/cm^3 in full dose in the Non-Controlled Area on March 29. From April 3rd, the water level in the trench of Unit 3 increased by 15 cm. The route is not yet known, but there is a possibility that water in the turbine building of Unit 4 may be running to the trench of Unit 3. To be safe, at 09:22am, April 4th, we stopped transferring water to the turbine building of Unit 4. At this moment, the water level in the trench of Unit 3 became stable after stopping the water transfer.

* There is plenty of radioactive wastewater in the turbine buildings. Especially, Unit 2's wastewater is very highly radioactive. To store this stably, it was decided that this needed to be transferred to the Central Radioactive Waste Disposal Facility. However, within that facility, we are storing ten thousand tons of low level radioactive wastewater. In order to transfer more wastewater, we need to discharge the low level radioactive wastewater. In addition, as low radioactive subsurface water is piling up in sub-drain pits of Units 5 and 6 and a part of subsurface water is running into buildings. We are concerned that important equipment to secure the safety of reactors may be submerged.
Based on the Section 1 of the Article 64 of the Nuclear Reactor Regulation Law, we have decided to discharge to the sea approximately ten thousand tons of the accumulated low level radioactive water and a total of fifteen hundred tons of the low level radioactive subsurface water stored in the sub drain pits of Unit 5 and 6 as soon as we get ready.
At 7:03 pm, April 4th. we started discharging the low level radioactive wastewater stored in the Central Radioactive Waste Disposal Facility to the south of the water discharge canal. By 7:10 pm, we started ten pumps. Also, at 09:00 pm, April 4th, we started discharging the low level radioactive wastewater stored in the sub drain pits of Unit 5 and 6 by using one pump via the water discharge canal of Units 5 and 6.
We evaluate the impact on the discharge of the low radioactive wastewater to the sea as approximately 0.6 mSv per year per an adult if an adult eats adjacent fish and seaweeds everyday. The amount (0.6 mSv of effective radioactive doses per year) is one-forth of annual radioactive dose to which the general public is exposed from nature.

* The first barge of the U.S. Forces with fresh water to be used to cool down reactors etc. was towed by a ship of Maritime Self-Defense Force and docked at 3:42 pm on March 31st 2011. At approximately 3:58 pm, April 1st, we started to replenish filtrate tanks with the fresh water, and finished at 4:25 pm. At approximately 10:20 am, April 2nd, we resumed replenishing filtrate tanks with the fresh water, and finished at 4:40 pm. The second barge of the U.S. Forces with the fresh water towed by the ship of Maritime

Self-Defense Force came alongside the pier at approximately 9:10 am, April 2nd. It was in preparation for replenishing filtrate tanks with the fresh water. We began to transfer fresh water from the second barge to the first barge on April 3rd at 9:52 am and continued until 11:15 am on April 3rd.

* At 11:35 am, April 1st, a worker fell into the sea while stepping into the ship from the pier during the hose laying work of the barge. Other crew immediately rescued the worker. While no injury or contamination was confirmed, whole body counter will be implemented to check the contamination inside the body just in case.

* From 3:00 pm, April 1st, we started spraying inhibitor in order to prevent diffusion of radioactive materials. This attempt was conducted on a trial basis at the mountain side area of the common spent fuel pool in the range of 500m2. The spraying finished at 4:05 pm.

* Monitoring posts (no.1 to no.8) which were installed around the site boundary have been restored. We will continue monitoring the measured value and make announcements on those values accordingly.

*We will continuously endeavor to securing safety, and monitoring of the surrounding environment.

Fukushima Daini Nuclear Power Station:
Units 1 to 4: shutdown due to the earthquake
* The national government has instructed evacuation for those local residents within 10km radius of the periphery.

* In order to achieve cold shutdown, reactor cooling function was restored and cooling of reactors was conducted. As a result, all reactors achieved cold shutdown: Unit 1 at 5:00 pm, March 14th, Unit 2 at 6:00 pm, March 14th, Unit 3 at 0:15 pm, March 12th, Unit 4 at 7:15 am, March 16th.

* At 2:30 pm on March 30th, the power source of the residual heat removal system (B) to cool the reactor of Unit 1 was secured from an emergency power source in addition to an offsite power. This means that all the units secure backup power sources (emergency power sources) for the residual heat removal system (B).

* Unit 1
As it was confirmed that the temperature of the Emergency Equipment Cooling Water System *1 has increased, at 3:20 pm, March 15th, we stopped the Residual Heat Removal System (B) for the inspection. Subsequently, failure was detected in the power supply facility associated with the pumps of the Emergency Equipment Cooling Water System. At 4:25 pm, March 15th, after replacing the power facility, the pumps and the Residual Heat Removal System (B) have been reactivated.

* Unit 4
As it was confirmed that the pressure at the outlet of the pumps of the Emergency Equipment Cooling Water System*1 has been decreased, at 8:05 pm, March 15th, we stopped the Residual Heat Removal System (B) for the inspection. Subsequently, failure was detected in the power supply facility associated with the pumps of the Emergency Equipment Cooling Water System. At 9:25 pm, March 15th, after replacing the relevant facility, the pumps and the Residual Heat Removal System (B) have been reactivated.

*1:emergency water system in which cooling water (pure water) circulates which exchanged the heat with sea water in order to cool down bearing pumps and/or heat exchangers etc.

Kashiwazaki Kariwa Nuclear Power Station:
Units 1, 5, 6, 7: normal operation
(Units 2 to 4: outage due to regular inspection)

[Thermal Power Station]
- Hirono Thermal Power Station Units 2 and 4: shutdown due to the earthquake
- Hitachinaka Thermal Power Station Unit 1: shutdown due to the earthquake
- Kashima Thermal Power Station Units 2, 3, 5, 6: shutdown due to the earthquake

[Hydro Power Station]
- Power supply has returned to normal, but facilities damaged by the earthquake are now being handled in a timely manner.

[Impacts on Transmission Facilities]
- Power supply has returned to normal, but facilities damaged by the earthquake are now being handled in a timely manner.

[Potential Implementation on Planned Rolling Blackouts and Request for Conserving Electricity Consumption]
- Considering the critical balance of our power supply capacity and expected power demand going forward, in order to avoid unexpected blackout in large areas, TEPCO has been implementing rolling blackout

(planned blackout alternates from one area to another) since March 14th. We will make our utmost to secure the stable power supply as early as possible. For customers who will be subject to rolling blackout, please be prepared for the announced blackout periods. Also for customers who are not subject to blackouts, TEPCO appreciates your continuous cooperation in reducing electricity usage by turning of unnecessary lights and electrical equipment.

[Others]
- Please do NOT touch cut-off electric wires.
- In order to prevent fire, please make sure to switch off the electric appliances such as hair driers when you leave your house.
- For the customer who has in-house power generation, please secure fuel for generator.

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Press Releases

Press Release (Apr 05,2011)
Out flow of fluid containing radioactive materials to the ocean from areas near intake channel of Fukushima Daiichi Nuclear Power Station Unit 2 (continued report)

Today at around 9:30 am, we detected water containing radiation dose over 1,000 mSv/h in the pit* where supply cables are stored near the intake channel of Unit 2. Furthermore, there was a crack about 20 cm on the concrete lateral of the pit, from where the water in the pit was out flowing. At around 12:20 pm, we reaffirmed the event at the scene.
We have implemented sampling of the water in the pit, together with the seawater in front of the bar screen near the pit. These samples were sent to Fukushima Daini Nuclear Power Station for analysis. (We already informed on April 2nd, 2011)

Afterward, we implemented sea water sampling at the inside of the pit and in front of the bar screen near the pit. We made radionuclide analysis and found radioactive materials (For details to Appendix). Therefore, we reported to Nuclear and Industrial Safety Agency (NISA), Ministry of Economy, Trade and Industry (METI), and Fukushima prefecture respectively.

We considered announcing 3 type of nucleus (iodine- 131, cesium-131, and cesium-137) as definite value at the result of the analysis. In addition, we will re-evaluate other type of nucleus based on the preventive measures under a strong warning of NISA on April 1st,

We will implement the countermeasure continuously in order to prevent radioactive materials influx to the sea from near the pit.

*pit: a shaft made of concrete

Appendix1:The result of the nuclide analysis of the seawater at the cable pit of Unit 2 and screen(PDF 12.3KB)
Appendix2:Place of Collection (April 2nd)(PDF 227KB)
Appendix3:The result of the nuclide analysis of the seawater at the front of shallow draft quay and screen of Unit 2, 4(PDF 10.6KB)
Appendix4:Place of Collection (April 3rd)(PDF 434KB)
Appendix5:The result of the nuclide analysis of the seawater at the front of shallow draft quay and screen of Unit 2, 4(PDF 10.9KB)
Appendix6:Place of Collection (April 4th)(PDF 433KB)
Appendix7:Assumed cause and Tentative planned countermeasure construction (PDF 31.3KB)
Appendix8:Tentative Preventive Measure of Spreading Radioactive Materials (PDF 35.3KB)

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Wagner, Katie

From: Wagner, Katie
Sent: Tuesday, April 05, 2011 3:08 PM
To: Santiago, Patricia
Subject: RE: Article from Japanese newspaper

No prob, it is #64 on the log. - Katie

From: Santiago, Patricia
Sent: Tuesday, April 05, 2011 3:05 PM
To: Wagner, Katie
Subject: FW: Article from Japanese newspaper

Did this get logged do you know?
Sorry as I was out last week.
Thanks!

From: Sheron, Brian
Sent: Thursday, March 31, 2011 3:58 PM
To: Uhle, Jennifer; Santiago, Patricia; Gibson, Kathy
Subject: FW: Article from Japanese newspaper

See below. How well does this scenario agree or disagree with the SOARCA scenario for PB?

From: ET02 Hoc
Sent: Thursday, March 31, 2011 3:56 PM
To: Sheron, Brian
Subject: Article from Japanese newspaper

AJW by the Asahi Shimbun
AJW 3/11 quake update:

U.S. simulation predicted similar problems at Fukushima nuclear plant

A U.S. simulation exercise conducted about 30 years ago of what would happen at a boiling-water reactor if all power sources were lost eerily matches what has unfolded at the Fukushima No. 1 nuclear power plant.
...While the simulation demonstrated the dangers of losing all power sources, Japan's nuclear authorities took the optimistic position that power transmission lines and other power sources would be restored quickly.
The simulation was conducted by the Oak Ridge National Laboratory in 1981 and 1982. A report was later submitted to the U.S. Nuclear Regulatory Commission, which used the report's findings to establish safety regulations.
The simulation was based on the No. 1 reactor at the Browns Ferry Nuclear Plant in Alabama.
The reactor had an output of 1.1 gigawatts and was the same Mark I boiling-water reactor manufactured by General Electric Co. that is used at the No. 1 to No. 5 reactors at the Fukushima No. 1 nuclear plant.
One part of the simulation assumes that an external AC power source as well as emergency diesel generators have been lost, which is what actually happened at the Fukushima No. 1 plant after the Great East Japan Earthquake and subsequent tsunami hit on March 11.
The simulation goes on to predict what would likely occur depending on how long the emergency batteries were operable as well as on how the emergency cooling mechanism was working.
If the batteries could be used for four hours, the simulation predicts that after five hours without external power, the fuel rods in the core would become exposed. Thirty minutes later, the fuel rods would reach 485 degrees and start producing hydrogen. Another 30 minutes later, the fuel rods would begin to melt, according to the simulation.

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It goes on to predict that seven hours after the loss of an external power source, the lower part of the pressure container would be damaged. Ninety minutes later, the containment vessel would be damaged.
Another simulation exercise assuming the use of batteries for six hours has fuel rods being exposed after eight hours and starting to melt after 10 hours. Damage to the containment vessel would occur after 13-and-a-half hours.
At the Fukushima No. 1 plant, the external power source was lost when the earthquake struck. It switched to an emergency diesel generator, but that was flooded and irreparably damaged by the tsunami about an hour later.
The only remaining power source was a DC battery.
At that point, the conditions at the Fukushima plant were nearly identical to those used in the simulation exercise.
Despite the fact that the batteries at the Fukushima plant could be used for eight hours, rather than six, the ensuing events at the Fukushima plant closely mimicked those in the simulation.
Moreover, if the predictions are extrapolated, it would mean that the containment vessels may no longer be sound, despite contrary comments by officials of Tokyo Electric Power Co., the operator of the Fukushima plant.
Satoshi Sato is a nuclear consultant who worked for many years at a GE-affiliated company, managing boiling-water reactors.
"The simulation is still sufficiently valid today," he said. "But I do not know if such knowledge has been passed down within electric power companies."
In Japan, the possibility that all external power sources could be lost at nuclear plants has not been seriously considered.
In 1990, when the Nuclear Safety Commission of Japan decided on guidelines for approving safety design at nuclear plants, it stated, "There is no need to consider the loss of all AC power sources for a long period of time because we can expect a restoration of power transmission lines or the recovery of emergency AC power source facilities."
Shojiro Matsuura, president of the Nuclear Safety Research Association, once served as NSC chairman.
"There was the unspoken understanding that we did not have to think about a situation in which everything failed," Matsuura said. "It was not possible to foresee every possibility, such as a direct hit by a meteor."

(This article was written by Ichiro Matsuo and Ryoma Komiyama.)

