3

Cartwright, William

From: Bernardo, Robert NRR
Sent: Friday, March 11, 2011 8:07 AM
To: Brown, Michael NRR
Cc: King, Mark; Sigmon, Rebecca
Subject: RE: Japanese Tsunami

Nothing yet other than what we've gotten through news sources.

A fire broke out in the turbine building of Onagawa nuclear plant in Miyagi Prefecture on Friday, Kyodo News reported, after an 8.9-magnitude earthquake struck Japan and triggered a huge tsunami. It was not immediately clear if there was a risk of a radioactive leak as a result of the fire at the plant operated by Tohoku Electric Power. Miyagi prefecture was one of the areas worst hit by the tsunami.
Kyodo also reported that an emergency core-cooling unit had been activated at Fukushima nuclear plant, without giving further details.
Earlier Friday Prime Minister Naoto Kan had said no radiation leaks have been detected from Japan's nuclear power stations after the massive quake struck the country.
Four Japanese nuclear power plants closest to the epicentre of the quake have been safely shut down, the UN atomic watchdog said Friday.
The quake struck just under 400 kilometres (250 miles) northeast of Tokyo, the US Geological Survey said. It was followed by more than a dozen aftershocks, one as strong as 7.1.

The four Japanese nuclear power plants closest to the epicenter of the quake have been safely shut down, the United Nations atomic watchdog (IAEA) said Friday.

Some reports of EDG challenges at one of the Fukushima nuclear plants.

Bob Bernardo
Reactor Systems Engineer
US Nuclear Regulatory Commission
NRR/DIRS/IOEB
Mail Stop: O-7C02A
301-415-2621
Robert.Bernardo@nrc.gov

From: Brown, Michael NRR
Sent: Friday, March 11, 2011 7:48 AM
To: King, Mark; Bernardo, Robert; Sigmon, Rebecca NRR
Subject: Japanese Tsunami

Mark et al,

Any report on the Japanese Reactors and how they faired during the earthquake?

8.9 is that greater than design basis?

Just wondering

Mike

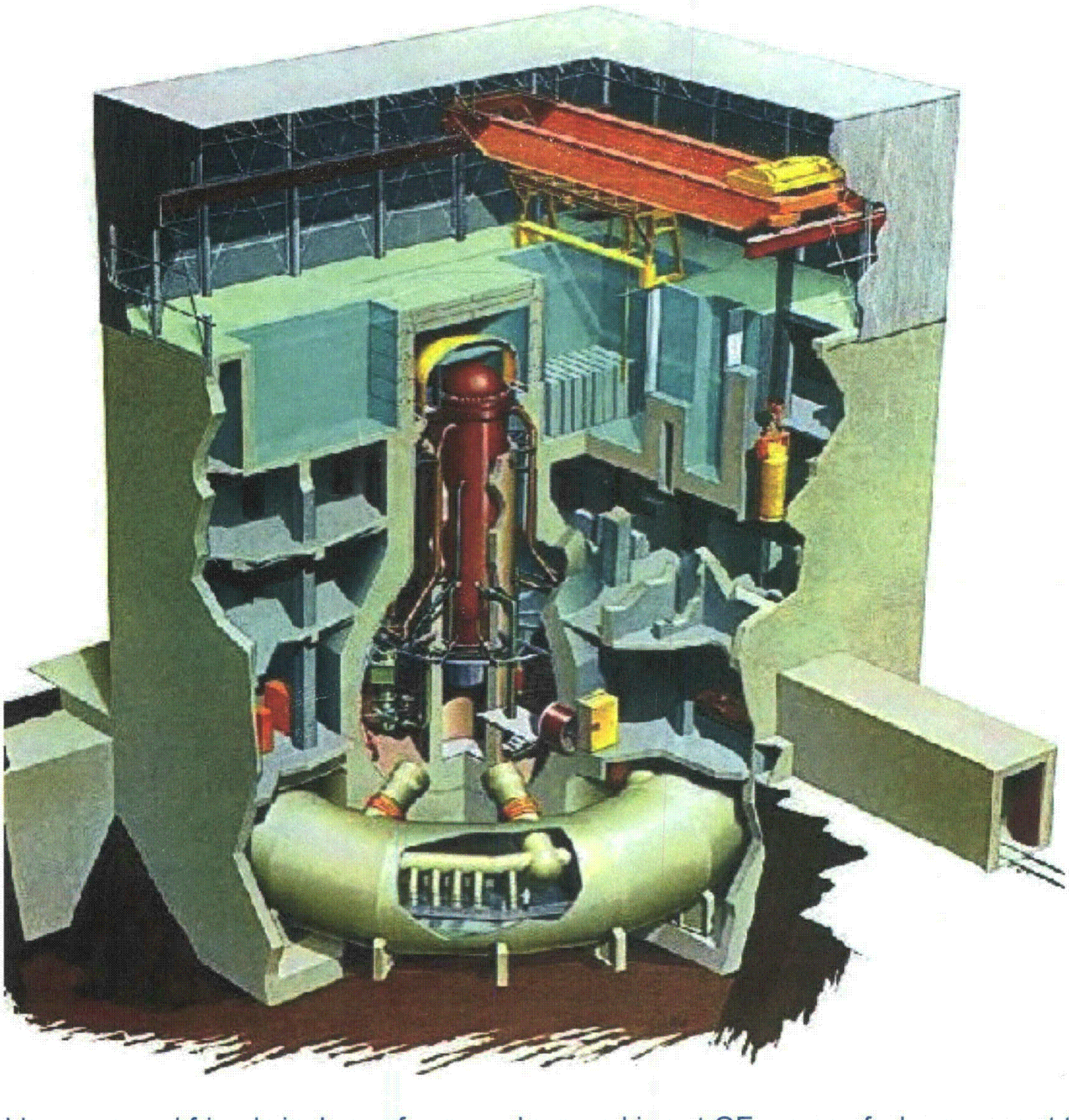
H-6

Stevens, Gary

From: Stevens, Gary
Sent: Monday, March 14, 2011 7:56 AM
To: RES_DE_CIB; Case, Michael; Richards, Stuart
Subject: Japanese Nuclear Situation
Attachments: ANS Japan Backgrounder.pdf; image001.jpg

Several folks have been asking me questions on this topic, so I thought I would share some facts with you from my background experience.

Amidst all of the sensationalizing and speculation coming out of Japan, below and attached is the first report I've seen that seems to contain some good rational facts from NEI and ANS about the Fukushima Unit 1 accident in Japan. Note that Fukushima Daiichi Unit 1 is a GE-designed BWR-3, RPV ID = 188", ~500 MWe, that has operated for about 40 years (entered service in 1971). The explosion you saw on TV was the reactor building (see below, top portion of building) due to hydrogen build-up, as explained in the attachment. The plant has a Mark I containment, which looks like this:



H-7

I have several friends in Japan from my days working at GE, some of whom were at the plant performing outage work. I am happy to report, based on an e-mail I received this a.m. containing correspondence from one of them, that GE's crew of about 40 engineers made it out of the area safely. Under a separate e-mail, I will share that first-hand report anonymously with you.

Gary L. Stevens
Senior Materials Engineer
NRC/RES/DE/CIB
Gary.Stevens@nrc.gov
301-251-7569

March 13, 2011, 7 p.m. EDT Update

Fukushima Daiichi

The hydrogen explosion on March 11 between the primary containment vessel and secondary containment building of the reactor did not damage the primary containment vessel or the reactor core. To control the pressure of the reactor core, TEPCO began to inject seawater and boric acid into the primary containment vessels of Unit 1 on March 12 and Unit 3 on March 13. There is likely some damage to the fuel rods contained in reactors 1 and 3.

At both reactors 1 and 3, seawater and boric acid is being injected into the reactor using fire pumps. On reactor 3, a pressure relief valve in the containment structure failed to open, but was restored by connecting an air pressure to the line driving valve operation.

The water level in the reactor vessel of reactor 2 reactor is steady.

Personnel from TEPCO are closely monitoring the status of all three reactors.

The highest recorded radiation level at the Fukushima Daiichi site was 155.7 millirem at 1:52 p.m. on March 13. Radiation levels were reduced to 4.4 millirem by the evening of March 13. The NRC's radiation dose limit for the public is 100 millirem per year.

Japanese government officials acknowledged the potential for partial fuel meltdowns at Fukushima Daiichi Unit 1 and 3 reactors, but there is no danger for core explosion, as occurred at the nuclear power station at Chernobyl in 1986. Control rods have been successfully inserted at all of the reactors, thereby ending the chain reaction. The reactor cores at Fukushima Daiichi and Daini power stations are surrounded by steel and concrete containment vessels of 40 to 80 inches thick that are designed to contain radioactive materials.

Fukushima Daini

The Fukushima Daini plants remains in a state of emergency. There is electricity available at all four of the reactors at Fukushima Daini, although there is limited availability of the cooling water pumps at reactors 1, 2 and 4.

TEPCO is working to maintain constant cooling in the primary containment vessels of those reactors. No radioactivity has been recorded outside of the secondary containment buildings at Fukushima Daini, according to TEPCO.

Two other nuclear power plants in the Tohoku region, Onagawa Nuclear Power Station and Tokai Nuclear Power Station, were automatically shut down in response to the earthquake. The four reactors at these plants have functioning cooling systems and are being monitored by plant operators.

The Rokkasho Reprocessing Plant and accompanying facilities, located far north of the tsunami zone in Rokkasho Town, is operating safely on backup power generation systems.

Japanese nuclear facilities are designed to withstand powerful seismic events, such as earthquakes. In this earthquake—the strongest recorded over the past 100 years in Japan—the containment structures of Fukushima Daiichi maintained their structural integrity. These facilities were designed to withstand tsunamis within a range of assumed strength, however the force of the tsunami on March 10 exceeded the assumed range and flooded diesel generators at Fukushima Daiichi power station. This precipitating the loss of power for the reactor cooling systems.

The automatic shutdown of the 11 operating reactors at the Onagawa Nuclear Power Station, Tokai Nuclear Power Station, Fukushima Daiichi and Daini, represents a loss of 3.5% of electric generation capacity for Japan.

American Nuclear Society Backgrounder:
Japanese Earthquake/Tsunami; Problems with Nuclear Reactors

3/12/2011 5:22 PM EST

To begin, a sense of perspective is needed... right now, the Japanese earthquake/tsunami is clearly a catastrophe; the situation at impacted nuclear reactors is, in the words of IAEA, an "Accident with Local Consequences."

The Japanese earthquake and tsunami are natural catastrophes of historic proportions. The death toll is likely to be in the thousands. While the information is still not complete at this time, the tragic loss of life and destruction caused by the earthquake and tsunami will likely dwarf the damage caused by the problems associated with the impacted Japanese nuclear plants.

What happened?

Recognizing that information is still not complete due to the destruction of the communication infrastructure, producing reports that are conflicting, here is our best understanding of the sequence of events at the Fukushima I-1 power station.

- The plant was immediately shut down (scrammed) when the earthquake first hit. The automatic power system worked.
- All external power to the station was lost when the sea water swept away the power lines.
- Diesel generators started to provide backup electrical power to the plant's backup cooling system. The backup worked.
- The diesel generators ceased functioning after approximately one hour due to tsunami induced damage, reportedly to their fuel supply.
- An Isolation condenser was used to remove the decay heat from the shutdown reactor.
- Apparently the plant then experienced a small loss of coolant from the reactor.
- Reactor Core Isolation Cooling (RCIC) pumps, which operate on steam from the reactor, were used to replace reactor core water inventory, however, the battery-supplied control valves lost DC power after the prolonged use.
- DC power from batteries was consumed after approximately 8 hours.
- At that point, the plant experienced a complete blackout (no electric power at all).
- Hours passed as primary water inventory was lost and core degradation occurred (through some combination of zirconium oxidation and clad failure).

- Portable diesel generators were delivered to the plant site.
- AC power was restored allowing for a different backup pumping system to replace inventory in reactor pressure vessel (RPV).
- Pressure in the containment drywell rose as wetwell became hotter.
- The Drywell containment was vented to outside reactor building which surrounds the containment.
- Hydrogen produced from zirconium oxidation was vented from the containment into the reactor building.
- Hydrogen in reactor building exploded causing it to collapse around the containment.
- The containment around the reactor and RPV were reported to be intact.
- The decision was made to inject seawater into the RPV to continue to the cooling process, another backup system that was designed into the plant from inception.
- Radioactivity releases from operator initiated venting appear to be decreasing.

Can it happen here in the US?

- While there are risks associated with operating nuclear plants and other industrial facilities, the chances of an adverse event similar to what happened in Japan occurring in the US is small.
- Since September 11, 2001, additional safeguards and training have been put in place at US nuclear reactors which allow plant operators to cool the reactor core during an extended power outage and/or failure of backup generators – "blackout conditions."

Is a nuclear reactor "meltdown" a catastrophic event?

- Not necessarily. Nuclear reactors are built with redundant safety systems. Even if the fuel in the reactor melts, the reactor's containment systems are designed to prevent the spread of radioactivity into the environment. Should an event like this occur, containing the radioactive materials could actually be considered a "success" given the scale of this natural disaster that had not been considered in the original design. The nuclear power industry will learn from this event, and redesign our facilities as needed to make them safer in the future.

What is the ANS doing?

ANS has reached out to The Atomic Energy Society of Japan (AESJ) to offer technical assistance.

ANS has established an incident communications response team.

This team has compiling relevant news reports and other publicly available information on the ANS blog, which can be found at ansnuclearcafe.org.

The team is also fielding media inquiries and providing reporters with background information and technical perspective as the events unfold.

Finally, the ANS is collecting information from publicly available sources, our sources in government agencies, and our sources on the ground in Japan, to better understand the extent and impact of the incident.

Stevens, Gary

From: Stevens, Gary
Sent: Monday, March 14, 2011 8:04 AM
To: RES_DE_CIB; Richards, Stuart; Case, Michael
Subject: FW: FW: Fuku-1 building explosion

First-hand reports from some folks who were actually on-site. Incredible.

Gary L. Stevens
Senior Materials Engineer
NRC/RES/DE/CIB
Gary.Stevens@nrc.gov
301-251-7569

----- Forwarded Message -----

Difficult times for our friends in Japan and challenges for the nuclear industry in Japan and elsewhere in the world.

----- Forwarded Message -----

Thank you very much for your kind message.
Please see below status. I am barely OK.
I was at Fuku site during quake hit together with GEH-I Japanese Employee + 39 US Crew for 1F-4 RIR project.
It was hell and super huge earthquake ever. However, everybody(GEH, USA, Tokai Kosan, Atox) were safe/OK and we evacuated from Fuku. GEH site office was quite messy.
1F-1 could avoid worst scenario by injecting sea water into PCV/RPV- partial top core meltdown - looks like. Top section of reactor building was broken off due to Hydrogen detonation-I believe this was not expected event, but Hydrogen was generated inside RPV due to metal/water reaction and H2 leaked from PCV to Reactor Building. PCV/RPV are maintaining its intended function.
1F-3 -- could be quite similar to 1F-1 but looks like no top core melt-down yet-we do not know.
Tokai-2 is running Standby DG and Rx is being cooled - no off site power available. They have 7 days fuel for DG so should be OK.
2F site - three reactors were auto-scrammed. They are having difficulty to cool the reactor residual heat due to no off site power and Diesel Engine Driven Generator are not operable. Could be similar to 1F-3.

It took almost 23 hours to come back to my home(traffic jammed, gas problem, engine problem, etc).
My home was heavily damaged and big headache. I do not know how to restore, no water supply, no sewage, no gas. Only electric power but from tomorrow morning, periodic power supply stoppage.
Physically, to my knowledge, all of our friend/family including our supporting company people looks OK.

----- Forwarded Message -----

We are all happy that you both are safe. Having been at Fukushima many times and having done work related to both the 1F and 2F units, I hope and pray that they will come out with minimal damage. The news outlets here are describing horror stories and at one point I was under the impression that the primary containment had exploded. Your description of this as hydrogen explosion on the operating floor makes it less alarming (it is something we have seen before!). Anyway the news media here is uninformed and is spreading all kinds of mis-information.

I have a lot of affection and admiration for the Japanese people and it pains us all to see the extensive damage. But if anyone can come out of this successfully (like they did after Kobe), it will be the Japanese. Hope things become normal soon and the rebuilding starts soon.

H-8

----- Forwarded Message -----

This is only hydorogen explosion at 1F-1 operating floor and came off operating floor wall during steam out through off gas stack,nor by PCV and reactor explosion.

H2 will Leak through valves and go up to top floor of Reactor BLDG,Media people didn't understand details.

I'm sure TEPCO can handle this issue therefore they are made decision of seawater injection with boron for RPV and Torus/SC.

> ----- Forwarded Message -----
>
> ... just in case you are not seeing it on Japanese television, see the NHK/twitter's link showing the before and after damage to the F1 plant building from the H2 explosion. Also included are comments relating to the explosion.
>
> http://twitpic.com/48pqvs
>
> ---
>
> ----- Forwarded Message -----
>
> Thanks for the link. Dramatic photo. I agree that it looks like a hydrogen explosion, but I don't recall any recombiners for the secondary containment at any BWR - just SBGT with HEPA and particle filters and heaters which may have ignited any H2. Only recombiners I recall are in the off-gas system and at some BWRs in the primary containment (some catalytic, some with spark plug igniters to burn it off). My guess is they burped the primary containment to protect it from overpressure and H2 got into the secondary containment that way.
>
> ----- Forwarded Message -----
>
> Thanks for forwarding updates. Pasted in a link that shows photos before and after the explosion. It appears that the top section of the reactor building may have suffered damage. Photo taken at a distance, but it looks like that the steelwork is in place and secondary containment barrier is compromised (gone). If there was no power available perhaps the secondary containment hydrogen recombiners (if they exist) were not operating and the explosion was due to hydrogen buildup. Glad to hear that folks are unharmed along with their families. Prayers and hope for those who were there and are struggling to control the situation.
>
> http://twitpic.com/48pqvs

Rudland, David

From: Rudland, David
Sent: Monday, March 14, 2011 8:16 AM
To: Stevens, Gary; RES_DE_CIB; Case, Michael; Richards, Stuart
Subject: RE: Japanese Nuclear Situation

Thanks Gary

I too have several Japanese friends that work for both JNES and Tokyo Gas. I have been in contact with all of them, and am happy to report that everyone is fine. They seem to be getting around by bicycle, and nothing else. Several of my Tokyo gas friends spent three full days without leaving the office, sleeping on the floor of their offices.

Dave

From: Stevens, Gary
Sent: Monday, March 14, 2011 7:56 AM
To: RES_DE_CIB; Case, Michael; Richards, Stuart
Subject: Japanese Nuclear Situation

Several folks have been asking me questions on this topic, so I thought I would share some facts with you from my background experience.

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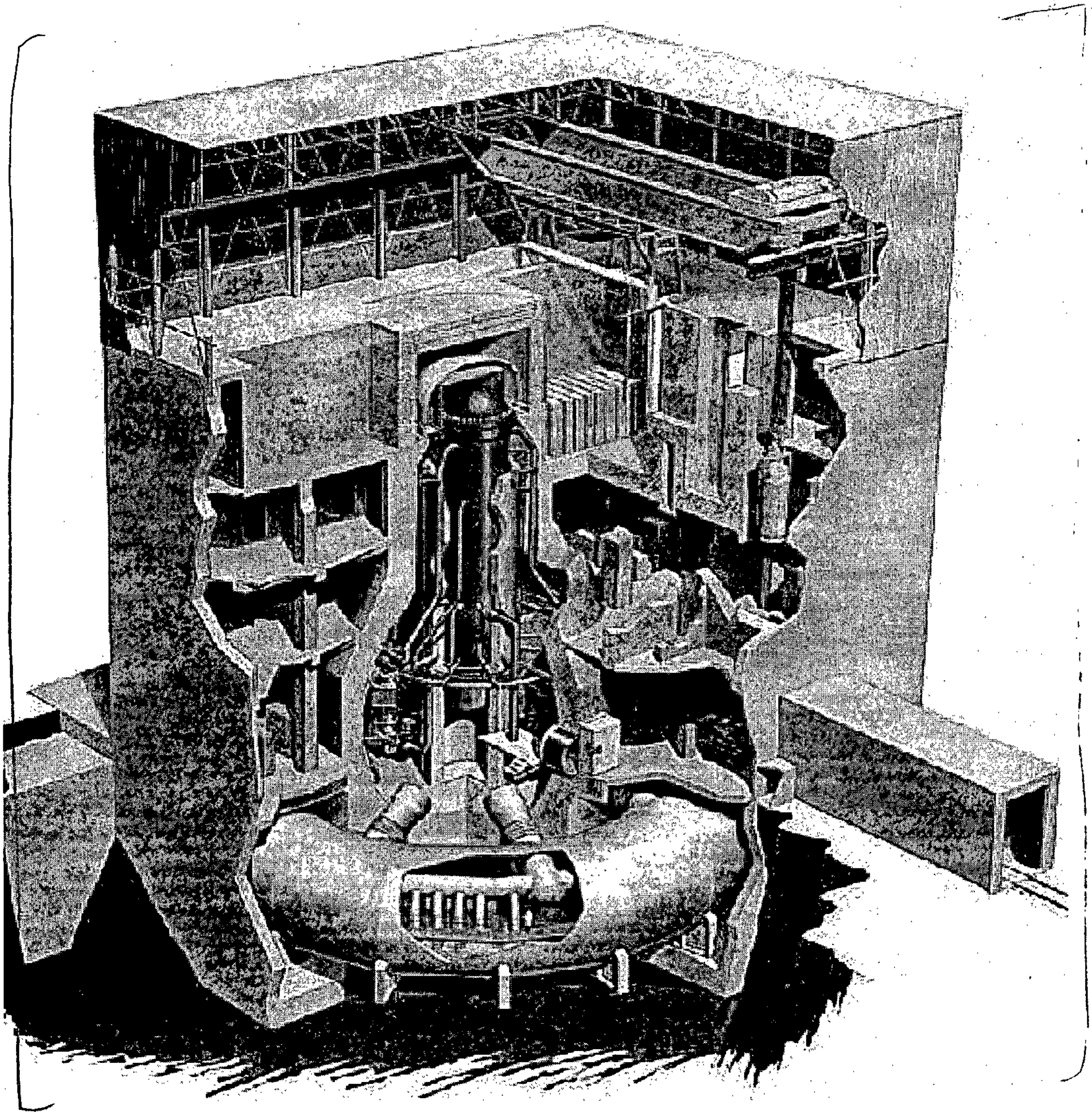
H-9



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Gary L. Stevens
Senior Materials Engineer
NRC/RES/DE/CIB
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301-251-7569

March 13, 2011, 7 p.m. EDT Update

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Rathbun, Howard

From: Rathbun, Howard
Sent: Monday, March 14, 2011 9:35 AM
To: 'Crooker, Paul'
Subject: RE: WRS Schedule

Hi Paul,

Yes, I agree we should begin scheduling the June meeting. The only caveat at this point is that we'll have to see how much we all get involved in the Japanese plants event response, etc.

-Howard

From: Crooker, Paul [mailto:pcrooker@epri.com]
Sent: Sunday, March 13, 2011 6:02 PM
To: Rathbun, Howard
Cc: John Broussard; Kerr, Matthew
Subject: RE: WRS Schedule

Howard,

Should we try to the final review meeting in the calendar.

- About June 1st or 2nd - Meeting of WRS FEA Validation R&D Teams (Palo Alto but fine if people want to hold at another location)

Plans and details are more tentative for:
- End of September 2011 – Complete Expert Review of Validation with Recommendations
- End of October 2011 – Complete NRC and Industry Final Reviews

Should we ask teams to tentatively plan for a final results meeting about June 1 at EPRI in Palo Alto?

Paul

From: Rathbun, Howard [mailto:Howard.Rathbun@nrc.gov]
Sent: Tuesday, March 01, 2011 2:29 PM
To: Crooker, Paul; John Broussard; Kerr, Matthew
Subject: RE: WRS Schedule

Hi Paul,

I've reviewed your proposed schedule for completion of the WRS work and it's entirely fine with me.

thanks, Howard

From: Crooker, Paul [pcrooker@epri.com]
Sent: Sunday, February 27, 2011 8:11 PM
To: John Broussard; Rathbun, Howard; Kerr, Matthew
Subject: WRS Schedule

Thanks for taking time to meet on Friday. Still much to do but we are getting there. I roughed out the enclosed schedule for what we discussed. I may have some tasks and dates wrong so please edit and send your changes. (We received some Phase 1A data from Cam on Friday and should be receiving more. Not sure about Phase 1B and Phase 3 though). Please comment/revise the schedule so we can finish up validation and initiate next steps.

H-10

Paul
<<Completion of WRS FEA Validation.ppt>>
-----Original Appointment-----
From: RES_DE_CIB Resource [mailto:RES_DE_CIB.Resource@nrc.gov]
Sent: Thursday, February 17, 2011 7:51 AM
To: Rudland, David; Kerr, Matthew; John Broussard; Crooker, Paul; RES_DE_CIB Resource
Subject: WRS & peening mtg with Paul Crooker
When: Friday, February 25, 2011 6:00 AM-8:00 AM (GMT-08:00) Pacific Time (US & Canada).
Where: Church street
When: Friday, February 25, 2011 9:00 AM-11:00 AM (GMT-05:00) Eastern Time (US & Canada).
Where: Church street

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*

Rodriguez-Luccioni, Hector

From: Boyce, Tom (RES)
Sent: Monday, March 14, 2011 9:58 AM
To: RES_DE_RGB
Subject: FW: Talking Points on Implications of Fukushima Accident to U.S. Nuclear Plants
Attachments: ANS Talking Points - 2011-03-13 R1_2.pdf

FYI

-----Original Message-----
From: Joe Colvin [mailto:president@ans.org]
Sent: Sunday, March 13, 2011 11:43 PM
To: Boyce, Tom (RES)
Subject: Talking Points on Implications of Fukushima Accident to U.S. Nuclear Plants

Dear ANS Members:

Over the last two days, the ANS Crisis Communications team has been very proactive and has handled a multitude of media and press calls. ANS spokespersons have participated in national television, radio and press interviews providing the views of the nuclear science and technology experts within the Society. We are particularly grateful to Dr. Dale Klein who has given tremendous support to the Society and the public in response to the events at Fukushima.

We have begun fielding media inquiries about the implications of the problems at Fukushima on the US program. We have prepared the attached talking points to assist responders to this line of questions. The talking points are consistent with the talking points prepared by the Nuclear Energy Institute (NEI) on the same subject.

Thank you all for your strong support!

Joe

H-11

The predominance of ANS members reside in the U.S. As we interact with our family, neighbors and citizens in our communities many questions will come based on news coverage of the nuclear power plant situation in Japan. These talking points key on the theme 'could it happen in the U.S.?' *

ANS Member Talking Points

Implications to U.S. nuclear energy program from the Japanese earthquake

It is premature for the technical community to draw conclusions from the earthquake and tsunami tragedy in Japan with regard to the U.S. nuclear energy program. Many opposed to nuclear power will try to use this event to call for changes in the U.S. Japan is facing beyond a "worst case" disaster since we, the technical community, did not hypotheses an event of this magnitude. Thus far, even the most seriously damaged of Japan's 54 reactors have not released radiation at levels that would harm the public. That is testament to the way professionals in our profession operate: our philosophy of defense in-depth, excellent designs, high standards of construction, conduct of operations, and most important the effectiveness of employees in following emergency preparedness planning.

The Nuclear Science and Technology (NS&T) community takes very seriously our commitment to safe operation of any nuclear facility and will incorporate lessons learned based on this experience into our safety and operating procedures. The ANS will facilitate the sharing of technical information so that these lessons receive wide distribution and be archived for future stewards of this technology. Some points to remember from this week:

- Nuclear power plants have proven their value to society in Japan, the United States and elsewhere. They provide large amounts of base load electricity on an around-the-clock basis, and they do so cost-effectively with the lowest electricity production costs of any large energy source. Both Japan and the United States have benefited greatly from nuclear energy; it has been instrumental in the nations' economic success over the past half century and their high standard of living.

- Our hallmark as a NS&T organization is to incorporate operating experience and lessons learned. When we fully understand the facts surrounding the event in Japan, we will share, document and use those insights to make NS&T even safer.

- Nuclear energy has been and will continue to be a key element in meeting America's energy needs. The nuclear industry sets the highest standards for safety and, through our focus on continuous learning; we will incorporate lessons learned from the events in Japan. The dominant factors determining technology used for new generation will be demand for new generation, the competitiveness of nuclear energy in comparison with other sources of electricity generation, and the continued safe operation of U.S. nuclear power plants.

- There has not been a rush to judgment on the part of U.S. policymakers during the first few days of this situation. We believe that is due in part to the recognition on their part that nuclear energy must continue to play a key role in a diversified energy portfolio that strengthens U.S. energy security and fuels economic growth.

* The genesis of this document is the NEI "Talking Points - Implications to U.S. nuclear energy program of the Japanese earthquake" dated March 13, 2011

Rodriguez-Luccioni, Hector

From: Boyce, Tom (RES)
Sent: Monday, March 14, 2011 10:42 AM
To: Rodriguez-Luccioni, Hector
Subject: FW: Fukushima Event Status as of this morning
Attachments: Fukushima_event-status. (12.30) Mar 14.pdf

From: ODonnell, Edward
Sent: Monday, March 14, 2011 9:04 AM
Subject: Fukushima Event Status as of this morning

The attached was a Japanese press release.

H-12

Status of nuclear power plants in Fukushima as of 12:30 March 14 (Estimated by JAIF)

Power Station	Fukushima #1 Nuclear Power Station					
Unit	1	2	3	4	5	6
Power output (MWe)	460	784	784	784	784	1100
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
Operational Status at the earthquake occur	Service	Service	Service	Outage	Outage	Outage
Fuel Integrity	Damaged	Not Damaged	Damaged	Not Damaged	Not Damaged	Not Damaged
Containment Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged	Not Damaged	Not Damaged
Core coolabilit-1 (ECCS/RHR)	Not Functional	Not Functional	Not Functional	Not necessary	Not necessary	Not necessary
Core coolabilit-2 (RCIC/MUWC)	Not Functional	RCIC Working	Not Functional	Not necessary	Not necessary	Not necessary
Building Integrity	Damaged	Not Damaged	Damaged	Not Damaged	Not Damaged	Not Damaged
Environmental effect	Radiation monitor detect radiation increase in the environment (NPS boarder: 20 μ Sv/h at 11:44AM)					
water level of the pressure vessel	Unknown	Above the top	Unknown	Safe	Safe	Safe
pressure of the pressure vessel	Stable	Stable	Stable	Safe	Safe	Safe
Containment pressure	Stable	Stable	Stable	Safe	Safe	Safe
Sea water injection to core	Suspended	To be decided	Done	Not necessary	Not necessary	Not necessary
Containment venting	Done	Preparing	Done	Not necessary	Not necessary	Not necessary
Evacuation Area	20km from NPS					
INES	Level 4 (estimated by NISA)					

Power Station	Fukushima #2 Nuclear Power Station			
Unit	1	2	3	4
Power output (MWe)	1100	1100	1100	1100
Type of Reactor	BWR-5	BWR-5	BWR-5	BWR-5
Status at the earthquake occurred	Service	Service	Service	Service
Fuel Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
Containment Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
Core coolabilit-1 (ECCS/RHR)	Functioning	Not Functional	Funcitioning	Not Functional
Core coolabilit-2 (RCIC/MUWC)	Not necessary	Functioning	Not necessary	Functioning
Building Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
Environmental effect	Stable (NPS boarder: 0.038 μ Sv/h at 8AM)			
water level of the pressure vessel	(No info)	(No info)	(No info)	(No info)
pressure of the pressure vessel	(No info)	(No info)	(No info)	(No info)
Containment pressure	(No info)	Increase	(No info)	Increase
Sea water injection to core	Not necessary	to be decided	Not necessary	to be decided
Containment venting	Not necessary	to be decided	Not necessary	to be decided
Evacuation Area	10km from NPS			
INES	(No Info)			

Source:
Governmental Emergency Headquaters: News Release (10:30), Press conference (11:45)
NISA (Nuclear and Industrial Safety Agency): News Release (7:30)
Tokyo Electric Powe Co.: Prsss Release (6:01, 8:00), Press Conference (12:10)

Abbreviations:
ECCS: Emergency Core Cooling System
RHR: Residual Heat Removal System
RCIC: Reactor Core Isolation Cooling System
MUWC: Make-Up Water Condensate System
INES: International Nuclear Event Scale

Rodriguez-Luccioni, Hector

To: ODonnell, Edward
Subject: RE: Fukushima. News up through 18.00 hrs March 15th.

From: ODonnell, Edward
Sent: Tuesday, March 15, 2011 8:20 AM
Subject: Fukushima. News up through 18.00 hrs March 15th.

Tuesday 15 March

Wikinews has related news: ***Third explosion at Fukushima Daiichi nuclear power plant***

06:14 (approximate)

Third explosion heard at Fukushima I. Afterwards, it was confirmed that the 4th floor rooftop area of the Unit 4 Nuclear Reactor Building had sustained damage, likely caused by the earlier blast of Unit 3 . [13] Reactor unit 2's pressure-suppression system was feared damaged, and the radiation level exceeded the legal limit to reach 965.5 microsieverts per hour. The radiation level later fluctuated up to 8,217 microsieverts per hour, two hours after the explosion. That is about eight times a normal annual exposure. The level went down to 2,400 microsieverts per hour shortly later.[14] Workers at the plant started evacuation, with a select few remaining to keep the reactors cooled.[15] The plant's operator said the nuclear fuel rods could be melting.[14]

Status of Fukushima I station at 07:00 March 15

Status of reactors at 07:00 March 15	**1**	**2**	**3**	**4**	**5**	**6**
Power output (MWe)	460	784	784	784	784	1100
Type of reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
Status at earthquake	In service	In service	In service	Shut down	Shut down	Shut down
Fuel integrity	Damaged	Damaged	Damaged	Not damaged	Not damaged	Not damaged
Containment integrity	Not damaged	Partly damaged	Not damaged	Not damaged	Not damaged	Not damaged
Core cooling system 1 (ECCS/RHR)	Not functional	Not functional	Not functional	Not functional	Not necessary	Not necessary
Core cooling system 2 (RCIC/MUWC)	Not functional	Not functional	Not functional	Not functional	Not necessary	Not necessary
Building integrity	Damaged	Partly damaged	Damaged	Not damaged	Not damaged	Not damaged
Environmental effect	**11,900 microSievert/hour at 09:10[16], between 0,1 and 0,4 Sievert later on.[17][18]**					
Pressure vessel, water level	None	Low (recovering)	Unknown	Safe	Safe	Safe
Pressure vessel, pressure	Low	Leaked	Stable	Safe	Safe	Safe
Containment pressure	Stable	Increasing	Stable	Safe	Safe	Safe
Sea water injection	Suspended	Performed	Performed	Not	Not	Not

H-13

				necessary	necessary	necessary
Containment venting	Performed	Preparing	Performed	Not necessary	Not necessary	Not necessary
Evacuation radius	30 km					
INES	Level 6 (estimated by NISA)					

Wikinews has related news: ***Fukushima reactor extinguished after fire, radiation leak confirmed***

09:40

The Fukushima I Unit 4 building caught fire, likely releasing radioactive contamination from the spent fuel stored there.[19][20] TEPCO said workers extinguished the fire by 12:00.[21][22] As radiation levels rose, some of the fifty employees still at the plant were evacuated.[23]

11:35

At Fukushima II (Dai-Ni), Units 1, 2, and 3 are in cold shutdown. For Unit 4, work is in progress to restore cooling and bring it to cold shutdown.[3]

13:35

No fly zone declared for 30 km around the Fukushima I plant. Japanese stock market down more than 13%. Prime Minister warns of radiation hazard and further radiation leaks.

16:09

There is a fire at a spent fuel pond of a reactor and radioactivity has been released into the atmosphere, says the IAEA according to AFP news agency.[24]

16:38

More on the fire at a spent fuel pond at Fukushima: It is at the number 4 reactor and "radioactivity is being released directly into the atmosphere", AFP quotes the IAEA as saying.[25]

17:00

The fire at the spent fuel pond has been put out by Japanese authorities according to the IAEA they state "Japanese authorities have confirmed that the fire at the spent fuel storage pond at the Unit 4 reactor of Fukushima I nuclear power plant was extinguished on 15 March at 17:00 JST."[26]

17:03

There has been a slight rise in temperature of two more reactors at Fukushima I nuclear plant, the chief government spokesman says according to AFP.[27]

18:00

Japanese nuclear safety official has confirmed reports that the water inside the waste fuel storage pool for the number 4 Fukushima reactor may be boiling, AP reports.[28]

22

Wengert, Thomas

From: Feintuch, Karl nrr
Sent: Monday, March 14, 2011 2:40 PM
To: Pascarelli, Robert
Cc: Beltz, Terry; Tam, Peter; Wengert, Thomas; Chawla, Mahesh
Subject: FW: Japanese event

FYI - Latest information from Region 3. Highlight is mine.