Wagner, Katie

From: Wagner, Katie
Sent: Tuesday, April 05, 2011 4:09 PM
To: Gibson, Kathy
Cc: Lee, Richard; Bowlin, Elizabeth
Subject: Japan Event Response (V6236) package status

Good Afternoon Kathy,

Richard reviewed the Japan Event Response (V6236) concurrence package and gave it to me to give back to you for management discussion. I have put the package on your chair since I was told that your schedule is blocked solid with meetings until at least 5pm tonight and tomorrow morning as well.

Please let me know if there is anything I can do to help.

Thanks,

Katie Wagner
General Engineer
U.S. Nuclear Regulatory Commission
(301) 251.7917
Katie.Wagner@nrc.gov

LLLL/179

Wagner, Katie

From: Wagner, Katie
Sent: Tuesday, April 05, 2011 2:30 PM
To: Santiago, Patricia
Cc: Lee, Richard
Subject: RE: SOARCA likely to be referenced, questioned tomorrow

Pat – Who are the Staff Contacts for this item (which looks like it is complete)? I saw R. Correia's email that Kevin Coyne and Dan (last name?) would develop material for it . . . who from your branch should I list? – Thanks, Katie

---

From: Santiago, Patricia
Sent: Tuesday, April 05, 2011 12:36 PM
To: Sheron, Brian; Uhle, Jennifer
Cc: Gibson, Kathy; Correia, Richard; Wagner, Katie; Chang, Richard; Lee, Richard; Rini, Brett; Armstrong, Kenneth; Scott, Michael
Subject: RE: SOARCA likely to be referenced, questioned tomorrow

Brian
Attached are bullets pulled from the RIC and NRR presentations. We did not get into a lot of detail but kept it high level. We will bring you a hard copy as well.
Thanks

From: Sheron, Brian
Sent: Tuesday, April 05, 2011 11:28 AM
To: Santiago, Patricia; Correia, Richard
Cc: Uhle, Jennifer; Gibson, Kathy
Subject: RE: SOARCA likely to be referenced, questioned tomorrow

The former.....

From: Santiago, Patricia
Sent: Tuesday, April 05, 2011 11:27 AM
To: Sheron, Brian; Correia, Richard
Cc: Uhle, Jennifer; Gibson, Kathy
Subject: RE: SOARCA likely to be referenced, questioned tomorrow

Richard and I can pull from RIC and other briefings on SOARCA. I suspect the audience is the congressional staffers you spoke to for ongoing Japan questions or is it budget related?

Thanks

From: Sheron, Brian
Sent: Tuesday, April 05, 2011 11:24 AM
To: Santiago, Patricia; Correia, Richard
Cc: Uhle, Jennifer; Gibson, Kathy
Subject: FW: SOARCA likely to be referenced, questioned tomorrow

See below. Can I get some background bullets on SOARCA and level 3 PRA within a couple of hours?

From: Rihm, Roger
Sent: Tuesday, April 05, 2011 11:17 AM

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To: Sheron, Brian
Subject: FW: SOARCA likely to be referenced, questioned tomorrow

It seems this hearing is going everywhere. I know you are sending over some material on dry cask storage. Can you also provide a limited amount of background material on SOARCA and level 3 PRAs? I have the one pagers from NUREG 1925 to start with. Thx.

From: Powell, Amy
Sent: Tuesday, April 05, 2011 11:10 AM
To: Virgilio, Martin
Cc: Rihm, Roger; Shane, Raeann; Schmidt, Rebecca; Sheron, Brian
Subject: SOARCA likely to be referenced, questioned tomorrow

Marty –

OCA got a heads up from Mr. Waxman's staff that he and Rep. DeGette may reference the concept of SOARCA, work to date, and ask related questions at tomorrow's hearing. Dr. Sheron did a briefing for a number of House Energy and Commerce staffers that referenced ongoing work on this; staff was impressed so encouraged their bosses to ask about it (understanding that it is evolving, draft, preliminary, etc.).

Amy

Amy Powell
Associate Director
U. S. Nuclear Regulatory Commission
Office of Congressional Affairs
Phone: 301-415-1673

Wagner, Katie

From: Wagner, Katie
Sent: Tuesday, April 05, 2011 2:20 PM
To: Jimenez, Juan
Subject: RE: Sharepoint status

It is, I checked this a.m. Thanks!!!

From: Jimenez, Juan
Sent: Tuesday, April 05, 2011 8:24 AM
To: Wagner, Katie
Subject: RE: Sharepoint status

Ok it should be working now

From: Wagner, Katie
Sent: Tuesday, April 05, 2011 8:18 AM
To: Jimenez, Juan
Subject: RE: Sharepoint status

Ok, I just changed the status of 2 items to "On Hold" ☺

From: Jimenez, Juan
Sent: Tuesday, April 05, 2011 7:30 AM
To: Wagner, Katie
Subject: RE: Sharepoint status

Ok I added the On Hold Option but you will have to add the On Hold item so I can modify the reports filter.

From: Wagner, Katie
Sent: Monday, April 04, 2011 3:50 PM
To: Jimenez, Juan
Subject: Sharepoint status

Hi Juan,

Could you please add a new status called "On Hold" to the Japan Sharepoint page? I would like items with this status to show up on the "Other" report versus having a separate "On Hold" report.

Thanks!
Katie

LLLL/181

Wagner, Katie

From: Wagner, Katie
Sent: Tuesday, April 05, 2011 1:59 PM
To: Lee, Richard
Subject: Sharepoint item #21

Richard,

FYI, when I spoke with Jason S. yesterday afternoon he indicated that he thought the item below should have Charlie Tinkler as the Staff Contact instead of Mourad as he thought it fell under Charlie's area of expertise. I told Jason that I would let you know his thoughts.

21	3/21/2011	Brian Sheron	Brian.Sheron@nrc.gov	Mourad Aissa x7511	FSTB	To evaluate the risk benefit of pulling spent fuel out of the SFP as soon as the specific assembly heat load permits. ***UPDATE as of 3/23***: An initial response was sent to B. Sheron on 3/23. B. Sheron requested additional information and a briefing once that information is obtained.	To evaluate the risk benefit of pulling spent fuel out of the SFP as soon as the specific assembly heat load permits. ***UPDATE as of 3/23***: An initial response was sent to B. Sheron on 3/23. B. Sheron requested additional information and a briefing once that information is obtained.	Pending

Thanks,
Katie

LLLL/182

Wagner, Katie

From: Wagner, Katie
Sent: Tuesday, April 05, 2011 8:18 AM
To: Jimenez, Juan
Subject: RE: Sharepoint status

Ok, I just changed the status of 2 items to "On Hold" ☺

From: Jimenez, Juan
Sent: Tuesday, April 05, 2011 7:30 AM
To: Wagner, Katie
Subject: RE: Sharepoint status

Ok I added the On Hold Option but you will have to add the On Hold item so I can modify the reports filter.

From: Wagner, Katie
Sent: Monday, April 04, 2011 3:50 PM
To: Jimenez, Juan
Subject: Sharepoint status

Hi Juan,

Could you please add a new status called "On Hold" to the Japan Sharepoint page? I would like items with this status to show up on the "Other" report versus having a separate "On Hold" report.

Thanks!
Katie

LLLL/183

From: LIA07 Hoc
Sent: Tuesday, April 05, 2011 5:08 AM
To: LIA07 Hoc
Subject: 0430 EDT (April 5, 2011) USNRC Earthquake/Tsunami Status Update
Attachments: NRC Status Update 4-05-11--0430EDT.pdf

Attached, please find a 0430 EDT, April 5, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

Please note that this information is ~~"Official Use Only"~~ and is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Jim

Jim Anderson
Executive Briefing Team Coordinator
Office of Nuclear Security and Incident Response
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)
james.anderson@nrc.gov

LLLL/184

From: LIA06 Hoc
Sent: Tuesday, April 05, 2011 9:17 PM
To: OST02 HOC
Subject: RE: NRC Charter

Sweeett! Thanks.

Mark Lombard
Liaison Team Director
U.S. Nuclear Regulatory Commission
Operations Center

From: OST02 HOC
Sent: Tuesday, April 05, 2011 9:10 PM
To: LIA08 Hoc; LIA01 Hoc; LIA06 Hoc
Subject: NRC Charter

As requested.

LLLL/185

Wagner, Katie

From: Wagner, Katie
Sent: Wednesday, April 06, 2011 4:56 PM
To: Greenwood, Carol
Cc: Lee, Richard
Subject: RE: If you have coded ANY T&A to Japan and you are not on this list

Carol – I have edited the table on Richard's behalf (highlighted below). – Thanks, Katie

---

From: Greenwood, Carol
Sent: Wednesday, April 06, 2011 4:34 PM
To: Bernard, Matthew; Bowlin, Elizabeth; Calvo, Antony; Figueroa, Gladys; Gingrich, Chester; Hoxie, Chris; Hudson, Nathanael; Ireland, Andrew; Li, Zhian; Murray, Christopher; Staudenmeier, Joseph; Thurston, Carl; Tien, Kirk; Velazquez-Lozada, Alexander; Whitman, Josh; Armstrong, Kenneth; Bajorek, Stephen; Bano, Mahmooda; Bowlin, Elizabeth; Boyd, Christopher; Elkins, Scott; Greenwood, Carol; Rubin, Stuart; Shaffer, Sarah; Sherbini, Sami; Voglewede, John; Aissa, Mourad; Algama, Don; Flanagan, Michelle; Notafrancesco, Allen; Raynaud, Patrick; Scott, Harold; Wagner, Katie; Brock, Terry; Bush-Goddard, Stephanie; Lewis, Doris; Saba, Mohammad; Schaffer, Steven; Shaffer, Vered; Tomon, John; Barr, Jonathan; Basu, Sudhamay; Kelly, Joseph; Madni, Imtiaz; Nosek, Andrew; Rubin, MichaelB; Shaffer, Sarah; Tene, Kimberly; Zaki, Tarek; Dorn, Jaclyn; Elkins, Scott; Frankl, Istvan; Harrington, Ronald; Krepel, Scott; Krotiuk, William; Lien, Peter; Marshall, Shawn; Ramirez, Annie; Yarsky, Peter; Chang, Richard; Coates, Anissa; Ghosh, Tina; Gonzalez, Sergio
Subject: If you have coded ANY T&A to Japan and you are not on this list

Please let me know as we need to provide names to the OCFO.

Please also let me know what type of support you provided.

Name	Kind of Support
Abdelghani Zigh	Office Support
Anthony Huffert	Ops Center: PMTR Dose Assessment (RASCAL)
Carlos Navarro	Office Support
Carol Greenwood	Ops Center: EST Admin. Assistant
Casper Sun	Ops Center: PMTR Dose Assessment (RASCAL)
Charles Tinkler	Office Support
Don Algama	Ops Center: EST Actions Officer
Hossein Esmali	Ops Center: Severe Accident / PRA
James Corson	Ops Center: EST Actions Officer
Jason Schaperow	Ops Center: Severe Accident / PRA
Kathy Halvey Gibson	Ops Center: PMTR Director
Michael Salay	Ops Center: Severe Accident / PRA
Patricia Santiago	Office Support
Ray Skarda	Ops Center: Severe Accident / PRA
Richard Lee	Office Support/DOE Science Council/DOE-OSTP-NRC-Japan consultation
Tarek Zaki	Office Support

Regards
Carol Greenwood
Lead Administrative Assistant

LLLL/186.

RES/DSA
Phone: 301-251-7499

Wagner, Katie

From: Wagner, Katie
Sent: Wednesday, April 06, 2011 4:47 PM
To: Greenwood, Carol
Cc: Lee, Richard
Subject: RE: If you have coded ANY T&A to Japan and you are not on this list

Carol – I have been using the Japan TAC. As a DSA POC for the Japan-Related Requests Sharepoint page I have been providing office support. Thanks, Katie

---

From: Greenwood, Carol
Sent: Wednesday, April 06, 2011 4:34 PM
To: Bernard, Matthew; Bowlin, Elizabeth; Calvo, Antony; Figueroa, Gladys; Gingrich, Chester; Hoxie, Chris; Hudson, Nathanael; Ireland, Andrew; Li, Zhian; Murray, Christopher; Staudenmeier, Joseph; Thurston, Carl; Tien, Kirk; Velazquez-Lozada, Alexander; Whitman, Josh; Armstrong, Kenneth; Bajorek, Stephen; Bano, Mahmooda; Bowlin, Elizabeth; Boyd, Christopher; Elkins, Scott; Greenwood, Carol; Rubin, Stuart; Shaffer, Sarah; Sherbini, Sami; Voglewede, John; Aissa, Mourad; Algama, Don; Flanagan, Michelle; Notafrancesco, Allen; Raynaud, Patrick; Scott, Harold; Wagner, Katie; Brock, Terry; Bush-Goddard, Stephanie; Lewis, Doris; Saba, Mohammad; Schaffer, Steven; Shaffer, Vered; Tomon, John; Barr, Jonathan; Basu, Sudhamay; Kelly, Joseph; Madni, Imtiaz; Nosek, Andrew; Rubin, MichaelB; Shaffer, Sarah; Tene, Kimberly; Zaki, Tarek; Dorn, Jaclyn; Elkins, Scott; Frankl, Istvan; Harrington, Ronald; Krepel, Scott; Krotiuk, William; Lien, Peter; Marshall, Shawn; Ramirez, Annie; Yarsky, Peter; Chang, Richard; Coates, Anissa; Ghosh, Tina; Gonzalez, Sergio
Subject: If you have coded ANY T&A to Japan and you are not on this list

Please let me know as we need to provide names to the OCFO.

Please also let me know what type of support you provided.