Karl

From: Riemer, Kenneth | R3
Sent: Monday, March 14, 2011 2:02 PM
To: Scarbeary, April; Ramirez, Frances; Ruiz, Robert; Haeg, Lucas; Murray, Robert; Thomas, Christopher; Voss, Patricia; Shah, Nirodh; Feintuch, Karl
Cc: Riemer, Kenneth
Subject: Japanese event

Just a quick update based on what we've heard so far. Just a couple of caveats and general info:

- As Nick indicated in his e-mail, if you get any requests for info or status, **forward them to the HOO**. That way the agency will have one voice.
- It's frustrating, but we have very little factual info as an agency. What we've been getting has been through the State Dept.
- The Japanese regulatory body is very mature, sophisticated and technically competent, as is the Japanese industry so the NRC is being very careful to not interfere or imply that they are not equipped to handle the reactor events.
- The NRC has sent 2 people over with the potential to send some more.
- The plants appear to have survived the earthquake pretty well, but lost the EDG fuel oil supplies (therefore complete station blackout situation) when the tsunami hit. EDG fuel oil tanks were above ground design.
- Repeat of first bullet – if you get any inquiries, **send them to the HOO**

The site has 6 reactors; three were operating and the other three were shut down for maintenance at the time of the earthquake. For the operating units:
Unit 1: similar design to Dresden with iso-condenser. core damage is likely. Core coverage is uncertain. Injecting borated sea water to the core, but have now lost that capability. Hydrogen explosion and have lost secondary containment, but believe primary containment is intact. Venting fission product daughters off-site, but prevailing winds are out to sea.
Unit 2: similar design to Quad Cities/Duane Arnold. in the best (very relative term) shape of the three previously operating reactors. Were operating on RCIC but that is now lost. Primary and secondary containment believed intact, however anticipate that a hydrogen explosion is imminent.
Unit 3: similar design to Quad Cities/Duane Arnold . Hydrogen explosion yesterday with breach of secondary containment. Injecting seawater into the core

Boiling in the spent fuel pools – feeding as able with seawater.

I'll provide more tomorrow if we get it.

Ken

ML12a9?

H-14

From: Astwood, Heather NRR
To: Leeds, Eric; Boger, Bruce; McGinty, Tim; Brown, Frederick
Subject: INFORMATION : possible person with Fukushima experience
Date: Monday, March 14, 2011 1:39:00 PM

FYI – OIP asked that I forward this to you. You can see it went originally to Bill Dean and Ho Nieh.

Heather Astwood
International Team Leader
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-1075

From: Noggle, James
To: Trapp, James; Nieh, Ho; Schwartzman, Jennifer
Sent: Sat Mar 12 12:13:20 2011
Subject: FW: Fukushima NPP Event

FYI

From: Noggle, James RI
Sent: Saturday, March 12, 2011 9:36 AM
To: Dean, Bill; Lew, David
Cc: Wilson, Peter; Henderson, Pamela
Subject: Fukushima NPP Event

Bill and Dave,

I am sure the Japanese Government Ministry of Economic Trade and Industry (METI) is very capable of handling the current nuclear event in Japan. But in case they do reach out for help or the IAEA is looking for assistance, I wanted you to know of my previous experience at that nuclear facility.

Between January 1980 and July 1989, I worked approximately 10 different projects at the Fukushima Daiichi Unit one Nuclear Power Plant as a health physics manager for General Electric International Field Services. My cumulative experience at Fukushima is well over one year onsite. I know the TEPCO organization, the health physics program there (circa 1980's), and how to work well with the Japanese staff at Fukushima.

I am ready and willing to assist if the NRC is called upon for help.

Regards,

Jim

H-15

NRC

From: Cullingford, Michael
To: Ruland, William; Lubinski, John; Hiland, Patrick; Cheok, Michael; Holian, Brian; Giitter, Joseph; Brown, Frederick
Cc: McGinty, Tim
Subject: FW: WNN Weekly 8-14 March 2010
Date: Tuesday, March 15, 2011 8:30:19 AM

---

fyi

From: World Nuclear News [mailto:wnn=world-nuclear-news.org@mcsv8.net] **On Behalf Of** World Nuclear News
Sent: Tuesday, March 15, 2011 8:00 AM
To: Cullingford, Michael
Subject: WNN Weekly 8-14 March 2010

View WNN Weekly in your browser.

8-14 March 2011

REGULATION & SAFETY:

Dramatic escalation in Japan
15 March 2011
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H-16

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CORPORATE:

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Our mailing address is:
World Nuclear Association
Carlton House, 22a St James's Square
London, Westminster SW1Y4JH

Balarabe, Sarah

From: Miranda, Samuel NRC
Sent: Tuesday, March 15, 2011 7:27 AM
To: Mendiola, Anthony; Ruland, William
Cc: Lyon, Warren
Subject: Crisis Revives Doubts on Regulation

THE WALL STREET JOURNAL.
WSJ.com

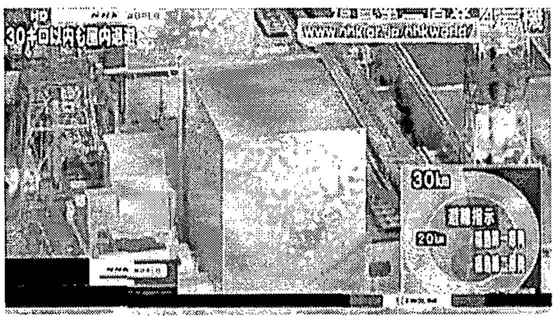
- ASIA NEWS
- MARCH 15, 2011

Crisis Revives Doubts on Regulation

By NORIHIKO SHIROUZU in Tokyo and ALISON TUDOR in Hong Kong

Japan's nuclear-power crisis is reviving long-held doubts about the strength of the nation's nuclear regulatory system and its independence from government efforts to sell nuclear technology abroad.

There aren't indications that any government regulatory failures contributed to the problems at the Fukushima Daiichi complex in northeastern Japan, where government and industry officials are battling to keep three of the six nuclear reactors from overheating and releasing dangerous levels of radioactivity.



The health of the badly damaged nuclear plant in Japan is deteriorating by the hour. Video courtesy of Reuters

More

- **Nuclear Risk Rising in Japan**
- **Germany Rethinks Atomic Power**
- **French Firms Face New Fears Over Reactors**
- **Obama Stands By Nuclear Power**

However, the woes there put a spotlight on Japan's Nuclear and Industrial Safety Agency, which oversees design and regulation of Japan's nuclear plants.

H-17

It also highlights past problems with falsified safety records at the Fukushima Daiichi plant and with its parent company, Tokyo Electric Power Co., or Tepco, though there is no evidence those prior problems are adding to the current problems.

The Japanese nuclear safety agency, known as NISA, is part of Japan's Ministry of Economy, Trade and Industry. The larger ministry, known as METI, has in recent months revved up a push to help Japanese power companies, including Tepco, win deals to build nuclear reactors abroad.

A METI statement issued by ministry spokesman Tatsuji Narita says Japan maintains a healthy regulatory environment through a redundant, second agency attached to the Cabinet named the National Safety Commission. That agency reviews METI's nuclear-regulation efforts with a focus on safety.

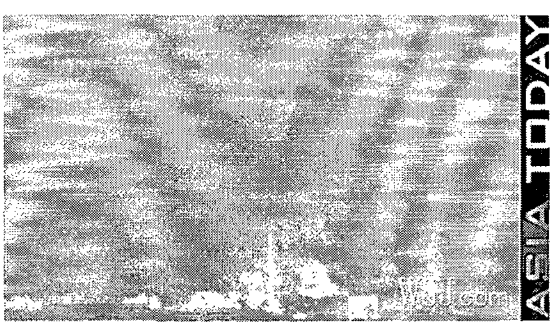
"Japan maintains the independence of its nuclear regulatory agencies through this redundant 'double-check' system," the statement said.

In August, Masayuki Naoshima, then Japan's Minister of Economy, Trade and Industry, led a delegation to Vietnam to promote the sale of nuclear power plants to the Southeast Asian country for the second phase of its atomic power project. The delegation included Tepco Chairman Tsunehisa Katsumata, as part of a group of Japanese power companies that banded together to win contracts in the face of rising competition from companies in South Korea and Russia, among other places.

Japan will likely win a contract to build Vietnam's second nuclear power plant, following a joint statement late last year by Vietnamese Prime Minister Nguyen Tan Dung and Japan's Prime Minister Naoto Kan saying that "Vietnam confirms that the Vietnamese government chooses Japan as a cooperation partner to build two nuclear reactors."

Tepco couldn't be reached to comment.

In the U.S., the previous nuclear-energy regulator, the U.S. Atomic Energy Commission, came under attack in the 1970s, accused by members of Congress of being unwilling to stand up to the commercial nuclear industry because it was supposed to promote the nuclear industry even as it assured public safety.



Confusion and panic levels are rising across Japan following another blast and fire in Fukushima. WSJ's Mariko Sanchanta and Yumiko Ono separate fact from fiction in the latest nuclear reports.

In 1975, a new independent agency was created, the U.S. Nuclear Regulatory Commission, which was charged with overseeing safety issues. A newly formed Department of Energy was to guide research and grant monetary support to the sector.

The Fukushima Daiichi plant has a black mark on its record from earlier in the last decade, when a scandal involving falsified safety records led to parent company Tepco briefly shutting down its entire nuclear fleet in

Japan. In 2002, Tepco admitted to the Nuclear and Industrial Safety Agency that it had falsified the results of safety tests on the containment vessel of the No. 1 reactor, which is now one of three reactors that workers are struggling to keep from overheating. The test took place in 1991-1992.

The scandal was the latest in a string of nuclear safety records cover-ups by Tepco, including the revelation that the company's doctoring of safety records concerning reactor shrouds, a part of the reactors themselves, in the 1980s through the early 1990s. Five top executives resigned after the company admitted to having falsified safety.

In 2003, Tepco shut down all of its nuclear reactors for inspections, acknowledging the systematic cover-up of inspection data showing cracks in reactors.

Japanese regulators already have some credibility issues after previous episodes in which the strength of the response was called into question.

In Japan in 1999, an uncontrolled nuclear chain reaction at a uranium-reprocessing plant killed two employees and spewed radioactive neutrons over the countryside. Government officials later said safety equipment at the plant was missing and the people involved lacked training, adding that their assessment of the accident's seriousness was "inadequate."

In 2007, an earthquake heavily damaged Tepco's Kashiwazaki-Kariwa plant. The company initially said there was no release of radiation, but admitted later that the quake released radiation and spilled radioactive water into the Sea of Japan.

"The Japanese government is saying that the containment's OK, but that belies belief when you see the violence of the explosion," said John Large, a nuclear consultant, referring to the current troubles at the plant. He added, "Understandably, they do not want to panic their population."

The recent problems have prompted new rounds of warnings from anti-nuclear groups. "A nuclear disaster which the promoters of nuclear power in Japan said wouldn't happen is in progress," the Tokyo-based Citizens' Nuclear Information Center said in a statement on its website. "It is occurring as a result of an earthquake that they said would not happen."

—Alison Tudor
and Dionne Searcey contributed to this article.

Balarabe, Sarah

From: Cullingford, Michael
Sent: Tuesday, March 15, 2011 8:30 AM
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WNN WEEKLY
world nuclear news
The week's top stories

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Our mailing address is:
World Nuclear Association
Carlton House, 22a St James's Square
London, Westminster SW1Y4JH

Stevens, Gary

From: Stevens, Gary
Sent: Tuesday, March 15, 2011 3:36 PM
To: Csontos, Aladar
Subject: Mark I Containment Corrosion
Attachments: IN 86-99 (Degradation of Steel Containments - ML031250248).pdf; IN 86-99 Supplement 1 (Degradation of Steel Containments - ML03250234).pdf; IN 88-82 (Torus Shells with Corrosion and Degraded Coatings - ML031150069).pdf; IN 88-82, SUPPLEMENT 1.txt

Al:

As I mentioned, there was significant corrosion of the Oyster Creek torus in the 1980s. This was the subject of several NRC Information Notices, which are attached.

Gary L. Stevens
Senior Materials Engineer
NRC/RES/DE/CIB
Gary.Stevens@nrc.gov
301-251-7569

H-19

SSINS No.: 6835
IN 86-99

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

December 8, 1986

IE INFORMATION NOTICE NO. 86-99: DEGRADATION OF STEEL CONTAINMENTS

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is to provide recipients with current information of a potentially significant safety problem regarding the degradation of a steel containment resulting from corrosion. It is expected that recipients will review this information for applicability to their facilities and consider actions, as appropriate, to promptly recognize or prevent a similar problem from occurring. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

The Oyster Creek Nuclear Generating Station first discovered water in the gap between the boiling-water-reactor drywell and the concrete shield in 1980 and began investigation of the cause in 1983. It appeared that the collection of water varied from a few drops to 2 gallons per minute, depending on whether the unit was in operation or an outage for refueling. During the spring and summer of 1986, the licensee planned work to identify and eliminate this water problem. The bellows at the drywell to cavity seal was repaired and a gasket was replaced, thus stopping the leakage. Since the bellows is located at the top of the drywell and the region above the bellows is flooded during refueling, it would explain why leakage was high during refueling and low during operation.

To determine if the water in the gap had caused damaged to the steel containment, the licensee measured the wall thickness, using an ultrasonic testing (UT) technique at two elevations. The 51-ft level near the drywell seal was sound, but there appeared to be loss of metal on the gap side at the 11-ft 3-in. level immediately above the concrete floor. In this area, the gap is packed with sand and contains five equally spaced drain pipes (see attached Figure 1). A total of 143 measurements were made at this level and 60 indicated a reduction in thickness of more than 1/4 in. from the drawing thickness of 1.154 in. These readings were found throughout seven of the ten downcomer bays. The licensee plans to cut the steel containment and remove about 12 samples to confirm and evaluate the corrosion damage.

8612050463

The licensee plans to remove a section of the drain pipe to perform a visual examination of the outside of the drywell. Wipe samples will be taken from several areas and a chemical analysis will be performed. Sand samples will be taken adjacent to the core holes and will be analyzed for chemicals, bacteria, and water composition. Some channels are being cut in the concrete floor that is inside the drywell to provide access for further UT examination of the containment-sand interface.

Discussion:

The purpose of the sand is to act as a cushion and allow expansion of the drywell during operation. The steel containment is in contact with sand in those areas where corrosion has been detected. The containment material is ASTM A-212 Grade B carbon steel plate. The licensee stated that the outside surface was protected with a red lead coating from above the drywell down to about the 10-ft. level, which means that the interface between the lead paint and the unprotected steel was in contact with wet sand. Red lead protects steel by providing a stable and impenetrable surface, but the steel is sacrificial with respect to the lead in dilute, acidic water conditions.

It is possible that condensation during initial construction, moisture pickup through the drain line during operation, and the leaking bellows wetted the sand, thereby causing corrosion of the containment steel plates. During construction, water was seen running down the outside of containment into the sand. The five drain lines, as well as other penetrations in the concrete shield, are open during operation and would allow moist air to enter and rise up the gap and later cool and condense as water. Water also was able to enter the gap through the holes in the bellows during refueling until repairs were made.

A related matter is discussed in IE Information Notice 86-35, "Fire in Compressible Material at Dresden Unit 3," where a large amount of water was used to extinguish the slowly burning fire between the drywell and the concrete shield. Oyster Creek uses different filler material.

The NRC is continuing to obtain and evaluate pertinent information. If specific actions are required, an additional notification will be made.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate regional office or this office.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: Paul Cortland, IE
(301) 492-4175

Attachments:
1. Figure 1, Sketch of Possible Degraded Area
2. List of Recently Issued IE Information Notices

Sketch of Possible Degraded Areas

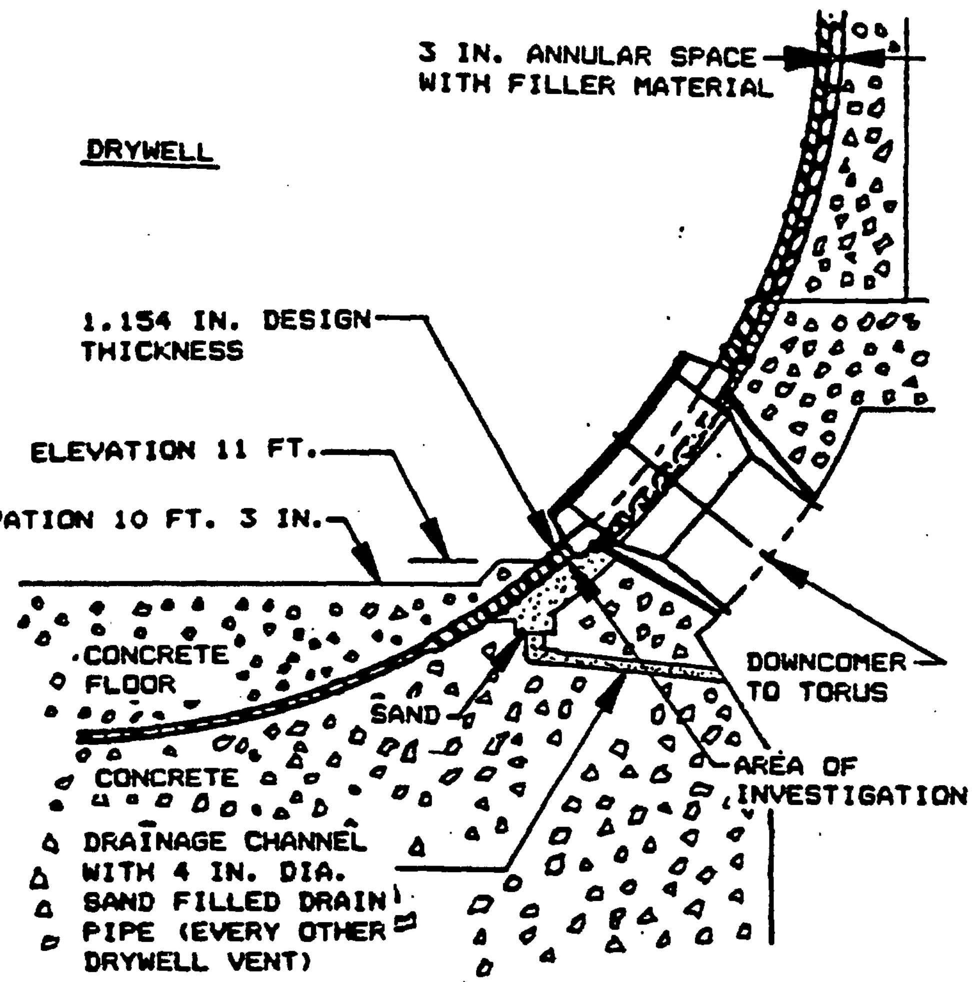

Figure 1

Attachment 2
IN 86-99
December 8, 1986

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-21 Sup. 1	Recognition Of American Society Of Mechanical Engineers Accreditation Program For N Stamp Holders	12/4/86	All power reactor facilities holding an OL or CP
86-98	Offsite Medical Services	12/2/86	All power reactor facilities holding an OL or CP
86-97	Emergency Communications System	11/28/86	All power reactor facilities holding an OL or CP and fuel facilities
86-96	Heat Exchanger Fouling Can Cause Inadequate Operability Of Service Water Systems	11/20/86	All power reactor facilities holding an OL or CP
86-95	Leak Testing Iodine-125 Sealed Sources In Lixi, Inc. Imaging Devices and Bone Mineral Analyzers	11/14/86	All NRC licensees authorized to use Lixi, Inc. imaging devices
86-94	Hilti Contrete Expansion Anchor Bolts	11/6/86	All power reactor facilities holding an OL or CP
86-93	IEB 85-03 Evaluation Of Motor-Operators Identifies Improper Torque Switch Settings	11/3/86	All power reactor facilities holding an OL or CP
86-82 Rev. 1	Failures Of Scram Discharge Volume Vent And Drain Valves	11/4/86	All power reactor facilities holding an OL or CP
86-92	Pressurizer Safety Valve Reliability	11/4/86	All PWR facilities holding an OL or CP

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

February 14, 1991

NRC INFORMATION NOTICE NO. 86-99, SUPPLEMENT 1: DEGRADATION OF STEEL CONTAINMENTS

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This supplement to Information Notice (IN) 86-99 is intended to alert addressees to additional information about a potential degradation problem regarding corrosion in steel containments. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this supplement to the information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Discussion:

IN 86-99 was issued on December 8, 1986, in response to the discovery of significant corrosion on the external surface of the carbon steel drywell in the sand bed region of the Oyster Creek plant. This supplement updates the status of Oyster Creek containment corrosion and the licensee's mitigation program.

Since drywell corrosion was detected in 1986, the licensee instituted periodic wall thickness measurements by the ultrasonic testing (UT) technique to determine corrosion rates. The most severe corrosion was found in the sand bed region at a nominal elevation of 11'-3". The highest corrosion rate determined was 35.2±6.8 mils per year. To mitigate the corrosion in the sand bed region, water was drained from the sand bed and cathodic protection (CP) was installed in the bays with the greatest wall thinning in early 1989. Subsequent UT thickness measurements in these bays indicated that CP was ineffective. The licensee's consultants indicated that it would be necessary to flood the sand bed and to install CP in all the bays to make the CP system effective. The licensee decided that large amounts of water in the sand bed would be counterproductive.

9102080329

In the spherical portion of the drywell above the sand bed region, the highest corrosion rate determined was 4.6±1.6 mils per year at a nominal elevation of 51'. In the cylindrical portion of the drywell above the spherical portion, where minor corrosion was discovered and was thought to have originated mostly during construction, no significant wall thinning was detected (at a nominal elevation of 87'). However, this is the region in which the nominal thickness of the wall has the least margin, thus requiring periodic monitoring of actual thickness.

The licensee has instituted a drywell program to arrest corrosion and to ensure containment integrity for the full licensed term of the plant. The licensee has taken action to investigate, identify, and correct leak paths into the drywell gap and plans to take more action to survey leakage and prevent it. The stainless steel liners in the refueling cavity and the equipment pool developed cracks along the perimeter of the liner plates where they were welded to embedded channels. For the refueling cavity, all potential leakage pathways have been thoroughly checked and liner cracks are sealed with adhesive stainless steel tape before a strippable coating is applied. Since the refueling cavity is flooded only during refueling, no leakage concerns exist at other times. At the end of an outage, the refueling cavity is drained, and the tape and strippable coating are removed. The licensee found leaks related to the equipment pool and stopped them with liner weld repairs. The equipment pool also will be protected with a strippable coating during flooded periods of operation.

The licensee believes that a thorough program has been established for managing leakage that could affect drywell integrity due to corrosion from moisture ingress into the drywell gap. Recent surveillance of the sand bed drains indicates that the sand bed is free of water. To further mitigate drywell corrosion, the licensee is considering removing the sand, insulation, gap filler material, and corrosion film and applying a protective coating to the exterior drywell surface. The licensee is proceeding with the analysis, engineering and planning to support removing the sand from the drywell sand bed region in the near future. Removal of the insulation and gap filler material from the drywell gap is being evaluated for future consideration.

The BWR Owners Group is surveying its members to determine whether other plants are experiencing water leakage into the drywell gap and possible corrosion of the exterior surfaces in the sand bed region as well as in the spherical and cylindrical parts of the drywell.

This supplement requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate NRR project manager.

Charles E. Rossi

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contacts: Frank J. Witt, NRR
(301) 492-0767

C.P. Tan, NRR
(301) 492-3315

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-32, Supp. 1	Surveillance Testing of Low-Temperature Overpressure-Protection Systems	02/12/91	All holders of OLs or CPs for nuclear power reactors.
91-10	Summary of Semiannual Program Performance Reports on Fitness-for-Duty (FFD) in the Nuclear Industry	02/12/91	All holders of OLs or CPs for nuclear power reactors.
91-09	Counterfeiting of Crane Valves	02/05/91	All holders of OLs or CPs for nuclear power reactors.
91-08	Medical Examinations for Licensed Operators	02/05/91	All holders of OLs or CPs for nuclear power, test and research reactors.
90-77, Supp. 1	Inadvertent Removal of Fuel Assemblies from the Reactor Core	02/04/91	All holders of OLs or CPs for pressurized-water reactors (PWRs).
91-07	Maintenance Deficiency Associated with General Electric Horizontal Custom 8000 Induction Motors	02/04/91	All holders of OLs or CPs for nuclear power reactors.
91-06	Lock-up of Emergency Diesel Generator and Load Sequencer Control Circuits Preventing Restart of Tripped Emergency Diesel Generator	01/31/91	All holders of OLs or CPs for nuclear power reactors.
91-05	Intergranular Stress Corrosion Cracking in Pressurized Water Reactor Safety Injection Accumulator Nozzles	01/30/91	All holders of OLs or CPs for pressurized water reactors (PWRs).
91-04	Reactor Scram Following Control Rod Withdrawal Associated with Low Power Turbine Testing	01/28/91	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

October 14, 1988

NRC INFORMATION NOTICE NO. 88-82: TORUS SHELLS WITH CORROSION AND DEGRADED COATINGS IN BWR CONTAINMENTS

Addressees:

All holders of operating licenses or construction permits for boiling water reactors (BWRs).

Purpose:

This information notice is being provided to alert addressees to the discovery of suppression pool steel shells with corrosion and degraded coatings in BWR containments. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

During recent NRC inservice inspections (50-220/88-09 and 50-410/88-09) at the Nine Mile Point Nuclear Station (NMPNS), inspectors found that the inside surface of the torus shell at Unit 1, which was designed and constructed as uncoated, had corroded. Furthermore, the NRC inspectors' independent thickness measurements of the torus shell revealed several areas in which the thickness was at or below the minimum specified wall thickness. Based on additional analysis, it was determined that the shell thickness is acceptable until June 1989 at which time the licensee will perform an ultrasonic reexamination of the torus shell. Based on the findings, the licensee is committed to take corrective actions.

A recent survey of BWRs located in NRC Region I also revealed that some Mark I tori had experienced degradation of the coating and that cleaning and recoating were required. The cause of these degradations is not yet fully understood.

Discussion:

Although the torus shell thinning due to corrosion observed at NMPNS Unit 1 and the coating degradation in tori of other Region I plants have no immediate effect on plant operation, the NRC staff considers these deficiencies to be significant because the measured corrosion rates of torus shells are greater than the corrosion rates assumed as part of the original design. The torus shell degradation, if it continues, may jeopardize containment integrity.

Many licensees of BWR plants are currently required to perform periodic visual inspections of the suppression pool steel shells or liners in accordance with their technical specifications, but the methods used by licensees vary. Some licensees examine only those portions of the torus above the water line, and others employ divers or use cameras to inspect submerged surfaces. Such inspections can only detect general degradation. Localized degradation such as pitting can be detected most effectively by draining the torus and inspecting it under dry conditions. In view of the importance of the containment to the health and safety of the general public, licensees may wish to review and evaluate the adequacy of their containment surveillance programs to determine if any problems similar to those described above exist at their plants.

This information notice also applies to suppression pools for other types of BWR containments (Mark II and Mark III), whether built of steel or of concrete with a steel liner, because the steel shell or liner may degrade through disintegration of the paint system and /or corrosion of the base metal.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contact: Chen P. Tan, NRR
(301) 492-0829

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-81	Failure of Amp Window Indent Kynar Splices and Thomas and Betts Nylon Wire Caps During Environmental Qualification Testing	10/7/88	All holders of OLs or CPs for nuclear power, test, and research reactors.
88-80	Unexpected Piping Movement Attributed to Thermal Stratification	10/7/88	All holders of OLs or CPs for PWRs.
88-79	Misuse of Flashing Lights for High Radiation Area Controls	10/7/88	All holders of OLs or CPs for nuclear power reactors.
88-69, Supp 1	Movable Contact Finger Binding in HFA Relays Manufactured by General Electric (GE)	9/29/88	All holders of OLs or CPs for nuclear power reactors.
88-78	Implementation of Revised NRC-Administered Requalification Examinations	9/22/88	All holders of OLs or CPs for nuclear power reactors.
88-77	Inadvertent Reactor Vessel Overfill	9/22/88	All holders of OLs or CPs for BWRs.
88-76	Recent Discovery of a Phenomenon not Previously Considered in the Design of Secondary Containment Pressure Control	9/19/88	All holders of OLs or CPs for nuclear power reactors.
88-75	Disabling of Diesel Generator Output Circuit Breakers by Anti-Pump Circuitry	9/16/88	All holders of OLs or CPs for nuclear power reactors.
88-74	Potentially Inadequate Performance of ECCS in PWRs During Recirculation Operation Following a LOCA	9/14/88	All holders of OLs or CPs for W and B&W-designed nuclear power reactors.

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UNITED STATES
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OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

May 2, 1989

Information Notice No. 88-82, SUPPLEMENT 1: TORUS SHELLS WITH CORROSION AND DEGRADED COATINGS IN BWR CONTAINMENTS

Addressees:

All holders of operating licenses or construction permits for boiling water reactors (BWRs).

Purpose:

This information notice updates Information Notice No. 88-82, dated October 14, 1988, by providing additional insight into the underwater inspection method for detecting corrosion and degraded coatings of suppression pool steel shells in BWR containments. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Background:

Information Notice No. 88-82 discussed the problem of corrosion and degraded coatings in BWR suppression pool steel shells. The notice indicated that the measured corrosion rate of some torus shells exceeds the design corrosion rate. Because torus shell degradation affects containment integrity, BWR licensees perform periodic visual inspections of the suppression pool steel shells. These visual inspections can be performed in several different ways. Information Notice No. 88-82 stated that the most effective inspection method was to drain the torus and inspect it under dry conditions.

Discussion:

The NRC has obtained additional information about underwater inspection techniques of BWR suppression pool shells that addressees may wish to consider. The capabilities of the underwater technique appear to include desludging, mapping of critical areas, coating adhesion tests, measurement of dry film thickness, and spot repairs of degraded areas. Potential advantages from the technique appear to be reduced radiation exposure of personnel and elimination of the need for draining the suppression pool.

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No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contact: Daniel Prochnow, NRR
(301) 492-1166

Attachment: List of Recently Issued NRC Information Notices
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Attachment IN 88-82, Supplement 1 May 2, 1989 Page 1 of 1

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-43	Permanent Deformation of Torque Switch Helical Springs in Limitorque SMA-Type Motor Operators	5/1/89	All holders of OLs or CPs for nuclear power reactors.
88-97, Supp. 1	Potentially Substandard Valve Replacement Parts	4/28/89	All holders of OLs or CPs for nuclear power reactors.
89-42	Failure of Rosemount Models 1153 and 1154 Transmitters	4/21/89	All holders of OLs or CPs for nuclear power reactors.
89-41	Operator Response to Pressurization of Low-Pressure Interfacing Systems	4/20/89	All holders of OLs or CPs for nuclear power reactors.
88-75, Supplement 1	Disabling of Diesel Generator Output Circuit Breakers by Anti-Pump Circuitry	4/17/89	All holders of OLs or CPs for nuclear power reactors.
89-40	Unsatisfactory Operator Test Results and Their Effect on the Requalification Program	4/14/89	All holders of OLs or CPs for nuclear power reactors.
89-39	List of Parties Excluded from Federal Procurement or Non-Procurement Programs	4/5/89	All holders of OLs or CPs for nuclear power reactors.
89-38	Atmospheric Dump Valve Failures at Palo Verde Units 1, 2, and 3	4/5/89	All holders of OLs or CPs for nuclear power reactors.
89-37	Proposed Amendments to 40 CFR Part 61, Air Emission Standards	4/4/89	All U.S. NRC licensees.

for Radionuclides

OL = Operating License
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Stevens, Gary

From: Stevens, Gary
Sent: Tuesday, March 15, 2011 3:32 PM
To: Csontos, Aladar
Subject: The Torus (Suppression Chamber) Portion of the Mark I Containment
Attachments: image002.png; image006.png

Al:

Provided below is general description of the torus of a Mark I containment for an un-named BWR-4 plant.

Gary L. Stevens
Senior Materials Engineer
NRC/RES/DE/CIB
Gary.Stevens@nrc.gov
301-251-7569

Suppression Chamber (Torus)

The suppression chamber is in the general form of a torus and is constructed of 16 mitered cylindrical shell segments as shown in Figure 1. The mitered cylinders which make up the torus have an inside diameter of 30'-8", with a shell plate thickness of 1". The radius from the centerline of the drywell to the center of the torus at a section taken midway between the mitered joints is 56'-4". The suppression chamber shell is reinforced at each mitered joint and at the midpoint of each mitered cylinder by T-shaped ring beams. The centerline of the ring beam at the mitered joint is offset 3-1/2" in a plane paralle1 to the plane of the mitered joint. The flange and cover plates of the mitered joint ring beams are rolled to a constant inside radius. The mitered joint ring beam web depth varies around the circumference of the suppression chamber. The mid-cylinder ring beams are of constant depth. The components of the suppress ion chamber are shown in Figure 2.

Figure 1: PLAN VIEW OF CONTAINMENT

H-20

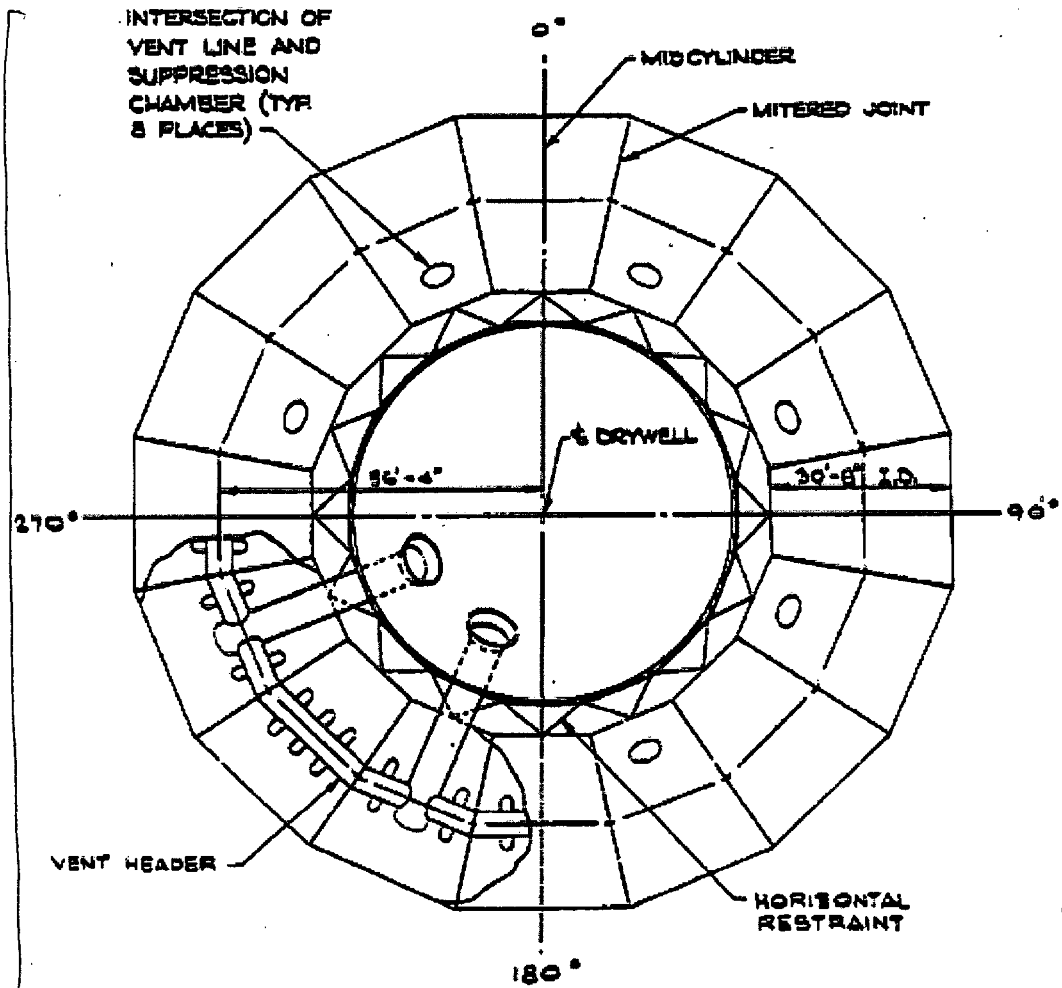
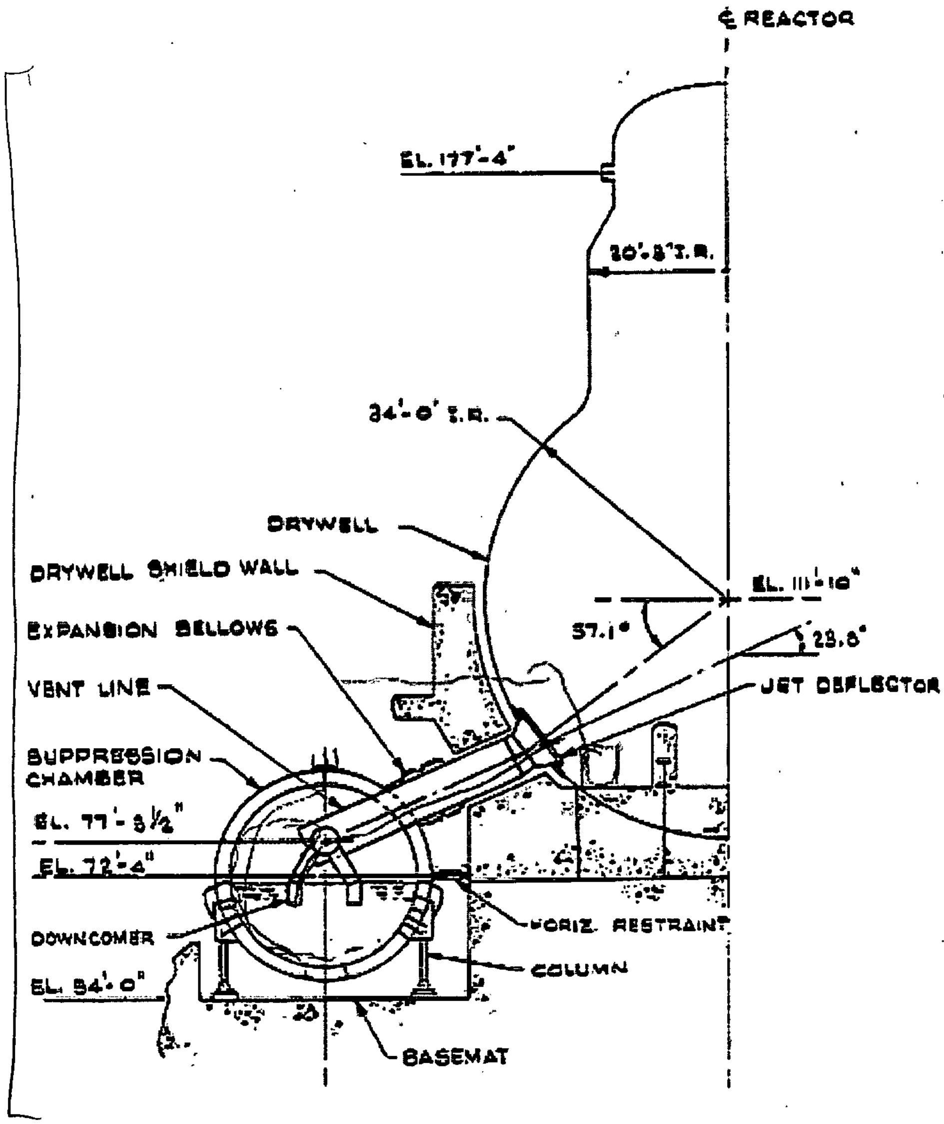


Figure 2: ELEVATION VIEW OF CONTAINMENT



℄ REACTOR
EL. 177'-4"
30'-3" I.R.
34'-0" I.R.
DRYWELL
DRYWELL SHIELD WALL
EXPANSION BELLOWS
VENT LINE
SUPPRESSION CHAMBER
EL. 77'-3½"
EL. 72'-4"
DOWNCOMER
EL. 54'-0"
EL. 111'-10"
57.1°
23.8°
JET DEFLECTOR
HORIZ. RESTRAINT
COLUMN
BASEMAT

Stevens, Gary

From:	Stevens, Gary
Sent:	Tuesday, March 15, 2011 2:40 PM
To:	Csontos, Aladar
Subject:	Mark I Containment
Attachments:	NUREG-0661 Supplement 1 (SER for Mark I Containment Program).pdf; NUREG-0661 (SER for Mark I Containment Program).pdf

Al:

In response to your request, here is background on the BWR Mark I containment structure, which is the containment design for 5 of the 6 BWR units at the Fukushima-Daiichi site in Japan (Unit 1 = BWR-3 with Mark I, Units 2 – 5 = BWR-4 with Mark I, Unit 6 = BWR-5 with Mark II). Please note that this was a very complex and significant issue, and I have only grazed the surface in this summary.

In the early to mid-1970s, during testing for an Advanced Boiling Water Reactor (ABWR) containment system design (Mark III), suppression pool hydrodynamic loads were identified which had not been considered in the original design of the Mark I containment system. To address this issue, a Mark I Owners Group was formed and the assessment was divided into a short-term and long-term program. The results of the NRC staff's review of the Mark I Containment Short Term Program are described in NUREG-0408 (I have requested this report from the Library as it is not available electronically). NUREG-0661 and NUREG-0661 Supplement 1 (both attached) describe the results of the NRC staff's review of the generic Mark I Containment Long Term Program (LTP). The LTP was conducted to provide a generic basis to define suppression pool hydrodynamic loads and the related structural acceptance criteria, such that a comprehensive reassessment of each Mark I containment system would be performed. A series of experimental and analytical programs were conducted by the Mark I Owners Group to provide the necessary bases for the generic load definition and structural assessment techniques. The generic methods proposed by the Mark I Owners Group, as modified by the NRC staff's requirements, will be used to perform plant-unique analyses, which will identify the plant modifications, if any, that will be needed to restore the originally intended margin of safety in the Mark I containment designs.

Note that all U.S. Mark I plants performed plant unique analyses, which are documented in Plant Unique Analysis Reports (PUARs) specific to each plant. Most of these analyses led to plant-specific modifications that were made to the Mark I containment structure at each plant.

This was the subject of significant litigation and settlement between several of the U.S. utilities and GE during the 1980s.

I have some other supporting reports, if needed.

Let me know if you need anything else.

Gary L. Stevens
Senior Materials Engineer
NRC/RES/DE/CIB
Gary.Stevens@nrc.gov
301-251-7569

H-21

NRC FORM 335 (7-77)

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

1. REPORT NUMBER (Assigned by DDC): NUREG-0661 Supplement No. 1

4. TITLE AND SUBTITLE (Add Volume No., if appropriate):
Safety Evaluation Report for the Mark I Containment Long-Term Program
Resolution of Generic Technical Activity A-7

2. (Leave blank)

3. RECIPIENT'S ACCESSION NO.

7. AUTHOR(S)

5. DATE REPORT COMPLETED: MONTH August, YEAR 1982

9. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code):
U.S. Nuclear Regulatory Commission
Division of Safety Technology
Office of Nuclear Reactor Regulation
Washington, DC 20555

DATE REPORT ISSUED: MONTH August, YEAR 1982

6. (Leave blank)

8. (Leave blank)

12. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code):
U.S. Nuclear Regulatory Commission
Division of Safety Technology
Office of Nuclear Reactor Regulation
Washington, DC 20555

10. PROJECT/TASK/WORK UNIT NO.

11. CONTRACT NO.

13. TYPE OF REPORT: Regulatory

PERIOD COVERED (Inclusive dates)

15. SUPPLEMENTARY NOTES

14. (Leave blank)

16. ABSTRACT (200 words or less)

NUREG-0661 was originally issued in July 1980 with four open items which have now been resolved. The four open items consisted of the downcomer oscillation load definition and the confirmatory analyses and test programs which were intended to justify the adequacy of the load specification. The confirmatory efforts concern the assessment of compressible flow effects in the scaled pool swell tests and the confirmation of condensation oscillation load magnitude and global symmetry.

The staff has reviewed the improved downcomer condensation oscillation load definition provided by the Mark I Owners' Group and find it acceptable. The staff has also reviewed the confirmatory experimental and analytical programs conducted by the Mark I Owners' Group and have concluded that the adequacy of the various load specifications have been justified.

This Supplement No. 1 to NUREG-0661 therefore serves as the staff's final resolution of Unresolved Safety Issue A-7.

17. KEY WORDS AND DOCUMENT ANALYSIS:
Mark I Containment
Long Term Program

17a. DESCRIPTORS

17b. IDENTIFIERS/OPEN-ENDED TERMS:
Mark I Containment

18. AVAILABILITY STATEMENT: Unlimited

19. SECURITY CLASS (This report): Unclassified

20. SECURITY CLASS (This page): Unclassified

21. NO. OF PAGES

22. PRICE: $

NRC FORM 335 (7-77)

NUREG-0661
Supplement No. 1

Safety Evaluation Report
Mark I Containment Long-Term Program
Resolution of Generic Technical Activity A-7

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

August 1982

NOTICE

Availability of Reference Materials Cited in NRC Publications

Most documents cited in NRC publications will be available from one of the following sources:

1. The NRC Public Document Room, 1717 H Street, N.W.
   Washington, DC 20555
2. The NRC/GPO Sales Program, U.S. Nuclear Regulatory Commission,
   Washington, DC 20555
3. The National Technical Information Service, Springfield, VA 22161

Although the listing that follows represents the majority of documents cited in NRC publications, it is not intended to be exhaustive.

Referenced documents available for inspection and copying for a fee from the NRC Public Document Room include NRC correspondence and internal NRC memoranda; NRC Office of Inspection and Enforcement bulletins, circulars, information notices, inspection and investigation notices; Licensee Event Reports; vendor reports and correspondence; Commission papers; and applicant and licensee documents and correspondence.

The following documents in the NUREG series are available for purchase from the NRC/GPO Sales Program: formal NRC staff and contractor reports, NRC-sponsored conference proceedings, and NRC booklets and brochures. Also available are Regulatory Guides, NRC regulations in the *Code of Federal Regulations*, and *Nuclear Regulatory Commission Issuances*.

Documents available from the National Technical Information Service include NUREG series reports and technical reports prepared by other federal agencies and reports prepared by the Atomic Energy Commission, forerunner agency to the Nuclear Regulatory Commission.

Documents available from public and special technical libraries include all open literature items, such as books, journal and periodical articles, and transactions. *Federal Register* notices, federal and state legislation, and congressional reports can usually be obtained from these libraries.

Documents such as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings are available for purchase from the organization sponsoring the publication cited.

Single copies of NRC draft reports are available free upon written request to the Division of Technical Information and Document Control, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at the NRC Library, 7920 Norfolk Avenue, Bethesda, Maryland, and are available there for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

NUREG-0661
Supplement No. 1

Safety Evaluation Report
Mark I Containment Long-Term Program
Resolution of Generic Technical Activity A-7

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

August 1982

ii

ABSTRACT

When the NRC staff published "Safety Evaluation Report, Mark I Containment Long-Term Program" (NUREG-0661) in July 1980, four areas were identified where the technical issues had not been fully resolved. These were: (1) specification for condensation oscillation loads acting on the downcomers, (2) adequacy of the data base for specifying torus wall pressures during condensation oscillations, (3) possibility of asymmetric torus loading during condensation oscillations, and (4) effect of fluid compressibility in the vent system on pool swell loads. The first item, downcomer condensation oscillation loads, lacked an acceptable load definition. The remaining three items had acceptable specifications; however, NRC requested additional confirmatory information to justify the adequacy of the load specifications.

This supplement addresses the resolution of the four issues listed above. In response to NRC concerns expressed in NUREG-0661, the Mark I Owners Group conducted additional experimental and analytical studies. The experimental studies consisted basically of two additional condensation oscillation tests in the Full-Scale Test Facility (Norco, California). The staff has reviewed these efforts and has concluded that all technical issues connected with the generic Mark I Long-Term Program have been resolved.

TABLE OF CONTENTS

ACKNOWLEDGMENTS

The following individuals contributed substantially to this report:

C. I. Grimes, USNRC, Division of Licensing
J. D. Ranlet, Brookhaven National Laboratory
G. Maise, Brookhaven National Laboratory
R. L. Kosson, Brookhaven National Laboratory (Grumman Aerospace Corporation)
C. Brennen, California Institute of Technology
A. A. Sonin, Massachusetts Institute of Technology
G. Bienkowski, Princeton University

ACRONYMS AND INITIALISMS

BWR	boiling water reactor
DBA	design-basis accident
EPRI	Electric Power Research Institute
FSI	fluid-structure interaction
FSTF	Full-Scale Test Facility
GE	General Electric Company
IBA	intermediate-break accident
LDR	Load Definition Report
LLL	Lawrence Livermore Laboratory
LOCA	loss-of-coolant accident
LTP	long-term program
NRC	Nuclear Regulatory Commission
PSD	power spectral density
PUAAG	plant-unique analysis-applications guide
QSTF	Quarter-Scale Test Facility
RMS	root-mean-square
SBA	small-break accident
SER	Safety Evaluation Report
STP	short-term program

1 INTRODUCTION AND SUMMARY

The suppression pool hydrodynamic loads associated with a postulated loss-of-coolant accident (LOCA) were first identified during large-scale testing of an advanced design pressure-suppression containment (Mark III). These additional loads, which had not explicitly been included in the original Mark I contain ment design, result from the dynamic effects of drywell air and steam being rapidly forced into the suppression pool (torus). Because these hydrodynamic loads had not been considered in the original design of the Mark I containment, a detailed reevaluation of the Mark I containment system was required.

The historical development of the bases for the original Mark I design as well as a summary of the two-part overall program (i.e., Short-Term and Long-Term Programs) used to resolve these issues is in Section 1 of NUREG-0661, "The Safety Evaluation Report Mark I Long-Term Program" (SER) (Ref. 1). Reference 2 describes the staff's evaluation of the Short-Term Program (STP) used to verify that licensed Mark I facilities could continue to operate safely while the Long-Term Program (LTP) was being conducted.

The objectives of the LTP were to establish design-basis (conservative) loads that are appropriate for the anticipated life of each Mark I boiling water reactor (BWR) facility (40 years) and to restore the originally intended design-safety margins for each Mark I containment system. The principal thrust of the LTP has been the development of generic methods for the definition of suppression pool hydrodynamic loadings and the associated structural assessment techniques for the Mark I configuration. The generic aspects of the Mark I Owners Group LTP were completed with the submittal of "Mark I Containment Program Load Definition Report" (Ref. 3), hereafter referred to as LDR, and "Mark I Containment Program Structural Acceptance Guide" (Ref. 4), hereafter referred to as the PUAAG, as well as supporting reports on the LTP experimental and analytical tasks.

The Mark I containment LTP SER (Ref. 1) presented the staff's review of the generic suppression pool hydrodynamic load definition and structural assessment techniques proposed in the reports cited above. On the basis of the review of the experimental and analytical programs conducted by the Mark I Owners Group, the staff has concluded that, with one exception, the proposed suppression pool hydrodynamic load definition procedures, as modified by the NRC Acceptance Criteria in Appendix A of Reference 1, will provide a conservative estimate of these loading conditions. The exception is the lack of an acceptable specification for the downcomer condensation oscillation loads. In addition, the staff requested confirmatory programs to justify the adequacy of the load specifications in the following three areas: (1) adequacy of the data base for specifying torus wall pressures during condensation oscillations, (2) possibility of asymmetric torus loading during condensation oscillations, and (3) effect of fluid compressibility in the vent system on pool-swell loads. This report supplements the Mark I SER (NUREG-0661) by addressing the outstanding issues relating to the Mark I containment LTP, namely the downcomer condensation oscillation load definition and the confirmatory analyses and test programs that are intended to justify the adequacy of the load specifications.

A discussion of these issues can be found in Reference 1, as shown in Table 1. Also shown in Table 1 are the sections of this report where the supplemental reviews of these items are discussed.

Based on the above reviews, the staff has concluded that the improved load definition submitted by the Mark I Owners Group for downcomer condensation oscillation loads is acceptable. In addition, the staff has concluded that the load specification associated with the confirmatory experimental and analytical programs has been justified. Thus, the staff has concluded that the outstanding issues relating to the Mark I containment LTP have been resolved.

Table 1 Tabulation of Pertinent Mark I Outstanding Issues Documentation

Issue	NUREG-0661 SER Section	Supplement Section
Downcomer Condenstion Oscillation Loads	3.8.2	2.1
Condensation Oscillation Load Magnitude Confirmation	3.8	2.2
Confirmation of Condensation Oscillation Load Global Symmetry	3.8.1	2.3
Compressibility Effects in Scaled Pool Swell Tests	3.4	2.4

2 HYDRODYNAMIC LOAD EVALUATION AND CONFIRMATION

2.1 Downcomer Condensation Oscillation Loads

Condensation oscillation loads and chugging loads refer to the oscillatory pressure loads imparted to structures as a result of the unsteady, transient behavior of the condensation of the steam (released during a LOCA) occurring near the end of the downcomers. Because the nature of this unsteadiness has been found to be significantly different at high steam-flow rates than it is at low steam-flow rates, it is convenient to divide the phenomena into two types: (1) "condensation oscillations," which occur at relatively high vent-flow rates and are characterized by continuous periodic oscillations, with neigh boring downcomers oscillating in phase, and (2) "chugging," which occurs at lower vent-flow rates and is characterized by a series of random pulses that are typically a second or more apart. The classifications--condensation oscillation and chugging--are somewhat arbitrary because there is a continuous spectrum of unsteady condensation phenomena. However, they are convenient for the purposes of defining the nature of the various loading conditions.

When the NRC published NUREG-0661, all the loading specifications in the chugging regime were found acceptable. The concerns with periodic loads related only to those loads resulting from condensation oscillations. Thus, the downcomer loads discussed below, as well as the loads addressed in the next two sections, stem from condensation oscillations.

During the condensation oscillation phase of the blowdown, a harmonic pressure oscillation occurs at the exit of each downcomer. In all Mark I systems the downcomers are tied in pairs: a pair comprises the two downcomers on opposite sides of the vent header, tied together by a tie bar near the exit level (see Figure 2.1-2 in Ref. 1). An inphase harmonic pressure oscillation in the two downcomers of a pair will tend to make the pair oscillate vertically, with each downcomer flexing somewhat at its "knee" and in the region where the downcomer is joined to the ring header. An out-of-phase pressure oscillation will tend to make the pair oscillate in a lateral swinging motion, and this oscillation may give rise to more significant strains in the vent header region.

In the Mark I LTP SER (NUREG-0661), NRC expressed reservations about the then-extant load definition for tied downcomers, and concluded that an improved specification should be developed based on new supplemental experiments in the Full-Scale Test Facility (FSTF). The reservations centered on two concerns: first, that the original load definition lacked an out-of-phase driving force that could excite the swinging motion of a downcomer pair; and second, that more information was needed on the structural response frequencies and damping in the downcomer pair systems.

Based on the new series of tests that the Mark I owners carried out in the FSTF in response to NRC's request, a revised load definition was submitted

(Ref. 5). The new definition applies two superposed components of loading to the downcomers in a pair (see Figure 7-1 and Table 7-1 in Ref. 5) as follows:

(1) An internal pressure of the same magnitude in both of the downcomers in a pair. This tends to cause the vertical oscillation of the pair.

(2) An internal pressure differential between the two downcomers in a pair. This tends to set up the swinging motion of the pair.

These two load components (pressures) are applied synchronously. The load is presented in terms of sinusoids at three frequencies: a fundamental, a second harmonic at twice the fundamental, and a third harmonic at three times the fundamental (further harmonics were not deemed important because even the second and third harmonics contributed relatively little to the strains in the FSTF, which is typical of the Mark I systems). These three sinusoids, each split into components (1) and (2) as described above, are applied simultaneously to represent the total dynamic downcomer load. The amplitudes of the sinusoids were obtained by Fourier analysis from the worst case loading conditions observed in the FSTF tests. The frequencies are based on those observed in the FSTF, modified by an uncertainty band that conservatively accounts for frequency variability within and between tests. For a design-basis accident (DBA), for example, the fundamental is specified to be between 4 and 8 Hz. The actual fundamental frequency to be used in the load specification of a particular plant (the two higher harmonics follow once the fundamental is specified) is to be that frequency from within the uncertainty bands that produces the highest structural strains in the system.

Based on the FSTF data, separate load definitions are derived for DBA and intermediate-break accident (IBA) conditions. The IBA (see Table 7-2 in Ref. 5) has somewhat higher frequencies but lower load amplitudes.

The above discussion defines the dynamic load on a single tied downcomer pair. The FSTF data showed that the swinging motion of one downcomer pair, caused by the pressure differential in (2) above, can be either out-of-phase or inphase with the swinging motion of an adjacent downcomer pair, with no clear rule as to which may be expected. To cover the worst expected loading conditions of the Mark I vent header/downcomer system, eight different combinations of phasing are prescribed for the swinging motion of the various downcomer pairs between two vents. These eight load cases are defined in Figure 7-7 of Reference 5; they include the case in which all downcomers on one side of the header experience positive pressure differentials with respect to their pair-mates on the other side. The load specification calls for the evaluation of all eight load cases for each plant.

This revised load definition is acceptable. It derives primarily from worst case FSTF data and provides for frequency spreading to account for uncertainty. The staff has concluded that the definition addresses and resolves the concerns raised relative to the original specification. Worst case combinations of swinging motion of the various downcomer pairs associated with a bay are conservatively addressed via the eight load cases that are part of the specification.

2.2 Condensation Oscillation Load Magnitude Confirmation

The condensation oscillations that occur at the ends of the downcomers, as described in Section 2.1, produce pressure fluctuations within the pool that are transmitted to the torus walls. This section addresses the adequacy of the data base used to define these wall pressure loadings. The condensation phenomenon involves an unsteady, turbulent, two-phase flow. No reliable analytical methods exist that allow the modelling of such flows. Furthermore, because of the apparently random element in the condensation phenomenon, no reliable and proven empirical engineering methods exist that would allow accurate assessment of either (1) the load magnitudes, (2) the parametric variation of the loads, or (3) the scaling of the loads. Consequently, the load definition must rely on a data base taken from experiments that model closely the conditions in an actual plant. For this reason, condensation oscillation loads for load definition were based on the results of tests conducted in the Full-Scale Test Facility (FSTF), which is a full-scale, 22.5 sector of a typical Mark I torus connected to a simulated drywell and pressure vessel (Ref. 6).

Ten tests were conducted, with parametric variations of break size and type (steam or liquid), submergence, initial pool temperature, and torus pressure (see Table 3.8-1 of Ref. 1). The complete series of tests simulated blowdowns over a range from small breaks to the design-basis accident.

The principal design parameters for the FSTF (vent-area-to-pool-area ratio and distance of the downcomer exit to the torus shell) were selected to produce conservative data from which the loads could be derived. Structurally the FSTF torus sector was a replica of the Monticello plant. (Monticello is considered to be structurally "average" in relation to the range of the Mark I design characteristics.) The FSTF was intended to be prototypical so that loads measured in that facility could be applied directly in the plant-unique analyses. However, condensation oscillation loads transmitted to the structure by the water in the pool have been found to be affected by fluid-structure interaction (FSI) effects. Because there are variations in the structures of different plants, and, consequently, between the individual plants and the FSTF, some analysis and identification of these effects in both the FSTF and individual plants are necessary to define appropriate plant loads.

To assess this effect, the Mark I Owners Group developed a coupled fluid-structure analytical model simulating the FSTF structure and suppression pool (Ref. 7). In this model an assumed oscillatory source applied at the end of each downcomer is varied until the wall pressures match the maximum amplitude pressures observed in the FSTF tests. The source function thus determined is used to derive an equivalent "rigid-wall" pressure transient. From these analyses, a global pressure load on the torus shell is generated. The detailed procedure is described in the LDR (Ref. 3) and summarized in the SER (Ref. 1).

The load specification proposed in the LDR was derived from selected periods of maximum-amplitude test data from the FSTF. The FSI model used to derive the pressure amplitude-frequency spectra incorporates assumptions that are not all necessarily conservative by themselves. However, the overall conservatism of this technique is demonstrated by comparisons of the predicted structural response using the load specification and the measured structural response in the FSTF (Ref. 8). The measured peak structural responses (stresses, displacements and column loads) in the FSTF facility were generally exceeded by the values computed according to the LDR procedure by 80% or more. This suggests that the load application procedure contains conservatisms that should lead to an overall conservative specification as long as the data base is adequate to establish a reasonable representation of the amplitudes of the pressure sources.

The maximum condensation oscillation loads in the FSTF were found to occur for the large-break, liquid blowdown test. Only one such test was conducted in the original test series (M8). The load definition is therefore based almost exclusively on this single blowdown. In view of the periodic nature of the condensation oscillations, as well as the stochastic nature of the complex condensation processes, the staff concluded that test M8 constitutes only a single data point. Consequently, statistical variance or load magnitude uncertainty cannot be established with any useful accuracy from this single test run, even when magnitudes from test runs at much lower vent-flow rates are factored into the analysis. Thus, although the staff accepted the M8 test conditions as both conservative and prototypical for the Mark I design, the information was considered insufficient to establish a reasonable measure of the uncertainty in the loading functions and, hence, to ensure margins of safety in the containment structure.

Nevertheless, the staff concluded that the loads derived from M8 are probably conservative (although the degree of conservatism cannot be quantified) and, therefore, form a sufficient basis to proceed with the implementation of the Mark I LTP. In letters dated October 2, 1979 (Ref. 9), the NRC advised each Mark I licensee that additional FSTF tests would be required to establish the uncertainty in each of the condensation oscillation loads and to confirm the adequacy of the load specifications.

In response, the Mark I Owners Group, with the staff's concurrence, conducted two additional large-break liquid blowdowns in the FSTF Facility (Ref. 5). One test, M11B (meant as a repeat of test M8), was performed under geometric and flow conditions as nearly identical to M8 as was practicable. The type and size of the break as well as the submergence were identical. The nominal initial pool pressure was also identical to M8, and the initial pool temperature was held at 70°F, as in test M8. Test M12 was performed at conditions nominally identical to M8 except that the initial pool temperature was 95°F. The overall blowdown parameters--such as drywell pressure history, flow rate, and wetwell pressure history--are in Reference 5. These parameters are similar for all three tests (M8, M11B, and M12) and do not differ significantly from one another, suggesting a high degree of repeatability of the tests.

The wetwell bottom center pressure, as well as the pressure averaged over all the wetwell transducer locations, shows sufficient similarity in the time history of amplitudes and the frequency content of the oscillations to conclude that condensation oscillations in the FSTF are repeatable phenomena with a dominant deterministic character. The overall amplitude (root-mean-square (RMS) value) of the averaged wetwell pressure in run M11B peaks at a value about 25% below the peak in run M8 that was used to establish the LDR value.

The frequency content is essentially similar, with a fundamental frequency of about 6 Hz as measured in run M8. In run M12 the peak RMS amplitude exceeds run M8 (and the LDR value) by about 15%. The fundamental frequency is shifted slightly from 6 Hz to 5 Hz, but there is no significant difference in the energy content in that frequency range. This is consistent with the model of larger bubbles oscillating at the downcomers as a result of the hotter pool temperature in M12. The major contribution to the increased overall (RMS) amplitude appears to arise from increased energy content in the 20-to-30-Hz range.

On the basis of this information, the Mark I owners conclude that the new tests demonstrate that condensation phenomena are highly repeatable and not overly sensitive to the parameters within their expected ranges. They further conclude that the LDR bounds all of the new pressure data below 20 Hz and is slightly nonconservative between 20 and 30 Hz. The owners further demonstrate (Table 2-11 in Ref. 5) that this slight nonconservatism is not significant because of the conservatisms introduced by the methodology when the loads are applied to the structure. The LDR load definition applied to the FSTF facility using the methodology that is to be applied to the Mark I plants yields peak structural stresses and loads that exceed those measured in M12 by at least 70% and by as much as 150%. The owners therefore conclude that the two supplementary tests confirm the adequacy of the data base used for the load definition in the LDR.

The staff has carefully reviewed the new data and concurs with the Mark I owners' conclusion. While it is difficult to quantify the degree of uncertainty in the results from three blowdowns, reasonably conservative estimates can be made by using 1-second RMS pressure values from all three runs between 22 and 30 seconds (24 points). On this basis, the mean RMS pressure at this high-mass-flow condition is about 2.1 psi, the standard deviation is about 0.5 psi, the LDR value is about 2.5 psi, and run M12 peaks at about 2.9 psi. Because of the high degree of conservatism introduced by the methodology when the loads are applied to the structures, the potential variation of the pressure loading from the LDR value is well within the demonstrated conservatisms for the structural loads. For example, the assumption of a pressure loading that is three standard deviations from the mean (3.6 psi RMS) but that has spatial and frequency distribution identical to run M12 would reduce the demonstrated margin on the hoop membrane stress from 1.7 to about 1.4, thus retaining a substantial conservatism.

The staff considers the condensation oscillation load definition acceptable because of (1) the demonstrated repeatability of the condensation oscillation pressure measurements on the wetwell boundary, (2) the conservative nature of the data base, and (3) the conservative methodology for applying the loads to the torus.

2.3 Confirmation of Condensation Oscillation Load Global Symmetry

The Mark I Containment Program Load Definition Report (Ref. 3) specifies only a symmetric loading of the torus during the condensation oscillation phase of a postulated LOCA. The methodology assumes uniform amplitudes of the sources (or rigid wall pressures) and identical inphase time histories along the circumferential direction of the torus. The FSTF measurements indicated that the amplitudes of the pressure oscillations within all of the instrumented downcomers were approximately the same and showed no discernible trend in the small variations. Comparison of pressure traces also tended to suggest that essentially inphase oscillation was occurring at all of the instrumented downcomers.

The staff concurred with the Mark I owners' specification of a symmetric loading (Ref. 1) subject only to confirmatory analysis verifying that no significant asymmetric loading could be inferred from FSTF data when they are applied to a full Mark I torus.

The staff's concern was based on the potential for a significantly different structural response arising from asymmetric loading coupled with the necessity to extrapolate data from a 22.5° sector (FSTF) data to a full 360 torus. The staff felt that the information on the amplitudes in the original series of FSTF tests (Ref. 6) was sufficient to conclude that no significant asymmetry in amplitude variation can be expected. Because of the need to extrapolate phasing information to a Mark I torus, the staff requested an additional analysis of phasing in the original FSTF data and the confirmation tests (Ref. 9).

The General Electric Company letter report of April 1981 (Ref. 5) responds to this request. The report presents data showing that only the dominant frequency (near 5 Hz) is correlated between the downcomers in the FSTF run M8. The higher frequency components appear more stochastic in character and show no correlation. Phase data for the pressure signals at downcomers spaced 5, 9, and 14 ft apart for the 5-Hz frequency component are presented from the peak condensation oscillation periods in runs M8, M11B, and M12. Phase angles between -16° and 44° are observed with no systematic trend observed in any single time period from a single run. The Mark I owners, therefore, conclude that an asymmetric torus shell load does not need to be specified.

The NRC staff has reviewed the new data and analysis and concurs with that conclusion. The staff examined the data presented for potential systematic variation of phase with distance between downcomers because of the potential consequences that such a trend might have on the extrapolation to a full torus. If all 12 tests are considered for each distance between downcomers, the plot of phase angle vs. distance shows a slightly increasing trend with distance. The statistical scatter, however, totally overwhelms this trend within any single run. In addition, pressure amplitudes at different vents, while similar to each other, do show some variation of a stochastic nature without any evident trend.

Although the data cannot be used to unequivocally conclude that the load at all times must remain symmetric on a full-scale torus, the evidence is very strong that any expected asymmetry will be small and strongly random in direction. The phasing and amplitude correlation information of Reference 5 is consistent with a picture of waves travelling through the venting system, causing phasing between the dominant oscillations at different vents. In addition, the smaller scale, higher frequency oscillations can be attributed to local phenomena occurring at each vent. Thus, the lack of any known mechanism to create a standing wave with some defined direction of asymmetry in the full-scale Mark I geometry, together with the data from Reference 5, provides a reasonable basis for assuming that asymmetries in the condensation load will be small and will be constantly shifting in direction.

The staff, therefore, concludes that there is no need to define an asymmetric condensation oscillation load on the torus shell.

2.4 Compressibility Effects in Scaled Pool-Swell Tests

The Mark I specification for torus upward and downward loads during pool swell is derived from scale model tests. One of the shortcomings of these tests is that the compressibility in the vent system was not properly scaled (acoustic waves in the model vents travel much too fast relative to the velocity of the water slug in the downcomers). As described below, this scaling deficiency could lead to modest underprediction (or overprediction) of the pool-swell loads in Mark I containments.

The general description of events during the pool swell is as follows: In the case of a postulated DBA, as described in SER Section 2.2.1 (Ref. 1), the drywell and vent system are pressurized, causing the water leg initially in the downcomers to be accelerated downward into the suppression pool. Immediately following downcomer clearing, air bubbles form at the exit of the downcomers. As these bubbles form, their presence is felt on the submerged portion of the torus walls as an increase in pressure. Consequently, the torus experiences a dynamic net downward load as the bubble pressure is transmitted through the suppression pool. At that time, the torus airspace has not yet sensed the effects of the transient. The air bubbles continue to expand and decompress, causing a ligament of solid water above the bubbles to be accelerated upward. As the water slug continues to rise, the wetwell airspace volume above the water in the torus is compressed, resulting in a dynamic net upward load on the torus. The pool swell continues until there is a breakup of the water ligament, and direct communication between the bubble and airspace is achieved.

The loading specifications associated with the pool-swell transient are based on the subscale results of the plant-unique test series conducted in the Quarter-Scale Test Facility (QSTF) (Ref. 10) and the Electric Power Research Institute (EPRI) 1/11.7-scale three-dimensional test facility (Ref. 11). The scaling relationships utilized for these tests were developed by Moody (Ref. 12) during the STP and are based on the method of similitude. These scaling relationships have been confirmed by the experimental study presented in Reference 13, as well as by the independent research studies performed for the NRC, as described in References 14 to 16.

Note, however, that all of these confirmations were between scale models of various sizes, with 1/4 scale as the largest. During preliminary calculations to provide justification for the scaled three-dimensional flow distribution in the EPRI 1/11.7-scale pool swell tests, it was discovered that compressibility effects could cause higher torus loadings at full-scale conditions than those loadings derived from scaled-up test data. The mechanism responsible for this stems from communication delays within the vent system. These are negligible in scale models but not in full-scale Mark I systems. These calculations indicated that prior to vent clearing, for example, the vent system exhibited a closed-pipe-type response to the drywell pressure ramp. In other words, acoustic waves travelled back and forth through the vent system during the downcomer clearing process, causing the pressure at the interface (between air and water) to oscillate above and below the instantaneous drywell pressure. Thus, at vent clearing, the pressure at the downcomer end (which is commumicated to the torus bottom) could conceivably be greater than the drywell pressure at that time. Because these effects were not considered in the original load by the above scaling definition (Ref. 3), the staff required that the Mark I Owners Group perform an assessment of compressible flow effects and justify the adequacy of the pool-swell-related loads. A discussion of this assessment, along with the staff's review, follows.

The Mark I Owners Group used the computer code described in Reference 17 to investigate the effects of compressibility on the scaled pool-swell loads. The pool-swell transient was analyzed by means of a one-dimensional, compressible vent-flow model that was coupled to a semi-empirical bubble/pool-swell model. The vent system was treated as a series of nodes connected by flow paths which are used to simulate the lengths, friction losses, and area changes associated with the effective vent and vent header areas that service a single downcomer in a prototype Mark I configuration. The describing equations for the vent flow model, which included both area change and friction, were cast into algebraic form by the use of an implicit backward differencing technique coupled with a linearization method. Of special interest is the semi-empirical bubble model that is used at the exit node of the vent system. The model uses a modified Rayleigh bubble formulation that includes two empirically determined constants. These constants are used to simulate the effects of side walls as well as bubble growth or rise velocity and must be calibrated against available test data. The calibration phase of the model evaluation consisted of benchmarking the model against QSTF test data to select optimal values of the model bubble parameters. Good overall agreement with the test data was obtained over a wide range of Δp (i.e., drywell-to-wetwell pressure differential) and submergence for the drywell pressure, wetwell airspace pressure, bubble pressure, load transients, and torus up and down loads. The parameters selected on this basis were utilized for all remaining calculations, with appropriate variations to account for different scales.

The verification of the computer code was separately performed for the vent system and combined vent-system/pool-swell models. The vent-system model was verified by demonstrating that it accurately describes various test cases with known analytic solutions. The test cases considered were isentropic nozzle flow, constant area Fanno flow, and a transient ramp pressure at the entrance to a dead-end pipe. The vent-flow model quickly converged to a steady state solution for each of the cases, and the resulting values agreed with the known solutions.