Name	Kind of Support
Abdelghani Zigh	Office Support
Anthony Huffert	Ops Center: PMTR Dose Assessment (RASCAL)
Carlos Navarro	Office Support
Carol Greenwood	Ops Center: EST Admin. Assistant
Casper Sun	Ops Center: PMTR Dose Assessment (RASCAL)
Charles Tinkler	Office Support
Don Algama	Ops Center: EST Actions Officer
Hossein Esmali	Ops Center: Severe Accident / PRA
James Corson	Ops Center: EST Actions Officer
Jason Schaperow	Ops Center: Severe Accident / PRA
Kathy Halvey Gibson	Ops Center: PMTR Director
Michael Salay	Ops Center: Severe Accident / PRA
Patricia Santiago	Office Support
Ray Skarda	Ops Center: Severe Accident / PRA
Richard Lee	Office Support
Tarek Zaki	Office Support

Regards
Carol Greenwood
Lead Administrative Assistant

LLLL/187

RES/DSA
Phone: 301-251-7499

Wagner, Katie

From: Wagner, Katie
Sent: Wednesday, April 06, 2011 8:26 AM
To: Gibson, Kathy
Cc: Lee, Richard; Bowlin, Elizabeth
Subject: RE: Japan Event Response (V6236) package status

Good Morning Kathy,

I talked with Richard and he is ok with Jennifer's changes.

Thanks,
Katie

From: Gibson, Kathy
Sent: Tuesday, April 05, 2011 5:50 PM
To: Wagner, Katie
Cc: Lee, Richard; Bowlin, Elizabeth
Subject: RE: Japan Event Response (V6236) package status

Is Richard ok with Jennifer's changes?

From: Wagner, Katie
Sent: Tuesday, April 05, 2011 4:09 PM
To: Gibson, Kathy
Cc: Lee, Richard; Bowlin, Elizabeth
Subject: Japan Event Response (V6236) package status

Good Afternoon Kathy,

Richard reviewed the Japan Event Response (V6236) concurrence package and gave it to me to give back to you for management discussion. I have put the package on your chair since I was told that your schedule is blocked solid with meetings until at least 5pm tonight and tomorrow morning as well.

Please let me know if there is anything I can do to help.

Thanks,

Katie Wagner
General Engineer
U.S. Nuclear Regulatory Commission
(301) 251.7917
Katie.Wagner@nrc.gov

LLLL/188

From: LIA07 Hoc
Sent: Wednesday, April 06, 2011 6:10 PM
Subject: OUO -- 1800 EDT (April 6, 2011) USNRC Earthquake-Tsunami Update
Attachments: USNRC Earthquake-Tsunami Update.040611.1800EDT.pdf

Attached, please find a 1800 EDT, April 6, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

Please note that this information is "Official Use Only" and is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Sara

Sara K. Mroz
Executive Briefing Team Coordinator
Office of Nuclear Security and Incident Response
US Nuclear Regulatory Commission
Sara.Mroz@nrc.gov
LIA07.HOC@nrc.gov (Operations Center)

LLLL/189

From: Brown, Frederick
Sent: Wednesday, April 06, 2011 9:33 AM
To: RST06 Hoc; Ruland, William; Hiland, Patrick; Holian, Brian
Cc: Dudes, Laura
Subject: RE: RST transition

I like it!

From: RST06 Hoc
Sent: Wednesday, April 06, 2011 6:32 AM
To: Ruland, William; Brown, Frederick; Hiland, Patrick; Holian, Brian
Cc: Dudes, Laura
Subject: FW: RST transition

Gentlemen,

See attached draft strategy for RST transition. PMT is working on a similar document.

Would like your thoughts/comments, have shared with Mike Johnson and we would like to be able to put something in front of Marty/Mike W.

I am working mids again tonight and will incorporate your comments.

Thanks,
Laura

LLLL/190

From: ET02 Hoc
Sent: Wednesday, April 06, 2011 9:41 AM
To: ET07 Hoc
Subject: FW: 0430 EDT (April 6, 2011) USNRC Earthquake/Tsunami Status Update
Attachments: NRC Status Update 4.06.11--0430EDT.pdf

From: ET01 Hoc
Sent: Wednesday, April 06, 2011 9:40:47 AM
To: ET02 Hoc
Subject: FW: 0430 EDT (April 6, 2011) USNRC Earthquake/Tsunami Status Update
Auto forwarded by a Rule

From: Sheron, Brian
Sent: Wednesday, April 06, 2011 9:40:44 AM
To: Wiggins, Jim; ET01 Hoc
Subject: FW: 0430 EDT (April 6, 2011) USNRC Earthquake/Tsunami Status Update
Auto forwarded by a Rule

Jim, when I was the ET Director du jour Sunday, and Ruland was the RST director, I pushed him to explain where all the energy and mass was going. I said that if they were putting in more water than what boiled off, then the vessel should be filling up, which means at some time the vessel will fill with water. I said that if they were putting in just enough water (~30 gpm) to boil off, then the steam must be going to the suppression pool. Hence, the suppression pool must be condensing the steam and heating up, which means the suppression pool should be saturated and boiling by now. Therefore, they have to be venting the suppression pool.

The bottom line from our conversation is that the RST really had no idea where all the mass and energy was going.

From: LIA07 Hoc
Sent: Wednesday, April 06, 2011 4:49 AM
To: LIA07 Hoc
Subject: 0430 EDT (April 6, 2011) USNRC Earthquake/Tsunami Status Update

Attached, please find a 0430 EDT, April 6, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

Please note that this information is ~~"Official Use Only"~~ and is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Jim

Jim Anderson
Executive Briefing Team Coordinator

LLLL/191

Office of Nuclear Security and Incident Response
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)
james.anderson@nrc.gov

From: ET02 Hoc
Sent: Thursday, April 07, 2011 12:48 PM
To: ET07 Hoc
Subject: FW: Breaking News: Magnitude 7.4 earthquake hits off Japan; tsunami warning issued

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From: ET01 Hoc
Sent: Thursday, April 07, 2011 12:48:23 PM
To: ET02 Hoc
Subject: FW: Breaking News: Magnitude 7.4 earthquake hits off Japan; tsunami warning issued
Auto forwarded by a Rule

From: Sheron, Brian
Sent: Thursday, April 07, 2011 12:48:21 PM
To: ET01 Hoc; Weber, Michael; Virgilio, Martin; Borchardt, Bill; RST01 Hoc; HOO Hoc
Subject: FW: Breaking News: Magnitude 7.4 earthquake hits off Japan; tsunami warning issued
Auto forwarded by a Rule

FYI.

From: Correia, Richard
Sent: Thursday, April 07, 2011 12:44 PM
To: Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Valentin, Andrea; Barnes, Valerie; Hudson, Daniel; Nicholson, Thomas; Siu, Nathan; Stutzke, Martin; Beasley, Benjamin; Coe, Doug; Coyne, Kevin; Demoss, Gary; Ott, William; Peters, Sean; Salley, MarkHenry
Subject: FW: Breaking News: Magnitude 7.4 earthquake hits off Japan; tsunami warning issued

FYI...

Richard Correia, PE
Director, Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: "The Washington Post" <newsletters@email.washingtonpost.com>
Date: April 7, 2011 11:02:36 AM EDT
To: richcinva@cox.net
Subject: Breaking News: Magnitude 7.4 earthquake hits off Japan; tsunami warning issued
Reply-To: "The Washington Post" <newslettersK9OPHU.999603@email.washingtonpost.com>

LLL/192

Breaking News Alert: Magnitude 7.4 earthquake hits off Japan; tsunami warning issued
April 7, 2011 10:57:08 AM

Japan's northeastern coast has been rattled by a strong aftershock. Japan's meteorological agency has issued a tsunami warning for a wave of up to one meter. The warning was issued for a coastal area already ravaged by last month's tsunami.

Officials say the quake was a 7.4-magnitude and hit 25 miles under the water and off the coast of Miyagi prefecture. The quake that preceded last month's tsunami was a 9.0-magnitude.

http://link.email.washingtonpost.com/r/92KH5M/NSPSBO/JQ63TP/4JUVZR/T42OZ/D5/h

For more information, visit washingtonpost.com

Washington Post Digital
E-mail Customer Care
1150 15th Street NW
Washington, DC 20071

From: RST01 Hoc
Sent: Thursday, April 07, 2011 2:04 PM
To: Hoc, RST16
Subject: FW: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

For notes section of status report on earthquake, reported at 7.1 magnitude.

From: Emche, Danielle
Sent: Thursday, April 07, 2011 1:21 PM
To: LIA02 Hoc
Subject: Fw: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

Summary of power to nuclear facilities
Danielle
Sent from an NRC BlackBerry.

From: PROTOCOLOFFICE-EM <protocoloffice-em@mofa.go.jp>
To: PROTOCOLOFFICE-EM <protocoloffice-em@mofa.go.jp>
Sent: Thu Apr 07 13:05:35 2011
Subject: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

URGENT
(1:45) Friday, 8 April 2011

To All Missions (Embassies, Consular posts and International Organizations in Japan)

According to the NISA press release issued at 23:50, 0:35 and 1:00:

- The spent fuel reprocessing plant at Rokkasho-mura, Aomori Prefecture is in test operation and the uranium enrichment plant is NOT IN OPERATION. The Higashi-dori (Aomori Prefecture), Onagawa (Miyagi Prefecture), Fukushima Dai-ichi and Fukushima Dai-ni nuclear power plants are NOT IN OPERATION after the Tohoku-Pacific earthquake of March 11. Tokai Dai-ni nuclear power plant (Ibaraki Prefecture) is NOT IN OPERATION.
- The spent fuel reprocessing plant and the uranium enrichment plant at Rokkasho-mura keep power supply by the emergency diesel generator as the power supply from outside has been cut after the earthquake.
- The Higashi-dori nuclear power plant keeps power supply by the emergency diesel generator as the power supply from outside has been cut after the earthquake, and the cooling of the spent fuel rods continues. There is no fuel rod in the core of the plant.
- The Onagawa nuclear power plant keeps power supply from outside though two power lines out of the three have been cut. There is no significant change in the readings of the monitoring posts. The cooling of the spent fuel rods continues.
- There is no significant change in the readings of the monitoring posts of the Fukushima Dai-ichi nuclear power plant. Water injection into the reactor continues.
- There is no significant change of the parameters of the Fukushima Dai-ni nuclear power plant.
- There is no trouble seen with the Tokai Dai-ni nuclear power plant.

LLLL/193

Contact: International Nuclear Energy Cooperation Division, Tel 03-5501-8227

From: LIA08 Hoc
Sent: Thursday, April 07, 2011 4:13 PM
To: LIA06 Hoc; LIA01 Hoc
Subject: FW: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

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From: Sellers, Charles R [mailto:SellersCR@state.gov]
Sent: Thursday, April 07, 2011 3:53 PM
To: LIA08 Hoc; SES-O
Subject: RE: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

Sir, thank you for the message. We look forward to continued updates.

Regards,

Charles Sellers
Watch Officer
State Department Operations Center
(202) 647-1512
sellerscr@state.gov

From: LIA08 Hoc [mailto:LIA08.Hoc@nrc.gov]
Sent: Thursday, April 07, 2011 3:24 PM
To: SES-O
Subject: FW: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

Same information I sent to Julie Bentz at the white house. Jeff Temple US NRC Liaison Team

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From: LIA02 Hoc
Sent: Thursday, April 07, 2011 1:37 PM
To: LIA08 Hoc; ET07 Hoc; LIA06 Hoc; RST01 Hoc; Hoc, PMT12; PMT02 Hoc
Subject: FW: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

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From: Emche, Danielle
Sent: Thursday, April 07, 2011 1:21 PM
To: LIA02 Hoc
Subject: Fw: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

Summary of power to nuclear facilities
Danielle
Sent from an NRC BlackBerry.

LLLL/194

From: PROTOCOLOFFICE-EM <protocoloffice-em@mofa.go.jp>
To: PROTOCOLOFFICE-EM <protocoloffice-em@mofa.go.jp>
Sent: Thu Apr 07 13:05:35 2011
Subject: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

URGENT
(1:45) Friday, 8 April 2011

To All Missions (Embassies, Consular posts and International Organizations in Japan)

According to the NISA press release issued at 23:50, 0:35 and 1:00:

- The spent fuel reprocessing plant at Rokkasho-mura, Aomori Prefecture is in test operation and the uranium enrichment plant is NOT IN OPERATION. The Higashi-dori (Aomori Prefecture), Onagawa (Miyagi Prefecture), Fukushima Dai-ichi and Fukushima Dai-ni nuclear power plants are NOT IN OPERATION after the Tohoku-Pacific earthquake of March 11. Tokai Dai-ni nuclear power plant (Ibaraki Prefecture) is NOT IN OPERATION.
- The spent fuel reprocessing plant and the uranium enrichment plant at Rokkasho-mura keep power supply by the emergency diesel generator as the power supply from outside has been cut after the earthquake.
- The Higashi-dori nuclear power plant keeps power supply by the emergency diesel generator as the power supply from outside has been cut after the earthquake, and the cooling of the spent fuel rods continues. There is no fuel rod in the core of the plant.
- The Onagawa nuclear power plant keeps power supply from outside though two power lines out of the three have been cut. There is no significant change in the readings of the monitoring posts. The cooling of the spent fuel rods continues.
- There is no significant change in the readings of the monitoring posts of the Fukushima Dai-ichi nuclear power plant. Water injection into the reactor continues.
- There is no significant change of the parameters of the Fukushima Dai-ni nuclear power plant.
- There is no trouble seen with the Tokai Dai-ni nuclear power plant.