The combined vent-system/pool swell model, which had been calibrated using the QSTF data, was checked against available information that consisted of the EPRI 1/11.7-scale test data, the FSTF test data (run M8), and the compressible flow analysis of the EPRI data presented in Reference 18. The comparison of the model-predicted pressures with the EPRI test data showed good agreement, whereas the comparison with the FSTF data provided only a rough estimate of the pressure histories. However, the agreement with the FSTF test data was considered reasonable because of the limitations of the data because the FSTF tests were not pool swell tests and thus did not have the appropriate instrumentation to accurately define the phenomena. The comparison with the compressible flow analysis of Reference 18, which originally identified the possibility of compressibility effects, provided an important part of the program verification. The analyses were compared at both the EPRI 1/11.7-scale as-tested conditions and with correctly scaled compressibility. Both models gave generally similar results, with particularly good agreement in the prediction of the acoustic delays and pressurization rates before vent clearing.

In addition to the above comparisons, timestep and nodalization sensitivity studies were performed to ensure that timestep and node spacings were small enough to achieve reliable results for the purposes of the compressibility study. The approach utilized to assess the possible effects of compressibility consisted of comparing computer runs of: (1) an idealized or "perfect" QSTF simulation of pool swell, within the context of Moody scaling (orifices in vents and air at room temperature), and (2) a corresponding full-scale Mark I scaled down to 1/4 size for purposes of comparison. The "perfect" QSTF configuration is correct in terms of drywell pressurization rate, vent friction, vent volume, and flow resistance split but not in terms of compressibility. The full-scale configuration is correct in all respects, thereby enabling the quantification of the compressibility effects.

The quantities that are most important with regard to load specification are the maximum torus downward and upward vertical pressure loads, and these are used as a measure of the possible effects of compressibility. The calculations were performed using the drywell-to-wetwell pressure differential (Δp) as the variable parameter, with all other quantities kept constant at nominal Mark I conditions. The comparison of the peak downloads (i.e., the ratio of the full-scale download to the "perfect" QSTF download compared at quarter-scale) indicated that for water legs of 4 in. or greater the download is either virtually unaffected or mitigated by the effects of compressibility. For water legs less than 4 in., the peak download comparison affected by compressibility, with a maximum of 11% increase at full Δp. However, because the Mark I plant unique water legs are all greater than or equal to 6 in., no adverse effects as a result of compressibility are indicated. Similarly, the QSTF uploads are shown in Reference 16 to be conservative with respect to the full-scale values by as much as 18%. As a result of the above comparisons, it was concluded in Reference 16 that compressibility effects mitigate the pool-swell loads for operating Mark I conditions.

As stated earlier in this section, the oscillation of interface pressure in the downcomer is responsible for the dependence of the peak downloads on the length of the downcomer water leg. Later in the pool-swell transient, specifically during bubble expansion, mass-flow demands at the downcomer exit are delayed because of compressibility effects. This delay is due to the time required for an acoustic wave to communicate with the drywell or with any other mass-storing volume within the vent system. The delay in the full-scale mass-flow response is termed the compressible mass decrement; it is discussed in detail in Reference 17.

Additional analyses were performed in response to staff questions on the above issues, and the results are presented in Reference 19. The purpose of the calculations was to obtain a quantitative assessment of the compressible mass decrement through comparison of the QSTF "perfect" and full-scale prototype analyses. Mass defects ranging from 7.1% to 11.4% were obtained for several prototypical exit conditions. To estimate the effect of mass defect on peak upload and thereby verify the computer results of Reference 17, a simplified pool-swell analysis consisting of a slab bubble model was utilized. The analysis showed that a mass defect of 7% would yield a 20% upload reduction, which is consistent with the results of Reference 17.

The confirmatory analyses described above have been reviewed by the staff and found to satisfactorily address the concerns raised regarding compressible flow effects in scaled pool-swell tests. Consequently, the staff has concluded that the load definition procedures for the torus downward and upward vertical pressure loads, the torus pool-swell pressure distribution, the vent header pool-swell impact timing, and the vent header deflector impact timing, as modified by the NRC acceptance criteria in Appendix A of the SER, (Ref. 1), are acceptable for the present Mark I operating conditions. However, although the staff is in agreement with the Mark I Owners Group that compressibility effects mitigate the pool-swell loads, no quantitative credit should be taken for these mitigating effects without considerable additional justification. This justification would require a quantitatively correct three-dimensional model of the pool swell process in Mark I containments.

3. REFERENCES

References cited in this report are available as follows:

Those items marked with one asterisk (*) are available in the NRC Public Document Room for inspection; they may be copied for a fee.

Material marked with two asterisks (**) is not publicly available because it contains proprietary information; however, a nonproprietary version is available in the NRC Public Document Room for inspection and may be copied for a fee.

Those reference items marked with three asterisks (***) are available for purchase from the NRC/GPO Sales Program, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, and/or the National Technical Information Service, Springfield, Virginia 22161.

All other material referenced is in the open literature and is available through public technical libraries.

(1) U.S. Nuclear Regulatory Commission, "Safety Evaluation Report, Mark I Long Term Program, Resolution of Generic Technical Activity A-7," NUREG-0661, July 1980.***

(2) U.S. Nuclear Regulatory Commission, "Mark I Containment Short-Term Program Safety Evaluation Report," NUREG- 0408, December 1977.***

(3) General Electric Company, "Mark I Containment Program Load Definition Report," General Electric Topical Report NEDO-21888, Revision 0, December 1978.*

(4) Mark I Owners Group, "Mark I Containment Program Structural Acceptance Criteria Plant-Unique Analysis Applications Guide, Task Number 3.1.3," General Electric Topical Report NEDO-24583, Revision 1, July 1979.*

(5) General Electric Company, "Mark I Containment Program Letter Report: Supplemental Full-Scale Condensation Test Results and Load Confirmation," MI-LR-81-01-P, April 1981.**

(6) G. W. Fitzsimmons, et al., "Mark I Containment Program Full-Scale Test Program Final Report, Task Number 5.11," General Electric Proprietary Report NEDE-24539-P, April 1979.**

(7) Bechtel Power Corporation, "Mark I Containment Program Analysis of Full-Scale Test Facility for Condensation Oscillation Loading, Task 5.17.3," General Electric Proprietary Report NEDE-24645-P, July 1979.**

(8) Letter from L. J. Sobon, General Electric Company, to D. G. Eisenhut, NRC, Subject: Mark I Containment Program Additional Information on NEDO-21888, "Mark I Containment Program Load Definition Report," September 7, 1979.**

(9) Letter from D. G. Eisenhut, NRC, to all boiling water reactor licensees (except Dresden 1, Humboldt Bay, Big Rock Point, and LaCrosse), Subject:

Confirmatory Requirements Relating to Condensation Oscillation Loads for the Mark I Containment Long-Term Program, October 2, 1979.*

(10) General Electric Company, "Mark I Containment Program Quarter-Scale Plant-Unique Tests, Task Number 5.5.3, Series 2," General Electric Proprietary Report NEDE-21944-P, Vols. 1-4, April 1979.**

(11) R. L. Kiang and B. J. Grossi, "Three-Dimensional Pool Swell Modeling of a Mark I Suppression System," Electric Power Research Institute Report EPRI NP-906, October 1978.*

(12) F. J. Moody, "A Systematic Procedure for Scale-Modeling Unsteady Thermo-Fluid Systems," General Electric Topical Report NEDO-25210.

(13) D. L. Galyardt, C. G. Hayes, and S. L. Kushman, "Mark I Containment Pro gram Quarter-Scale Pressure Suppression Pool Swell Test Program: Scaling Evaluation, Task Number 5.5.1," General Electric Proprietary Report NEDE-21627-P, January 1978.**

(14) W. G. Anderson, P. W. Huber, and A. A. Sonin, Massachusetts Institute of Technology, "Small-Scale Modeling of Hydrodynamic Forces in Pressure Suppression Systems," USNRC Report NUREG/CR-003, March 1978.***

(15) Lawrence Livermore Laboratory, "Final Air Test Results for the One-Fifth-Scale Mark I Boiling Water Reactor Pressure Suppression Experiment," USNRC Report NUREG/CR-0151, October 1977.***

(16) C. K. Chan et al., University of California, Los Angeles, "Suppression Pool Dynamics," USNRC Report NUREG/CR-0264-3, February 1978.***

(17) General Electric Company, "Mark I Containment Program, Vent System Compressibility - Effects on Mark I Pool Swell, Task 9.1.4.3," General Electric Proprietary Report NEDE-24778-P, January 1980.**

(18) P. L. Chambre and J. Nitao, "Modeling of the Mark I Pool Suppression System," Nuclear Engineering and Design 64, No. 3, pp. 361-373, April 1981.

(19) W. S. Kennedy, et al., "Response to NRC Questions on NEDE-24778-P, Vent System Compressibility - Effects on Mark I Pool Swell," Prepared for General Electric Co. by Acurex Corporation, May 1980.**

Stutzke, Martin

From:	Stutzke, Martin
Sent:	Tuesday, March 15, 2011 11:40 AM
To:	Beasley, Benjamin
Subject:	FW: draft responses to NBC
Attachments:	NBC_questions.docx
Importance:	High

Looks like RES/DE, et. al. have developed responses as well (see attached). Who's on first?!

Marty

-----Original Message-----
From: Ake, Jon
Sent: Tuesday, March 15, 2011 11:09 AM
To: Stutzke, Martin; Munson, Clifford
Cc: Murphy, Andrew
Subject: draft responses to NBC

Marty, Cliff and Andy-
Here is my first pass at answers to these questions, please revise as you see fit, let me know if we need more, I don't know how to answer the question on timeline.....

H-22

I have these questions:

1. I'd like to make sure that I accurately place in layman's terms the seismic hazard estimates. I need to make sure that I'm understanding the nomenclature for expressing the seismic core-damage frequencies. Let's say there's an estimate expressed as "2.5E-06." (I'm looking at Table D-2 of the safety/risk assessment of August 2010.) I believe that this expression means the same as 2.5 x 10^-06, or 0.0000025, or 2.5 divided by one million. In layman's terms, that means an expectation, on average, of 2.5 events every million years, or once every 400,000 years. Similarly, "2.5E-05" would be 2.5 divided by 100,000, or 2.5 events every 100,000 years, on average, or once every 40,000 years. Is this correct?

   A1: Yes, at least partly. In the subject documents the frequencies for core damage or ground motion exceedance have been expressed in the form "2.5E-06". As you noted this is equivalent to 2.5×10^{-6}, or 0.000025 ***per year***. If, for example, the core damage frequency was estimated as 2.5E-06, this would be equivalent to an expectation of 2.5 divided by a million ***per year***. It is not really correct to think of these values as "once every 400,000 years".

2. These documents give updated probabilistic seismic hazard estimates for existing nuclear power plants in the Central and Eastern U.S. What document has the latest seismic hazard estimates (probabilistic or not) for existing nuclear power plants in the Western U.S.?

   A2: At this time the staff has not formally developed updated probabilistic seismic hazard estimates for the existing nuclear power plants in the Western U.S. NRC staff has continued to stay abreast of the latest research on seismic hazards in the Western U.S. and interface with colleagues at the U.S. Geological Survey. The focus of Generic Issue 199 has been on the CEUS. However, the Information Notice that summarized the results of the Safety/Risk Assessment was sent to all existing reactor licensees. The documents that summarize existing hazard estimates are contained in the FSARS and in the IPEEE submittals.

3. The documents refer to newer data on the way. Have NRC, USGS et al. released those? I'm referring to this: "New consensus seismic-hazard estimates will become available in late 2010 or early 2011 (these are a product of a joint NRC, U.S. Department of Energy, U.S. Geological Survey (USGS) and Electric Power Research Institute (EPRI) project). These consensus seismic hazard estimates will supersede the existing EPRI, Lawrence Livermore National Laboratory, and USGS hazard estimates used in the GI-199 Safety/Risk Assessment."

   A3: The new consensus hazard curves are being developed in a cooperative project that has NRC, U.S. Department of Energy, U.S. Geological Survey (USGS) and Electric Power Research Institute (EPRI) participation. The title is: the Central and Eastern U.S. Seismic Source Characterization (CEUS-SSC) project. The project is being conducted following comprehensive standards to ensure quality and regulatory defensibility. It is in its final phase and is expected to be released in the fall of 2011.

The project manager is Larry Salamone (Lawrence.salamone@srs.gov, 803-645-9195) and the technical lead on the project is Dr. Kevin Coppersmith (925-974-3335, kcoppersmith@earthlink.net).

4. What is the timetable now for consideration of any regulatory changes from this research?

   A4: The next step in this process is to finalize a Generic Letter to be sent to all operating power reactor licensees in the CEUS requesting additional information. That letter is currently being drafted and will be finalized in the upcoming months.

Dion, Jeanne

From: Deegan, George
Sent: Wednesday, March 16, 2011 5:39 PM
To: Dion, Jeanne; Turtil, Richard; Rivera, Alison
Cc: Piccone, Josephine; Jackson, Deborah; Moore, Scott; Wittick, Susan
Subject: RE: Assistance with Commission Brief

Jeanne- Thanks.

Rich/Alison: Can FSME/DILR provide some talking points on the Communication Challenges we're having with States and other stakeholders (for Eliot Brenner's section). Once we have our message (bullets, talking points, background, possible Q&A's) I will provide this to Susan Wittick in OPA. We are probably looking at 2 minutes total out of Eliot's 5 minute presentation.

From: Dion, Jeanne
Sent: Wednesday, March 16, 2011 5:28 PM
To: Howe, Allen; Deegan, George
Cc: Moore, Scott; Piccone, Josephine; Jackson, Deborah; Turtil, Richard; Brock, Kathryn; Frazier, Alan; Wittick, Susan
Subject: RE: Assistance with Commission Brief

Yes- we can. We have staff with expertise in severe accidents (SOARCA) and health effects branch.

Can you provide more information on the agenda item ("advance our understanding of safety and risk")- RES is noted as the lead for the item.

Thanks- Jeanne

From: Howe, Allen
Sent: Wednesday, March 16, 2011 5:22 PM
To: Deegan, George; Dion, Jeanne
Cc: Moore, Scott; Piccone, Josephine; Jackson, Deborah; Turtil, Richard; Brock, Kathryn; Frazier, Alan; Wittick, Susan
Subject: RE: Assistance with Commission Brief

Thanks George – Susan Wittick is coordinating for OPA.

Jeanne – can RES address the consequence projections?

Thanks - Allen

From: Deegan, George
Sent: Wednesday, March 16, 2011 5:18 PM
To: Howe, Allen
Cc: Moore, Scott; Piccone, Josephine; Jackson, Deborah; Turtil, Richard; Brock, Kathryn; Frazier, Alan
Subject: FW: Assistance with Commission Brief
Importance: High

Allen- I think our two emails may have crossed with one another (see my earlier response). I think RES would be best on Consequence Projections, not FSME. We may have some input to provide regarding Communication Challenges (since we serve in a liaison capability with States). If you'd like, I can check with our folks and see if they can develop some talking points to support Eliot's part of the presentation.

H-23

From: Howe, Allen
Sent: Wednesday, March 16, 2011 5:09 PM
To: Dion, Jeanne; Williams, Donna; Bajwa, Chris; Wittick, Susan; Shropshire, Alan; VandenBerghe, John; Deegan, George; Milligan, Patricia
Cc: Meighan, Sean; Hall, Randy; Boska, John
Subject: Assistance with Commission Brief
Importance: High

I am looking for assistance to pull together background information, slides, key messages, talking points and possible Q&A for the Commission briefing on the Japan event. The briefing is likely to happen Monday. Looks like a busy weekend. A rough draft outline is attached with leads for the areas. Please keep in mind that the meeting will be public and the information will be at a fairly high level. If you know of a point of contact that is best suited to address the information, please let me know.

I am working to schedule a meeting tomorrow afternoon @1:30 to flesh this out. I will send out a scheduler with a bridge line.

Thanks - Allen

Dion, Jeanne

From: Howe, Allen
Sent: Wednesday, March 16, 2011 6:00 PM
To: Dion, Jeanne
Subject: RE: Assistance with Commission Brief

Jeanne – I should know more after the EDO alignment meeting tomorrow. This was from a brainstorming session that Marty Virgilio provided. My take on it is that we may ultimately take away some lessons learned from this event regarding initial preparedness, immediate response, any unanticipated phenomena and possible research such as what we did after Chernobyl.

Allen

From: Dion, Jeanne
Sent: Wednesday, March 16, 2011 5:28 PM
To: Howe, Allen; Deegan, George
Cc: Moore, Scott; Piccone, Josephine; Jackson, Deborah; Turtil, Richard; Brock, Kathryn; Frazier, Alan; Wittick, Susan
Subject: RE: Assistance with Commission Brief

Yes- we can. We have staff with expertise in severe accidents (SOARCA) and health effects branch.

Can you provide more information on the agenda item ("advance our understanding of safety and risk")- RES is noted as the lead for the item.

Thanks- Jeanne

From: Howe, Allen
Sent: Wednesday, March 16, 2011 5:22 PM
To: Deegan, George; Dion, Jeanne
Cc: Moore, Scott; Piccone, Josephine; Jackson, Deborah; Turtil, Richard; Brock, Kathryn; Frazier, Alan; Wittick, Susan
Subject: RE: Assistance with Commission Brief

Thanks George – Susan Wittick is coordinating for OPA.

Jeanne – can RES address the consequence projections?

Thanks - Allen

From: Deegan, George
Sent: Wednesday, March 16, 2011 5:18 PM
To: Howe, Allen
Cc: Moore, Scott; Piccone, Josephine; Jackson, Deborah; Turtil, Richard; Brock, Kathryn; Frazier, Alan
Subject: FW: Assistance with Commission Brief
Importance: High

Allen- I think our two emails may have crossed with one another (see my earlier response). I think RES would be best on Consequence Projections, not FSME. We may have some input to provide regarding Communication Challenges (since we serve in a liaison capability with States). If you'd like, I can check with our folks and see if they can develop some talking points to support Eliot's part of the presentation.

H-24

From: Howe, Allen
Sent: Wednesday, March 16, 2011 5:09 PM
To: Dion, Jeanne; Williams, Donna; Bajwa, Chris; Wittick, Susan; Shropshire, Alan; VandenBerghe, John; Deegan, George; Milligan, Patricia
Cc: Meighan, Sean; Hall, Randy; Boska, John
Subject: Assistance with Commission Brief
Importance: High

I am looking for assistance to pull together background information, slides, key messages, talking points and possible Q&A for the Commission briefing on the Japan event. The briefing is likely to happen Monday. Looks like a busy weekend. A rough draft outline is attached with leads for the areas. Please keep in mind that the meeting will be public and the information will be at a fairly high level. If you know of a point of contact that is best suited to address the information, please let me know.

I am working to schedule a meeting tomorrow afternoon @1:30 to flesh this out. I will send out a scheduler with a bridge line.

Thanks - Allen

Dion, Jeanne

From: Sheron, Brian
Sent: Wednesday, March 16, 2011 9:12 PM
To: Dion, Jeanne
Cc: Uhle, Jennifer
Subject: FW: IRC Staffing

From: Boyce, Tom (RES)
Sent: Wednesday, March 16, 2011 5:15 PM
To: Case, Michael
Cc: Richards, Stuart; Sheron, Brian
Subject: RE: IRC Staffing

The following people have expressed interest from RGDB:

IRC staffing:

- Hector Luis Rodriguez-Luccioni, NSPDP
- Mark Orr, 25 years of nuclear and large plant construction experience in PWRs
- Rick Jervey, former plant STA who played various roles in emergency response, particularly radiologiical response teams in the ops center, EOF and TSC
- Tom Boyce, RGDB Branch Chief, 20 years in NRR doing new reactor licensing for ABWR and System 80+, operating plant licensing in DORL, Technical Specifications in DIRS, and inspection program branch in DIRS.

Japan Team

- Hector Luis Rodriguez-Luccioni, NSPDP

From: Case, Michael
Sent: Wednesday, March 16, 2011 7:16 AM
To: Graves, Herman; Hogan, Rosemary; Csontos, Aladar; Koshy, Thomas; Lin, Bruce; Boyce, Tom (RES); Ali, Syed; Murphy, Andrew; Tregoning, Robert; Gavrilas, Mirela; Sydnor, Russell; Lorette, Phillip
Cc: Richards, Stuart
Subject: FW: IRC Staffing

Can you all start to think about this and let me know of any potential names by around noon?

From: Sheron, Brian
Sent: Tuesday, March 15, 2011 5:27 PM
To: Coyne, Kevin; Case, Michael; Coe, Doug; Correia, Richard; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Sangimino, Donna-Marie; Scott, Michael; Uhle, Jennifer; Valentin, Andrea
Cc: Dion, Jeanne

H-25

Subject: IRC Staffing

I participated on a conference call with other ODs and led by Michele Evans, acting deputy OD in NSIR at 4 pm today.

The purpose of the conference call was to discuss staffing for the IRC for the near future. The IRC is currently staffed with members of the Reactor safety team, the Protective Measures team, Liaison Team, etc. There is also an ET member there. None of the teams are at their full compliment. What Michele is looking for is people that can staff the IRC and relieve the staff that are currently there. She said they are currently running 3 shifts (11pm-7am, 7am – 3pm, and 3pm to 11 pm). They would like to find staff that can work shifts for 4 days in a row (I think she wants 4 days on, 3 days off). She said the staff do not have to have had IRC training.

Several of us said we would certainly canvas our staff to see who was qualified to work in the IRC and could work there, but we needed to know what technical disciplines they were looking for. Michele did not have a list of needed disciplines, but said she would generate one and send it out. As of 5:15 pm I have not received a list yet.

However, I am assuming they will be looking for staff with expertise in such areas as systems analysis, severe accidents, radiological dose assessment, etc. In anticipation that these are the technical disciplines of interest, can you please start identifying your staff that you believe have some of the requisite skills needed for the IRC, and start asking if they would be available to work shifts in the IRC if asked to. HR said they would be eligible for normal overtime compensation.

Also, they will be looking for staff to go to Japan and relieve the technical staff that recently went there. There were 2 BWR experts that left over the weekend, and a team of 9 more (6 engineers and 3 OIP staff) left yesterday. The thinking is that the staff that recently went over would come back in 2 weeks, which is when they want to send a replacement team over there. So please check to see if you have any staff with the proper technical credentials, are reasonably good communicators, and would be willing to spend about 2 weeks in Japan as part of the team there.

I will forward the list of desired disciplines as soon as I receive them from Michele. Michele said she will be looking for the list of potential IRC replacements by COB tomorrow (3/16/11), thus, I will need your candidates by mid-afternoon.

For the team that will replace the one that was just sent to Japan, she said she would like us to update the list we previously sent by COB 3/17.

Dion, Jeanne

From: Armstrong, Kenneth
Sent: Wednesday, March 16, 2011 11:12 AM
To: Dion, Jeanne
Cc: Rini, Brett
Subject: FW: Quick Question regarding any Published RES Documents Related to Tsunamis

This would be DE no?

From: Scott, Michael
Sent: Wednesday, March 16, 2011 11:08 AM
To: Zaki, Tarek; Bush-Goddard, Stephanie; Elkins, Scott; Hoxie, Chris; Lee, Richard; Santiago, Patricia; Armstrong, Kenneth; Bajorek, Stephen; Boyd, Christopher; Rubin, Stuart; Sherbini, Sami; Tinkler, Charles; Voglewede, John; Zigh, Ghani
Subject: FW: Quick Question regarding any Published RES Documents Related to Tsunamis

Is anyone aware of any recent RES-generated tsunami documents? If so, please respond to me ASAP. Thanks.

From: Weerakkody, Sunil
Sent: Wednesday, March 16, 2011 10:30 AM
To: Scott, Michael; Richards, Stuart; Coe, Doug
Cc: Gibson, Kathy; Uhle, Jennifer; Wilson, Peter
Subject: Quick Question regarding any Published RES Documents Related to Tsunamis

Mike, Doug, and Stu,

Region 1 is getting ready to perform End-of-Cycle meetings with regional licensees. Ironically, our first EOC is scheduled at TMI!
As you know, these are public meetings. RGN I is expecting sophisticated informed members of public to show up at these meetings. As such, regional management is performing necessary thinking and preparation at this time.

While we plan to rely heavily on communications developed by HQ, in getting ready for the EOC meetings, we want to become aware of any Tsunami related publications (e.g., NUREGs or NUREG\CRs). Are there any recent documents that you are aware of published by RES?

Just so that you or your staff doesn't spend too much time, we are simply trying to be aware (i.e., an answer can be simply a NUREG title or ML#...). In other word, if nothing comes to your or (your BC)'s mind, that is OK.

Sunil D. Weerakkody
Deputy Director - DRS (Acting)
NRC - RGN I
Tel: 610-337-5128

H-26

Dion, Jeanne

From: Rivera-Lugo, Richard
Sent: Wednesday, March 16, 2011 11:31 AM
To: Dion, Jeanne
Subject: POCs for Tsunami info

RES/DE/SGSEB:
Annie Kammerer
Rasool Anooshehpoor

Our contractor working with tsunami related projects are:
Vasily Titov, NOAA – Washington
Uri Ten Brink, USGS – Woods Hole, MA

Richard Rivera-Lugo, EIT, MEM
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission – HQ
RES/DE
Ph. 301-251-7652
Fax 301-251-7420
Mail M.S. C5C07M
E-mail Richard.Rivera-Lugo@nrc.gov

H-27

Dion, Jeanne

From: Rivera-Lugo, Richard
Sent: Wednesday, March 16, 2011 11:41 AM
To: Dion, Jeanne
Subject: Tsunami Related Reports 3

The report from NOAA is too big to send over email, but here is a direct link from our SharePoint site where you can download it.
http://portal.nrc.gov/edo/res/de/sgseb/Tsunami%20Generation%20and%20Propagation%20Modeling/Interim%20Products/NOAA%20nrc_finalreport%20AMk.pdf

Also, here are the links that contain the basic information on the referenced contracts.

N6401 – NOAA
http://portal.nrc.gov/edo/res/de/sgseb/Lists/seismic_projects/DispForm.aspx?ID=20&Source=http%3A%2F%2Fportal%2Enrc%2Egov%2Fedo%2Fres%2Fde%2Fsgseb%2FLists%2FSeismic%2520Projects%2FAllItems%2Easpx%3FPaged%3DTRUE%26p%5FTitle%3DN6180%253a%2520IAEA%2520Extra%252dBudgetary%2520Program%2520%2528EBP%2529%2520on%2520Seismic%2520Hazard%26p%5FID%3D15%26View%3D%257bFD7DDE04%252d8E30%252d4E69%252d94A9%252dB4A3AF782DE7%257d%26PageFirstRow%3D11

N6480 – USGS
http://portal.nrc.gov/edo/res/de/sgseb/Lists/seismic_projects/DispForm.aspx?ID=5&Source=http%3A%2F%2Fportal%2Enrc%2Egov%2Fedo%2Fres%2Fde%2Fsgseb%2FLists%2FSeismic%2520Projects%2FAllItems%2Easpx%3FPaged%3DTRUE%26p%5FTitle%3DN6180%253a%2520IAEA%2520Extra%252dBudgetary%2520Program%2520%2528EBP%2529%2520on%2520Seismic%2520Hazard%26p%5FID%3D15%26View%3D%257bFD7DDE04%252d8E30%252d4E69%252d94A9%252dB4A3AF782DE7%257d%26PageFirstRow%3D11

Hope this helps!

Richie

Richard Rivera-Lugo, EIT, MEM
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission – HQ
RES/DE
Ph. 301-251-7652
Fax 301-251-7420
Mail M.S. C5C07M
E-mail Richard.Rivera-Lugo@nrc.gov
Please consider the Environment before printing this e-mail.

A-28

Dion, Jeanne

From: Weerakkody, Sunil
Sent: Wednesday, March 16, 2011 1:31 PM
To: Dion, Jeanne
Subject: RE: Tsunami documents from RES

thanks

From: Dion, Jeanne
Sent: Wednesday, March 16, 2011 1:31 PM
To: Weerakkody, Sunil
Subject: RE: Tsunami documents from RES

My mistake- the second is ML072920474

From: Weerakkody, Sunil
Sent: Wednesday, March 16, 2011 1:29 PM
To: Dion, Jeanne
Subject: RE: Tsunami documents from RES

Jeanne,

Do both reports have the same ML#?

Sunil

From: Dion, Jeanne
Sent: Wednesday, March 16, 2011 12:36 PM
To: Weerakkody, Sunil
Cc: Uhle, Jennifer; Sheron, Brian; Richards, Stuart; Case, Michael; Hogan, Rosemary; Rini, Brett; Rivera-Lugo, Richard; Armstrong, Kenneth; Kammerer, Annie
Subject: Tsunami documents from RES

Sunil,
Per your request, here are two letter reports regarding tsunamis. If you have additional specific questions please call the Op center and ask to speak with a Reactor Safety team seismologist.

"Evaluation of Tsunami Sources with the Potential to Impact the US Atlantic and Gulf Coasts" ML082960196

"The Current State of Knowledge Regarding Potential Tsunami Sources Affecting U.S. Atlantic and Gulf Coasts." ML082960196

Let me know if I can be of further assistance.
Thanks,

Jeanne Dion
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research

H-29

Dion, Jeanne

From:	Case, Michael
Sent:	Wednesday, March 16, 2011 2:21 PM
To:	Dion, Jeanne
Subject:	RE: Follow-up from 4 pm teleconference on Ops Center Long Term Staffing

Severe Accident Management Guidelines (typically some of the PRA folks, reactor systems folks and maybe the human factors folks would have knowledge in that area.

From: Dion, Jeanne
Sent: Wednesday, March 16, 2011 2:19 PM
To: Case, Michael
Subject: RE: Follow-up from 4 pm teleconference on Ops Center Long Term Staffing

Thanks Mike,
In the table, what is SAMG?

Jeanne

From: Case, Michael
Sent: Wednesday, March 16, 2011 2:17 PM
To: Dion, Jeanne
Cc: Sheron, Brian; Uhle, Jennifer
Subject: FW: Follow-up from 4 pm teleconference on Ops Center Long Term Staffing

Hi Jeanne. With respect to the Op Center request, although about a dozen folks volunteered, I did not think any were a particularly good fit for the op center critical skills. Sapna Hurd, Tom Koshy and myself are already participating from DE.

From: Sheron, Brian
Sent: Wednesday, March 16, 2011 7:41 AM
To: Case, Michael; Coe, Doug; Correia, Richard; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Sangimino, Donna-Marie; Scott, Michael; Uhle, Jennifer; Valentin, Andrea
Subject: FW: Follow-up from 4 pm teleconference on Ops Center Long Term Staffing

Here is the list of expertise the Op center is looking for.

From: Evans, Michele
Sent: Tuesday, March 15, 2011 5:53 PM
To: Hackett, Edwin; Brenner, Eliot; Schmidt, Rebecca; Powell, Amy; Droggitis, Spiros; Doane, Margaret; Mamish, Nader; Dyer, Jim; Brown, Milton; Greene, Kathryn; Stewart, Sharon; Howard, Patrick; Miller, Charles; Moore, Scott; Cohen, Miriam; Tracy, Glenn; Haney, Catherine; Dorman, Dan; Johnson, Michael; Holahan, Gary; Leeds, Eric; Boger, Bruce; Grobe, Jack; Zimmerman, Roy; Campbell, Andy; Sheron, Brian; Uhle, Jennifer; Dean, Bill; Lew, David; McCree, Victor; Wert, Leonard; Casto, Chuck; Satorius, Mark; Pederson, Cynthia; Collins, Elmo; Howell, Art; Muessle, Mary; Andersen, James; Akstulewicz, Brenda; Belmore, Nancy; Quesenberry, Jeannette; Kreuter, Jane; Armstrong, Janine; Hudson, Sharon; Ellis, Marv; Hasan, Nasreen; Ronewicz, Lynn; Schumann, Stacy; Daniels, Stanley; Casby, Marcia; Thomas, Loretta; Walker, Dwight; Sprogeris, Patricia; Schwarz, Sherry; Ross, Robin; Cohen, Shari; Riddick, Nicole; Flory, Shirley; Veltri, Debra; Matakas, Gina; ODaniell, Cynthia; Miles, Patricia; Lee, Pamela; Dubose, Sheila; Buckley, Patricia; Tomczak, Tammy; Owen, Lucy; Tannenbaum, Anita; Gusack, Barbara; Harrington, Holly; Ricketts, Paul; Howell, Linda; Higginbotham, Tina; Ross, Brenda; Boyce, Thomas (OIS); Schaeffer, James; Jackson, Donald
Subject: Follow-up from 4 pm teleconference on Ops Center Long Term Staffing

Everyone,

H-30

Please find attached 1) a list of current positions being staffed in the Ops Center and 2) the staff identified as available to support in Japan.

Regarding additional staff available to support in the ops center, the primary needs are for the specialized positions on the PMT and anyone with previous international experience in OIP.

Regarding support in Japan, please provide any updates/changes to the list by COB March 17. The target time frame for sending these staff members is March 27-April 9, so please consider that when considering staff to put on the list.

Thanks for your support.

Michele

Stevens, Gary

From: Stevens, Gary
Sent: Wednesday, March 16, 2011 7:11 AM
To: Csontos, Aladar
Subject: RE: Mark I Containment Corrosion
Attachments: IN 2006-01 (Mark I Containment Torus Cracking).pdf

Al:

Two other items I forgot to mention in yesterday's e-mails:

1. There was a torus fatigue failure in 2006 at FitzPatrick due to periodic testing of the High Pressure Coolant Injection (HPCI) system (IN 2006-01 attached).
2. The 1980s Oyster Creek torus corrosion issue (subject of the 1980s Information Notices) re-surfaced during the Oyster Creek License Renewal Application (LRA) review due to ACRS questions. This was a BIG deal, spurring several hundred thousand dollars worth of structural re-analysis of the torus in order to get NRC approval for 60 years of operation. There should be tons of information available on this subject, as there were many public meetings on it, including ACRS briefings.

Gary L. Stevens
Senior Materials Engineer
NRC/RES/DE/CIB
Gary.Stevens@nrc.gov
301-251-7569

From: Stevens, Gary
Sent: Tuesday, March 15, 2011 3:36 PM
To: Csontos, Aladar
Subject: Mark I Containment Corrosion

Al:

As I mentioned, there was significant corrosion of the Oyster Creek torus in the 1980s. This was the subject of several NRC Information Notices, which are attached.

Gary L. Stevens
Senior Materials Engineer
NRC/RES/DE/CIB
Gary.Stevens@nrc.gov
301-251-7569

H-31

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

January 12, 2006

NRC INFORMATION NOTICE 2006-01: TORUS CRACKING IN A BWR MARK I CONTAINMENT

ADDRESSEES

All holders of operating licenses for nuclear power reactors having boiling water reactor (BWR) Mark I containments, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform the owners of BWR Mark I containments about the occurrence and potential causes of the through-wall cracking of a torus in a BWR Mark I containment. Recipients are expected to review the information for applicability to their facilities and consider appropriate actions to avoid similar problems. However, the measures suggested in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

On June 27, 2005, with the plant operating at 100-percent power during a licensee inspection of reactor core isolation cooling system torus suction piping, James A. FitzPatrick Nuclear Power Plant (FitzPatrick) personnel discovered a torus leak near a torus support. The plant's torus is a large doughnut-shaped steel structure that is partially filled with water and designed to act as a pressure suppression chamber (see Figure 1). The torus geometry and supports at the location of the torus crack are shown in Figure 2. The leak was located about 5 feet below the waterline and just below the high-pressure coolant injection (HPCI) turbine exhaust pipe.

The leak was characterized as a slight seepage with streaking and a small puddle below the leak. Subsequent nondestructive examination determined that the leakage was from a small through-wall torus crack which was x-shaped with an approximate 4.6 inch maximum length. The licensee determined that operability of the primary containment was not assured and declared an Unusual Event and subsequently shut down the reactor (see Event Notification 41815, Reference 1).

To correct this condition, the licensee installed an approximately 13 inch outer diameter torus repair plate with a full-penetration weld joint. Pressure testing and inspection of the torus and drywell were completed after the repairs were completed. An NRC special inspection team reviewed the licensee's repair methods, root cause and extent-of-condition determinations, and corrective actions before the reactor was restarted (see NRC Inspection Report 05000333/2005009; Accession No. ML053610132).

BACKGROUND

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a "Codes and Standards," incorporates by reference Subsections IWE and IWL of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for inspection of steel and concrete containments with certain modifications and limitations. These subsections require licensees to inspect the pressure-retaining components of containments at periodic intervals. Subsection IWE of the ASME Code is applicable to the inspection of the FitzPatrick containment, consisting of a steel drywell, a steel torus, and connecting vents.

The NRC also requires licensees to perform leak rate testing of the containment pressure-retaining components and isolation valves according to 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors." Option B of Appendix J is a performance-based regulation permitting licensees to set test frequencies based on the performance of the components. The pertinent testing requirement is the containment integrated leakage rate test (ILRT) requirement (Type A test). Based on the results of the earlier Type A tests and using the risk-informed methodology described in Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," the licensee had previously been granted a license amendment to use a 15-year interval for the ILRT, with the next test to be performed by March 2010.

10 CFR Part 50, Appendix J, Option B, III.A, requires that a general visual inspection of the accessible interior and exterior surfaces of the containment system for structural deterioration which may affect the containment leak-tight integrity must be conducted prior to each test, and at a periodic interval between tests based on the performance of the containment systems. These test requirements provide for periodic verification of the structural integrity of the primary reactor containment.

DISCUSSION

The FitzPatrick licensee performed a root cause investigation of the event, and after eliminating a number of possible causes (thermal fatigue, clearing load phenomena, metallurgical discontinuity, weld defects, corrosion, flow-induced phenomena, flow-accelerated corrosion, cavitation, and direct jet impingement), the licensee concluded that the most likely cause for the initiation and propagation of the crack was the hydrodynamic loads of the turbine exhaust pipe during HPCI operation coupled with the highly restrained condition of the torus shell at the torus column support (see Figure 2). The cracking occurred in the heat-affected zone of the lower gusset plate of the ring girder at the torus column support (Figure 3 shows the HPCI turbine exhaust pipe entering the torus and the approximate location of the crack). The licensee concluded that the crack was initiated by cyclic loading due to condensation oscillation during HPCI operation.

These condensation oscillations induced on the torus shell may have been excessive due to a lack of an HPCI turbine exhaust pipe sparger that many licensees have installed. The licensee could not pinpoint exactly when of the crack started. Subsequent HPCI system operation helped propagation of the crack. The licensee indicated that no detrimental torus condition was noted during the general visual examination performed (per the 1998 edition of Subsection IWE of Section XI of the ASME Code) during the refueling outage in 2002, and no leakage was observed from this torus area during a walkdown by plant personnel on April 19, 2005. As part of its assessment of the IWE inspection program, the licensee noted that the IWE inspection program is only capable of identifying conditions that are visually detectable. Based on its assessment, the licensee established a corrective action to address the need for augmented inspections in areas where high operating stresses may exist or high fatigue cycling is likely.

The NRC staff is aware of several instances where the torus and drywells of BWR Mark I containments have been subjected to pitting and general corrosion (see References 2 and 3, INs 86-99 and 88-82 and the related supplements). However, this is the first occurrence of a through-wall crack known to the NRC staff. The following measures could reduce the possibility of such an event in the future or enable early detection of similar degradation:

- Many licensees have installed HPCI turbine exhaust pipe condensing spargers as one possible way to adequately distribute the operational type hydrodynamic loads and ensure that the stresses developed by these loads are within the acceptable limits.

- 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures be established to assure that applicable regulatory requirements and design basis are correctly translated into specifications, drawings, procedures and instructions and any changes are subject to commensurate design control measures. Design changes (any past or planned modifications) that affect the operational and accident loads imposed on the containment torus need to be subjected to commensurate design control reviews to ensure that the critical areas meet the acceptance criteria of the design specifications.

- The combined operation of the HPCI system and the safety relief valve (SRV) discharges during the northeast grid blackout disturbance of August 2003 may have initiated the crack (although this could not be conclusively determined). The HPCI system operated for approximately 14.5 hours and SRVs lifted five times over a period of 28 hours following the grid blackout disturbance. The FitzPatrick licensee established a corrective action to address the need for augmented inspections in areas where high operating stresses may exist or high fatigue cycling is anticipated. Such actions may be warranted after such stress-inducing events or after a strong seismic event (i.e., operating basis earthquake).

- 10 CFR Part 50, Appendix J, provides for periodic verification of the leak-tight integrity of the primary reactor containment as specified in the technical specifications. Subsection IWE of the ASME code requires periodic inspection of the containment surfaces. These inspection programs are focused toward detecting structural deterioration that could affect either structural integrity or leak-tightness. The torus through-wall cracking in this event was revealed by water leakage. Water leakage is readily indicated for through-wall cracks below the torus water line. BWR Mark I containments also have areas above the water line, where only air or gas would leak, and cracking at these locations would not be as easily detected. Because cracks can affect structural integrity or leak tightness, licensee containment inspection programs are required to consider the potential for such cracking, in addition to detecting general and pitting corrosion-induced degradation to ensure that containment integrity is maintained as specified in technical specifications.

REFERENCES

1. Event Notification Report No. 41815, posted July 1, 2005, available on the NRC Web site at http://www.nrc.gov/reading-rm/doc-collections/event-status/event/2005/20050701en.html#en41815.

2. IN 86-99, "Degradation of Steel Containments," dated December 8, 1986 (Agencywide Documents Access and Management System (ADAMS), Accession No. ML0312502480), and Supplement 1, dated February 14, 1991 (Accession No. ML031250234).

3. IN 88-82, "Torus Shells with Corrosion and Degraded Coatings in BWR Containments," dated October 14, 1988 (Accession No. ML031150069), and Supplement 1, dated May 2, 1989, http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1988/in88082s1.html.

CONTACT

Please direct any questions about this matter to the technical contacts below or to the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Richard P. Correia for

Christopher I. Grimes, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contacts: Hansraj (Hans) G. Ashar, NRR
301-415-2851
E-mail: hga@nrc.gov

Mark S. King, NRR
(301) 415-1150
E-mail: msk1@nrc.gov

Attachments: Figure 1: Typical BWR with Mark I Containment and
Figure 2: Cutaway Side-view of Torus Shell and Support
Figure 3: Photograph of HPCI Turbine Exhaust Pipe Entering the Torus

Note: NRC generic communications may be found on the NRC public Web site: http://www.nrc.gov, under Electronic Reading Room/Document Collections.

Figure 1 Typical BWR with Mark I Containment

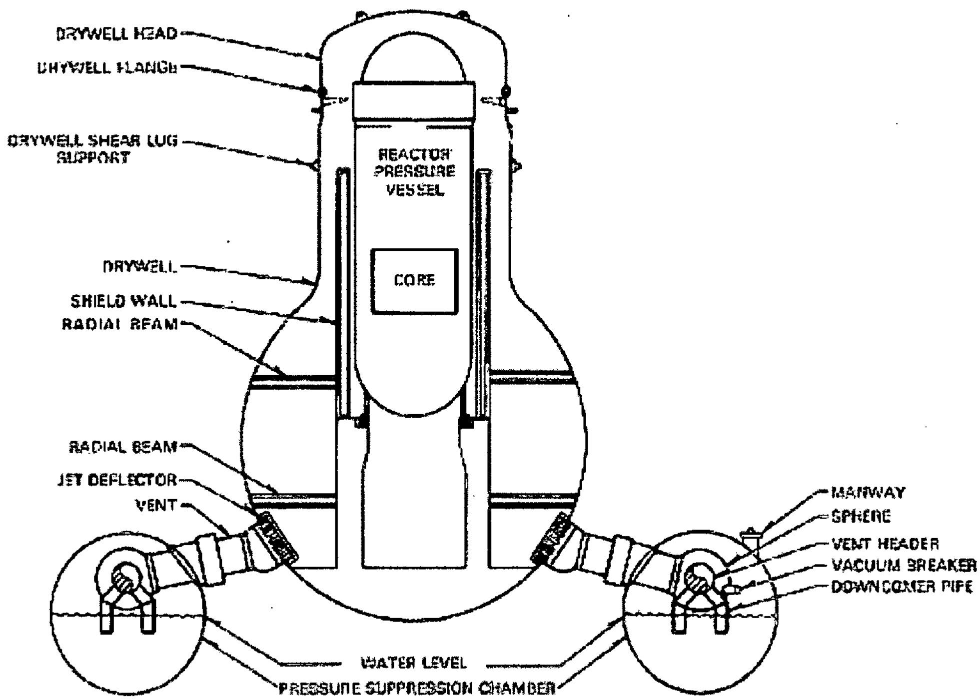


Figure 1 the cross-section of a pressure suppression chamber (or torus) is 29.6 feet wide. The pressure suppression chamber (torus) holds approximately 790,000 gallons of water.

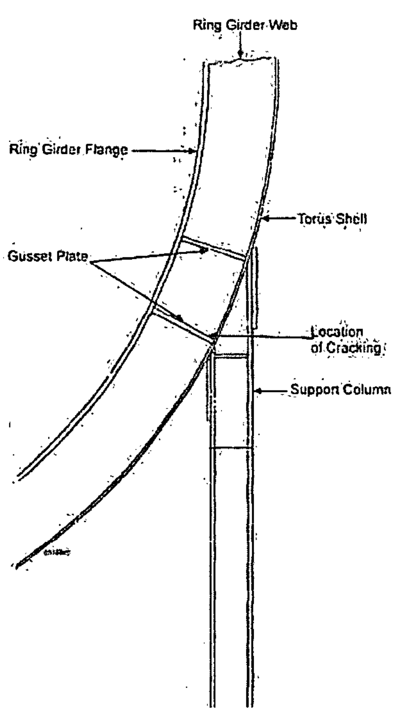


Figure 2
A cutaway side view of the torus shell and support showing the location of the cracking.

ex 4

Figure 3: Photograph from inside the torus of HPCI turbine exhaust pipe, with the approximate location of the crack at the gusset. This view is from inside the torus. The HPCI turbine exhaust pipe (in the center of the photo) is approximately 24 inches in diameter.

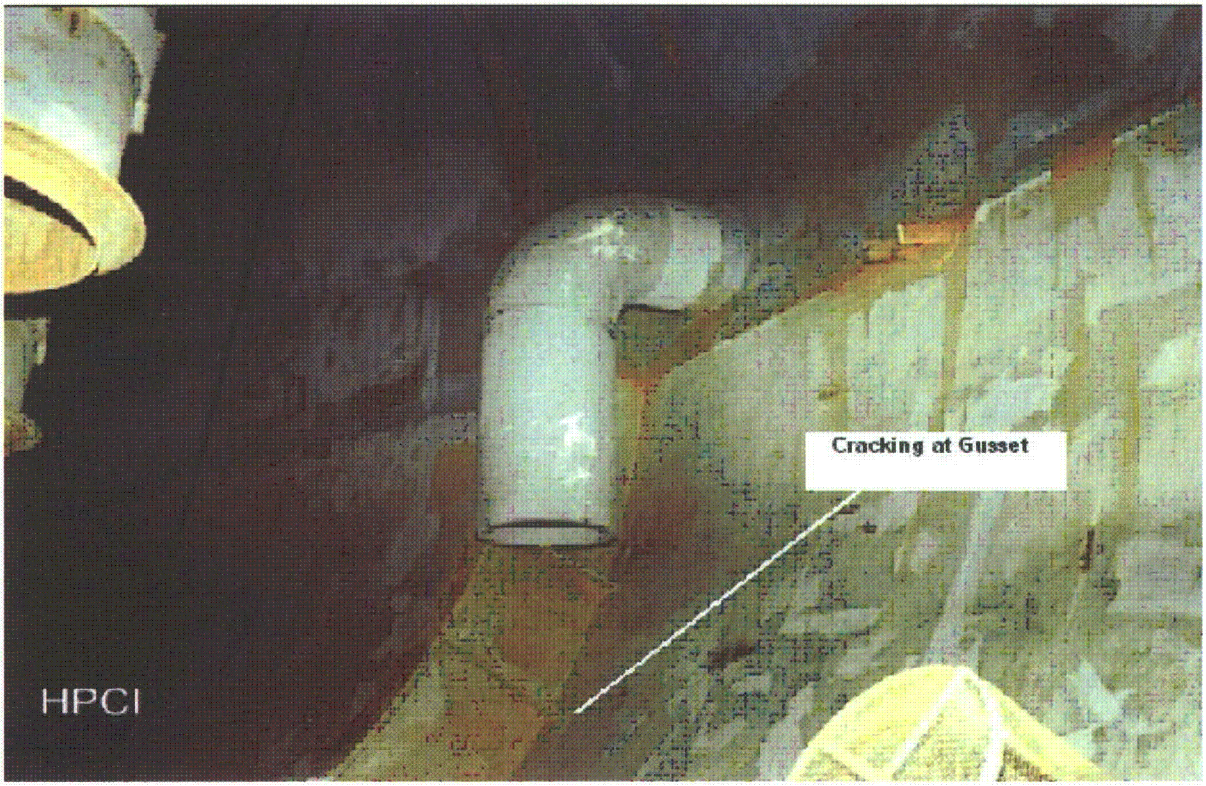


Figure 3

Brown, Eva

From: Hart, Ken , SECY
Sent: Wednesday, March 16, 2011 6:20 AM
To: Brown, Eva, NRR
Subject: NUREG-1353

5.6 Alternative 6 - Cover Fuel Debris With Solid Materials
This proposed alternative would require the development of a contingency plan to dump massive amount of solid materials into a drained spent fuel pool to cover the rubble bed to a depth of several feet. The necessary materials would not be stockpiled on site, but could be obtained in a timely manner on an ad hoc basis, the materials (sand, clay, dolomite, boron compounds, lead, etc.) being commonly available in all parts of the country. This alternative would be directed at risk mitigation, not prevention.
This alternative was not quantified as part of this value/impact study. The contingency plan would be concerned with a low frequency event (on the order of **lx10-6** per reactor year), with potential high consequence event. The results at Chernobyl can be used as a rough gauge of the efficacy of this measure, when carried out on a strictly ad hoc basis with no apparent advanced planning. However, since the dominant risk sequence for the spent fuel pool accident is a beyond design basis earthquake, BNL concludes that it is dubious that the measures could be implemented soon enough to prevent the major release to the environment during the first few hours of the accident (Ref. 13).

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B

Giitter, Joseph

From: Giitter, Joseph (NRR
Sent: Wednesday, March 16, 2011 5:16 PM
To: Nelson, Robert
Subject: FW: COMMISSION E-READER....WEDNESDAY, MARCH 16, 2011
Attachments: Tab B 03-15-11 Rep. Lowey 11-0119.pdf

Here is a letter that NRO started to draft a response to. Ruland suggested that Annie send it through us. Let me know who you need for the Tiger Team to support Correspondence. John Boska and Randy Hall are supporting Allen, but may be available after the Commission Meeting. Let me know who you want/need for the team.

From: Kammerer, Annie (RES
Sent: Wednesday, March 16, 2011 5:10 PM
To: Nelson, Robert; Giitter, Joseph
Cc: Munson, Clifford; Ake, Jon
Subject: FW: COMMISSION E-READER....WEDNESDAY, MARCH 16, 2011

Please see attached letter.

This came to Cliff when he was on duty in the ops center. Because we are in rapid answer mode, he's got some NRO folks started immediately. He was talking to John Boska (NRR/DORL) but we are not sure who in NRR has the lead.

FYI, we already earlier had a similar question that was dropped into the seismic Q&A document, but it needed a lot of work (too techie). So, even before this, I had asked cliff to get his folks to clean it up and make it more public friendly.

Since the question in the letter can mostly be answered by the Q&A they were already working on, Cliff asked his folks to add a couple of lines so that the response can be used by NRR, if NRR so desires. They are in process on this direction from Cliff.

So, in summary, you guys have the lead, but we are not sure who we should interface with. We have something to provide by way of support answering the question, but it is your responsibility and your call. Regardless, we would request that we get the "official" response to put in the Q&A document so that everyone knows the party line.

Also, as an aside, I got a call from the region and they heard of the letter and are not sure what is happening in terms of response. I said I'd get back to them. Regardless, they want to start working up Q&As on Indian point that are similar to what they see for DCNPP and SONGS in the seismic Q&A docs. Please advise who would also be the contact checking/answering Q&As on that as well.

Please provide a contact and advise us as to how you would like to proceed so that we can all get on the same page and have a common path forward on both the letter and the Indian Point Q&As.

I-33

Thanks so much!
Annie

From: Munson, Clifford ,NRO
Sent: Wednesday, March 16, 2011 3:39 PM
To: Boska, John
Cc: Kammerer, Annie; Karas, Rebecca; Chokshi, Nilesh
Subject: FW: COMMISSION E-READER....WEDNESDAY, MARCH 16, 2011

John,

I had Laurel Bauer come over and touch base with you since we anticipate more questions on Indian Pt 2. Annie Kammerer and I are coordinating the Seismic Q&A with regard to the Japanese earthquake and tsunami and the related questions about U.S. npps. Annie is in contact with Region 1 and so you may want to give her a call for further information. Attached is the letter we just received.

Cliff Munson
Clifford Munson, Ph.D.
Senior Level Advisor
U.S. NRC - Office of New Reactors
Division of Site and Environmental Reviews
301-415-6947
clifford.munson@nrc.gov

From: Case, Michael , RES
Sent: Wednesday, March 16, 2011 2:19 PM
To: Munson, Clifford; Murphy, Andrew; Kammerer, Annie; Hogan, Rosemary; Ake, Jon
Subject: FW: COMMISSION E-READER....WEDNESDAY, MARCH 16, 2011

Here's some test cases to see how well the Q&As hold together!

From: Sheron, Brian , RES
Sent: Wednesday, March 16, 2011 1:13 PM
To: Case, Michael; Coe, Doug; Correia, Richard; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Sangimino, Donna-Marie; Scott, Michael; Uhle, Jennifer; Valentin, Andrea
Subject: FW: COMMISSION E-READER....WEDNESDAY, MARCH 16, 2011

And so it starts.

From: Champ, Billie
Sent: Wednesday, March 16, 2011 12:14 PM
To: Commission E-Reader Distribution; E-Reader Distribution
Subject: COMMISSION E-READER....WEDNESDAY, MARCH 16, 2011

~~INTERNAL USE ONLY~~
Some of the information contained in the
Reader is not publicly available.
If there are any questions, please contact SECY.

READING FILE

INDEX

March 16, 2011

INCOMING CORRESPONDENCE

Tab "A" 03/15/11 -- Letter from Reps. Edward Markey and Lois Capps, requests additional information related to the seismic safety features in nuclear reactors in the U.S.

Tab "B" 03/15/11 -- Letter from Rep. Nita Lowey, concerns safety factors at Indian Point.

Billie A. C-Lopes

COMMITTEE ON APPROPRIATIONS

SUBCOMMITTEES:
RANKING MEMBER,
STATE, FOREIGN OPERATIONS, AND
RELATED PROGRAMS

LABOR, HEALTH AND HUMAN SERVICES,
AND EDUCATION

HOMELAND SECURITY

Nita M. Lowey
Congress of the United States
18th District, New York

lowey.house.gov

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FAX: (914) 328-1505

ROCKLAND
(845) 639-3485

Chairman Gregory B. Jaczko
U.S. Nuclear Regulatory Commission
Mail Stop O-16G4
Washington, DC 20555-0001

March 15, 2011

Dear Chairman Jaczko:

The tragedy in Japan and the threat of meltdowns at the Fukushima Daiichi Nuclear Power Station shine a new light on the need for the heightened evaluation of nuclear power plants within high-population areas. Following the Japan tragedy, it is imperative that the NRC evaluate all possible threats, including terrorism, natural disasters, and the challenges that must be met in developing safety standards and evacuation procedures while determining the re-licensing of the Indian Point Nuclear Facility in Buchanan, New York.

A 2008 study by seismologists at the Columbia University Lamont-Doherty Earth Observatory found that earthquakes in the New York metropolitan area are common and that risks are particularly high due to infrastructure and high population. A 3.9 magnitude earthquake occurred in the Atlantic Ocean approximately 80 miles off Long Island as recently as November 30, 2010. In fact, there have been five earthquakes in the same area in the past two decades, including a 4.7 magnitude earthquake in 1992.

The Ramapo Seismic Zone is a particular threat because the zone passes within two miles of Indian Point. The Ramapo Seismic Zone includes the Dobbs Ferry fault in Westchester, which generated a 4.1 magnitude earthquake in 1985. The Columbia University study suggests that this pattern of subtle but active faults increases the risk to the New York City area and that an earthquake with a magnitude of 7.0 on the Richter scale is within reach. Disturbingly, Entergy measures the risk of an earthquake near Indian Point to be between 1.0 and 3.0 on the Richter scale, despite evidence to the contrary.

As our nation stands ready to assist the Japanese to calm this potential nuclear meltdown and disaster, we must not let the same mistakes happen on our shores. The NRC should study Indian Point's risk of and ability to sustain a disaster, including the impact of earthquakes and hurricanes, as well as collateral impacts such as loss of power, inability to cool reactors, and emergency evacuation routes. The NRC should evaluate how a similar incident in the New York metropolitan area could be further complicated due to a dramatically higher population and the effectiveness of proposed evacuation routes. We simply cannot allow those who live in the New York metropolitan area to be susceptible to such risks.

Sincerely,

Nita M. Lowey
Member of Congress

3/15...To EDO to Prepare Response for Chairman's Signature...Date due Comm: March 30...Cpy to: RF, OCA to Ack....11-0119 Commission Correspondence

Rodriguez-Luccioni, Hector

From: Bayssie, Mekonen
Sent: Thursday, March 17, 2011 8:43 AM
To: Rivera-Lugo, Richard; RES_DE
Subject: RE: NRC's Congressional Hearing - March 16th

The Full Hearing could be found on C-span on
http://www.c-span.org/Events/Congress-looks-at-Nuclear-Safety-and-Crisis-in-Japan/10737420229-1/

From: Rivera-Lugo, Richard
Sent: Thursday, March 17, 2011 8:39 AM
To: RES_DE
Subject: NRC's Congressional Hearing - March 16th

FYI - Article from the NY Times about Chairman Jaczko's Congressional hearing on March 16th.

http://www.nytimes.com/2011/03/17/science/earth/17nrc.html?_r=2

Richard Rivera-Lugo, EIT, MEM
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission – HQ
RES/DE
Ph. 301-251-7652
Fax 301-251-7420
Mail M.S. C5C07M
E-mail Richard.Rivera-Lugo@nrc.gov

H-34

Dion, Jeanne

From: Armstrong, Kenneth
Sent: Thursday, March 17, 2011 9:57 AM
To: Dion, Jeanne
Subject: RE: Assistance with Commission Brief

Jeanne,

Mike Scott is leading this effort, we will assist.

From: Dion, Jeanne
Sent: Wednesday, March 16, 2011 5:38 PM
To: Armstrong, Kenneth
Subject: FW: Assistance with Commission Brief
Importance: High

Meant to cc you on this..

From: Dion, Jeanne
Sent: Wednesday, March 16, 2011 5:36 PM
To: Sheron, Brian; Uhle, Jennifer
Cc: Rini, Brett
Subject: FW: Assistance with Commission Brief
Importance: High

Brian and Jennifer,
There is a request for RES to support a Commission Meeting on Monday on 3/21 (see the scheduling note- 1st attachment).
Right now, RES is the lead for
1."advance our understanding of safety and risk" and

2. "Consequence Projections in Japan/and in the US" as noted in the meeting outline (2nd attachment). We will need to prepare Mike Weber's presentation/talking points/Q&A on "Consequence Projections for Japan and what we might expect to see in the US".

RES might also need to support NRR for "Situation assessment for US reactors and Applicants"- see the outline.

Tomorrow morning I'm in a meeting in 6B01 with AREVA until noon- Ken will attend the morning meeting. There is a conf call tomorrow- I'll get more info.

Jeanne

From: Howe, Allen
Sent: Wednesday, March 16, 2011 5:09 PM
To: Dion, Jeanne; Williams, Donna; Bajwa, Chris; Wittick, Susan; Shropshire, Alan; VandenBerghe, John; Deegan, George; Milligan, Patricia
Cc: Meighan, Sean; Hall, Randy; Boska, John
Subject: Assistance with Commission Brief
Importance: High

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I am looking for assistance to pull together background information, slides, key messages, talking points and possible Q&A for the Commission briefing on the Japan event. The briefing is likely to happen Monday. Looks like a busy weekend. A rough draft outline is attached with leads for the areas. Please keep in mind that the meeting will be public and the information will be at a fairly high level. If you know of a point of contact that is best suited to address the information, please let me know.

I am working to schedule a meeting tomorrow afternoon @1:30 to flesh this out. I will send out a scheduler with a bridge line.

Thanks - Allen

Dion, Jeanne

From: Beasley, Benjamin
Sent: Thursday, March 17, 2011 4:20 PM
To: Dion, Jeanne
Subject: FW: Hardened Vent for Mark I

From: Lane, John
Sent: Wednesday, March 16, 2011 10:04 AM
To: Sheron, Brian; Coe, Doug
Cc: Beasley, Benjamin; Marksberry, Don
Subject: Hardened Vent for Mark I

Brian and Doug:

In case this comes up, I just wanted to provide you a little background to remind you that we ordered the installation of hardened vents in BWR Mark I's back in 1989. (Bob Bernaro,the NRR office director at the time, was a strong supporter of it).

I was involved with the CPI program and the Mark I's were the first ones up.

Here is the GL order:

September 1, 1989

TO: ALL HOLDERS OF OPERATING LICENSES FOR NUCLEAR POWER REACTORS WITH MARK I CONTAINMENTS

SUBJECT: INSTALLATION OF A HARDENED WETWELL VENT (GENERIC LETTER 89-16)

As a part of a comprehensive plan for closing severe accident issues, the staff undertook a program to determine if any actions should be taken, on a generic basis, to reduce the vulnerability of BWR Mark I containments to severe accident challenges. At the conclusion of the Mark I Containment Performance Improvement Program, the staff identified a number of plant modifications that substantially enhance the plants' capability to both prevent and mitigate the consequences of severe accidents. The improvements that were recommended include (1) improved hardened wetwell vent capability, (2) improved reactor pressure vessel depressurization system reliability, (3) an alternative water supply to the reactor vessel and drywell sprays, and (4) updated emergency procedures and training. The staff as part of that effort also evaluated various mechanisms for implementing of these plant improvements so that the licensee and the staff efforts would result in a coordinated coherent approach to resolution of severe accident issues in accordance with the Commission's severe accident policy.

After considering the proposed Mark I Containment Performance Program (described in SECY 89-017, January 1989), the Commission directed the staff to pursue Mark I enhancements on a plant-specific basis in order to account for possible unique design differences that may bear on the necessity and nature of specific safety improvements. Accordingly, the Commission concluded that the recommended safety improvements, with one exception, that is, hardened wetwell vent capability, should be evaluated by licensees as part of the Individual Plant Examination (IPE) Program. With regard to the recommended plant improvement dealing with hardened vent capability, the Commission, in recognition of the circumstances and benefits associated with this modification, has directed a different approach. Specifically, the Commission has directed the staff to approve installation of a hardened vent under the provisions of 10 CFR 50.59 for licensees, who on their own initiative, elect to incorporate this plant improvement. The staff previously inspected the design of such a system that was installed by Boston Edison Company at the Pilgrim Nuclear Power Station. The staff found the installed system and the associated Boston Edison Company's analysis acceptable.

A copy of Boston Edison Company's description of the vent modification is enclosed for your information. For the remaining plants, the staff has been directed to initiate plant-specific backfit analyses for each of the Mark I plants to evaluate the efficacy of requiring the installation of hardened wetwell vents. Where the backfit analysis supports imposition of that requirement, the staff is directed to issue orders for modifications to install a reliable hardened vent.

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The staff believes that the available information provides strong incentive for installation of a hardened vent. First, it is recognized that all affected plants have in place emergency procedures directing the operator to vent under certain circumstances (primarily to avoid exceeding the primary containment pressure limit) from the wetwell airspace. Thus, incorporation of a designated capability consistent with the objectives of the emergency procedure guidelines is seen as a logical and prudent plant improvement. Continued reliance on pre-existing capability (non-pressure-bearing vent path) which may jeopardize access to vital plant areas or other equipment is an unnecessary complication that threatens accident management strategies. Second, implementation of reliable venting capability and procedures can reduce the likelihood of core melt from accident sequences involving loss of long-term decay heat removal by about a factor of 10. Reliable venting capability is also beneficial, depending on plant design and capabilities, in reducing the likelihood of core melt from other accident initiators, for example, station blackout and anticipated transients without scram. As a mitigation measure, a reliable wetwell vent provides assurance of pressure relief through a path with significant scrubbing of fission products and can result in lower releases even for containment failure modes not associated with pressurization (i.e., liner meltthrough). Finally, a reliable hardened wetwell vent allows for consideration of coordinated accident management strategies by providing design capability consistent with safety objectives. For the aforementioned reasons, the staff concludes that a plant modification is highly desirable and a prudent engineering solution of issues surrounding complex and uncertain phenomena. Therefore, the staff strongly encourages licensees to implement requisite design changes, utilizing portions of existing systems to the greatest extent practical, under the provisions of 10 CFR 50.59.

As noted previously, for facilities not electing to voluntarily incorporate design changes, the Commission has directed the staff to perform plant-specific backfit analyses. In an effort to most accurately reflect plant specificity, the staff herein requests that each licensee provide cost estimates for implementation of a hardened vent by pipe replacement, as described in SECY 89-017. In addition, licensees are requested to indicate the incremental cost of installing an ac independent design in comparison to a design relying on availability of ac power. In the absence of such information, the staff will use an estimate of $750,000. This estimate is based on modification of prevalent existing designs to bypass the standby gas treatment system ducting and includes piping, electrical design changes, and modifications to procedures and training.

CONF-871011--6

CONF-8710111--6

DE88 002534

THE IMPACT OF BWR MK I PRIMARY CONTAINMENT FAILURE DYNAMICS ON SECONDARY CONTAINMENT INTEGRITY

Sherrell R. Greene
Boiling Water Reactor Severe Accident
Technology (BWRSAT) Program*
Oak Ridge National Laboratory

For presentation at
15th Water Reactor Safety Information Meeting
October 29, 1987

*Research sponsored by the Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission under Interagency Agreement DOE 0551-0551-A1 with the U.S. Department of Energy under contract DE-AC05-84OR21400 with the Martin Marietta Energy Systems, Inc.

THE IMPACT OF BWR MK I PRIMARY CONTAINMENT FAILURE DYNAMICS ON SECONDARY CONTAINMENT INTEGRITY

Sherrell R. Greene
Oak Ridge National Laboratory

ABSTRACT

During the past four years, the ORNL BWRSAT Program has developed a series of increasingly sophisticated BWR secondary containment models. These models have been applied in a variety of studies to evaluate the severe accident mitigation capability of BWR secondary containments. This paper describes the results of a recent ORNL study of the impact of BWR MK I primary containment failure dynamics on secondary containment integrity. A 26-cell MELCOR Browns Ferry secondary containment model is described and the predicted thermodynamic response of the secondary containment to a variety of postulated primary containment failure modes is presented. The effects of primary containment failure location, timing, and ultimate hole size on secondary containment response is investigated, and the potential impact of hydrogen deflagrations on secondary containment integrity is explored.

1. INTRODUCTION

The most common boiling water reactor (BWR) plant design in the United States is the BWR-4/MK I primary containment system. These plants employ secondary containments (Exhibit 1) consisting of a reactor building and refueling bay that completely surround the primary containment. Detailed severe accident analyses of MK I containment designs generally indicate that the conditional probability of primary containment failure is quite high in the unlikely event that core debris escapes the reactor vessel.

Should the primary containment pressure boundary fail, the secondary containment becomes the final barrier between the plant's fission product inventory and the environment. Traditional BWR risk studies have, however, de-emphasized the ability of the secondary containment to act as an effective fission product trap. During the past four years, the ORNL BWRSAT Program has developed a series of increasingly sophisticated BWR secondary containment models. These models have been applied in a variety of studies to evaluate the severe accident mitigation capability of BWR secondary containments.

This paper describes the results of a recent ORNL study of the impact of BWR MK I primary containment failure dynamics on secondary containment integrity. The fundamental design characteristics of the Browns Ferry secondary containment are first discussed, followed by a brief description of potential MK I severe accident containment failure modes. A 26-cell MELCOR Browns Ferry secondary containment model is described and the predicted thermodynamic response of the secondary containment to a variety of postulated primary containment failure modes is presented. The effects of primary containment failure location, timing, and ultimate hole size on secondary containment response is investigated, and the potential impact of hydrogen deflagrations on secondary containment integrity is explored.

2. BWR SECONDARY CONTAINMENT DESIGN

Domestic BWRs of the MK I primary containment design employ a secondary containment which is comprised of a multi-floored reactor building and a refueling bay which completely surround and enclose the primary containment. Multi-unit plants employ separate reactor buildings for each unit but may utilize a common refueling bay to service all units. Exhibit 1 is a cross sectional view of the Browns Ferry Unit 1 reactor building and refueling bay (shared with Units 2 and 3). The Browns Ferry reactor building is a massive (1.4 million ft^3 or 40000 m^3), five floored structure with reinforced external concrete walls. The thickness of the walls varies from 6 ft (1.8 m) in the reactor building basement to 2.5 ft (0.76 m) at the junction of the refueling bay siding and the reactor building wall.

Secondary containment above the reactor building is provided by a 2.75 million ft^3 (77700 m^3) refueling bay which is constructed of corrugated sheet metal walls that contain large blowout panels to provide protection from the effects of tornados and steam line breaks. Not shown in Exhibit 1 are details such as stairways, elevator shafts, and internal blowout panels which provide communication pathways between the various floors of the reactor building and between the reactor building and the turbine building.

The Browns Ferry Final Safety Analysis Report[1] indicates that the above grade exterior walls of the reactor building are designed for pressures up to 250 lb/ft^2 (11970 Pa) without structural failure. The tornado design basis is a pressure decrease of 3 psi (20684 Pa) at a rate of 0.6 psi (4137 Pa) per second. The refueling bay siding is designed to withstand internal pressure in excess of 57.6 lb/ft^2 (2758 Pa) without structural failure. Pressures in excess of 50 lb/ft^2 (2394 Pa) will, however, be relieved by blowout panels in the siding.

3. MK I SEVERE ACCIDENT FAILURE MECHANISMS

The design basis accident for existing MK I primary containments is the large break loss of coolant accident in which one of the main re-

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REACTOR BUILDING AND REFUELING BAY PROVIDE BWR SECONDARY CONTAINMENT

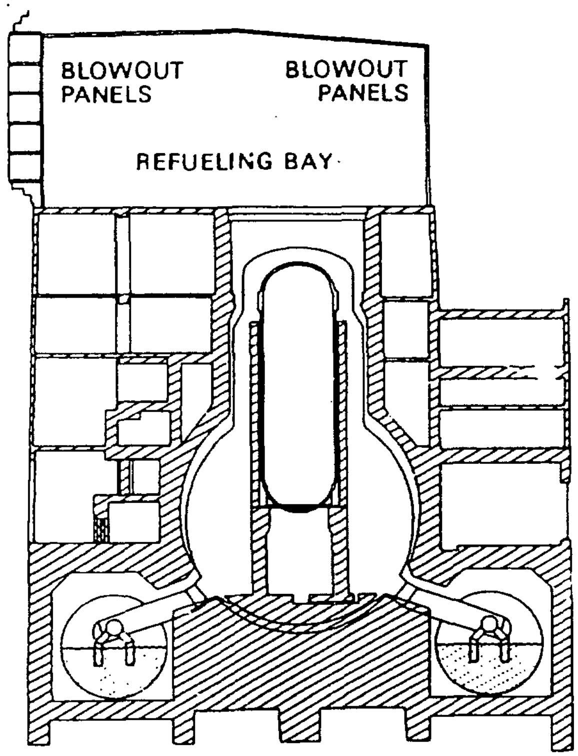

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Exhibit 1

circulation pipes is assumed to circumferentially rupture. The purpose of the primary containment is to limit the release of fission products from this accident to levels which will not exceed the limits of 10 CFR 100. This goal is accomplished by designing the containment to withstand the predicted transient pressure and temperature loads induced by the blowdown of steam and hydrogen (produced by cladding oxidation) from the reactor vessel. The design pressure and temperature of the Browns Ferry primary containment are 56 psig (487 kPa) and 281°F (411 K). The primary containment is inerted with nitrogen during reactor operation.

Recent ORNL calculations for an unmitigated short-term station blackout severe accident sequence at Browns Ferry[2] indicate that temperatures as high as 2700°F (1750 K) may be generated in the primary containment if the majority of the core was to be relocated onto the drywell floor. Maximum primary containment pressures for this case appear to be limited primarily by the containment's maximum pressure capability. A recent Chicago Bridge and Iron Company study[3] of the ultimate pressure capability of Peach Bottom's primary containment produced a maximum pressure capability estimate (assuming median gasket resiliency) of 140 psia (965 kPa), with failure predicted to occur via leakage past the drywell head flange assembly. Since the design of the drywell head flange assembly is plant specific, the Peach Bottom results cannot be applied a priori to other plants. It must be noted, of course, that the continued pressure increase associated with the evolution of noncondensible gases from an unmitigated core/concrete reaction would eventually result in over-pressure failure of the primary containment unless precluded by some other failure mechanism.