Contact: International Nuclear Energy Cooperation Division, Tel 03-5501-8227

From: LIA08 Hoc
Sent: Thursday, April 07, 2011 1:42 PM
To: LIA12 Hoc; Bentz, Julie A.
Subject: FW: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

Julie...more info from our NRC Japan site team about loss of power events. More as we get the info. Jeff Temple USNRC

From: LIA02 Hoc
Sent: Thursday, April 07, 2011 1:37 PM
To: LIA08 Hoc; ET07 Hoc; LIA06 Hoc; RST01 Hoc; Hoc, PMT12; PMT02 Hoc
Subject: FW: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

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From: Emche, Danielle
Sent: Thursday, April 07, 2011 1:21 PM
To: LIA02 Hoc
Subject: Fw: URGENT:NISA Press Release issued at 23:50, Thursday, 0:35 and 1:00, Friday

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Danielle
Sent from an NRC BlackBerry.

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To: PROTOCOLOFFICE-EM <protocoloffice-em@mofa.go.jp>
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URGENT
(1:45) Friday, 8 April 2011

To All Missions (Embassies, Consular posts and International Organizations in Japan)

According to the NISA press release issued at 23:50, 0:35 and 1:00:

- The spent fuel reprocessing plant at Rokkasho-mura, Aomori Prefecture is in test operation and the uranium enrichment plant is NOT IN OPERATION. The Higashi-dori (Aomori Prefecture), Onagawa (Miyagi Prefecture), Fukushima Dai-ichi and Fukushima Dai-ni nuclear power plants are NOT IN OPERATION after the Tohoku-Pacific earthquake of March 11. Tokai Dai-ni nuclear power plant (Ibaraki Prefecture) is NOT IN OPERATION.
- The spent fuel reprocessing plant and the uranium enrichment plant at Rokkasho-mura keep power supply by the emergency diesel generator as the power supply from outside has been cut after the earthquake.

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- The Higashi-dori nuclear power plant keeps power supply by the emergency diesel generator as the power supply from outside has been cut after the earthquake, and the cooling of the spent fuel rods continues. There is no fuel rod in the core of the plant.
- The Onagawa nuclear power plant keeps power supply from outside though two power lines out of the three have been cut. There is no significant change in the readings of the monitoring posts. The cooling of the spent fuel rods continues.
- There is no significant change in the readings of the monitoring posts of the Fukushima Dai-ichi nuclear power plant. Water injection into the reactor continues.
- There is no significant change of the parameters of the Fukushima Dai-ni nuclear power plant.
- There is no trouble seen with the Tokai Dai-ni nuclear power plant.

Contact: International Nuclear Energy Cooperation Division, Tel 03-5501-8227

Wagner, Katie

From: Wagner, Katie
Sent: Thursday, April 07, 2011 2:12 PM
To: Jimenez, Juan
Subject: RE: Japan Sharepoint

Juan,

I just talked with Kathy Gibson and it was decided to give the DE and DRA branch chiefs viewing rights as well so please add viewing rights for the following people:

DE BCs
- Rosemary Hogan
- Mirela Gavrilas
- Aladar Csontos
- Russell Sydnor
- Thomas Koshy
- Thomas H. Boyce (Note: there are 2 Thomas Boyces at NRC)

DRA BCs
- Bill Ott
- Mark Salley
- Sean Peters
- Ben Beasley
- Kevin Coyne (I think he already has viewing rights when he was acting Deputy Director for DRA)
- Gary DeMoss

Also, please add viewing rights for Richard Correia, the new DRA Div. Director

Thanks,
Katie

From: Jimenez, Juan
Sent: Friday, March 18, 2011 11:20 AM
To: Wagner, Katie
Subject: RE: Japan Sharepoint

Only DSA Branches?

From: Wagner, Katie
Sent: Friday, March 18, 2011 11:13 AM
To: Jimenez, Juan
Subject: Japan Sharepoint

Juan,

Please change the permissions of the site so that it is viewable ONLY by DSA staff, plus the following people:

Brian Sheron
Jennifer Uhle
Brett Rini
Michael Case
Stuart Richards

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Douglas Coe
Kevin Coyne

Also, if you haven't already added a column for branch near the staff contact please add that.

Thanks,
Katie

From: LIA07 Hoc
Sent: Thursday, April 07, 2011 5:58 PM
To: Batkin, Joshua; Borchardt, Bill; Bradford, Anna; Coggins, Angela; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; ET07 Hoc; Flory, Shirley; Gibbs, Catina; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
Subject: Go Book Update: 1800 EDT, April 7, 2011
Attachments: TEPCO Press Release 301.pdf; TEPCO Press Release 292.pdf; TEPCO Press Release 293.pdf; TEPCO Press Release 294.pdf; TEPCO Press Release 295.pdf; TEPCO Press Release 296.pdf; TEPCO Press Release 297.pdf; TEPCO Press Release 298.pdf; TEPCO Press Release 299.pdf; TEPCO Press Release 300.pdf; Pages 1-5 from ET Chronology 4-07-11 1800EDT.pdf; USNRC Earthquake-Tsunami Update 040711 1800EDT update.pdf

Attached, please find updated information for the "Go Books".

The update includes:

- The 1800 EDT, 04/07/11 Status Update
- The latest ET Chronology
- TEPCO Press Releases (292-301)

Please let me know if you have any questions or concerns.

Yen

Yen Chen
Executive Briefing Team Coordinator
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)

LLLL/197

Search

Press Releases

Press Release (Apr 07,2011)
Kashiwazaki Kariwa Nuclear Power Station Plant condition after the earthquake (as of 11:50 pm, First release)

Regarding the earthquake today at 11:32 pm, the operation status at Kashiwazaki Kariwa Nuclear Power Station at 11:50 pm is as follows:

Unit No.	Status before the earthquake		Status as of 23:50	
	In operation	In shutdown	In operation	In shutdown
1	○		○	
2		○		○
3		○		○
4		○		○
5	○		○	
6	○		○	
7	○		○	

Influence of radioactivity outside: None (as of 23:50)

The figures indicated at exhaust stack monitors and monitoring posts at the station boundary are within the usual range, and there is no influence of radioactivity outside as of now.

We are currently conducting an inspection for each unit.

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Press Releases

Press Release (Apr 07,2011)
Status of TEPCO's Facilities and its services after the Tohoku-Taiheiyou-Oki Earthquake (as of 4:00PM)

Due to the Tohoku-Taiheiyou-Oki Earthquake which occurred on March 11th 2011, TEPCO's facilities including our nuclear power stations have been severely damaged. We deeply apologize for the anxiety and inconvenience caused.

Below is the status of TEPCO's major facilities.
*new items are underlined

[Nuclear Power Station]
Fukushima Daiichi Nuclear Power Station:
Units 1 to 3: shutdown due to the earthquake
(Units 4 to 6: outage due to regular inspections)

*The national government has instructed the public to evacuate for those local residents within 20km radius of the site periphery and to evacuate voluntarily for those local residents between 20km and 30km radius of the site periphery.

*Off-site power has been connected to Unit 1 to 6 by March 22, 2011.

*Unit 1
-The explosive sound and white smoke was confirmed near Unit 1 when the big quake occurred at 3:36 pm, March 12th.
-We started injection of sea water at 8:20 pm, March 12th, and then boric acid which absorbs neutron into the reactor afterwards.
-At approximately 2:30 am, March 23rd, we started the injection of sea water into the reactor from feed water system. After that, the injection of freshwater was started from 3:37 pm on March 25th (switched from the seawater injection). At 8:32 am, Mar 29th, transfer from the fire fighting pump to a temporary motor driven pump was made. From 10:42am to 11:52am on April 3rd we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.
-At approximately 10:50 am on March 24th, white smoke was confirmed arising from the top of the reactor building.
-At approximately 11:30 am, March 24th, lights in the main control room were restored.
-At approximately 5:00 pm, March 24th, draining water from underground floor of turbine buildings into a condenser was started and it was paused at approximately 7:30 am, March 29th because we confirmed that the water level reached almost full capacity of a condenser. In order to move the water in the condenser into a condensate storage tank, water transfer from the condensate storage tank to suppression pool's water surge-tanks was conducted from around 0:00 pm, March 31st to 3:26 pm, April 2nd.
-From 1:03 pm, March 31st, the water spray by the concrete pumping vehicle was started, and finished at 4:04 pm.
-In order to confirm the position of water spray to the spent fuel pool by the concrete pumping vehicle, the water spray was conducted from 5:16 pm to 5:19 pm.
-Some of turbine building lights were turned on April 2nd.
-The water transfer from the condenser to the condensate storage tank has been implemented since 1:55 pm, April 3rd.
-As it is suspected that hydrogen gas may be accumulated inside reactor containment vessel, at 10:30 pm, April 6th, we started the operation of the valve for the injection of nitrogen to the reactor in order to prevent the increase of oxygen density. Following this, the injection of nitrogen to the reactor was started at 1:31AM, April 7th.

*Unit 2
-At 1:25 pm, March 14th, since the Reactor Core Isolation Cooling System has failed, it was determined that a specific incident stipulated in Clause 1, Article 15 of Act on Special Measures Concerning Nuclear

Emergency Preparedness occurred (failure of reactor cooling function). At 5:17 pm, March 14th, while the water level in the reactor reached the top of the fuel rod, we have restarted the water injection with the valve operation.
-At approximately 6:14 am, March 15th, the abnormal sound was confirmed near the suppression chamber and the pressure inside the chamber decreased afterwards. It was determined that there was a possibility that something happened in the suppression chamber. While sea water injection to the reactor continued, TEPCO employees and workers from other companies not in charge of injection work started tentative evacuation to a safe location.
Sea water injection to the reactor continued.
-On March 18th, power was delivered up to substation for backup power through offsite transmission line. We completed laying cable further to unit receiving facility in the building, and at 3:46 pm, March 20th the load-side power panel of the receiving facility started to be energized.
-From 3:05 pm to 5:20 pm on March 20th, about 40 tons of seawater was injected into Unit 2 by TEPCO employees.
-At approximately 6:20 pm on March 21st, white smoke was confirmed arising from the top of the reactor building. As of 7:11 am on March 22nd, smoke decreased to the level where we could hardly confirm.
-From around 4:00 pm to 5:00 pm on March 22nd, approximately 18 tons of sea water was injected into the spent fuel pool by TEPCO employees.
-From 10:10 am on March 26th, freshwater (with boric acid) injection was initiated. (switched from the seawater injection) At 6:31pm, March 27th, transfer from the fire fighting pump to a temporary motor driven pump was made. From 10:22am to 0:06pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.
-From 10:30 am on March 25th, seawater injection through Fuel Pool Cooling and Filtering System was initiated. The work was finished at 12:19 pm, March 25th. From 4:30 pm, March 29th, freshwater injection through Fuel Pool Cooling and Filtering System was initiated. (We switched from seawater to freshwater). The work was finished at 6:25 pm on March 29th. At 9:25 am, March 30th, we started fresh water injection by a temporary motor driven pump, but we switched the pump to the fire fighting pump due to the pump trouble. At 1:10 pm, March 30th, freshwater injection was suspended, because we found the crack on a part of the hose. At 7:05 pm, March 30th, freshwater injection was resumed and finished at 11:50 pm, March 31.
-At approximately 4:46 pm, March 26th, lights in the main control room were restored.
-At approximately 4:45 pm, March 29th, the water in a condensate storage tank was being transferred to suppression pool water surge-tanks to prepare for water transfer from a condenser to a condensate storage tank in order to drain water on the underground floor of the turbine building into a condenser. At 11:50 am, April 1st, transfer was completed.
-At 2:56 pm, April 1st, water injection into spent fuel pool in Unit 2 by temporary motor driven pump was initiated. At 5:05 pm on April 1st, the water injection was finished.
-The water transfer from the condenser to the condensate storage tank has been implemented since 5:10 pm, April 2nd.
-Some of turbine building lights were turned on April 2nd.
-At 11:05 am, April 4th, water injection into spent fuel pool in Unit 2 by a temporary motor driven pump was initiated. At 1:37 pm, April 4th, the water injection was finished.
-At 1:29 pm, April 7th, water injection into spent fuel pool in Unit 2 by a temporary motor driven pump was initiated. At 2:34 pm, April 7th, the water injection was finished.

*Unit 3
-At 6:50 am, March 14th, while water injection to the reactor was under operation (injection of boric acid was done on Mar 13th), the pressure in the reactor containment vessel increased to 530 kPa. As a result, at 7:44 am, it was determined that a specific incident stipulated in the Article 15, the Clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness occurred (abnormal increase of the pressure of reactor containment vessel). Afterwards, the pressure gradually decreased (as of 9:05 am, 490 kPa).
-At approximately 11:01 am, March 14th, an explosion followed by white smoke occurred near Unit 3. 4 TEPCO employees and 3 workers from other companies (all of them were conscious) sustained injuries and were taken to the hospital by ambulances.
-As the temperature of water in the spent fuel pool rose, spraying water by helicopters with the support of the Self Defense Force was considered. However the operation on March 16th was cancelled.
-At 6:15 am, March 17th, the pressure of the Suppression Chamber temporarily increased, but currently it is stable within a certain range. On March 20th, we were preparing to implement measures to reduce the pressure of the reactor containment vessel (partial discharge of air containing radioactive material to outside) in order to fully secure safety. However, at present, it was not a situation to immediately implement measures and discharge air containing radioactive material to outside. We will continue to monitor the status of the pressure of the reactor containment vessel.
-In order to cool spent fuel pool, water was sprayed by helicopters on

March 17th with the cooperation of Self-Defense Forces.
-At approximately past 7:00 pm, March 17th, Self-Defense Forces and the police started spraying water by water cannon trucks upon our request for the cooperation. At 8:09 pm, March 17th, they finished the operation.
-Before 2:00 pm, March 18th, spraying water by fire engines was started with the cooperation of Self-Defense Forces and the United States Armed Forces. At 2:45 pm, March 18th, the operation was finished.
-At approximately 12:30 am, March 19th, spraying water was started with the cooperation of Fire Rescue Task Forces of Tokyo Fire Department. At approximately 1:10 am, March 19th, the operation was finished. They resumed spraying water at 2:10 pm and finished at approximately 3:40 am, March 20th.
-At approximately 9:30 pm, March 20th, spraying water was started with the cooperation of Fire Rescue Task Forces of Tokyo Fire Department. At approximately 3:58 am, March 21st, the operation was finished.
-At approximately 3:55 pm, March 21st, light gray smoke was confirmed arising from the southeast side of the 5th floor roof of the Unit 3 building. The situation was reported to the fire department at approximately 4:21 pm. The parameters of reactor pressure vessel, reactor containment vessel, and monitored environmental data remained stable without significant change. However, employees working around Unit 3 evacuated to a safe location. On March 22nd, the color of smoke changed to somewhat white and it was slowly dissipating.
-At approximately 3:10 pm on March 22nd, spraying water to Unit 3 by Tokyo Fire Department's Hyper Rescue and Osaka City Fire Department was conducted, and completed at approximately 4:00 pm on the same day.
-At approximately 10:45 pm on March 22nd, lights in the main control room were restored.
-At approximately 11:00 am on March 23rd, the injection of sea water to spent fuel pool was conducted, and finished approximately at 1:20 pm on the same day.
-At 4:20 pm on March 23rd, light gray smoke was observed belching from Unit 3 building. The situation was reported to the fire department at 4:25 pm on March 23rd. The parameters of the reactor, the reactor containment vessel of Unit 3, and monitored figures around the site's immediate surroundings remained stable without significant change. To be safe, workers in the main control room of Unit 3 and around Unit 3 evacuated to a safe location. At approximately 11:30 pm on March 23rd and 4:50 am on March 24th, TEPCO employees confirmed the smoke has disappeared. Accordingly, workers evacuation was lifted.
-From approximately 5:35 am on March 24th, sea water injection through Fuel Pool Cooling and Filtering System was initiated, and finished at approximately 4:05 pm on the same day.
-From 1:28 pm on March 25th, Hyper Rescue team started water spray. The work finished at 4:00 pm on March 25th.
-From 6:02 pm on March 25th, the injection of freshwater to the reactor was started (switched from the seawater injection). At 8:30 pm on March 28th, the injection of fresh water was switched to temporary electricity pumps from the fire engine pumps. From 10:03am to 0:16pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.
-At approximately 12:34pm March 27th, the injection of water by the concrete pump truck was started. At approximately 2:36 pm, March 27th, the operation was finished.
-At approximately 2:17pm March 29th, the injection of fresh water by the concrete pump truck was started. (Sea water had been injected so far and transfer from seawater to freshwater was made). The water injection was finished at 6:18 PM, March 29th.
-At approximately 5:40 pm, March 28th, the water in a condensate storage tank was being transferred to suppression pool water surge-tanks to prepare for water transfer from a condenser to a condensate storage tank in order to drain water on the underground floor of the turbine building into a condenser. We finished the transfer work at approximately 8:40 am, March 31st.
-From 4:30 pm, March 31st, the water spray by the concrete pumping vehicle was started, and finished at 7:33 pm.
-From 9:52 am, April 2nd, the water spray by the concrete pumping vehicle was started, and finished at 0:54 pm.
-Some of turbine building lights were turned on April 2nd.
-From 5:03 am, April 4th, the water spray by the concrete pumping vehicle was started, and finished at 07:19 pm.
-From 6:53 am, April 7th, water spray by the concrete pumping vehicle was started, and finished at 8:53 am.

* Unit 4
-At approximately 6:00 am, March 15th, an explosive sound was heard and the damage in the 5th floor roof of Unit 4 reactor building was confirmed. At 9:38 am, the fire near the north-west part of 4th floor of Unit 4 reactor building was confirmed. At approximately 11:00 am, TEPCO employees confirmed that the fire was out.
-At approximately 5:45 am on March 16th, a TEPCO employee discovered a fire at the northwest corner of the Nuclear Reactor Building. TEPCO immediately reported this incident to the fire department and the local government and proceeded with the extinction of fire. At approximately

6:15 am, TEPCO staff confirmed at the site that there were no signs of fire.
-At approximately 8:21 am on March 20th, spraying water by fire engines was started with the cooperation of Self-Defense Forces and they finished the operation at approximately 9:40 am. At approximately 6:45 pm spraying water was started by Self-Defenses' water cannon trucks and finished at approximately 7:45 pm.
-At approximately 6:30 am, March 21st, spraying water by fire engines was started with the cooperation of Self-Defense Forces and the United States Armed Forces. At approximately 8:40 am, March 21, they had finished the operation.
-On March 21st, cabling has been completed from temporary substation to the main power center.
-From approximately 5:20 pm on March 22nd, spraying water from the concrete pumping vehicle was conducted and ended at approximately 8:30 pm on the same day.
-From approximately 10:00 am on March 23rd, spraying water from the concrete pumping vehicle was conducted and ended at approximately 1:00 pm on the same day.
-From approximately 2:35 pm on March 24th, spraying water by the concrete pumping vehicle was conducted and ended at approximately 5:30 pm on the same day.
-From 6:05 am on March 25th, seawater injection through Fuel Pool Cooling and Filtering System was initiated and finished at approximately 10:20 am on the same day.
-From 7:05 pm on March 25th, water spray by the concrete pumping vehicle was started and finished at 10:07 pm on March 25th.
-From 4:55 pm on March 27th, water spray by the concrete pumping vehicle was started and finished at 7:25 pm on March 27th.
-At approximately 11:50 am on March 29th, lights in the main control room were restored.
-From 2:04 pm on March 30th, water spray by the concrete pumping vehicle was started and finished at 6:33 pm on March 30th.
-Some of turbine building lights were turned on March 31st.
-From 8:28 am, April 1st, the water spray by the concrete pumping vehicle was started. At 2:14 pm, the water spray finished.
-From 5:14 pm, April 3rd, the water spray by the concrete pumping vehicle was started. At 10:16 pm, the water spray finished.
-From 5:35 pm, April 5th, the water spray by the concrete pumping vehicle was started. At 6:22 pm, the water spray finished.

*Unit 5 and 6
-At 5:00 am on March 19th, we started the Residual Heat Removal System Pump (C) of Unit 5 in order to cool the spent fuel pool. At 10:14 pm, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
-Unit 5 has been in reactor cold shutdown since 2:30 pm on March 20th. Unit 6 has been in reactor cold shutdown since 7:27 pm on March 20th.
-At Units 5 and 6, in order to prevent hydrogen gas from accumulating within the buildings, we have made three holes on the roof of the reactor building for each unit.
-At approximately 5:24 pm on March 23rd, the temporary Residual Heat Removal System Seawater Pump automatically stopped when its power source was switched. We restarted the pump at around 4:14 pm, March 24th, and resumed cooling of reactor at around 4:35 pm.

*On March 18th, regarding the spent fuel in the common spent fuel pool, we have confirmed that the water level of the pool was secured. At around 10:37 am March 21st, water spraying to common spent fuel pool and finished at 3:30 pm. At around 6:05 pm, fuel pool cooling pump was started to cool the pool.
*common spent fuel pool: a spent fuel pool for common use set in a separate building in a plant site in order to preserve spent fuel which are transferred from the spent fuel pool in each Unit building.

*On March 17th, we patrolled buildings for dry casks and found no signs of abnormal situation for the casks by visual observation. A detailed inspection was under preparation.
*dry cask: a measure to store spent fuel in a dry storage casks in storages. Fukushima Daiichi Nuclear Power Station started to utilize the measure from August 1995.

*On March 21st, 23rd to April 6th we detected technetium, cobalt, iodine, cesium, tellurium, barium, lanthanum and molybdenum from the seawater around the discharge canal of the station. (We are reevaluating)

*On March 20th, 21st, 23rd to April 6th, we detected iodine, cesium, tellurium and ruthenium in the air collected at the site of Fukushima Daiichi Nuclear Power Station. (We are reevaluating)

* Plutonium has been detected from the sample of soil at the site of Fukushima Daiichi Nuclear Power Station collected on 21st, 22nd, 25th and 28th of March, Concentration level of Plutonium detected was same as that of under usual environment and it was thought not to be harmful to human health. We will strengthen environmental monitoring of power station and surrounding environment.
Additionally Iodine, Cesium, Tellurium, Barium, Niobium, Ruthenium,

Molybdenum, Technetium, Lanthanum, Beryllium, Silver have been detected from the sample of soil collected at Fukushima Daiichi Nuclear Power Station on 21st, 22nd, 25th and 28th of March.

*We detected radioactive materials contained in the puddles found in the turbine building of Unit 1 to 4.

*At approximately 3:30 pm, March 27th, we found water pooling in the vertical shaft of the trench outside of the turbine buildings for Units 1 to 3. The radiation dose at the surface of the water amounted 0.4 mSv/h in Unit 1 and over 1,000 mSv/h in Unit 2. We could not confirm the amount of the radiation dose in Unit 3. We will keep observing the condition of the water in the vertical shaft.
On March 29th, we detected niobium, tellurium, ruthenium, silver, tellurium, iodine, cesium, and ruthenium in the water collected at the trench of unit 1.
On March 30th, we took samples from the water in the trench of Unit 2 and 3, and conducted nuclide analysis on them. We are now confirming the results of the analysis.

*At approximately 9:30 am, April 2nd, we found that there was water in the shaft for storing power cable (concrete product) near the intake of water for Unit 2, the radioactive air dose was over 1,000mSv/h and the water spilled into the sea from the crack (approximately 20 cm) on the side of the shaft. We injected fresh concrete to the shaft twice, however, we could not observe a change in the amount of water flowing into the sea. Therefore, we considered that a new method of stopping the water and determined to use the polymer. Necessary equipment and experts of water shutoff will be dispatched to the site and after checking the condition, we began to stop water shutoff and were injecting polymer on April 3rd. On April 4th, we injected the tracer from the vertical shaft of the trench to start to examine the water current. We did not observe reduction of flow or change of color or water leaking. We checked the diagram and confirmed the route. At the same time, we checked the situation of the pit in detail and considered the possibility that the water was not from the pit, rather, from the joint between the piping upstream of the pit and the duct, then the water seeped through a layer of gravel below the piping. In order to stop that seepage from the layer of gravel, we decided to conduct the water sealing to the bedrock around the piping. We arranged for the specialist and gathered equipments. On April 5th, liquid glass was injected to the bedrock. Tracer was put through the two new holes drilled near the pit to investigate the water flow. At 2:15 pm, April 5th, it was observed the water with tracer came out from the crack on the concrete wall of the pit. At 3:07 pm, April 5th, injection of coagulant from the holes was initiated and we have confirmed the outflow from the crack on the concrete wall of the pit has stopped at 5:38 am, April 6th. We confirmed water level has not been rising in the turbine building of unit 2. On April 6th, a countermeasure by using rubber plate and fixer was implemented to prevent discharge of radioactive materials, and we are continuously monitoring for any existence of leakage. From 3:00pm April 5th, a construction of installing large sandbags around the pier to prevent the outflow of the contaminated water from station's port on the south side to the ocean was started. Also we are preparing spillage prevention fences as countermeasures for lowering the outflow to the ocean. Iodine and Cesium were detected from the water sampled in the pit and in the sea near the water discharge. Additional nuclide analysis will be implemented.
In addition, from April 2nd, we will implement sampling at 15km offshore Fukushima Daiichi and Fukushima Daini Nuclear Power Stations(3 points have been added since April 5th) and will evaluate these samples comprehensively.

*Since approximately 9:20 am, March 31st, the water transfer from the vertical shaft of Unit 1 to the reservoir of the centralized environmental facility was conducted. We finished the task around 11:25 am of the same day.

*We found a puddle of water at the main building of the centralized environmental facility process. We analyzed and detected approximately 1.2×10^{1}Bq/cm3 of radioactivity in full dose in the Controlled Area and 2.2×10^{1}Bq/cm3 in full dose in the Non-Controlled Area on March 29.
From April 3rd, the water level in the trench of Unit 3 increased by 15 cm. The route is not yet known, but there is a possibility that water in the turbine building of Unit 4 may be running to the trench of Unit 3. To be safe, at 09:22am, April 4th, we stopped transferring water to the turbine building of Unit 4. At this moment, the water level in the trench of Unit 3 became stable after stopping the water transfer.