A second potential mechanism for MK I primary containment failure in an unmitigated severe accident is drywell liner (shell) ablation due to direct attack by molten corium. The ability of molten metals to erode steel structures is well documented.[4] While significant uncertainties surround the behavior of core/concrete reactions and corium spreading in a MK I containment configuration,[2] preliminary analyses indicate failure of the MK I drywell liner is quite likely if core debris does contact the inner liner surface[5].

Should the liner fail near the drywell floor elevation, the most probable sites for blowdown entry into the secondary containment are the reactor building basement torus room and the second floor of the reactor building (Exhibit 2). The transport path for the blowdown is the gap between the drywell shell and the surrounding reactor building concrete, and the annular gaps surrounding the drywell vent pipes and penetrations. These gaps provide a 145 ft^2 (13.5 m^2) flow path into the torus room and a 135 ft^2 (12.6 m^2) flow path into the second floor of the reactor building. Since elevated drywell pressures and temperatures result in swelling of the drywell liner and a reduction in the gap between the liner and the reactor building concrete (Exhibit 3), it appears that the effective flow path area for drywell blowdown would be limited by the actual size of the drywell shell rupture or the available space between the liner and the surrounding concrete. Significant

DRYWELL SHELL MELT-THROUGH WOULD RESULT IN BLOWDOWN TO TORUS ROOM OR SECOND FLOOR OF REACTOR BUILDING

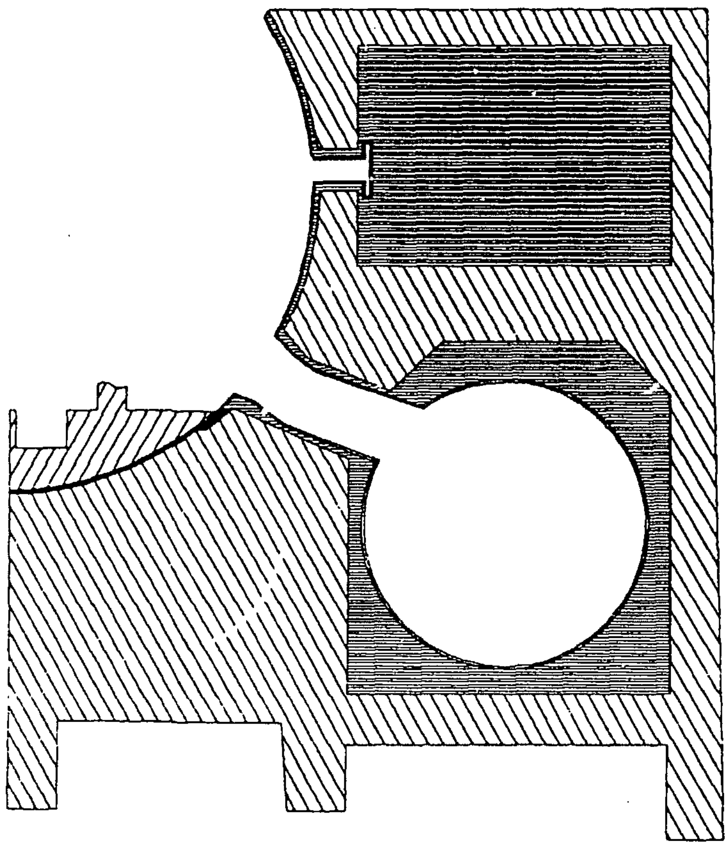

Exhibit 2

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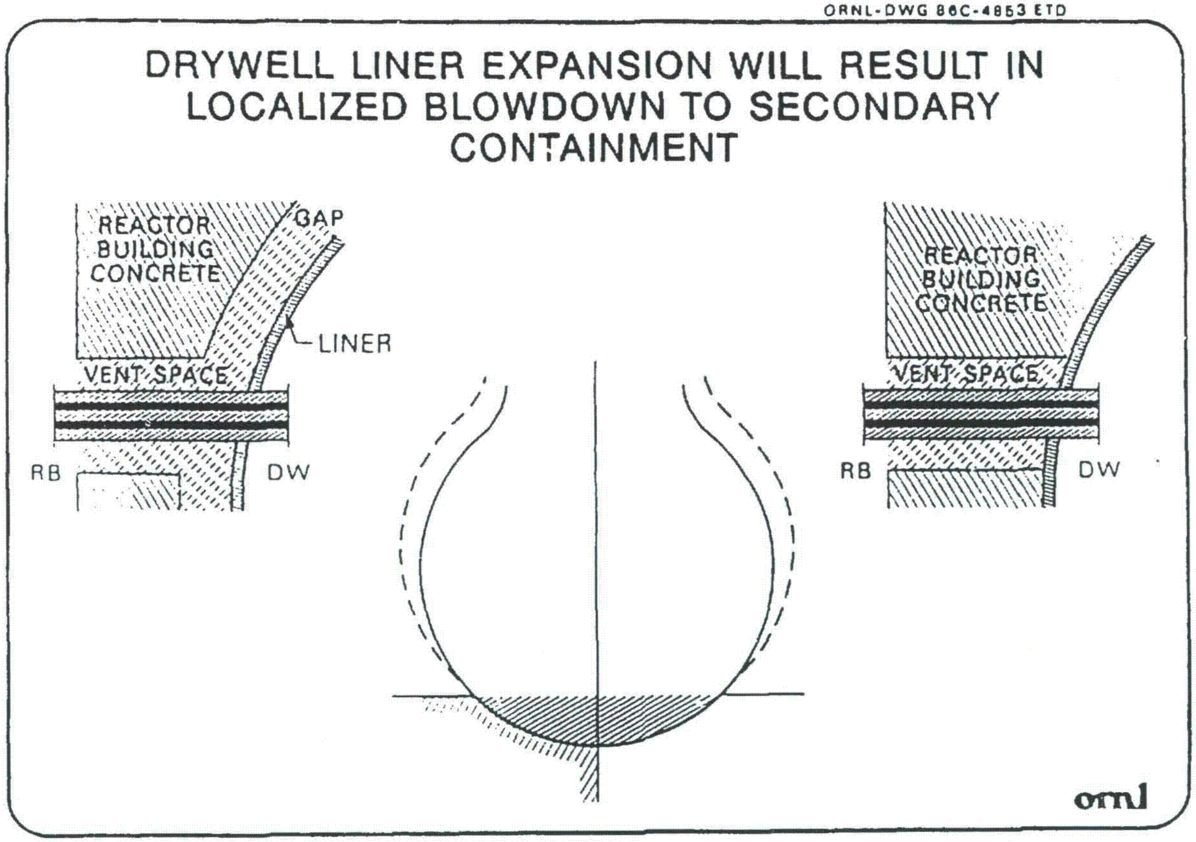

Exhibit 3

uncertainty therefore surrounds both the ultimate hole size and the ablation time associated with opening of the hole for this drywell failure mechanism.

Given the uncertainties surrounding the dynamics of MK I primary containment failure, it appears prudent to investigate the impact of a range of failure mode assumptions on secondary containment hydrogen deflagration phenomena and building survivability. Such an investigation is possible only via detailed computer simulations of secondary containment behavior. During the past two years ORNL has developed an extremely detailed computer model of the Browns Ferry Unit 1 secondary containment. That model is described in the following section.

4. DESCRIPTION OF ORNL 26 CELL BROWNS FERRY SECONDARY CONTAINMENT MODEL

Exhibit 4 is a schematic representation of the ORNL MELCOR[6] Browns Ferry secondary containment model utilized in this study. The model employs 26 computation cells (control volumes) and 51 flow paths to represent the Browns Ferry reactor building, refueling bay, the turbine building, and the interconnections between these compartments and the outside environment. The outside environment is represented by a single control volume yielding a total of 27 computational cells. The overall model topology is dictated by the actual reactor building architecture (Exhibit 5). Each distinct room in the reactor building is represented by a separate cell, while stairwells and open doorways are characterized as flow paths. The floors, ceilings, walls, and steel structures within the reactor building, refueling bay, and turbine building are represented by 126 distinct structures. Table 1 presents a summary of the physical characteristics of each of the 26 cells. The model structure and the parameters employed in the model are based on a detailed review of drawings and on measurements made at the plant by ORNL personnel.

The basement of the reactor building (Exhibit 5) is modeled with six cells representing the torus room, the four corner rooms, and the HPCI pump room (Cell 6). The 565 ft elevation of the reactor building (immediately above the basement) is simulated with five cells representing the north, west, south, and east quadrants of the building and the drywell personnel access room. Each floor of the reactor building above the 565 ft elevation (i.e., elevations 593, 621, and 639 ft) is modeled by four cells representing the north, west, south, and east quadrants of that floor. Additionally, the large refueling cask hatchway which provides the vent path from the blowout panels (at the 565, 593, and 621 ft elevations) to the refueling bay is represented by a single cell. The refueling bay and turbine building are each modeled with single cell representations.

Prior to primary containment pressure boundary failure, the major interaction between the primary and secondary containments is heating of the torus room atmosphere due to heat transfer from the outer surface of

BROWNS FERRY UNIT 1 SECONDARY CONTAINMENT MODEL

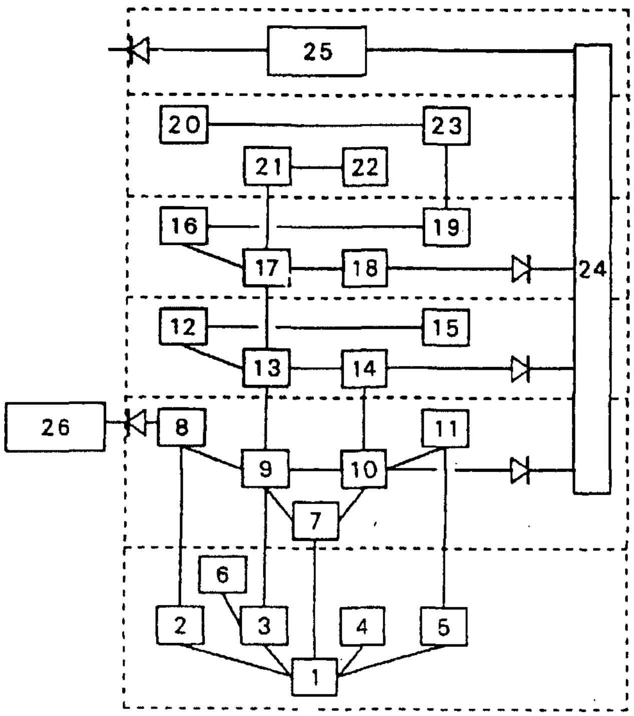

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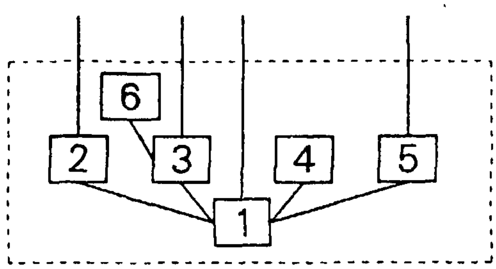
Exhibit 4

Table 1. ORNL 26 Cell Browns Ferry Secondary Containment Model Characteristics

Cell No.	Name	Volume (m^3)	Total area (m^2)		
			Floor	Ceiling	Walls
1	Torus room	5848	1172	1185	2535
2	North corner	775	71	69	346
3	West corner	2784	71	55	340
4	South corner	555	46	46	346
5	East corner	775	71	64	346
6	HPCI Pump rm	1147	144	144	238
7	565 P/A rm	198	58	58	118
8	565 north	2438	342	342	514
9	565 west	2240	276	284	584
10	565 south	1571	197	197	595
11	565 east	1698	235	242	565
12	593 north	1187	121	172	400
13	593 west	2934	321	318	566
14	593 south	1292	133	133	580
15	593 east	1022	117	117	608
16	621 north	526	123	123	226
17	621 west	1556	350	350	363
18	621 south	982	229	229	277
19	621 east	522	110	110	225
20	639 north	3660	158	158	452
21	639 west	3030	423	423	559
22	639 south	1711	239	239	505
23	639 east	525	73	73	402
24	Hatchway	1001	—	—	327
Reactor building total		39977	5080	5131	12017
25	Refueling bay	77730	4202	4756	5709
26	Turbine building	161567	8279	8279	7596

MODEL TOPOLOGY IS DICTATED BY REACTOR BUILDING ARCHITECTURE

REACTOR BUILDING BASEMENT



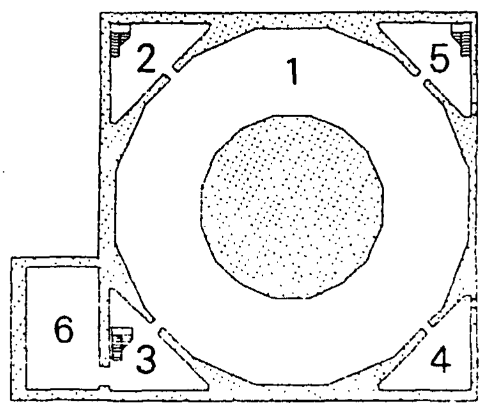


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Exhibit 5

the torus. This effect is captured by representing the torus wall as a steel slab with an appropriate surface area. A time-dependent surface temperature boundary condition is specified on the "inner" surface of the slab, while the outer surface is allowed to convect and radiate energy to the surrounding torus room atmosphere. The inner surface temperature history is taken from the appropriate BWRSAR[7] (prior to reactor vessel failure) and CONTAIN[8] (after reactor vessel failure) calculation results.

All blowout panels are modeled as pressure dependent flow areas. The panels are assumed to begin leaking with an area equivalent to 10% of the total panel area, at a pressure differential equivalent to 90% of the design basis pressure differential for the blowout panel. Eighty percent of the total panel area is assumed to be open at the design pressure differential, and all of the blowout panel is assumed to be open at 110% of the design actuation pressure. This modeling approach reflects the results of laboratory tests which indicate that the blowout panel retaining bolts may fail at pressure differentials equivalent to plus or minus 10% of the design value.[9]

Some BWR secondary containments incorporate comprehensive fire protection systems which utilize fused-link water sprinklers for fire suppression. The Browns Ferry plant utilizes fused-link sprinklers which are designed to actuate at 165°F (347 K). The system consists of two 10000 gallon (37.9 m^3) raw service water (RSW) storage tanks (located atop the reactor building), four RSW pumps (which maintain the tank inventory during normal operation), four fire system pumps (one of which is driven by a dedicated diesel), and the sprinkler system. The RSW storage tanks provide a 20000 gallon (75.7 m^3), gravity-fed sprinkler supply reservoir, and no power is required for actuation of the fused-link sprinklers. Additionally, and very importantly, the one diesel-driven pump provides a highly reliable supply of water to sprinklers located in the first two levels of the reactor building.

The Browns Ferry secondary containment fire protection system sprays would be expected to actuate following primary containment blowdown as a result of rising reactor building temperatures. The MELCOR secondary containment model incorporates a detailed representation of the reactor building fire protection system sprays. The model utilizes ten separate spray systems to simulate the spray heads installed in the west and south basement corner rooms, and the four quadrants of the 565 and 593 ft elevations. The spray flow rate characteristics of each of the ten systems were developed from an analysis of the expected performance characteristics for the situation in which (a) only the diesel-driven pump is available, and (b) all spray heads are open on all systems. The results of that analysis indicate that (for the assumed conditions) the 593 ft elevation sprays would function only until the RSW tank inventory is exhausted.

5. THE PARAMETRIC STUDY

The model described in Section 4 was employed to investigate the impact of MK I primary containment failure dynamics on the Browns Ferry secondary containment's response to the initial (first 5 min) drywell blowdown phase of the short-term station blackout severe accident sequence. A test matrix of 15 cases was defined as described in Table 2. The size of the drywell rupture was varied from 0.5 m^2 (775 in^2) down to 0.0005 m^2 (0.78 in^2), while the time for ablation of the hole was varied from 1 s to 60 s. Additionally, various assumptions were made regarding the hydrogen concentration necessary for deflagration (1, 8, and 12 mole %) and the location at which the blowdown enters the secondary containment (torus room, one corner of reactor building second floor, or all zones of reactor building second floor).

The Browns Ferry secondary containment model described in Section 4 was augmented for this study by the addition of a single cell to represent the entire primary containment (drywell and wetwell). The initial primary containment conditions for the analyses were based on Browns Ferry short-term station blackout CONTAIN calculations performed by C. R. Hyman at ORNL.[2] The drywell pressure boundary is assumed to fail at 9.6 h into the accident due to erosion of the drywell shell by molten corium. This failure is modeled by opening a flow path between the primary containment cell and the appropriate cell or cells of the secondary containment model. The drywell conditions at the time of failure are as noted in Table 2, and the secondary containment is assumed to be at 14.7 psia (101 kPa), 80°F (300 K), and 80 % relative humidity at the start of the accident. The MELCOR calculations for each case were conducted for the period from accident initiation until 5 minutes after drywell failure.

6. RESULTS OF THE ANALYSIS

The results of the various case studies are summarized in Table 3. Cases 1, 2, and 3 (0.5 m^2 cases) all result in hydrogen burn-induced secondary containment pressures well in excess of the design value of 17.7 psia. Case 7 produced the lowest pressure response of any of the cases, because no hydrogen deflagrations were predicted to occur during the first 5 minutes after primary containment failure.

Exhibit 6 depicts the results of Cases 3, 4, 5, 8, and 6, in which a 60 s ablation time was assumed, and hole sizes of 0.5, 0.05, 0.005, 0.0018, and 0.0005 m^2 were employed. The abscissa of Exhibit 6 is reactor building elevation, where RB1 is the reactor building basement, PA-RM is the drywell personnel access room (an interior room) on the second floor (565 ft elevation) of the reactor building, RB2 is the remainder of the second floor of the reactor building, RB3, RB4 and RB5 are the third, fourth, and fifth floors of the reactor building, and RF is the refueling bay. The ordinate of Exhibit 6 is the maximum observed

Table 2. Secondary Containment Study Cases[1]

Case	Description
1	0.5 m^2 hole, 1 s ablation time
2	0.5 m^2 hole, 30 s ablation time
3	0.5 m^2 hole, 60 s ablation time
4	0.05 m^2 hole, 60 s ablation time
5	0.005 m^2 hole, 60 s ablation time
6	0.0005 m^2 hole, 60 s ablation time
7	0.0005 m^2 hole, 1 s ablation time
8	0.0028 m^2 hole, 60 s ablation time
9	Case 5 except 1/2 primary containment H_2
10	Case 5 except no burn propagation allowed
11	Case 5 except flame speed fixed at 3.0 m/s
12	Case 5 except blowdown to one corner of second floor of reactor building
13	Case 5 except blowdown into all of second floor of reactor building
14	Case 5 except burn triggers at 1 mole % H_2
15	Case 5 except burn triggers at 12 mole % H_2

[1]Except as noted, all cases assume:

(a) blowdown to torus room,
(b) deflagration trigger at 8 mole % H_2,
(c) 4.1 mole % H_2 for upward flame propagation,
(d) 6 mole % H_2 for horizontal flame propagation,
(e) 9 mole % H_2 for downward flame propagation,
(f) drywell failure at 9.6 h,
(g) primary containment conditions at failure — 81 psia (559 kPa), 381°F (467 K), 53 mole % hydrogen, 1 mole % oxygen, 25 mole % nitrogen, 1 mole % carbon dioxide, and 20 mole % steam

Table 3. Results of Case Studies — Reactor Building Response

Case No.	Peak Basement		Peak Reactor Building[1]	
	Pressure (psia)	Temperature (°F)	Pressure (psia)	Temperature (°F)
1	37.7	3683	27.2	2397
2	32.3	3288	28.9	2286
3	32.1	3445	26.8	2225
4	24.6	3362	18.1	1978
5	20.8	1452	16.5	337
6	22.1	1340	19.6	946
7	14.8	101	14.7	88
8	20.8	137	16.5	783
9	20.7	1352	16.5	330
10	20.9	4404	16.4	662
11	18.0	1275	17.2	895
12	15.6	125	15.7	1292
13	16.3	189	16.8	1295
14	15.3	4756	15.0	836
15	25.9	1929	18.4	659

[1]Excluding basement compartments.

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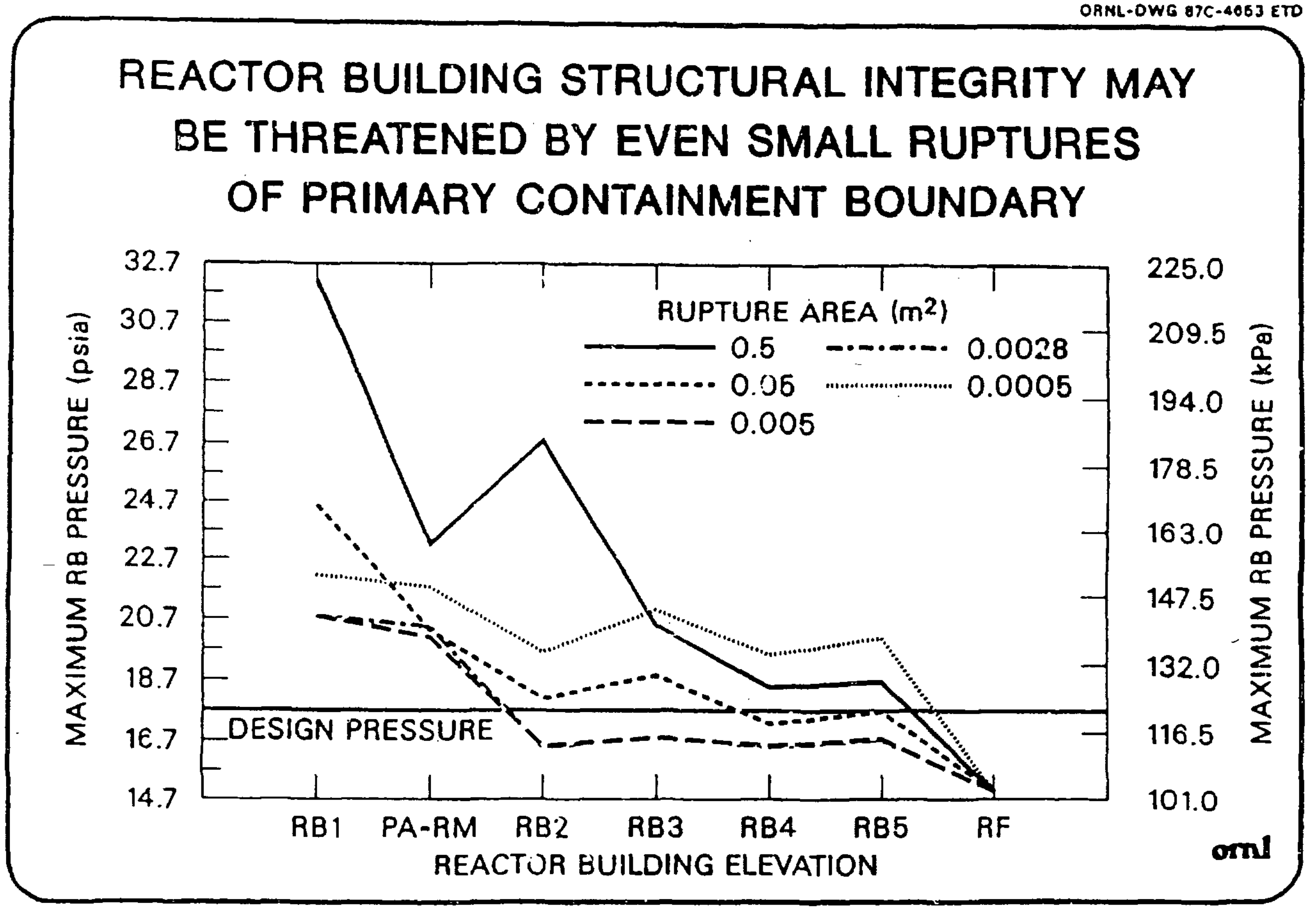

Exhibit 6

pressure on each respective floor of the reactor building during the duration of the 5 minute analysis period. (It should be noted that the pressures plotted in Exhibit 6 and the exhibits to follow may not have occurred at the same instant in time.)

A review of Exhibit 6 reveals that peak reactor building pressures in excess of the design pressure may be produced by a wide range of primary containment hole sizes (0.5, 0.05, and 0.0005 m^2). Interestingly, Exhibit 6 suggests that there may be an optimal hole size which minimizes the deflagration-induced secondary containment pressures. This inference is of little utility, however, since there is currently no available method for predicting the hole size resulting from corium ablation of the drywell liner.

The results of this evaluation indicate that reactor building survivability may be a function of the hydrogen concentration at which deflagrations initiate. This behavior is demonstrated by Exhibit 7, which depicts the results of Cases 5, 14, and 15. Case 5 is a default case in which a 0.005 m^2 hole is assumed to open over 60 s. Deflagration is allowed to occur at hydrogen concentrations of 8 mole %. Case 14 is identical to Case 5, except that deflagrations are allowed to occur at hydrogen concentrations of only 1 mole %. This case is a crude approximation of a situation in which the hydrogen is assumed to burn in a continuous fashion as it enters the torus room. Case 15 is a case in which hydrogen deflagration is delayed until 12 mole % concentrations are reached (as might occur in the absence of auto-ignition or ignition sources). Exhibit 7 demonstrates that, for a given primary containment hole size and ablation time, the survivability of the reactor building may depend on avoidance of delayed hydrogen deflagrations.

Not shown in Exhibit 7, but illustrated by Table 3, is the effect of continuous hydrogen burning (Case 14) on reactor building basement atmosphere temperatures. While continuous burning does reduce the magnitude of deflagration-induced reactor building pressure spikes, this reduction in pressure is coupled with a tremendous increase in thermal loading in the zone in which the burn is occurring. The maximum observed reactor building temperature (4756°F or 2898 K) occurs in conjunction with the continuous burning case. If maintained, temperatures of this magnitude would challenge the integrity of the pressure suppression pool torus and produce degassing of the structural concrete. Neither of these effects were considered in the present analysis.

Exhibit 8 displays the impact that the primary containment blowdown entrance site into the secondary containment has on peak deflagration-induced reactor building pressures. Each of the three cases depicted in Exhibit 8 assumes a 0.005 m^2 primary containment failure hole size and a 60 s ablation time. The lowest peak pressures are seen to result from the case in which the blowdown is assumed to enter the south quadrant of the second floor of the reactor building. Intermediate pressures are generated by the case in which the blowdown is assumed to enter all quadrants of the second floor of the reactor building. The highest pressures are produced by the case in which the primary containment

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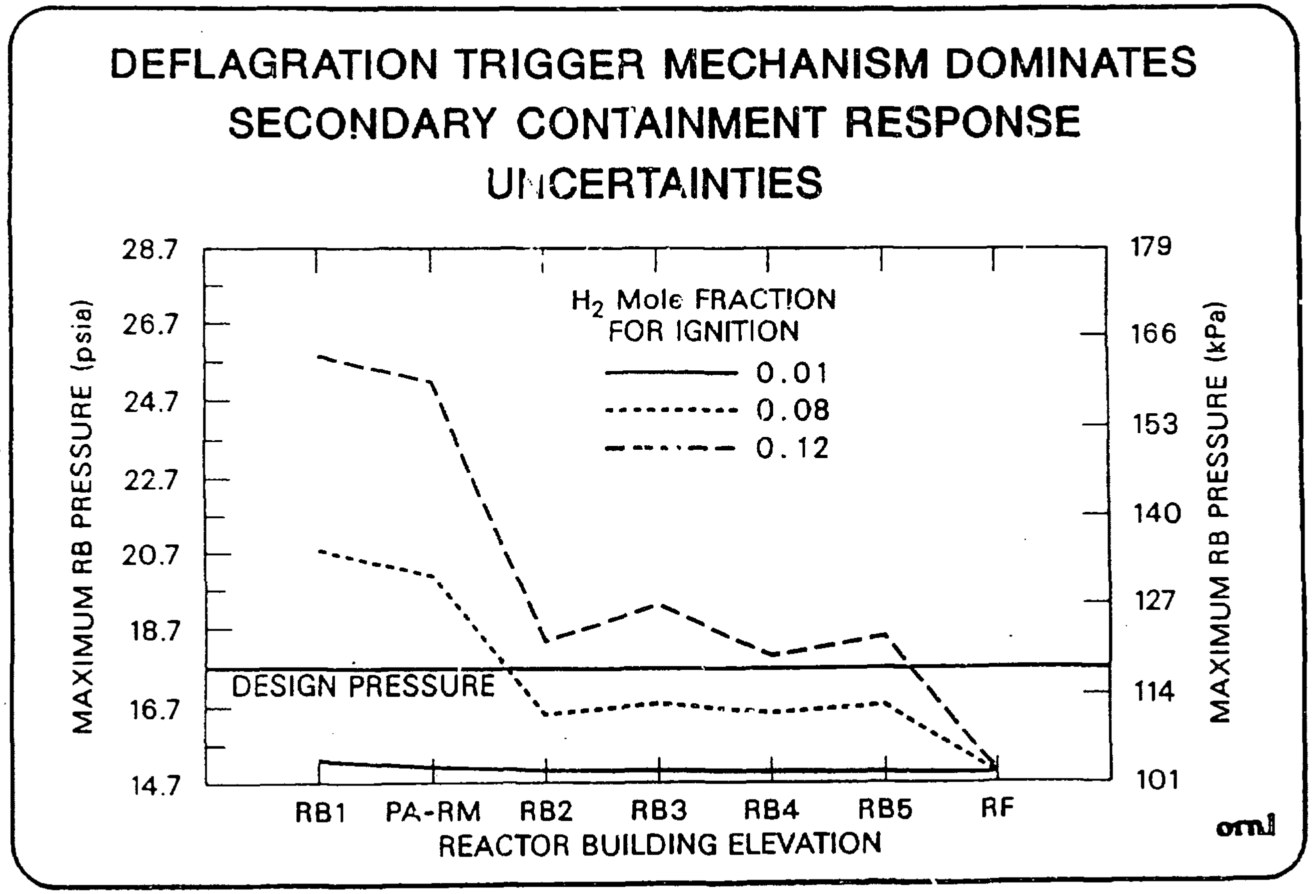
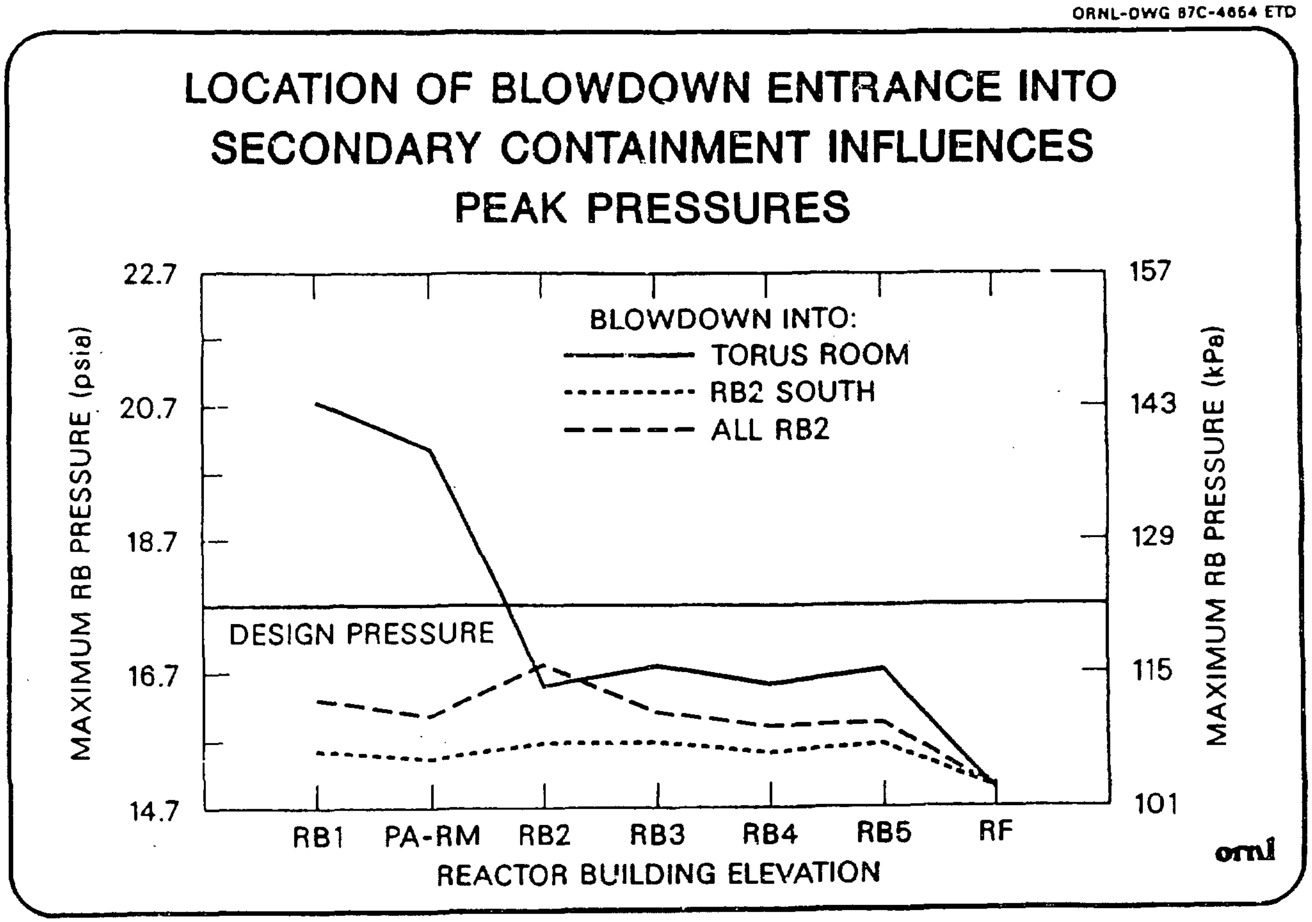


Exhibit 7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LOCATION OF BLOWDOWN ENTRANCE INTO SECONDARY CONTAINMENT INFLUENCES PEAK PRESSURES
BLOWDOWN INTO:
TORUS ROOM
RB2 SOUTH
ALL RB2
DESIGN PRESSURE
MAXIMUM RB PRESSURE (psia)
22.7
20.7
18.7
16.7
14.7
MAXIMUM RB PRESSURE (kPa)
157
143
129
115
101
RB1
PA-RM
RB2
RB3
RB4
RB5
RF
REACTOR BUILDING ELEVATION
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Exhibit 8

blowdown enters the torus room. Maximum pressures in the regions of the reactor building above ground level are below the design dynamic pressure of the concrete walls for all three cases.

7. SECONDARY CONTAINMENT SURVIVABILITY — UNCERTAINTIES

The results of the analysis presented here do not constitute a definitive assessment of reactor building survivability due to a host of unresolved phenomenological and modeling uncertainties. From the phenomenological standpoint, the major uncertainty is probably the characterization of the primary containment failure opening (hole size and ablation time). It must be noted, however, that a wide range of hole sizes result in peak deflagration-induced reactor building pressures significantly in excess of design values.

Secondly, the peak induced reactor building pressures are very sensitive to the assumed minimum hydrogen concentrations necessary for ignition. In the case of primary containment boundary failure due to corium attack of the drywell shell, the gases leaving the drywell would flow over hot core debris and might be heated to auto-ignition conditions (approximately 1000°F or 800 K). A spark source would be required for ignition of the resulting hydrogen mixtures for cases in which auto-ignition does not occur. While power would not be available during the station blackout scenario, the abundance of batteries and capacitive and inductive devices in the secondary containment should provide the necessary spark source. The length of the delay prior to ignition is an important unknown, since long delays would result in hydrogen-rich secondary containment gas concentrations and higher peak pressures when deflagrations do occur.

Modeling uncertainties which have the potential to significantly impact the results of this analysis include model topology issues and uncertainties in MELCOR's deflagration physics models. Previous ORNL secondary containment studies[10] have demonstrated the importance of detailed, architectural-based secondary containment models. The model employed in this study, while more detailed than any previous model employed by ORNL, does treat the reactor building torus room as a single, well mixed cell. The torus cell is the largest cell (volume) in the reactor building model, and approximately 83 lb (37.7 kg) of hydrogen are required to bring the torus room atmosphere up to default (8 mole % hydrogen) deflagration conditions. The intricacies of the communication between the torus room and the basement corner rooms are also not completely captured by this model. Sub-nodalization of this cell would result in more accurate representation of torus room and corner room interaction, and (perhaps) impact peak building pressures due to ignition of smaller quantities of hydrogen.

The second major area of modeling uncertainty which has the capacity to impact the results of this study is associated with MELCOR's hydrogen deflagration physics models. MELCOR employs the basic deflagration models developed for HECTR[11] and CONTAIN, with the exception that MELCOR's flame speed correlation does not include a term which reduces flame speeds for steam-rich atmospheres. Most of the experimental data upon which the deflagration models are based was generated by small and intermediate scale experiments (less than 10 m^3 compartments). The scaling of flame speed and burn completeness correlations, burn-induced heat flux partitioning fractions (convective versus radiative), and hydrogen concentration ignition thresholds from these small experiments to compartments with volumes of 1000 to 6000 m^3 is subject to many uncertainties.