*There is plenty of radioactive wastewater in the turbine buildings. Especially, Unit 2's wastewater is very highly radioactive. To store this stably, it was decided that this needed to be transferred to the Central Radioactive Waste Disposal Facility. However, within that facility, we are storing ten thousand tons of low level radioactive wastewater. In order to transfer more wastewater, we need to discharge the low level radioactive wastewater. In addition, as low radioactive subsurface water is piling up in sub-drain pits of Units 5 and 6 and a part of subsurface water is

running into buildings. We are concerned that important equipment to secure the safety of reactors may be submerged.
Based on the Section 1 of the Article 64 of the Nuclear Reactor Regulation Law, we have decided to discharge to the sea approximately ten thousand tons of the accumulated low level radioactive water and a total of fifteen hundred tons of the low level radioactive subsurface water stored in the sub drain pits of Unit 5 and 6 as soon as we get ready.
At 7:03 pm, April 4th. we started discharging the low level radioactive wastewater stored in the Central Radioactive Waste Disposal Facility to the south of the water discharge canal. By 7:10 pm, we started ten pumps. Also, at 09:00 pm, April 4th, we started discharging the low level radioactive wastewater stored in the sub drain pits of Unit 5 and 6 by using one pump via the water discharge canal of Units 5 and 6.
We evaluate the impact on the discharge of the low radioactive wastewater to the sea as approximately 0.6 mSv per year per an adult if an adult eats adjacent fish and seaweeds everyday. The amount (0.6 mSv of effective radioactive doses per year) is one-forth of annual radioactive dose to which the general public is exposed from nature.

* The first barge of the U.S. Forces with fresh water to be used to cool down reactors etc. was towed by a ship of Maritime Self-Defense Force and docked at 3:42 pm on March 31st 2011. At approximately 3:58 pm, April 1st, we started to replenish filtrate tanks with the fresh water, and finished at 4:25 pm. At approximately 10:20 am, April 2nd, we resumed replenishing filtrate tanks with the fresh water, and finished at 4:40 pm. The second barge of the U.S. Forces with the fresh water towed by the ship of Maritime Self-Defense Force came alongside the pier at approximately 9:10 am, April 2nd. It was in preparation for replenishing filtrate tanks with the fresh water. We began to transfer fresh water from the second barge to the first barge on April 3rd at 9:52 am and continued until 11:15 am on April 3rd.

*At 11:35 am, April 1st, a worker fell into the sea while stepping into the ship from the pier during the hose laying work of the barge. Other crew immediately rescued the worker. While no injury or contamination was confirmed, whole body counter has been implemented to check the contamination inside the body just in case.

*From 3:00 pm, April 1st, we started spraying inhibitor in order to prevent diffusion of radioactive materials. This attempt was conducted on a trial basis at the mountain side area of the common spent fuel pool in the range of 500m2. The spraying finished at 4:05 pm. On April 5th and 6th, we also sprayed the inhibitor in order to prevent the spread of radioactive materials on a trial basis at the mountain side area of the common spent fuel pool in the range of 600m^2.

*Monitoring posts (no.1 to no.8) which were installed around the site boundary have been restored. We will continue monitoring the measured value and make announcements on those values accordingly.

*We will continuously endeavor to securing safety, and monitoring of the surrounding environment.

Fukushima Daini Nuclear Power Station:
Units 1 to 4: shutdown due to the earthquake
*The national government has instructed evacuation for those local residents within 10km radius of the periphery.

*In order to achieve cold shutdown, reactor cooling function was restored and cooling of reactors was conducted. As a result, all reactors achieved cold shutdown: Unit 1 at 5:00 pm, March 14th, Unit 2 at 6:00 pm, March 14th, Unit 3 at 0:15 pm, March 12th, Unit 4 at 7:15 am, March 16th.

*At 2:30 pm on March 30th, the power source of the residual heat removal system (B) to cool the reactor of Unit 1 was secured from an emergency power source in addition to an offsite power. This means that all the units secure backup power sources (emergency power sources) for the residual heat removal system (B).

*Unit 1
As it was confirmed that the temperature of the Emergency Equipment Cooling Water System *1 has increased, at 3:20 pm, March 15th, we stopped the Residual Heat Removal System (B) for the inspection. Subsequently, failure was detected in the power supply facility associated with the pumps of the Emergency Equipment Cooling Water System. At 4:25 pm, March 15th, after replacing the power facility, the pumps and the Residual Heat Removal System (B) have been reactivated.

*Unit 4
As it was confirmed that the pressure at the outlet of the pumps of the Emergency Equipment Cooling Water System*1 has been decreased, at 8:05 pm, March 15th, we stopped the Residual Heat Removal System (B) for the inspection. Subsequently, failure was detected in the power supply facility associated with the pumps of the Emergency Equipment Cooling Water System. At 9:25 pm, March 15th, after replacing the relevant facility, the pumps and the Residual Heat Removal System (B) have been

reactivated.

*1:emergency water system in which cooling water (pure water) circulates which exchanged the heat with sea water in order to cool down bearing pumps and/or heat exchangers etc.

Kashiwazaki Kariwa Nuclear Power Station:
Units 1, 5, 6, 7: normal operation
(Units 2 to 4: outage due to regular inspection)

[Thermal Power Station]
-Hirono Thermal Power Station Units 2 and 4: shutdown due to the earthquake
-Hitachinaka Thermal Power Station Unit 1: shutdown due to the earthquake
-Kashima Thermal Power Station Units 2, 3, 5, 6: shutdown due to the earthquake
-Kashima Thermal Power Station Units 3: resumed generating at 2:13 am April 6th

[Hydro Power Station]
-Power supply has returned to normal, but facilities damaged by the earthquake are now being handled in a timely manner.

[Impacts on Transmission Facilities]
-Power supply has returned to normal, but facilities damaged by the earthquake are now being handled in a timely manner.

[Potential Implementation on Planned Rolling Blackouts and Request for Conserving Electricity Consumption]
-Considering the critical balance of our power supply capacity and expected power demand going forward, in order to avoid unexpected blackout in large areas, TEPCO has been implementing rolling blackout (planned blackout alternates from one area to another) since March 14th. We will make our utmost to secure the stable power supply as early as possible. For customers who will be subject to rolling blackout, please be prepared for the announced blackout periods. Also for customers who are not subject to blackouts, TEPCO appreciates your continuous cooperation in reducing electricity usage by turning of unnecessary lights and electrical equipment.

[Others]
-Please do NOT touch cut-off electric wires.
-In order to prevent fire, please make sure to switch off the electric appliances such as hair driers when you leave your house.
-For the customer who has in-house power generation, please secure fuel for generator.

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Press Releases

Press Release (Apr 08,2011)
Kashiwazaki Kariwa Nuclear Power Station Plant condition after the earthquake (as of 0:15 pm, Second release)

Regarding the earthquake yesterday at 11:32 pm, the operation status at Kashiwazaki Kariwa Nuclear Power Station at 0:15 today is as follows:

Unit No.	Status before the earthquake		Status as of 0:15	
	In operation	In shutdown	In operation	In shutdown
1	○		○	
2		○		○
3		○		○
4		○		○
5	○		○	
6	○		○	
7	○		○	

The maximum acceleration of the earthquake that was monitored within the station was at Unit 6 reactor building base at 4.0 Gal.

Influence of radioactivity outside: None (as of 0:15)

The figures indicated at exhaust stack monitors and monitoring posts at the station boundary are within the usual range, and there is no influence of radioactivity outside as of now.

We are currently conducting an inspection for each unit.

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Press Releases

Press Release (Apr 08,2011)
Fukushima Daini Nuclear Power Station Plant condition after the earthquake (as of 0:00)

Regarding the earthquake at 23:32 7th April, the operation status at Fukushima Daini Nuclear Power Station is as follows:

Unit No.	Status before the earthquake		Current status	
	In operation	In shutdown	In operation	In shutdown
1		○		○
2		○		○
3		○		○
4		○		○

The maximum acceleration of the earthquake that was monitored within the station was at Unit 3 reactor building base at 58.1 Gal.

Influence of radioactivity outside: None

The figures indicated at exhaust stack monitors and monitoring posts at the station boundary are within the usual range, and there is no influence of radioactivity outside as of now.

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Press Releases

Press Release (Apr 07,2011)
Out flow of fluid containing radioactive materials to the ocean from areas near intake canal of Fukushima Daiichi Nuclear Power Station Unit 2 (continued report 3)

At around 9:30 am on April 2nd, we detected water containing radiation dose over 1,000 mSv/h in the pit* where supply cables are stored near the intake channel of Unit 2. Furthermore, there was a crack about 20 cm on the concrete lateral of the pit, from where the water in the pit was out flowing. At around 12:20 pm on April 2nd, we reaffirmed the event at the scene.
We have implemented sampling of the water in the pit, together with the seawater in front of the bar screen near the pit. These samples were sent to Fukushima Daini Nuclear Power Station for analysis. (Reported on April 2nd already)

Today at 5:38 am, we have observed stoppage of spilling of water from the crack on the concrete lateral of the pit. For the sake of completeness, we put further reinforcement for the stoppage of leakage and consider countermeasure including continuous injection of coagulant. We will also note the water level of turbine building of unit 2 remain unchanged. We will further investigate if there is any other leakage. (Reported on April 6th already)

We have been conducting sampling of seawater in front of the bar screen near the pit. In regard to the sample collected yesterday (April 6th), as a result of conducting nuclide analysis, radioactive materials were detected as described in the exhibit. Accordingly, we have reported the result of analysis to Nuclear and Industrial Safety Agency and Fukushima Prefecture.

Regarding the results on three nuclides (iodine 131, cesium 134, cesium 137), we would like to assume those as definite result, however, as for other nuclides, we will revaluate in accordance with the preventive measures formulated after being given warning from Nuclear and Industrial Safety Agency on April 1st.

* pit: a shaft made of concrete

Appendices:
Results of nuclide analysis on seawater sampled in front of quay and screens of Unit 2/4(PDF 11.1KB)
Radioactivity density of seawater near the quay of Fukushima Daiichi Nuclear Power Station (PDF 13.5KB)

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Press Releases

Press Release (Apr 07,2011)
Plant Status of Fukushima Daiichi Nuclear Power Station (as of 7:00 pm, April 7)

*Updates are underlined
All 6 units of Fukushima Daiichi Nuclear Power Station have been shut down.

Unit 1(Shut down)
-Explosive sound and white smoke were confirmed after the big quake occurred at 3:36 pm on March 12th. It was assumed to be hydrogen explosion.
-At approximately 2:30 am on March 23rd, seawater injection to the nuclear reactor through the feed water system was initiated.
-We had been injecting seawater into the reactor, but from 3:37 pm on March 25th, we started injecting freshwater.
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:42am to 11:52am on April 3rd we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.
-As it is suspected that hydrogen gas is accumulated inside reactor containment vessel, we commenced the valve opening operation concerning injection of nitrogen gas into the reactor container vessel at 10:30 pm April 6th and commenced injection at 1:31am April 7th.

Unit 2(Shut down)
-At approximately 6:00 am on March 15th, an abnormal noise began emanating from nearby Pressure Suppression Chamber and the pressure within the chamber decreased.
-We have been injecting seawater into the reactor, but from 10:10 am on March 26th, we started injecting freshwater (with boric acid).
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:22am to 0:06pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.

Unit 3(Shut down)
-Explosive sound and white smoke were confirmed at 11:01am March 14th. It was assumed to be hydrogen explosion.
-We had been injecting seawater into the reactor pressure vessel, but from 6:02 pm on March 25th, we started injecting freshwater.
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:03am to 0:16pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.

Unit 4 (outage due to regular inspection)
-At approximately 6 am on March 15th, we confirmed the explosive sound and the sustained damage around the 5th floor rooftop area of the Nuclear Reactor Building.
-Some of turbine building lights were turned on March 31st.
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 5 (outage due to regular inspection)
-Sufficient level of reactor coolant to ensure safety is maintained.
-At 5 am, March 19th, we started the Residual Heat Removal System Pump (C) in order to cool the spent fuel pool.
-At 2:30 pm, March 20th, the reactor achieved reactor cold shutdown. At around 5:24 pm on March 23rd, when we switched the temporary Residual Heat Removal System Seawater Pump, it has stopped automatically. At around 4:14 pm, March 24th we replaced the pump, and restarted cooling of

reactor at around 4:35 pm.
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 6 (outage due to regular inspection)
-Sufficient level of reactor coolant to ensure safety is maintained.
-At 10:14 pm, March 19th, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
-At 7:27 pm, March 20th, the reactor achieved reactor cold shutdown.
-In relation to the two seawater side pumps of the Residual Heat Removal System, we switched the power source from temporary to permanent at 3:38 PM and 3:42PM, Mar 25 respectively.
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Operation for cooling the spent fuel pools
-From 6:53am to 8:53am on April 7th, spraying water to Unit 3 by the concrete pump vehicle was conducted.
-From 1:29 pm to 2:34 pm, April 7th, freshwater injection to Unit 2 by a temporary motor-driven pump was conducted.
-*From 6:23am, April 7th, spraying water to Unit 4 by the concrete pump vehicle was conducted.*
-We will conduct further water spray depending on the conditions of spent fuel pools.

Draining water from underground floor of turbine buildings
-At 1:55 pm April 3rd, in Unit 1, water transfer from a condensate storage tank to a suppression pool water surge-tank was initiated.
-At 5:10 pm, April 2nd, in Unit 2, water transfer from a condensate storage tank was to a suppression pool water surge-tank was initiated.

Others
-We measured radioactive materials (iodine etc.) inside of the nuclear power station area (outdoor) by monitoring car and confirmed that radioactive materials level is getting higher than ordinary level. As listed below, we have determined that specific incidents stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) have occurred.
·Determined at 4:17 pm Mar 12th (Around Monitoring Post 4)
·Determined at 8:56 am Mar 13th (Around Monitoring Post 4)
·Determined at 2:15 pm Mar 13th (Around Monitoring Post 4)
·Determined at 3:50 am Mar 14th (Around Monitoring Post 6)
·Determined at 4:15 am Mar 14th (Around Monitoring Post 2)
·Determined at 9:27 am Mar 14th (Around Monitoring Post 3)
·Determined at 9:37 pm Mar 14th (Around main entrance)
·Determined at 6:51 am Mar 15th (Around main entrance)
·Determined at 8:11 am Mar 15th (Around main entrance)
·Determined at 4:17 pm Mar 15th (Around main entrance)
·Determined at 11:05 pm Mar 15th (Around main entrance)
·Determined at 8:58 am Mar 19th (Around MP5)
From now on, if the measured figure fluctuates and goes above and below 500 micro Sv/h, we deem that as the continuous same event and will not regard that as a new specific incidents stipulated in article 15, clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) has occurred. In the interim, if we measure a manifestly abnormal figure and it is evident that the event is not the continuous same event, we will determine and notify.

-The national government has instructed evacuation for those local residents within 20km radius of the periphery and evacuation to inside for those residents from 20km to 30km radius of the periphery, because it is possible that radioactive materials are discharged.
-In total 12 fire engines are lent for the water spraying to the spent fuel pools and water injection to the nuclear reactors by various regional fire departments* as well as Tokyo Fire Department. Also, instruction regarding the setting and operation of large scale decontamination system was provided by Niigata City Fire Headquarter and Hamamatsu City Fire Headquarter.
*:Koriyama Fire Department, Iwaki Fire Brigade Headquarters, Fire Headquarters of Sukagawa District Wide Area Fire-fighting Association, Yonezawa City Fire Headquarters, Utsunomiya City Fire Headquarters, Fire Headquarters of Aizu-Wakamatsu wide area municipal association, Saitama City Fire Bureau, and Niigata City Fire Bureau.
-By March 22nd, Units 1 through 6 started to be energized from the external power source.
-At around 11:35 am April 1st, a worker fell into the sea when he got into a barge of the U.S. Forces to repair a hose of the ship. The worker was rescued immediately, and was not injured and not contaminated. The worker will be checked using the whole-body counter to ensure his health.
-From April 2nd, we began to transfer the radioactive water we collected from the Central Environmental Facility to the Unit 4 turbine building. On April 4th, water level of the pit in the trench of Unit 3 increased by 15cm from previous day. Pathway of water flow is unknown. We can not deny the possibility that water in the turbine building of Unit 4 flows into the trench of Unit 3. So, we stopped transferring water to the Unit 4

turbine building to make assurance. Present water level of the pit in the trench of Unit 3 is not changed from the time we stopped transferring, and is being stable.

-As a countermeasure against outflow of radioactive water into the sea near the cooling water intake at unit 2 of Fukushima Daiichi Nuclear Power Station, we have injected coagulant into the pit from April 5th and we have observed stoppage of spilling of water from the crack on the concrete lateral of the pit at 5:38 am, April 6th.

-Continued work from yesterday, we have put 6,000 litters of coagulant into the breakage and surrounding ground after investigation of the leakage route by putting tracer into the 9 holes drilled around electrical conduit and the pit. As at 9:30 am, we have been observing there is no leakage of water into the sea from the pit..

-For the sake of completeness, we put further reinforcement for the stoppage of leakage and consider countermeasure including continuous injection of coagulant. We will also note the water level of turbine building of unit 2 remain unchanged. We will further investigate if there is any other leakage.

(Previously announced on April 6th)

On April 6th, we installed rubber boards as a countermeasure against outflow from the intake. We will further investigate if there is any other leakage.

-There is plenty of radioactive wastewater in the turbine buildings. Especially, Unit 2's wastewater is very highly radioactive. To store this stably, it was decided that this needed to be transferred to the Central Radioactive Waste Disposal Facility. However, within that facility, we are storing ten thousand tons of low level radioactive wastewater. In order to transfer more wastewater, we need to discharge the low level radioactive wastewater. In addition, as low radioactive subsurface water is piling up in sub-drain pits of Units 5 and 6 and a part of subsurface water is running into buildings. We are concerned that important equipment to secure the safety of reactors may be submerged. Based on the Section 1 of the Article 64 of the Nuclear Reactor Regulation Law, we have decided to discharge to the sea approximately ten thousand tons of the accumulated low level radioactive water and a total of fifteen hundred tons of the low level radioactive subsurface water stored in the sub drain pits of Unit 5 and 6 as soon as we get ready.

-We evaluate the impact on the discharge of the low radioactive wastewater to the sea as approximately 0.6 mSv per year per an adult if an adult eats adjacent fish and seaweeds everyday. The amount (0.6 mSv of effective radioactive doses per year) is one-forth of annual radioactive dose to which the general public is exposed from nature.

(Previously announced on April 4th)

-At 7:03 pm, April 4th, discharge of low radioactive wastewater (approximately 10,000 ton in total) from Central Radioactive Waste Disposal Facility to the sea was initiated.

-At 9:00 pm, April 4th, discharge of low radioactive subsurface water (1,500 ton in total) from sub-drain pits of Units 5 and 6 to the sea was initiated.

-From 3:00 pm to 4:30 pm, April 5th, in order to prevent diffusion of radioactive contaminated water out from the site port facility to breakwater area which is south to the power station, we began repair of breakwater by founding the large sandbag around it to replace damaged steel water bar. We will continue the operation to prevent diffusion.

-At 2:33 pm, April 7th, one of the workers in charge of stuffing sandbags at the soil disposal situated at the northern part of the site became ill and was brought to J-Village. After we confirmed that he was not contaminated, he was brought to Iwaki City Kyoritsu Hospital by an ambulance.

-We will continue to take all measures to ensure the safety and to continue monitoring the surrounding environment around the Power Station.

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Press Releases

Press Release (Apr 08,2011)
Fukushima Daiichi Nuclear Power Station Plant condition after the earthquake (as of 0:00)

Regarding the earthquake at 23:32 7th April, the operation status at Fukushima Daiichi Nuclear Power Station is as follows:

Unit No.	Status before the earthquake		Current Status	
	In operation	In shutdown	In operation	In shutdown
1		○		○
2		○		○
3		○		○
4		○		○
5		○		○
6		○		○

Influence of radioactivity outside: None

The figures indicated at monitoring posts at the station boundary are within the usual range, and there is no influence of radioactivity outside as of now.

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Press Releases

Press Release (Apr 07,2011)
Plant Status of Fukushima Daiichi Nuclear Power Station (as of 0:00 pm, April 7)

*Updates are underlined
All 6 units of Fukushima Daiichi Nuclear Power Station have been shut down.

Unit 1 (Shut down)
-Explosive sound and white smoke were confirmed after the big quake occurred at 3:36 pm on March 12th. It was assumed to be hydrogen explosion.
-At approximately 2:30 am on March 23rd, seawater injection to the nuclear reactor through the feed water system was initiated.
-We had been injecting seawater into the reactor, but from 3:37 pm on March 25th, we started injecting freshwater.
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:42am to 11:52am on April 3rd we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.
-As it is suspected that hydrogen gas is accumulated inside reactor containment vessel, we commenced the valve opening operation concerning injection of nitrogen gas into the reactor container vessel at 10:30 pm April 6th and commenced injection at 1:31am April 7th.

Unit 2(Shut down)
-At approximately 6:00 am on March 15th, an abnormal noise began emanating from nearby Pressure Suppression Chamber and the pressure within the chamber decreased.
-We have been injecting seawater into the reactor, but from 10:10 am on March 26th, we started injecting freshwater (with boric acid).
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:22am to 0:06pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.

Unit 3(Shut down)
-Explosive sound and white smoke were confirmed at 11:01am March 14th. It was assumed to be hydrogen explosion.
-We had been injecting seawater into the reactor pressure vessel, but from 6:02 pm on March 25th, we started injecting freshwater.
-Some of turbine building lights were turned on April 2nd.
-We injected fresh water to the reactor by a temporary motor driven pump, but, from 10:03am to 0:16pm on April 3rd, we temporarily switched the pump to the fire fighting pump to inject fresh water to use power through off-site transmission line. We're now injecting fresh water to the reactor by a motor driven pump powered by off-site transmission line.

Unit 4 (outage due to regular inspection)
-At approximately 6 am on March 15th, we confirmed the explosive sound and the sustained damage around the 5th floor rooftop area of the Nuclear Reactor Building.
-Some of turbine building lights were turned on March 31st.
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 5 (outage due to regular inspection)
-Sufficient level of reactor coolant to ensure safety is maintained.
-At 5 am, March 19th, we started the Residual Heat Removal System Pump (C) in order to cool the spent fuel pool.
-At 2:30 pm, March 20th, the reactor achieved reactor cold shutdown. At around 5:24 pm on March 23rd, when we switched the temporary Residual Heat Removal System Seawater Pump, it has stopped automatically. At around 4:14 pm, March 24th we replaced the pump, and restarted cooling of

reactor at around 4:35 pm.
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Unit 6 (outage due to regular inspection)
-Sufficient level of reactor coolant to ensure safety is maintained.
-At 10:14 pm, March 19th, we started the Residual Heat Removal System Pump (B) of Unit 6 in order to cool the spent fuel pool.
-At 7:27 pm, March 20th, the reactor achieved reactor cold shutdown.
-In relation to the two seawater side pumps of the Residual Heat Removal System, we switched the power source from temporary to permanent at 3:38 PM and 3:42PM, Mar 25 respectively.
-At this moment, we do not consider any reactor coolant leakage inside the reactor happened.

Operation for cooling the spent fuel pools
-From 6:53am to 8:53am on April 7th, spraying water to Unit 3 by concrete pump vehicle was conducted.
-We will conduct further water spray depending on the conditions of spent fuel pools.

Draining water from underground floor of turbine buildings
-At 1:55 pm April 3rd, in Unit 1, water transfer from a condensate storage tank to a suppression pool water surge-tank was initiated.
-At 5:10 pm, April 2nd, in Unit 2, water transfer from a condensate storage tank was to a suppression pool water surge-tank was initiated.

Others
-We measured radioactive materials (iodine etc.) inside of the nuclear power station area (outdoor) by monitoring car and confirmed that radioactive materials level is getting higher than ordinary level. As listed below, we have determined that specific incidents stipulated in article 15, clause 1 of Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) have occurred.
·Determined at 4:17 pm Mar 12th (Around Monitoring Post 4)
·Determined at 8:56 am Mar 13th (Around Monitoring Post 4)
·Determined at 2:15 pm Mar 13th (Around Monitoring Post 4)
·Determined at 3:50 am Mar 14th (Around Monitoring Post 6)
·Determined at 4:15 am Mar 14th (Around Monitoring Post 2)
·Determined at 9:27 am Mar 14th (Around Monitoring Post 3)
·Determined at 9:37 pm Mar 14th (Around main entrance)
·Determined at 6:51 am Mar 15th (Around main entrance)
·Determined at 8:11 am Mar 15th (Around main entrance)
·Determined at 4:17 pm Mar 15th (Around main entrance)
·Determined at 11:05 pm Mar 15th (Around main entrance)
·Determined at 8:58 am Mar 19th (Around MP5)
From now on, if the measured figure fluctuates and goes above and below 500 micro Sv/h, we deem that as the continuous same event and will not regard that as a new specific incidents stipulated in article 15, clause 1 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (Abnormal increase in radiation dose measured at site boundary) has occurred. In the interim, if we measure a manifestly abnormal figure and it is evident that the event is not the continuous same event, we will determine and notify.

-The national government has instructed evacuation for those local residents within 20km radius of the periphery and evacuation to inside for those residents from 20km to 30km radius of the periphery, because it is possible that radioactive materials are discharged.
-In total 12 fire engines are lent for the water spraying to the spent fuel pools and water injection to the nuclear reactors by various regional fire departments* as well as Tokyo Fire Department. Also, instruction regarding the setting and operation of large scale decontamination system was provided by Niigata City Fire Headquarter and Hamamatsu City Fire Headquarter.
*: Koriyama Fire Department, Iwaki Fire Brigade Headquarters, Fire Headquarters of Sukagawa District Wide Area Fire-fighting Association, Yonezawa City Fire Headquarters, Utsunomiya City Fire Headquarters, Fire Headquarters of Aizu-Wakamatsu wide area municipal association, Saitama City Fire Bureau, and Niigata City Fire Bureau.
-By March 22nd, Units 1 through 6 started to be energized from the external power source.
-At around 11:35 am April 1st, a worker fell into the sea when he got into a barge of the U.S. Forces to repair a hose of the ship. The worker was rescued immediately, and was not injured and not contaminated. The worker will be checked using the whole-body counter to ensure his health.
-From April 2nd, we began to transfer the radioactive water we collected from the Central Environmental Facility to the Unit 4 turbine building. On April 4th, water level of the pit in the trench of Unit 3 increased by 15cm from previous day. Pathway of water flow is unknown. We can not deny the possibility that water in the turbine building of Unit 4 flows into the trench of Unit 3. So, we stopped transferring water to the Unit 4 turbine building to make assurance. Present water level of the pit in the trench of Unit 3 is not changed from the time we stopped transferring, and is being stable.
-As a countermeasure against outflow of radioactive water into the sea

near the cooling water intake at unit 2 of Fukushima Daiichi Nuclear Power Station, we have injected coagulant into the pit from April 5th and we have observed stoppage of spilling of water from the crack on the concrete lateral of the pit at 5:38 am, April 6th.
-Continued work from yesterday, we have put 6,000 litters of coagulant into the breakage and surrounding ground after investigation of the leakage route by putting tracer into the 9 holes drilled around electrical conduit and the pit. As at 9:30 am, we have been observing there is no leakage of water into the sea from the pit..
-For the sake of completeness, we put further reinforcement for the stoppage of leakage and consider countermeasure including continuous injection of coagulant. We will also note the water level of turbine building of unit 2 remain unchanged. We will further investigate if there is any other leakage.