Finally, the results of this study suggest that primary containment venting might be employed as a solution to the secondary containment survivability issue. One can envision scenarios in which hydrogen would be vented via a "hard" (special purpose) wetwell vent, thereby reducing the amount of hydrogen available for combustion in the secondary containment should the primary containment boundary fail. The vent could (in theory) be closed prior to drywell liner failure to insure that subsequent hydrogen deflagrations in the reactor building basement would not result in torus or vent ducting failure and the opening of a direct vent path from the primary containment to the outside atmosphere. Although we intend to investigate this concept further, it should be noted that (a) corium attack of the drywell shell would not be precluded by containment venting, and (b) recent ORNL studies[2,7] indicate that significant hydrogen might be generated by the core/concrete reaction after the drywell liner is failed.

8. CONCLUSIONS

The impact of BWR MK I primary containment boundary failure dynamics on Browns Ferry's secondary containment integrity has been explored via a parametric study approach. The results of the study indicate that peak hydrogen deflagration-induced reactor building pressures exceed design pressures for a wide range of primary containment hole sizes and ablation times, but that reactor building survivability appears probable for some scenarios. The major uncertainty in the analysis is the assumption regarding the minimum hydrogen concentration necessary for deflagration. Low minimum hydrogen concentrations (an approximation to continuous burning) result in low reactor building peak pressures but extremely high temperatures. The location at which the primary containment blowdown enters the secondary containment influences the peak deflagration-induced reactor building pressures. Primary containment venting for the purpose of reducing the hydrogen inventory available for deflagration in the secondary containment may improve the probability of secondary containment survivability for some scenarios. Additional analysis is underway to explore the potential benefits of this procedure. Finally, existing hydrogen deflagration physics models incorporated in present codes are based on small and intermediate scale experiments. Significant uncertainties are implicit in the application of these models to the simulation of deflagrations in large compartments.

REFERENCES

1. *Browns Ferry Final Safety Analysis Report*, Sect. 5.3, Tennessee Valley Authority.

2. C. R. Hyman, "Multicell CONTAIN Analysis Of BWR MK I Drywell Response To Time-Dependent Vessel Release Of Core Debris," Presented at *Severe Fuel Damage, Containment Loads, and Source Term Research Program Review Meeting*, Silver Spring, Maryland, October 19-23, 1987.

3. *Mark I Containment Severe Accident Analysis*, Chicago Bridge and Iron Company, for the Mark I Owners Group, April 1987.

4. D. A. Powers, "Erosion of Steel Structures by High-Temperature Melts", *Nuclear Science and Engineering*, 88, 357-366 (1984).

5. G. A. Greene, K. R. Perkins, and S. A. Hodge, "Impact of Core-Concrete Interactions in the Mark I Containment Drywell On Containment Integrity and Failure Of The Drywell Liner", IAEA-SM-281/36, *International Symposium on Source Term Evaluation For Accident Conditions*, Columbus, Ohio, 28 October — 1 November, 1985.

6. F. E. Haskin, et al., "Development and Status of MELCOR", SAND86-2115C, Sandia National Laboratories, presented at the *Fourteenth Water Reactor Safety Information Meeting*, National Bureau of Standards, Gaithersburg, Maryland, October, 1986

7. L. J. Ott, "Advanced Severe Accident Response Models for BWR Application," Oak Ridge National Laboratory, presented at the *Fifteenth Water Reactor Safety Information Meeting*, National Bureau of Standards, Gaithersburg, Maryland, October 1987.

8. K. D. Bergeron, et al., *User's Manual for CONTAIN 1.0, A Computer Code for Severe Nuclear Reactor Accident Containment Analysis*, NUREG/CR-4085, Sandia National Laboratories, May, 1985

9. *Browns Ferry Final Safety Analysis Report*, p. 5.3-23

10. S. R. Greene, "The Role of BWR MK I Secondary Containments In Severe Accident Mitigation," Oak Ridge National Laboratory, presented at the *Fourteenth Water Reactor Safety Information Meeting*, National Bureau of Standards, Gaithersburg, Maryland, October, 1986.

11. S. E. Dingman, et al., *HECTR Version 1.5 User's Manual*, NUREG/CR-4507, SAND86-0101, Sandia National Laboratories, April, 1986.

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Tsunami Requirements and Measures

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Tsunami Regulations, Guidelines and References

- 10 CFR PT. 100.23
- American National Standard Institute (ANSI) N170-1992, "Standards for Determining Design Basis Flooding at Power Reactor Sites"
- Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants," Rev. 1 1976
- Regulatory Guide 1.59, "Design Basis for Nuclear Power Plants," Rev. 2. 1977
- US NRC, Standard Review Plan, "Probable Maximum Tsunami Flooding," Section 2.4.6

Regulations and Guidelines on Tsunami

- 10 CFR 100.23 – Geological and seismic siting criteria
  - The size of seismically induced floods and water waves that could affect a site from either locally or distantly generated seismic activity must be determined
- ANSI N170 – Standards for Determining Design Basis Flooding at Power Reactor Sites
  - Probable maximum flood is the hypothetical flood (peak discharge, volume, and hydrograph shape) that is considered to be the most severe reasonably possible, based on hydrologic factors favorable for maximum flood runoff such as sequential storms or snowmelt.

Regulations and Guidelines on Tsunami (Cont.)

- RG 1.102 – Flood Protection for Nuclear Power Plants

Describes types of flood protection acceptable to the NRC staff

- Exterior Barriers
  - **Levee** – embankment to protect land from inundation
  - **Seawall or floodwall** – a structure separating land and water areas, primarily to prevent erosion and other damages due to wave action
  - **Bulkhead** – similar to seawall, purpose is to restrain the land area
- Incorporated Barriers
  - Protection provided by specially designed walls and penetration closures. Walls are usually reinforced concrete designed to resist static and dynamic forces of a Design Basis Flood Level of a Probable Maximum Flood.

Regulations and Guidelines on Tsunami (Cont.)

- RG 1.59 – Design Basis Floods for Nuclear Power Plants
  - The most severe seismically induced floods reasonably possible should be considered for each site.
  - Tsunami requires consideration of seismic events of the severity of the Safe Shutdown Earthquake occurring at the location that would produce the worst such flood at the nuclear power plant site.
- US NRC, Standard Review Plan, "Probable Maximum Tsunami Flooding," Section 2.4.6, Rev. 2
  - Areas of Review
    - Probable maximum tsunami postulated for a site should include wave runup and drawdown
    - Hydrologic characteristics of maximum locally and distantly generated tsunami (e.g., volcanoes, landslides)
    - Geological and seismic characteristics of potential tsunami faults (e.g., magnitude, focal depth, source dimensions, fault orientation, and vertical displacement)

Tsunami Requirements and Measures taken at U.S. NPPs on the West Coast

Diablo Canyon

The licensing basis for tsunami represents the following two classes on tsunamis:

- Distantly-generated tsunami: a tsunami whose generator is located more than several time the principal source dimension (e.g., length of postulated fault rapture) from the plant
  - The predominant sources of distantly-generated tsunamis are limited to areas of earthquake and volcanic activity on the circum-Pacific belt. (e.g., Aleutian area, Kuril-Kamchatkda region, and the South American coast)
- Locally-generated (near-shore) tsunami: a tsunami whose generator is closer than the distance defined for distantly-generated tsunami
  - Near-Shore Earthquake faults
  - Santa Lucia Bank Fault, located approximately 29 mile from the site, considering a resultant displacement of 9.8 feet and a vertical displacement (6.6 feet) equal to 2/3 of the resultant displacement
  - Santa Maria Basin Fault (later identified as the Hosgri fault), located approximately 3.5 miles from the site, considering a resultant displacement of 11 feet and a vertical displacement (7.3 feet) equal to 2/3 of the resultant displacement

Dion, Jeanne

From: Scott, Michael
Sent: Thursday, March 17, 2011 2:03 PM
To: Navarro, Carlos; Zigh, Ghani; Dion, Jeanne; Santiago, Patricia
Subject: FW: Overview of Japanese Event (Meeting Slides)
Attachments: Staff Slides for March 21 Meeting (Japanese Event) (2).pptx

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From: Thorpe, April
Sent: Thursday, March 17, 2011 2:00 PM
To: Scott, Michael; Bajwa, Chris; Milligan, Patricia
Subject: Overview of Japanese Event (Meeting Slides)

Good Day:

Attached is a completed copy of meeting slides regarding the Japanese Event.

If you should have any questions, please feel free to contact me at your earliest convenience.

Thank you,

April R. Thorpe
Contract Secretary
Region II Plant Licensing Branches
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation
Phone 301-415-2024 Fax 301-415-1222
April.Thorpe@nrc.gov

H-37

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

Briefing on NRC Response to Recent Nuclear Events in Japan

Bill Borchardt
Executive Director for Operations

March 21, 2011

Agenda

- Event Overview
- Immediate NRC Response
- Continuing NRC Response
- Health Effects of Radiation
- Domestic Reactor Safety
- Path Forward

Event Overview

- **Discussion of initiating event**
- **Current status of reactors**
- **Current status of spent fuel pools**

Immediate NRC Response

- Activated Operations Center
- Dispatched NRC experts to Japan
- Areas of focus
- Extensive outreach to stakeholders

Continuing NRC Response

- Operations Center
- Support U.S. response
- Provide assistance
- Mobilize resources

Health Effects of Radiation

- **Offsite Doses**
- **Radiological Consequences**

Domestic Reactor Safety

- NRC oversight of U.S. plant safety
- Continuous improvement based on operating experience

NRC Activities – Near Term

- Inspection Activities
- Generic Communications
- Immediate regulatory actions

NRC Activities – Longer Term

- Lessons learned and recommendations
- Regulatory actions, for example, to identify potential:
  - Research projects
  - Generic issues
  - Regulatory enhancements

Conclusion

1. Latest weather-related LOOP data for U.S plants.

From our latest 2009 summary of Loss of Offsite Power Events: http://nrcoe.inel.gov/results/index.cfm?fuseaction=LOSP.showDoc&doc=loop%2Dsummary%2Dupdate%2D2009%2Epdf, it looks like the incidence of occurrence of LOOP due to weather-related effects is <u>not</u> declining:

P-value = 0.725 Year P-value = 0.963

Note: *The confidence interval for 2003 does not account for the dependence of the events and is, therefore, too narrow (by an undetermined amount).*

Figure 5. Trend plot of LOOP frequency for 1986–1996 and 1997–2009. Grid-related LOOPs: trend plot of industry performance during critical operation.

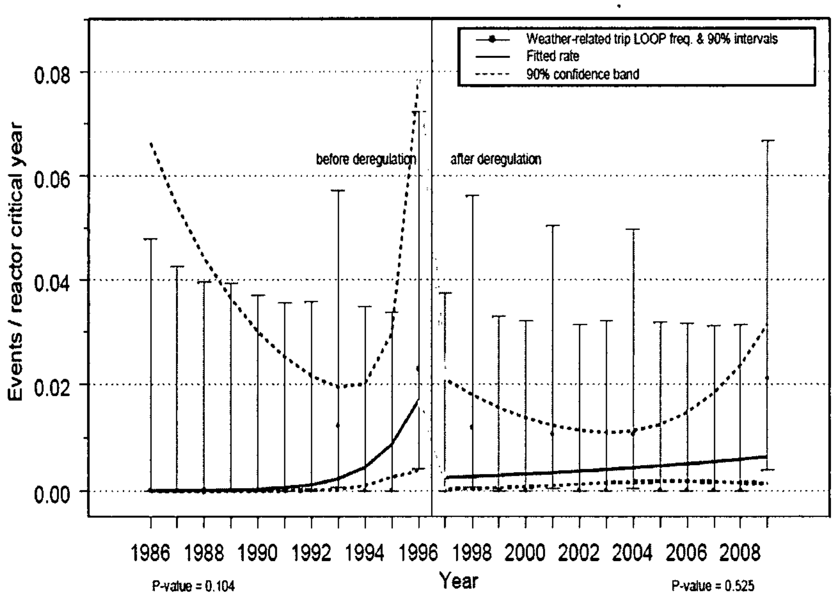

Figure 6. Trend plot of LOOP frequency for 1986–1996 and 1997–2009. Weather-related LOOPs: trend plot of industry performance during critical operation.

2. A study of the effectiveness of the hardened vent was performed by INL in 1989, "An Overview of BWR Mark-1 Containment Venting Risk Implications" NUREG/CR-5225 (I have a copy).

The report provides dose effects resulting from core melt sequences.

It was reported that the TW sequence, loss of loss of long term DHR, pressure in containment builds up slowly enough that the venting procedure would likely be effective in risk reduction provided core cooling was eventually brought on line:

> *"Higher TW core melt frequencies, typical of some Mark I plants, show the potential for 50-mile population doses in the thousands of man-rem per ry. Based upon questions about vital equipment performance, the safety of onsite personnel, and the ability to continue repair operations, a reliable hard pipe system makes good engineering sense."* *But, "procedures and equipment necessary to maintain an alternate vessel injection source during venting operations are needed."*

Rebstock, Paul

From: Betancourt, Luis
Sent: Thursday, March 17, 2011 3:28 PM
To: RES_DE_DICB; NRO_DE_ICE1 Distribution; NRO_DE_ICE2 Distribution; NRR_DE_EICB Distribution
Subject: Status of Japan's Nuclear Power Plants
Attachments: Japanese Reactors March 16th.pdf

Folks,

The attachment gives an informative, up-to-date summary of the status of the ten Fukushima Boiling Water Reactors. It is provided by the Japan Atomic Industrial Forum (JAIF) and I believe it is updated from time to time at http://www.jaif.or.jp/english/. The attachment also provides the latest radiation readings at the site boundary. What is lacking is information on what radionuclides are causing that dose rate.

Enjoy!

Luis D. Betancourt, EIT
Digital I&C Engineer
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Digital Instrumentation and Control Branch
21 Church Street, Rockville MD, 20850, USA
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301-251-7409
301-251-7422
Luis.Betancourt@nrc.gov
"We are what we believe we are" - C.S. Lewis

H-38

of 19:00 March 16 (Estimated by JAIF)

Fukushima #1 Nuclear Power Station			
3	4	5	6
784 / 2381			1100 /3293
BWR-4	BWR-4	BWR-4	BWR-5
Service	Outage	Outage	Outage
Damaged	No fuel rods	Not Damaged	Not Damaged
ıge Suspected	Not Damaged	Not Damaged	Not Damaged
t Functional	Not necessary	Not necessary	Not necessary
t Functional	Not necessary	Not necessary	Not necessary
rely Damaged	Severely Damaged	Not Damaged	Not Damaged
half of the Fuel	Safe	Safe	Safe
Stable	Safe	Safe	Safe
Stable	Safe	Safe	Safe
ıuing(Seawater)	Not necessary	Not necessary	Not necessary
ecided(Seawater)	Not necessary	Not necessary	Not necessary
ıuing(Seawater)	Not necessary	Not necessary	Not necessary
Low, Preparing ter Injection	Level Low, Preparing Water Injection Damage to Fuel Rods Suspected	Pool Temp. Increasing	Pool Temp. Increasing
PS border: 1937 μSv/h at 14:30, Mar. 16			
20km from NPS ı 20km to 30km from the Fukushima #1NPS are to stay indoors.			
6AM, Mar. 15, and the radiation monitor readings increased outside of the building: beside Unit-4 at 10:22, Mar. 15. and hydrogen was generated from these fuels, resulting in explosion. e was observed at 5:45, Mar. 16, and then disappeared later. ıged in water injection operation have been evacuated. 3:30, Mar. 16. TEPCO estimates that failing to cool the SFP has resulted in evaporation of pool water,			

ower Station	
3	4
BWR-5	BWR-5
Service	Service
ıt Damaged	Not Damaged
ıt Damaged	Not Damaged
unctioning	Functioning
t necessary	Not necessary
ıt Damaged	Not Damaged
(No info)	(No info)
(No info)	(No info)
(No info)	(No info)
t necessary	Not necessary
t necessary	Not necessary
t necessary	Not necessary
(No Info)	(No Info)
t 12:00, Mar. 16	
PS	
l shutdown.	

), 11:00, 16:25, 3/16 11:15)

[Significance judged by JAIF]

: low

: high

: severe

Status of nuclear power plants in Fukushima as of 19:00 March 16 (Estimated by JAIF)

Power Station	Fukushima #1 Nuclear Power Station					
Unit	1	2	3	4	5	6
Electric / Thermal Power output (MW)	460 / 1380	784 / 2381				1100 /3293
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
Operation Status at the earthquake occurred	Service	Service	Service	Outage	Outage	Outage
Core and Fuel Integrity	Damaged	Damaged	Damaged	No fuel rods	Not Damaged	Not Damaged
Containment Integrity	Not Damaged	Damage Suspected	Damage Suspected	Not Damaged	Not Damaged	Not Damaged
Core cooling requiring AC power	Not Functional	Not Funcional	Not Functional	Not necessary	Not necessary	Not necessary
Core cooling not requiring AC power	Not Functional	Not Functional	Not Functional	Not necessary	Not necessary	Not necessary
Building Integrity	Severely Damaged	Slightly Damaged	Severely Damaged	Severely Damaged	Not Damaged	Not Damaged
water level of the pressure vessel	Around half of the Fuel	Recovering after Dried-up	Around half of the Fuel	Safe	Safe	Safe
pressure of the pressure vessel	Stable	Fluctuating	Stable	Safe	Safe	Safe
Containment pressure	Stable	D/W: Unknown, S/P: Atmosphere	Stable	Safe	Safe	Safe
Water injection to core (Accident Management)	Continuing (Seawater)	Continuing(Seawater)	Continuing(Seawater)	Not necessary	Not necessary	Not necessary
Water injection to Containment Vessel (AM)	Continuing(Seawater)	to be decided(Seawater)	to be decided(Seawater)	Not necessary	Not necessary	Not necessary
Containment venting (AM)	Continuing(Seawater)	Preparing(Seawater)	Continuing(Seawater)	Not necessary	Not necessary	Not necessary
Fuel Integrity in the spent fuel pool	(No info)	(No info)	Level Low, Preparing Water Injection	Level Low, Preparing Water Injection Damage to Fuel Rods Suspected	Pool Temp. Increasing	Pool Temp. Increasing
Environmental effect	NPS border: 1937 μSv/h at 14:30, Mar. 16					
Evacuation Area	20km from NPS * People who live between 20km to 30km from the Fukushima #1NPS are to stay indoors.					
Remarks	A fire broke on the 4th floor of the Unit-4 Reactor Building around 6AM, Mar. 15, and the radiation monitor readings increased outside of the building: 30mSv between Unit-2 and Unit-3, 400mSv beside Unit-3, 100mSv beside Unit-4 at 10:22, Mar. 15. It is estimated that spent fuels stored in the spent fuel pit heated and hydrogen was generated from these fuels, resulting in explosion. TEPCO later announced the fire was been burned out. Another fire was observed at 5:45, Mar. 16, and then disappeared later. Other staff and workers than fifty TEPCO employees who are engaged in water injection operation have been evacuated. White smoke was seen rising from the vicinity of Unit-3 at around 8:30, Mar. 16. TEPCO estimates that failing to cool the SFP has resulted in evaporation of pool water, generating steam.					

Power Station	Fukushima #2 Nuclear Power Station			
Unit	1	2	3	4
Electric / Thermal Power output (MW)	1100 / 3293			
Type of Reactor	BWR-5	BWR-5	BWR-5	BWR-5
Operation Status at the earthquake occurred	Service	Service	Service	Service
Core and Fuel Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
Containment Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
Core cooling requiring AC power	Functioning	Functioning	Functioning	Functioning
Core cooling not requiring AC power	Not necessary	Not necessary	Not necessary	Not necessary
Building Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
water level of the pressure vessel	(No info)	(No info)	(No info)	(No info)
pressure of the pressure vessel	(No info)	(No info)	(No info)	(No info)
Containment pressure	(No info)	(No info)	(No info)	(No info)
Water injection to core (Accident Management)	Not necessary	Not necessary	Not necessary	Not necessary
Water injection to Containment Vessel (AM)	Not necessary	Not necessary	Not necessary	Not necessary
Containment venting (AM)	Not necessary	Not necessary	Not necessary	Not necessary
Fuel Integrity in the spent fuel pool	(No Info)	(No Info)	(No Info)	(No Info)
Environmental effect	NPS border: 29.4 μSv/h at 12:00, Mar. 16			
Evacuation Area	10km from NPS			
Remarks	All the units are in cold shutdown.			

[Source]
Governmental Emergency Headquarters: News Release (3/16 7:00), Press conference (3/14 11:45, 16:15, 3/15 8:00, 11:00, 16:25, 3/16 11:15)
NISA: News Release (3/14 7:30), Press conference (3/16 12:00)
TEPCO: Press Release (3/14 16:00, 17:35, 3/15 6:00, 12:00, 16:30, 23:35, 3/16 0:00),
Press Conference (3/14 12:10, 20:00, 3/15 8:00, 8:30, 3/16 early morning)

[Abbreviations]
INES: International Nuclear Event Scale
NISA: Nuclear and Industrial Safety Agency
SFP: spent fuel pool
TEPCO: Tokyo Electric Power Company, Inc.

[Significance judged by JAIF]
: low
: high
: severe

Dion, Jeanne

From: Rivera-Lugo, Richard
Sent: Thursday, March 17, 2011 3:49 PM
To: Dion, Jeanne
Subject: RE: ACTION: OGC request for all Yucca Mt documents

Btw, who was the person that requested the tsunami reports that I sent you yesterday?

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 3:36 PM
To: Rivera-Lugo, Richard
Subject: RE: ACTION: OGC request for all Yucca Mt documents

Thanks much!

From: Rivera-Lugo, Richard
Sent: Thursday, March 17, 2011 3:34 PM
To: Dion, Jeanne
Subject: RE: ACTION: OGC request for all Yucca Mt documents

Jeanne,

I requested the DE staff to provide any Yucca Mountain-related work information they had at hand, and so far this is what I have received (I attached their e-mails for your reference):

From Edward O'Donnell:
Job Code: unknown

Title: "Application of GPS for measuring tectonic movement in Southeastern California and Adjacent Nevada" (title is approximate)
done by the University of Southern California, Principal Investigator Dr. Brian Wernicke

Technical area focus: Structural Geology, Tectonics

Brief Description: GPS was used to measure tectonic movement of precisely survey stations through time.

Key references relating to the NRC funded research

42 Bennett, R.A., Davis, J.L., and Wernicke, B.P., 1998, Continuous GPS measurements of contemporary deformation across the northern Basin and Range: Geophysical Research Letters, v. 25, p. 563-566.

41 Wernicke, Brian, Davis, J.L., Bennett, R.A., El�segui, P., Abolins, M., Brady, R.J., House, M.A., Niemi, N.A., and Snow, J.K., 1998, Anomalous strain accumulation in the Yucca Mountain area, Nevada: Science, v. 279, p. 2096-2100.

40 Bennett, R.A., Davis, J.L., El�segui, P., Wernicke, B.P., Snow, J.K., Abolins, M.J., House, M.A., Stirewalt, G.L., and Ferrill, D.A. 1997, Global Positioning System constraints on fault slip rates in the Death Valley region, California and Nevada: Geophysical Research Letters, v. 24, p. 3073-3076.

From Mirela Gavrilas:

H-39

Roger Staehle, and independent consultant from Minnesota, supported the NRC on steam generator corrosion issues sometime in the late nineteen nineties. Subsequently, the contractor used the some of his research results, in support of the state of Nevada in Yucca Mountain hearings between 2001 and 2004. Dr. Staehle was not under contract to the NRC during those hearings.

I do not believe that this interaction is covered by your inquiry, but I'm providing it, just in case. If you need further information, you will have to wait until 3/28 when Darrell Dunn returns from vacation. Someone in NMSS might also have independent recollection of these hearings, if your information is urgent.

From Leroy Hardin:
I have not worked on Yucca at research. I was involved when I worked at NRC's Atomic Safety Licensing Board (ASLBP). That was a while ago

Here is the info as I have it. I can't really give you everything as it is not all applicable. So I will do my best in narrative.

Most work was for Atomic Safety Licensing Board
Licensing Support Network (LSN).
Responsible for electronic loading of documents that were to be used in the Yucca Mountain hearings. Went to affected units of local government in the area of the planned repository to support their database submissions. Supported computer work at Las Vegas courthouse (NRC facility). Also worked DDMS system which was basically a hearing support system. All the work really involved computer database efforts and support but it was for Yucca Mountain. FYI, no one from ASLBP have contacted me so this may be irrelevant information. But I just wanted to be sure. I hope this helps.

From Greg Oberson:
Before coming to RES I worked in the Yucca Mountain division in NMSS. I don't know if this counts towards what you're looking for. If so, I'll provide further information.

Richie

Richard Rivera-Lugo, EIT, MEM
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission – HQ
RES/DE
Ph. 301-251-7652
Fax 301-251-7420
Mail M.S. C5C07M
E-mail Richard.Rivera-Lugo@nrc.gov
Please consider the Environment before printing this e-mail.

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 1:18 PM
To: Rivera-Lugo, Richard; Ibarra, Jose; Armstrong, Kenneth
Cc: Gibson, Kathy; Case, Michael; Coyne, Kevin; Rini, Brett; Sheron, Brian; Uhle, Jennifer; Dempsey, Heather
Subject: ACTION: OGC request for all Yucca Mt documents
Importance: High

Everyone,

I apologize for the quick turnaround for this. The House of Representatives Committee on Oversight and Government Reform has requested all records and information related to Yucca High-level waste repository. See the Attached announcement and ticket.

ACTION

Divisions: Respond to me ASAP **today 3/17** with the approximate number of projects that supported Yucca Mountain.

I don't need all the details yet- I do need to respond to OGC with an approximate date we can produce the documents.

Call me if you any questions

Thanks,

Jeanne Dion
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Jeanne.dion@nrc.gov
301-251-7482

Dion, Jeanne

From:	Graves, Herman
Sent:	Thursday, March 17, 2011 4:08 PM
To:	Tadesse, Rebecca
Cc:	Hogan, Rosemary; Rivera-Lugo, Richard; Csontos, Aladar; Richards, Stuart; Case, Michael; Chokshi, Nilesh; Dion, Jeanne
Subject:	TSUNAMI QUESTION
Attachments:	TsunamiRequirementsAndMeasures_3.ppt

Ms. Tadesse (Rebecca),

As discussed with you and Al Csontos this afternoon I have attached a set of slides prepared by myself and Nilesh Chokshi that may answer any questions Commissioner Magwood has on tsunamis. Please note that the slide were prepared in 2005.

The NUREG/CR-6996 is entitled "**Tsunami Hazard Assessment at Nuclear Power Plant Sites in the United States of America,**" published March 2009.

Feel free to contact me if there anymore questions.

~~~~~~~~~~~~~~~~~~~~
Herman L. Graves, P. E., F. ACI
Sr. Structural Engineer
USNRC-RES
Mail Stop : C-5A24M
Telephone: 301.251.7625
Fax: 301-251-7425
email: Herman.Graves@NRC.GOV
~~~~~~~~~~~~~~~~~~~~~~
"The contents of this message are mine personally and do not necessarily reflect any position of NRC"

H-40

Tsunami Requirements and Measures taken at U.S. NPPs on the West Coast

Diablo Canyon

- Protective Structures
  - Auxiliary seawater system (ASWS) – is the only safety-related system that has components within the projected sea wave zone. The ASW pump motors are housed in watertight compartments within the intake structure.
  - These compartments are designed for a combination tsunami-storm wave activity to elevation +48 feet mllw (+45 feet MSL). The massive concrete intake structure ensures that the pumps remain in place and operate during extreme wave events.
  - The intake structure is also arranged to provide redundant paths for seawater to the pumps, ensuring a dependable supply of water.
  - In addition to the ASW pumps, the buried ASW piping outside of the intake structure, which is not attached to the circulating water tunnels, is vulnerable to the effects of tsunami and storm waves.
  - An evaluation was conducted and based on this evaluation, erosion protection, consisting of gabion mattresses, reinforced concrete pavement above this buried piping, and an armored embankment southeast of the intake structure, were designed and installed to resist the effects of tsunami and storm waves

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Tsunami Requirements and Measures taken at U.S. NPPs on the West Coast

San Onofre

- Probable Maximum Tsunami
  - The maximum possible tsunami wave heights tat could occur at the San Onofre site would be generated by local offshore earthquake activity
  - The effects of distantly generated tsunamis are minimized at southern California by the presence of a broad continental borderland, which reflects much incident low frequency energy back out to sea
  - The wave induced by this earthquake occurring during simultaneous high tide and storm surge would have a maximum elevation of 15.6 feet mllw
  - When storm waves are superimposed, the resulting is to elevation of +27.5 feet mllw

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Tsunami Requirements and Measures taken at U.S. NPPs on the West Coast

San Onofree

- Protective Structures
  - Reinforced concrete cantilevered retaining seawall and screen well parameter wall at +30 feet mllw designed to withstand, without loss of functional capacity, the design basis earthquake (DBE) followed by the maximum predicted tsunami with coincident storm wave action
  - No further design provisions for protection of safety-related structures from waves are necessary because wave action will not generate water levels above the elevation at the top of the seawall

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US NPP Tsunami Design Parameters

Design Parameters	Diablo Canyon 1&2	San Onofre 2&3
Plant elevation above MLLW	15.5 ft	30 ft
PMT		
Distant generated tsunami combined runup	30 ft	6.32 ft
Local generated tsunami combined runup	34.6 ft	-2.63 ft
Distant generated tsunami combined drawdown	9.0 ft	15.6 ft
Local generated tsunami combined drawdown	4.0? ft	-11.9 ft
Source of Tsunami wave height		
Distant	Aleutian area, Kuril-Kamchatka region, South American coast	Aleutian trench
Local or near	Santa Lucia Bank fault Santa Maria Basin fault	Santa Ana wind
Exterior Barriers		
Seawall, intake structure	Intake structure	Reinforced concrete seawall

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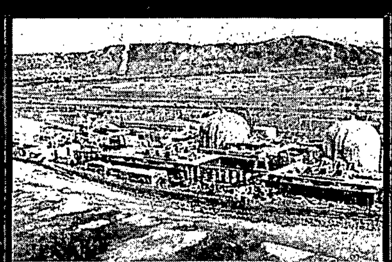
San Onofre NPP



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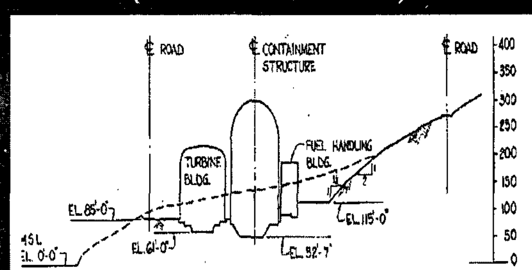
Diablo Canyon Site
(Excavation and Backfill)



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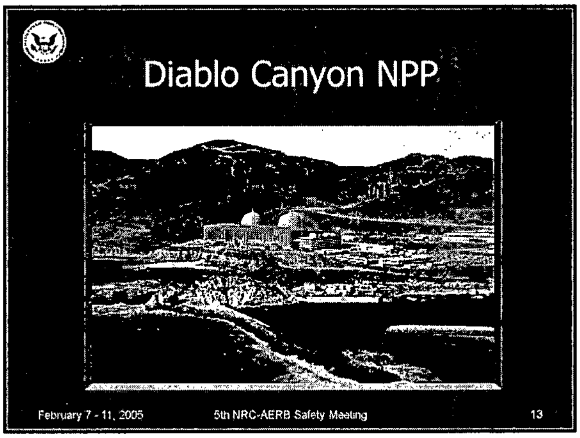
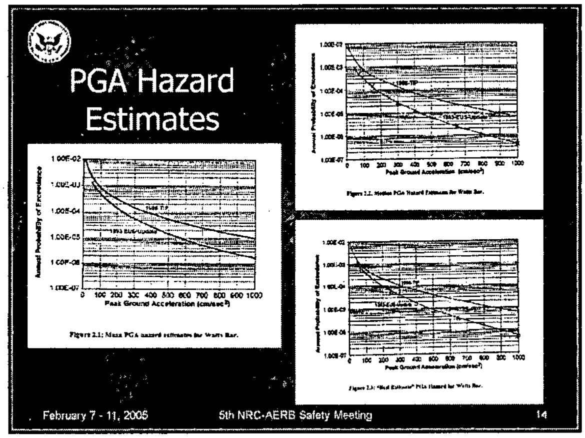

Diablo Canyon NPP
February 7 - 11, 2005
5th NRC-AERB Safety Meeting
13


PGA Hazard Estimates
Peak Ground Acceleration (cm/sec²)
Annual Probability of Exceedance
February 7 - 11, 2005
5th NRC-AERB Safety Meeting
14

Dion, Jeanne

From:	Howe, Allen
Sent:	Thursday, March 17, 2011 4:32 PM
To:	Dion, Jeanne
Subject:	FW: Help with Commission brief

From: Howe, Allen
Sent: Thursday, March 17, 2011 4:23 PM
To: Collins, Timothy; Tinkler, Charles; Scott, Michael
Cc: Bahadur, Sher; Gratton, Christopher; Boska, John; Ruland, William
Subject: RE: Help with Commission brief

Tim – first of all thanks. Can you get with Chris to talk specifics?

Mike/Scott – can you help with the SAMGs? We are on a very tight timeline here, so high level bullets is what is needed and someone to respond to Qs Monday. Note that this meeting will have media coverage.

Thanks - Allen

From: Collins, Timothy
Sent: Thursday, March 17, 2011 4:19 PM
To: Howe, Allen; Ruland, William
Cc: Bahadur, Sher
Subject: RE: Help with Commission brief

I can help with Mark I containments improvements ... we probably need some help from RES (Charlie Tinkler most likely) for SAMGs

---

From: Howe, Allen
Sent: Thursday, March 17, 2011 4:05 PM
To: Ruland, William; Collins, Timothy
Cc: Bahadur, Sher
Subject: Help with Commission brief
Importance: High

Bill – need someone who can work with Chris Gratton/John Boska on one line talking points for Bill Borchardt. Topic areas are SAMGs and Mark 1 containment improvements.

Thanks - Allen

H-41

Rodriguez-Luccioni, Hector

From: ODonnell, Edward
Sent: Thursday, March 17, 2011 5:01 PM
Subject: FW: some more aftermath stuff

good video on cnn.com showing a small town where the tsunami seawall didn't protect the town. The reporter has a hard time reaching the town on foot.

http://www.cnn.com/video/#/video/world/2011/03/17/homson.japan.quake.kamaishi.itn?hpt=C2

H-42

Dion, Jeanne

From: Giitter, Joseph
Sent: Thursday, March 17, 2011 5:45 PM
To: Mahoney, Michael; Howe, Allen; Dion, Jeanne; Collins, Timothy
Subject: DefenseinDepth.docx--Correct Version
Attachments: DefenseinDepth.docx

I think fatigue is setting in. I keep sending out the wrong version. This is the latest (as far as I know).

H-43

Q: Although there undoubtedly will be many lessons learned from the tragic events at Fukushima have you identified any early lessons that you could share with us?

A: There will undoubtedly be many lessons learned in the months and years to come as we learn more about the tragic events at the Fukushima Daiichi plant in Japan. However, one of the early lessons is this: You can't anticipate—either in the deterministic design basis of the plant or through probabilistic risk assessment models—everything that could happen. That is why the NRC's defense in depth philosophy is fundamental to ensuring that safety is achieved, even under extreme circumstances, such as those experienced at the Fukushima Daiichi plant. This NRC focus on defense in depth has led to a number of improvements in the design and operation of U.S. Nuclear Power Plants:

- Studies of severe accident prevention and mitigation in the 1980s led to a number of improvements at plants, such as installation of hardened vents at BWRs with Mark I containments. (details below).
- Also, in the 1980s (specifically in 1988) the NRC concluded that additional regulatory requirements were justified in order to provide further assurance that a loss of both offsite and onsite emergency ac power systems—a station blackout condition--would not adversely affect public health and safety. Studies conducted by the NRC have shown that the hardware and procedures that have been implemented to meet the station blackout requirements have resulted in significant risk reduction and have further enhanced defense in depth. However, we plan to carefully evaluate the lessons learned from the events in Japan to determine if enhancements to the station blackout rule are warranted.
- Emergency procedure guidelines that address conditions well beyond design basis accidents and can be used for severe accident management (SAMGs).
-

Details on plant modifications made to address a severe accidents at a BWR with a Mark 1 containment,

In the 1980s the NRC undertook a program to determine if any actions needed to be taken, on a generic basis, to reduce the vulnerability of all LWR designs to severe accident challenges. As part of this effort, the NRC looked specifically at the BWR Mark I containment design and identified a number of plant modifications that substantially enhance the ability of the design to prevent and mitigate the consequences of severe accidents. These recommendations (in GL 89-10) included installation of a hardened vent that allows operators, in accordance with their emergency procedures, to relieve pressure from the containment to avoid exceeding the containment pressure limit. At this time the NRC also concluded that continued reliance on pre-existing capability—which was a non-pressure-bearing vent path—could jeopardize access to vital plan areas or other equipment and create an impediment to implementing a successful accident management strategy. Furthermore, the NRC determined that implementation of reliable venting capability and procedures can reduce the likelihood of core melt from accident sequences involving loss of long-term decay heat removal, such as a station blackout event. Finally, it was concluded that the hardened vent provides assurance of a pressure relief path with significant scrubbing of fission products which would result in lower releases, even for containment failure modes not associated with pressurization, such as liner meltthrough. All U.S. BWRs with the Mark I containment design have installed hardened vents (need to verify).