(Previously announced on April 6th)
On April 6th, we installed rubber boards as a countermeasure against outflow from the intake. We will further investigate if there is any other leakage.
-There is plenty of radioactive wastewater in the turbine buildings. Especially, Unit 2's wastewater is very highly radioactive. To store this stably, it was decided that this needed to be transferred to the Central Radioactive Waste Disposal Facility. However, within that facility, we are storing ten thousand tons of low level radioactive wastewater. In order to transfer more wastewater, we need to discharge the low level radioactive wastewater. In addition, as low radioactive subsurface water is piling up in sub-drain pits of Units 5 and 6 and a part of subsurface water is running into buildings. We are concerned that important equipment to secure the safety of reactors may be submerged. Based on the Section 1 of the Article 64 of the Nuclear Reactor Regulation Law, we have decided to discharge to the sea approximately ten thousand tons of the accumulated low level radioactive water and a total of fifteen hundred tons of the low level radioactive subsurface water stored in the sub drain pits of Unit 5 and 6 as soon as we get ready.
-We evaluate the impact on the discharge of the low radioactive wastewater to the sea as approximately 0.6 mSv per year per an adult if an adult eats adjacent fish and seaweeds everyday. The amount (0.6 mSv of effective radioactive doses per year) is one-forth of annual radioactive dose to which the general public is exposed from nature.

(Previously announced on April 4th)
-At 7:03 pm, April 4th, discharge of low radioactive wastewater (approximately 10,000 ton in total) from Central Radioactive Waste Disposal Facility to the sea was initiated.
-At 9:00 pm, April 4th, discharge of low radioactive subsurface water (1,500 ton in total) from sub-drain pits of Units 5 and 6 to the sea was initiated.
-From 3:00 pm to 4:30 pm, April 5th, in order to prevent diffusion of radioactive contaminated water out from the site port facility to breakwater area which is south to the power station, we began repair of breakwater by founding the large sandbag around it to replace damaged steel water bar. We will continue the operation to prevent diffusion.
-We will continue to take all measures to ensure the safety and to continue monitoring the surrounding environment around the Power Station.

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Press Releases

Press Release (Apr 07,2011)
The status of the consideration of the countermeasures against tidal waves in Kashiwazaki Kariwa Nuclear Power Station after the Tohoku-Chihou-Taiheiyou-Oki Earthquake (2nd release)

Considering the situation of the damages at Fukushima Daiichi Nuclear Power Station and Fukushima Daini Nuclear Power Station caused by the Tohoku-Chihou-Taiheiyou-Oki Earthquake on March 11th, 2011, we have taken measures to improve waterproof performance of each building in Kashiwazaki Kariwa Nuclear Power Station after the earthquake.
Also on the assumption that tidal waves that are hard to expect cause the blackout in the station (lose all alternating-current power), we have installed facilities on the upland in the site for back-up power supply, injection of water in reactors and spent fuel pools and securement of cooling system. As stated above, we have taken measures to ensure cooling function in case of water exposure due to tidal waves inside the buildings.

(Previously announced on March 30th, 2011)

Then we have been considering further safety measures against tidal waves that are hard to expect, consulting with the Ministry of Economy, Trade and Industry (METI) and we have determined that we will build new tide barriers in the nuclear reactor buildings of Unit 1 to 4 in order to prevent the buildings from being flooded.

We plan to prevent the waves from flooding inside the nuclear reactor buildings where important facilities in terms of safety such as power-supply facilities and emergency diesel electric power generator are installed and to ensure the fundamental safety in the station.

We will design the details such as the height of the tide barriers and begin the installation construction in a rapid manner.

We will organize and consider countermeasures regarding safety including the ones implemented so far based on the instructions of METI and Nigta Prefecture, and will report them.
Also we will further improve the safety in the station by analyzing and evaluating the circumstances of the accident in Fukushima Daiichi Nuclear Power Station hereafter.

Attachment: The image of installation of tide barriers in Kashiwazaki Kariwa Nuclear Power Station (PDF 92.3KB)

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Press Releases

Press Release (Apr 07,2011)
Detection of radioactive materials from the seawater near Fukushima Daiichi Nuclear Power Station (15th release)

On March 21st 2011, a sampling survey, conducted as a part of monitoring of surrounding environment, detected radioactive materials in the seawater around the discharge canal (south) of Fukushima Daiichi Nuclear Power Station which was damaged by the Tohoku-Taiheiyou-Oki Earthquake. Therefore, we informed the result to Nuclear and Industrial Safety Agency (NISA) and Fukushima prefecture.

We have also informed NISA on the results of seawater sampling survey which has been implemented since April 2nd at three different points within 15km area of the Fukushima Daiichi Nuclear Power Plant.

The data of three nuclides (Iodine-131, Cesium-134 and Cesium-137) will be reported as fixed data. Other nuclides figures are to be reinvestigated by improved measures under NISA instruction on April 1st.
(We already informed.)

On April 5th, 2011 we conducted sampling survey to evaluate the spread of the radioactive substances which were detected at Fukushima Daiichi Nuclear Power Station. Since the survey detected radioactive substances as shown in appendix, we informed NISA and Fukushima Prefecture about the result.

Also, regarding the sampling points at 15km offshore, a monitor was carried out twice a day at the same sampling points (6 points in total) as the day before yesterday. We have informed the results to NISA and Fukushima today.

We are intending to conduct the same sampling investigation.

Appendix1: The result of the nuclide analysis of the seawater (Around the water discharge (north) of Unit 5 and 6 of Fukushima Daiichi Nuclear Power Station(approx. 30m north from the water discharge of Unit 5 and 6))(PDF 12.7KB)
Appendix2: The result of the nuclide analysis of the seawater (Around the water discharge (south) of Fukushima Daiichi Nuclear Power Station(approx. 330m south from the water discharge of Unit 1 to 4))(PDF 12.6KB)
Appendix3: The result of the nuclide analysis of the seawater (Around the north water discharge of Fukushima Daini Nuclear Power Station (around Units 3 and 4)(approx. 10km from Fukushima Daiichi Nuclear Power Station))(PDF 11.0KB)
Appendix4: The result of the nuclide analysis of the seawater (Around Iwasawa shore at Fukushima Daini Nuclear Power Station (Approx. 7,000m to the south of Units 1 and 2 water discharge) (Approx. 16km from Fukushima Daiichi))(PDF 11.0KB)
Appendix5: The result of the nuclide analysis of the seawater (Around 15km off shore from Minami-Soma City)(PDF 16.0KB)
Appendix6: The result of the nuclide analysis of the seawater (Around 15km off shore from Ukedogawa River)(PDF 16.2KB)
Appendix7: The result of the nuclide analysis of the seawater (Around 15km off shore of Fukushima Daiichi Nuclear Power Station)(PDF 12.0KB)
Appendix8: The result of the nuclide analysis of the seawater (Around 15km off shore of Fukushima Daini Nuclear Power Station)(PDF 16.1KB)
Appendix9: The result of the nuclide analysis of the seawater (Around 15km off shore from Iwasawa Sea Shore)(PDF 16.1KB)
Appendix10: The result of the nuclide analysis of the seawater (Around 15km off shore from Hirono Town)(PDF 16.1KB)
Appendix11: Radioactivity Density of Seawater(PDF 36.7KB)

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From: RST01 Hoc
Sent: Thursday, April 07, 2011 1:29 PM
To: RST06 Hoc
Subject: FW: Items for call today at 1700

From: RST01 Hoc
Sent: Thursday, April 07, 2011 12:21 PM
To: Richards, Stuart
Subject: Items for call today at 1700

Congressman Markey asked Marty Virgilio about whether any core material had exited the RPV. ET has requested site team to obtain the Japanese point of view on whether any of the core has exited the RV. No Unit was specified. Please provide information to Marty V.

Any information on changing conditions at the site as a result of the Magnitude 7.4 aftershock and tsunami (warning)?

04.07.11 @1000hrs Conference Call with Commission TAs, question was asked: What SFPs should be considered for a sand slurry?

Tom Boyce
RST Coordinator

LLLL/198

From: RST01 Hoc
Sent: Thursday, April 07, 2011 2:25 PM
To: Blamey, Alan; Casto, Chuck
Cc: RST06 Hoc; RST09 Hoc; RST08 Hoc; Hoc, RST16
Subject: Items for call today at 1700

Chuck/Alan,

1. Congressman Markey asked Marty Virgilio during yesterday's hearing about whether any core material had exited the RPV by melting through the bottom head. ET has requested site team to obtain the Japanese point of view on whether any of the core has exited the RV. No Unit was specified. Please provide information to RST (for review and further conveyance to Marty Virgilio).

2. Any information on changing conditions at the site as a result of the Magnitude 7.4 aftershock and tsunami (warning)? NISA press release issued Thursday at 23:50, Friday at 0:35 and 1:00 (Japan time) states: "There is no significant change in the readings of the monitoring posts of the Fukushima Dai-ichi nuclear power plant. Water injection into the reactor continues."

3. On Thursday, 4/7/2011 during the 1000 Conference Call with the Commission TAs, while discussing the possibility for a sand slurry, the TAs asked which SFPs should be considered for a sand slurry. Our question for you is "Does the team have any insights from the Japanese?"

4. Has the stability document been shared or discussed with the Japanese? Note that the document is still a draft.

Tom Boyce
RST Coordinator

LLLL/199

From: ET02 Hoc
Sent: Thursday, April 07, 2011 9:11 AM
To: ET07 Hoc
Subject: FW: 0430 EDT (April 7, 2011) USNRC Earthquake/Tsunami Status Update

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From: ET01 Hoc
Sent: Thursday, April 07, 2011 9:10:55 AM
To: ET02 Hoc
Subject: FW: 0430 EDT (April 7, 2011) USNRC Earthquake/Tsunami Status Update
Auto forwarded by a Rule

From: RST01 Hoc
Sent: Thursday, April 07, 2011 9:10:52 AM
To: Sheron, Brian; ET01 Hoc; RST06 Hoc
Subject: RE: 0430 EDT (April 7, 2011) USNRC Earthquake/Tsunami Status Update
Auto forwarded by a Rule

We will look at that.

From: Sheron, Brian
Sent: Thursday, April 07, 2011 8:22 AM
To: RST01 Hoc; ET01 Hoc
Subject: FW: 0430 EDT (April 7, 2011) USNRC Earthquake/Tsunami Status Update

Unit 1 vessel pressure is either ~45 psig or ~94 psig depending on which instrument you believe. The drywell and torus are reported to be at ~7 psig, and the SRV is reported to be stuck open. Is this a credible situation? Can I have that much of a pressure difference between the vessel and the drywell with an SRV stuck open, this long after shutdown?

From: LIA07 Hoc
Sent: Thursday, April 07, 2011 4:54 AM
To: LIA07 Hoc
Subject: RE: 0430 EDT (April 7, 2011) USNRC Earthquake/Tsunami Status Update

Attached, please find a 0430 EDT, April 7, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

Please note that this information is ~~"Official Use Only~~" and is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Jim

LLLL/200

Jim Anderson
Executive Briefing Team Coordinator
Office of Nuclear Security and Incident Response
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)
james.anderson@nrc.gov

From: LIA07 Hoc
Sent: Friday, April 08, 2011 4:21 PM
To: Batkin, Joshua; Borchardt, Bill; Bradford, Anna; Coggins, Angela; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; ET07 Hoc; Flory, Shirley; Gibbs, Catina; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Monninger, John; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
Subject: April 8, 1500 EDT "One Pager"
Attachments: April 8.1500 EDT.pdf

Please find attached today's 1500 EDT "one pager" from the ET.
-Sara

LLLL/201

Wagner, Katie

From: Wagner, Katie
Sent: Friday, April 08, 2011 11:44 AM
To: Lee, Richard
Subject: RE: Sand reaction

Richard – I have been looking for info on this topic basically since I got in this morning and have not found anything that looks like it is specifically on the exothermic reaction with silicon from sand slurry, but can keep looking. Do you want me to forward Dana's email below to PMT09 Hoc for now or hold off until Monday when Dana can offer more precise information? - Katie

---

From: Powers, Dana
Sent: Friday, April 08, 2011 11:38 AM
To: Wagner, Katie
Cc: Lee, Richard
Subject: Sand reaction

Katie, Richard says that you need some reactions. I don't have my tables with me so I can't give you a quantitative account today but I can on Monday. The basic reaction is the simple metathetical reaction

$Zr + SiO_2 = ZrO_2 + Si + heat$

I "estimate" the heat given off by this reaction to be about 88 kJ/mole Zr reacted. The process is complicated by the further reaction of ZrO_2 with SiO_2 (also exothermic but often kinetically controlled) to form zircon, $ZrSiO_4$, and the alloying of the silicon product with residual Zr metal which may be mildly exothermic (need my tables to tell for sure!). In some circumstances – like in a vacuum furnace - you can also get the formation and evaporation of SiO gas which is endothermic, but I really don't expect much of that in this circumstance since the silicon monoxide would have opportunity to continue to react with the Zr metal given slow mass transport through the sand bed. Dana

LLLL/202