The NRC also identified certain containment performance improvements that licensees should "seriously consider" individual plant examinations in addition to the implementation of a hardened vent. These improvements included an alternate source of water injection into the reactor vessel to reduce the likelihood of core melt due to a station blackout or a loss of long-term decay heat removal, and an enhanced reactor pressure vessel depressurization system that could be operated in an extended station blackout after station batteries have been depleted. (Tim Collins: Can we say something about the extent to which licensees have implemented this).

Station Blackout Rule
Also, in the 1980s--specifically in 1988-- the NRC concluded that additional regulatory requirements were justified in order to provide further assurance that a loss of both offsite and onsite emergency ac power systems—a station blackout condition--would not adversely affect public health and safety. Studies conducted by the NRC have shown that the hardware and procedures that have been implemented to meet the station blackout requirements have resulted in significant risk reduction and have further enhanced defense in depth. However, we plan to carefully evaluate the lessons learned from the events in Japan to determine if enhancements to the station blackout rule are warranted. (Add some detail form George Wilson input.)

SAMGs
One of the most significant lessons learned from the Three Mile Island Accident in 1979 was that operating procedures need to be symptom based and less prescriptive. Procedures that previously directed operators to take a series of actions based on a pre-established accident were replaced with procedures that directed operators to maintain the critical safety functions-- such as keeping the core covered and cooled. Emergency procedure guidelines that address conditions well beyond design basis accidents and can be used for severe accident management were also developed. Operators routinely practice these procedures on a plant specific simulator to ensure that they can be implemented for a wide range of accident scenarios, including a station blackout scenario. (Should have DIRS review. Barry to provide input)

50.54hh
More recently, since the 9/11 terrorist attack, NRC has required licensees to develop, test, and be prepared to implement procedures that allow for actions pre-stage equipment that would allow operators to ensure critical safety functions are met even under extreme conditions involving fires and explosions. NRC routinely evaluates the ability of licensees to implement these strategies. (Not sure what we can and can't say. Should have DIRS review. Barry to provide input)

Near term actions
Mention steps that INPO has taken in their level 1 directive and our corresponding regulatory footprint—whatever it might be. (Not sure what we can and can't say. Might point to NEI fact sheet. Should have DIRS review. Barry to provide input)

Dion, Jeanne

From: Coyne, Kevin
Sent: Thursday, March 17, 2011 5:59 PM
To: Scott, Michael; Wagner, Katie
Cc: Dion, Jeanne; Santiago, Patricia
Subject: RE: Eric Leeds Remarks.docx

Mike –

I'm lost – I didn't see any reference to Level 3 in your attachment. Can you point me better at what you need?

Kevin

From: Scott, Michael
Sent: Thursday, March 17, 2011 5:47 PM
To: Wagner, Katie
Cc: Dion, Jeanne; Santiago, Patricia; Coyne, Kevin
Subject: FW: Eric Leeds Remarks.docx
Importance: High

Katie: Here is the item I noted to you earlier today I have asked around and we believe the best source of info on SAMGs is Donnie Harrison in NRR.

Regarding severe accident research, NRC is developing methods for so-called "Level 3" PRAs, that include evaluation of offsite consequences. In addition, NRC is sponsoring a separate project to evaluate, using state-of-the-art tools, the public safety consequences of a severe accident at two sample plants..

Suggest that DRA validate or change the words regarding L-3. Hence I am copying Kevin Coyne.

Mike

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 3:42 PM
To: Scott, Michael
Subject: FW: Eric Leeds Remarks.docx
Importance: High

Joe Giitter requested RES review this Q&A.

He specifically asked for our insights in SAMG and our Research in Severe accidents.
He also specifically asked about the GI on mark 1 containments and about verifying that all Mark 1 have hardened ventilation.

Comments are requested back to NRR ASAP.

Thanks,
Jeanne

From: Giitter, Joseph
Sent: Thursday, March 17, 2011 3:34 PM

H-44

To: Dion, Jeanne
Subject: FW: Eric Leeds Remarks.docx

From: Giitter, Joseph
Sent: Thursday, March 17, 2011 3:03 PM
To: Nelson, Robert
Cc: Howe, Allen
Subject: Eric Leeds Remarks.docx

The attached Q/As evolved out of a script I was preparing for Eric to support the Commission meeting on Monday. We learned this morning that only Bill Borchardt was going to speak—at least during the public portion of the meeting. Therefore I've started to turn this into a draft Q/A for Eric since he will be at the table and there will undoubtedly be many Q's and A's focused on NRR. Michael Mahoney will be incorporating some additional input from Barry Westreich and George Wilson. Mike is also looking at the Q/As developed for the Chairman to ensure that they are consistent.

Dion, Jeanne

From: Santiago, Patricia
Sent: Thursday, March 17, 2011 6:25 PM
To: Dion, Jeanne
Subject: RE: Eric Leeds Remarks.docx

Funny...can u call me at 251-7982

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 6:24 PM
To: Santiago, Patricia
Subject: RE: Eric Leeds Remarks.docx

Yes ☹

From: Santiago, Patricia
Sent: Thursday, March 17, 2011 6:24 PM
To: Dion, Jeanne
Subject: RE: Eric Leeds Remarks.docx

R u here

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 6:16 PM
To: Santiago, Patricia
Subject: RE: Eric Leeds Remarks.docx

Yes you can toss the other one

From: Santiago, Patricia
Sent: Thursday, March 17, 2011 6:15 PM
To: Dion, Jeanne
Subject: RE: Eric Leeds Remarks.docx

Can I toss the other one?
thanks

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 5:54 PM
To: Scott, Michael; Wagner, Katie
Cc: Santiago, Patricia; Coyne, Kevin
Subject: RE: Eric Leeds Remarks.docx
Importance: High

See attachment for updated Q&A

From: Scott, Michael
Sent: Thursday, March 17, 2011 5:47 PM
To: Wagner, Katie
Cc: Dion, Jeanne; Santiago, Patricia; Coyne, Kevin
Subject: FW: Eric Leeds Remarks.docx
Importance: High

H-45

Katie: Here is the item I noted to you earlier today I have asked around and we believe the best source of info on SAMGs is Donnie Harrison in NRR.

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To: Scott, Michael
Subject: FW: Eric Leeds Remarks.docx
Importance: High

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Subject: FW: Eric Leeds Remarks.docx

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Cc: Howe, Allen
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Dion, Jeanne

From: Giitter, Joseph
Sent: Thursday, March 17, 2011 6:50 PM
To: Dion, Jeanne
Subject: RE: DefenseinDepth.docx--Correct Version

You're right! Fatigue factor.

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 6:49 PM
To: Giitter, Joseph; Mahoney, Michael; Howe, Allen; Collins, Timothy
Subject: RE: DefenseinDepth.docx--Correct Version

*Hello- one thing that stands out in the Q&A is the reference to **GL- 80-10** I think should **be GL 89-16** see below*
I'll have more comments later-

September 1, 1989

TO: ALL HOLDERS OF OPERATING LICENSES FOR NUCLEAR POWER REACTORS WITH MARK I CONTAINMENTS

SUBJECT: INSTALLATION OF A HARDENED WETWELL VENT (GENERIC LETTER 89-16)

As a part of a comprehensive plan for closing severe accident issues, the staff undertook a program to determine if any actions should be taken, on a generic basis, to reduce the vulnerability of BWR Mark I containments to severe accident challenges. At the conclusion of the Mark I Containment Performance Improvement Program, the staff identified a number of plant modifications that substantially enhance the plants' capability to both prevent and mitigate the consequences of severe accidents. The improvements that were recommended include (1) improved hardened wetwell vent capability, (2) improved reactor pressure vessel depressurization system reliability, (3) an alternative water supply to the reactor vessel and drywell sprays, and (4) updated emergency procedures and training. The staff as part of that effort also evaluated various mechanisms for implementing of these plant improvements so that the licensee and the staff efforts would result in a coordinated coherent approach to resolution of severe accident issues in accordance with the Commission's severe accident policy.

After considering the proposed Mark I Containment Performance Program (described in SECY 89-017, January 1989), the Commission directed the staff to pursue Mark I enhancements on a plant-specific basis in order to account for possible unique design differences that may bear on the necessity and nature of specific safety improvements. Accordingly, the Commission concluded that the recommended safety improvements, with one exception, that is, hardened wetwell vent capability, should be evaluated by licensees as part of the Individual Plant Examination (IPE) Program. With regard to the recommended plant improvement dealing with hardened vent capability, the Commission, in recognition of the circumstances and benefits associated with this modification, has directed a different approach. Specifically, the Commission has directed the staff to approve installation of a hardened vent under the provisions of 10 CFR 50.59 for licensees, who on their own initiative, elect to incorporate this plant improvement. The staff previously inspected the design of such a system that was installed by Boston Edison Company at the Pilgrim Nuclear Power Station. The staff found the installed system and the associated Boston Edison Company's analysis acceptable.

A copy of Boston Edison Company's description of the vent modification is enclosed for your information. For the remaining plants, the staff has been directed to initiate plant-specific backfit analyses for each of the Mark I plants to evaluate the efficacy of requiring the installation of hardened wetwell vents. Where the backfit analysis supports imposition of that

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requirement, the staff is directed to issue orders for modifications to install a reliable hardened vent.

The staff believes that the available information provides strong incentive for installation of a hardened vent. First, it is recognized that all affected plants have in place emergency procedures directing the operator to vent under certain circumstances (primarily to avoid exceeding the primary containment pressure limit) from the wetwell airspace. Thus, incorporation of a designated capability consistent with the objectives of the emergency procedure guidelines is seen as a logical and prudent plant improvement. Continued reliance on pre-existing capability (non-pressure-bearing vent path) which may jeopardize access to vital plant areas or other equipment is an unnecessary complication that threatens accident management strategies. Second, implementation of reliable venting capability and procedures can reduce the likelihood of core melt from accident sequences involving loss of long-term decay heat removal by about a factor of 10. Reliable venting capability is also beneficial, depending on plant design and capabilities, in reducing the likelihood of core melt from other accident initiators, for example, station blackout and anticipated transients without scram. As a mitigation measure, a reliable wetwell vent provides assurance of pressure relief through a path with significant scrubbing of fission products and can result in lower releases even for containment failure modes not associated with pressurization (i.e., liner meltthrough). Finally, a reliable hardened wetwell vent allows for consideration of coordinated accident management strategies by providing design capability consistent with safety objectives. For the aforementioned reasons, the staff concludes that a plant modification is highly desirable and a prudent engineering solution of issues surrounding complex and uncertain phenomena. Therefore, the staff strongly encourages licensees to implement requisite design changes, utilizing portions of existing systems to the greatest extent practical, under the provisions of 10 CFR 50.59.

As noted previously, for facilities not electing to voluntarily incorporate design changes, the Commission has directed the staff to perform plant-specific backfit analyses. In an effort to most accurately reflect plant specificity, the staff herein requests that each licensee provide cost estimates for implementation of a hardened vent by pipe replacement, as described in SECY 89-017. In addition, licensees are requested to indicate the incremental cost of installing an ac independent design in comparison to a design relying on availability of ac power. In the absence of such information, the staff will use an estimate of $750,000. This estimate is based on modification of prevalent existing designs to bypass the standby gas treatment system ducting and includes piping, electrical design changes, and modifications to procedures and training.

Jeanne Dion
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Jeanne.dion@nrc.gov
301-251-7482

From: Giitter, Joseph
Sent: Thursday, March 17, 2011 5:45 PM
To: Mahoney, Michael; Howe, Allen; Dion, Jeanne; Collins, Timothy
Subject: DefenseinDepth.docx--Correct Version

I think fatigue is setting in. I keep sending out the wrong version. This is the latest (as far as I know).

Dion, Jeanne

From: Santiago, Patricia
Sent: Thursday, March 17, 2011 7:25 PM
To: Scott, Michael; Dion, Jeanne
Cc: Gibson, Kathy; Armstrong, Kenneth; Coyne, Kevin
Subject: Q&A to support OCM Brief on Japan
Attachments: Q&A on severa accident research.docx

Attached are a few Qs&As....the first one is a general one on what severe accident research we are doing. I coordinated with Kevin
Other questions are from the SOARCA communication plan and can be removed.

If NRR continues to need support on SAMGs, I will talk to Tina at 9am. The last set of Qs&As from NRR did have a sentence in the document.

Thanks,

Pat

Patricia A. Santiago
Chief, Special Projects Branch
Division of Systems Analysis
Office of Nuclear Regulatory Research
Phone- 301-251-7982
Fax- 301-251-7426
Patricia.Santiago@nrc.gov

H-47

What severe accident research is the U.S. Nuclear Regulatory Commission (NRC) doing?

The NRC and its contractor presently are completing a research project entitled "State-of-the-Art Reactor Consequence Analysis" (SOARCA). This research project develops best estimates of the potential public health effects from a nuclear power plant accident where low-likelihood scenarios could release radioactive material into the environment and potentially cause offsite consequences. The project also evaluates and improves, as appropriate, methods and models for evaluating outcomes of such severe accidents.

In addition, research is being conducted to develop advanced risk assessment modeling techniques (e.g., dynamic probabilistic risk assessment (PRA) using simulation based methods) to improve the state-of-the practice in PRA severe accident modeling. Key goals of this research include increased analysis realism, reduced reliance on modeling simplification, and improved the treatment of human interactions with the reactor plant system.

Why is the NRC performing the SOARCA study?

NRC is doing this study to develop the most realistic evaluations for the potential consequences of severe nuclear accidents. Over the years, NRC, industry, and international nuclear safety organizations have completed substantial research on plant response to hypothetical accidents that could damage the core and containment. The results have significantly improved NRC's ability to analyze and predict how nuclear plant systems and operators would respond to severe accidents. Also, plant owners have improved the plant design, emergency procedures, maintenance programs, and operator training, all of which have improved plant safety. Emergency preparedness measures also have been refined and improved to further protect the public in the highly unlikely event of a severe accident. Combining all of this new information and analysis will improve the realism of accident consequence evaluations.

How will the SOARCA study be different from earlier studies?

The SOARCA project will:

- Use an improved understanding of source terms and severe accident phenomenology.
- Credit the use of severe accident mitigation strategies and procedures.
- Use updated emergency preparedness modeling.
- Account for plant improvements.
- Use modern computer resources and advanced software to yield more accurate results.

In addition, the SOARCA project is designed to be a more realistic estimate. Some of the earlier studies also were designed to be best estimates; however, because they were limited by the available knowledge of accident phenomenology, these older studies were conservative (particularly the very improbable severe accidents) in their estimates of off-site releases and early fatalities. The SOARCA project will provide the latest basis from which the public and decision makers can assess the consequences of severe reactor accidents.

Dion, Jeanne

From: Santiago, Patricia
Sent: Thursday, March 17, 2011 7:32 PM
To: Coyne, Kevin; Scott, Michael; Dion, Jeanne
Cc: Gibson, Kathy; Armstrong, Kenneth
Subject: RE: Q&A to support OCM Brief on Japan

Will do
thanks

From: Coyne, Kevin
Sent: Thursday, March 17, 2011 7:31 PM
To: Santiago, Patricia; Scott, Michael; Dion, Jeanne
Cc: Gibson, Kathy; Armstrong, Kenneth
Subject: RE: Q&A to support OCM Brief on Japan

Pat –

The only comment I have is with the inclusion of the DRA dynamic PRA work, the rest of the write-up is a bit confusing since it refers to "this study". Perhaps changing the title of the last two questions to explicitly refer to SOARCA would reduce this confusion. Also, since I don't have the entire context of the question, I'd leave it to you guys to decide if our dynamic MELCOR-based PRA work fits into this Q&A...

Kevin

From: Santiago, Patricia
Sent: Thursday, March 17, 2011 7:25 PM
To: Scott, Michael; Dion, Jeanne
Cc: Gibson, Kathy; Armstrong, Kenneth; Coyne, Kevin
Subject: Q&A to support OCM Brief on Japan

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Thanks,

Pat

Patricia A. Santiago
Chief, Special Projects Branch
Division of Systems Analysis
Office of Nuclear Regulatory Research
Phone- 301-251-7982
Fax- 301-251-7426
Patricia.Santiago@nrc.gov

H-48

Dion, Jeanne

From: Giitter, Joseph
Sent: Thursday, March 17, 2011 7:39 PM
To: Dion, Jeanne
Subject: RE: Need more help.

Thanks Jeanne. It does help.

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 7:00 PM
To: Giitter, Joseph; Chernoff, Harold
Cc: Miller, Ed; Bamford, Peter; Hughey, John; Ennis, Rick
Subject: RE: Need more help.

This is what I've found so far. I'm not sure if this info you already have.

From NUREG 0933- Resolution of Generic Safety Issues
http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0933/sec3/157r1.html

1. **Alternate water supply for drywell spray/vessel Injection**

Alternate Water Supply for Reactor Vessel Injection and Containment Drywell Sprays: An important proposed improvement was to employ a backup or alternate supply of water and a pumping capability independent of normal and emergency AC power. By connecting this source to the low pressure residual heat removal system as well as to the existing drywell sprays, water could be delivered either into the reactor vessel or to the drywell by use of an appropriate valve arrangement.

An alternate source of water injection into the reactor vessel would reduce the likelihood of core-melt due to station blackout or loss of long-term decay heat removal, as well as provide significant accident management capability.

Water for the drywell sprays would also provide significant mitigative capability to cool the containment steel shell to delay or prevent its failure and either to cool core debris or, if the debris configuration is not coolable, to scrub particulate fission products through an overlying water pool.

A review of some MARK I facilities indicated that most plants have one or more diesel-driven pumps which could be used to provide an alternate water supply. The flow rate using this backup water system may be significantly less than the design flow rate for the drywell sprays. The potential benefits of modifying the spray headers to ensure a spray were compared to having the water run out of the spray nozzles. The result of this comparison was that removal of airborne fission products in the small crowded volume in which the sprays would be effective did not change sufficiently to warrant modifications to the spray nozzles.

2. **Reactor pressure vessel (RPV) depressurization system reliability**

Enhanced RPV Depressurization System Reliability: The ADS consists of safety relief valves which can be remotely operated to depressurize the RCS. Actuation of the ADS valves requires DC power. In an extended station blackout after station batteries have been depleted, the ADS would not be available and the reactor would re-pressurize. With enhanced RPV depressurization system reliability, depressurization of the RCS would have a greater degree of assurance. A major benefit of enhanced RPV depressurization reliability would be to significantly reduce the likelihood of high pressure severe accidents, such as from short-term station blackout. Together with a low pressure alternate source of water injection into the reactor vessel, another benefit would be to reduce the likelihood of low pressure severe accidents such as from long-term station blackout.

An additional benefit is in the area of accident mitigation. Reduced reactor pressure would reduce the possibility of core debris being expelled under high pressure, given a core-melt and failure of the RPV. Enhanced RPV

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depressurization system reliability would also delay containment failure and could reduce the quantity and type of fission products ultimately released to the environment.

In order to increase reliability of the RPV depressurization system, assurance of electrical power beyond the requirements of existing regulations may be necessary. In addition, performance of the cables needs to be reviewed for temperature capability during a severe accident.

3. SAMG's (an BWROG effort).

NRR has expertise in SAMG- not research. I hear Donnie Harrison in NRR is a good contact.

Let me know if this addresses your concerns.

Jeanne Dion
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Jeanne.dion@nrc.gov
301-251-7482

From: Giitter, Joseph
Sent: Thursday, March 17, 2011 6:53 PM
To: Chernoff, Harold
Cc: Miller, Ed; Bamford, Peter; Hughey, John; Ennis, Rick
Subject: Need more help.

First. Kudos to you and you staff for the quick turnaround on the hardened vent issue. We now need to know whether (or to what extent) licensees have implemented the other improvements discussed in GL 89-16 (attached.) The NRC staff has identified these as containment performance improvements that would likely reduce the vulnerability of the Mark I containment to severe
accident challenges. The Commission stated in GL 89-16 that it expects that licensees of Mark I plants will seriously consider these improvements during their Individual Plant Examinations. So, what we need to know is whether licensees implemented the recommendations for an alternate water supply for drywell spray/vessel Injection and enhanced reactor pressure vessel (RPV) depressurization system reliability. I think these changes were relatively easy to make and that many, if not all, licensees implemented. I'm also sure that licensees implemented EPGs—the third item—but I'm not 100% sure about SAMG's, so we need to check on that too. In summary we need to know whether licensees implemented:

4. Alternate water supply for drywell spray/vessel Injection
5. Reactor pressure vessel (RPV) depressurization system reliability
6. SAMG's (an BWROG effort).

Let me know if you need any clarification. Thanks.

Joseph G. Giitter
Director
Division of Operating Reactor Licensing

Office of Nuclear Reactor Regulation

Ali, Syed

From: uchiyama-yuichi@jnes.go.jp
Sent: Thursday, March 17, 2011 9:09 PM
To: Alejandro.HUERTA@oecd.org; Murphy, Andrew; Ali, Syed
Cc: okano-kenta@jnes.go.jp; kobayashi-koichi@jnes.go.jp; yamazaki-hiroaki@jnes.go.jp
Subject: Appology of absence of JNES in IAGE meeting

Dear Mr.Huerta, Dr. Murphy, Dr. Ali,

This is Uchiyama, in JNES.
As you know, we have a very big trouble in Japan.
All people relating nuclear safety are struggling to contain this situation.

Because of this, the management of JNES decided to prohibit participations in oversea meetings.

I and Mr. Okano, who is in charge of EQ observation in deep bore hole project, were planning to participate in Seismic and Concrete Sub-group meetings from the Seismic Safety Department of JNES. But we cannot participate because of the reason above. Moreover, it is thought that the greater part of possible participants from Japan will be absent too.

Please understand this situation.
But I want to make an effort to deliver the electronic file about the draft report of the workshop on earthquake observation in deep borehole.

Truly yours,
18 Mar., 2010
Y. Uchiyama, JNES

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Rodriguez-Luccioni, Hector

From: Rodriguez-Luccioni, Hector
Sent: Thursday, March 17, 2011 10:00 AM
To: Bayssie, Mekonen; Borges, Jennifer; Boyce, Tom (RES); Carpenter, Robert; Hicks, Angelisa; Jervey, Richard; Karagiannis, Harriet; ODonnell, Edward; Orr, Mark; Rodriguez-Luccioni, Hector
Subject: Slides for today's meeting
Attachments: BWR's.pptx

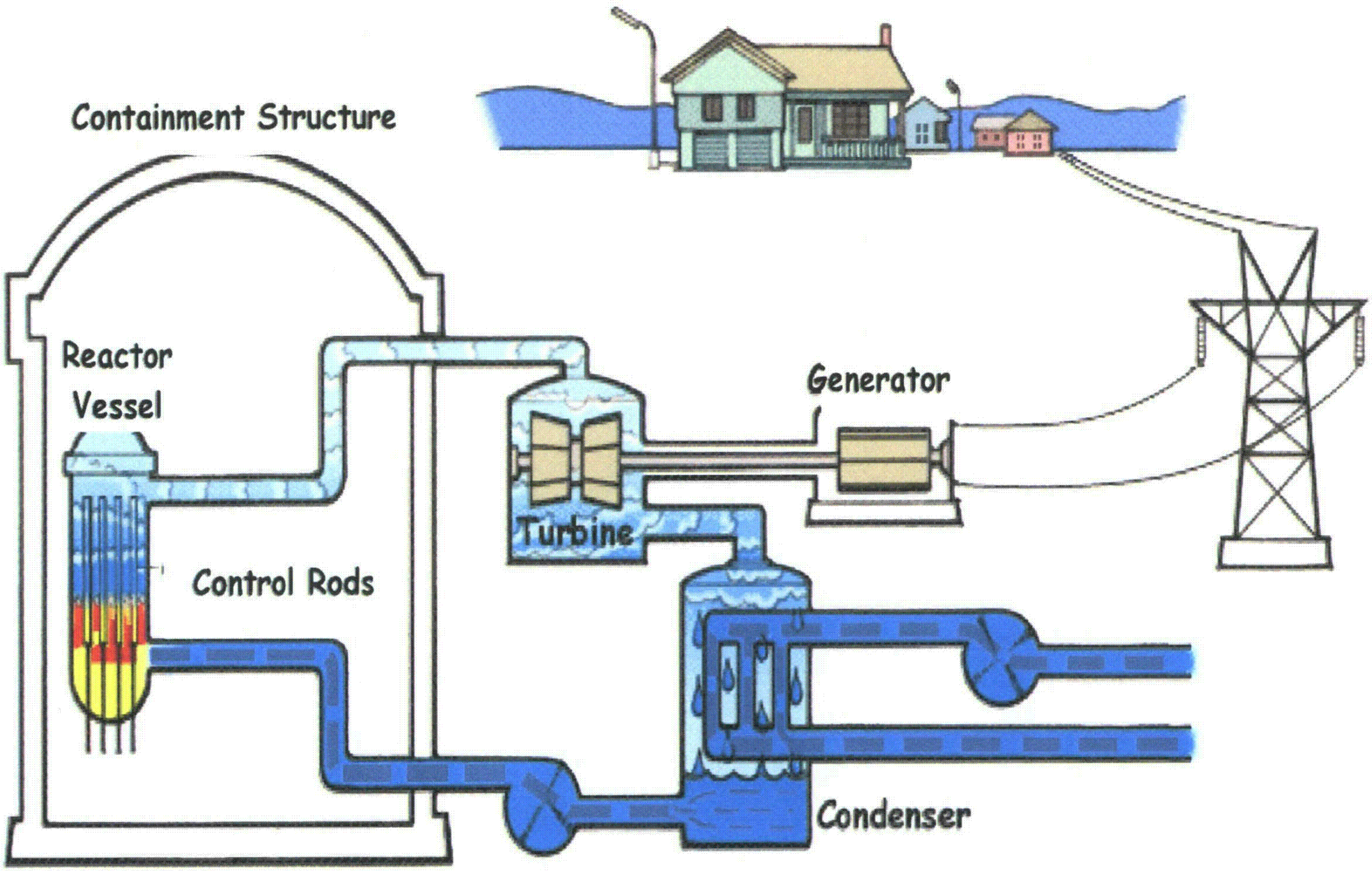
Hello RGDB,

Attached are the slides for today's meeting discussion. Please bring a copy with you. Thank you.

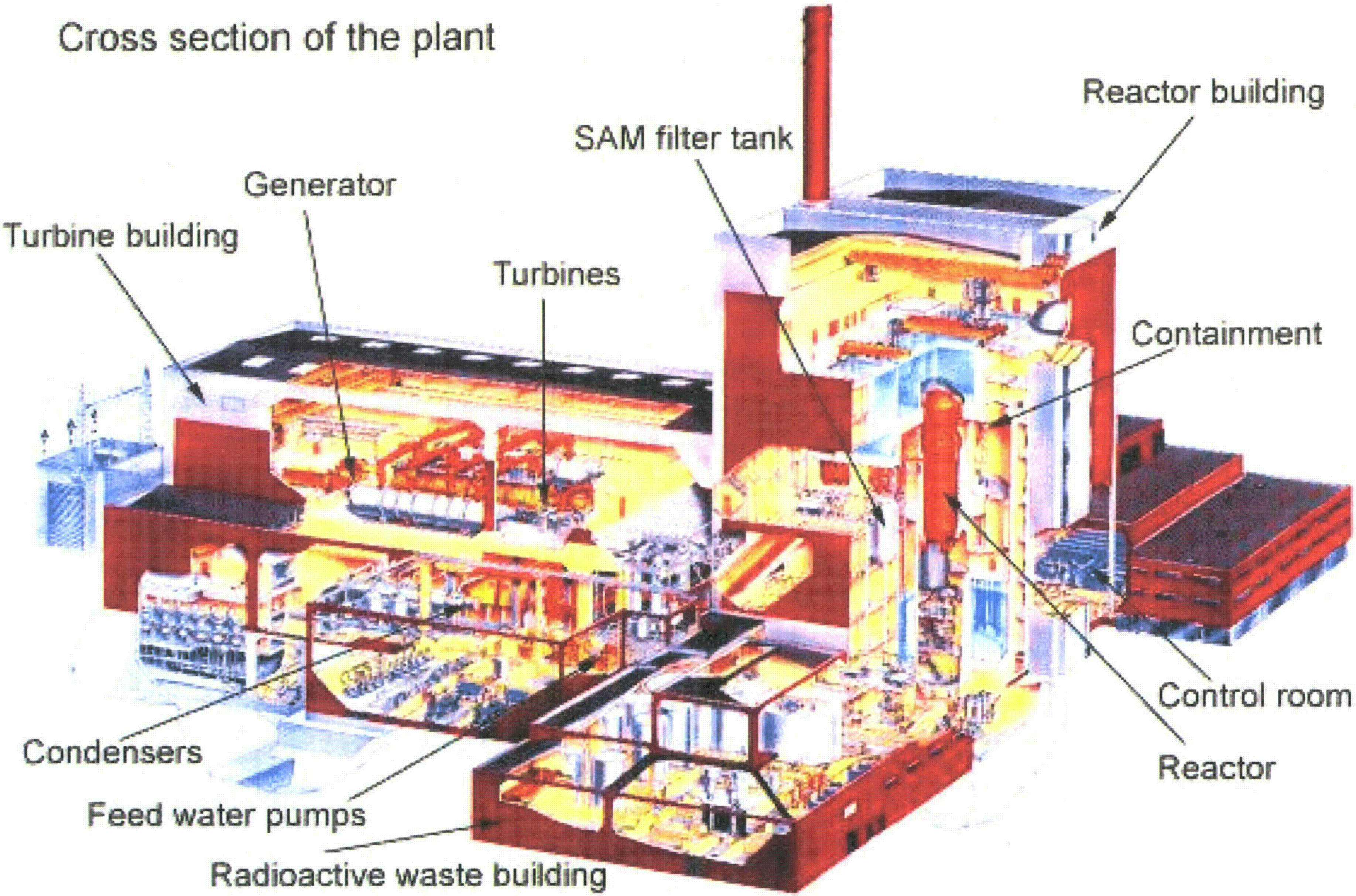
Hector Luis Rodriguez-Luccioni

H-51

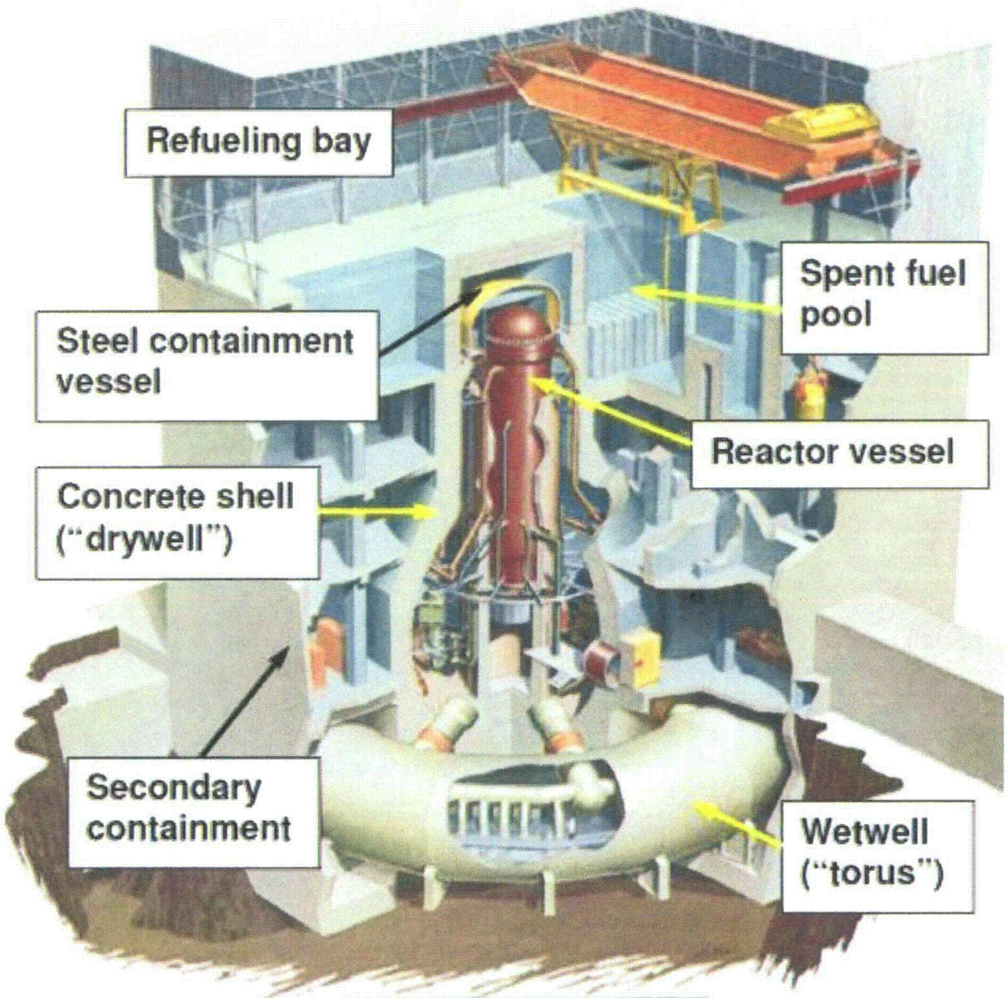
Boiling Water Reactors



Cross section of the plant

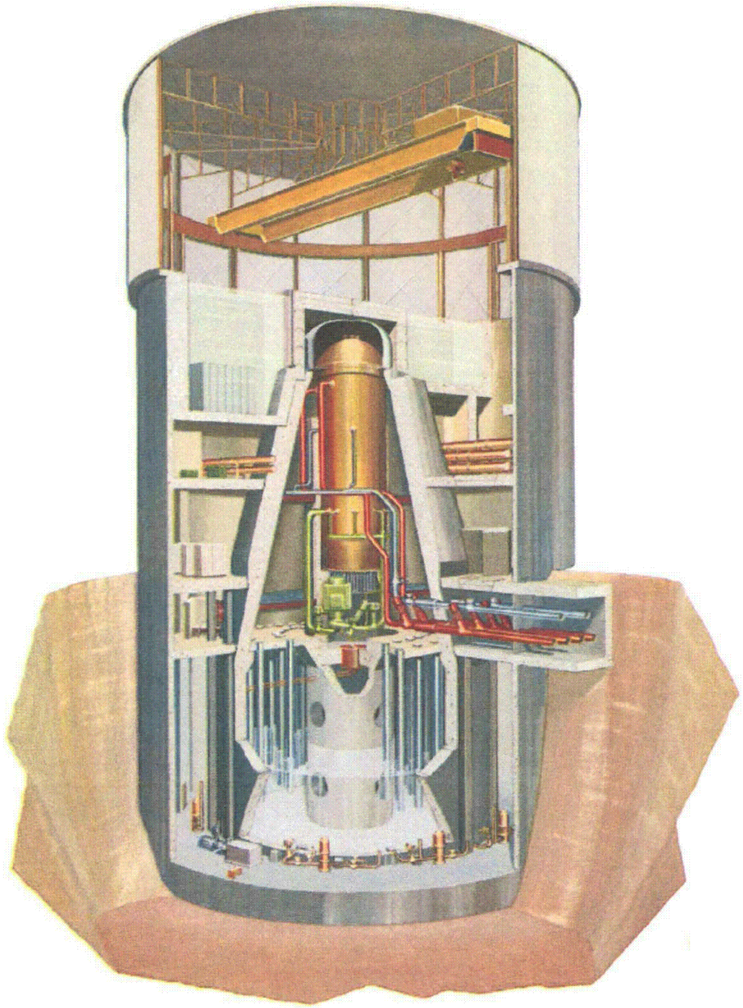


BWR Mark 1 Containment Building

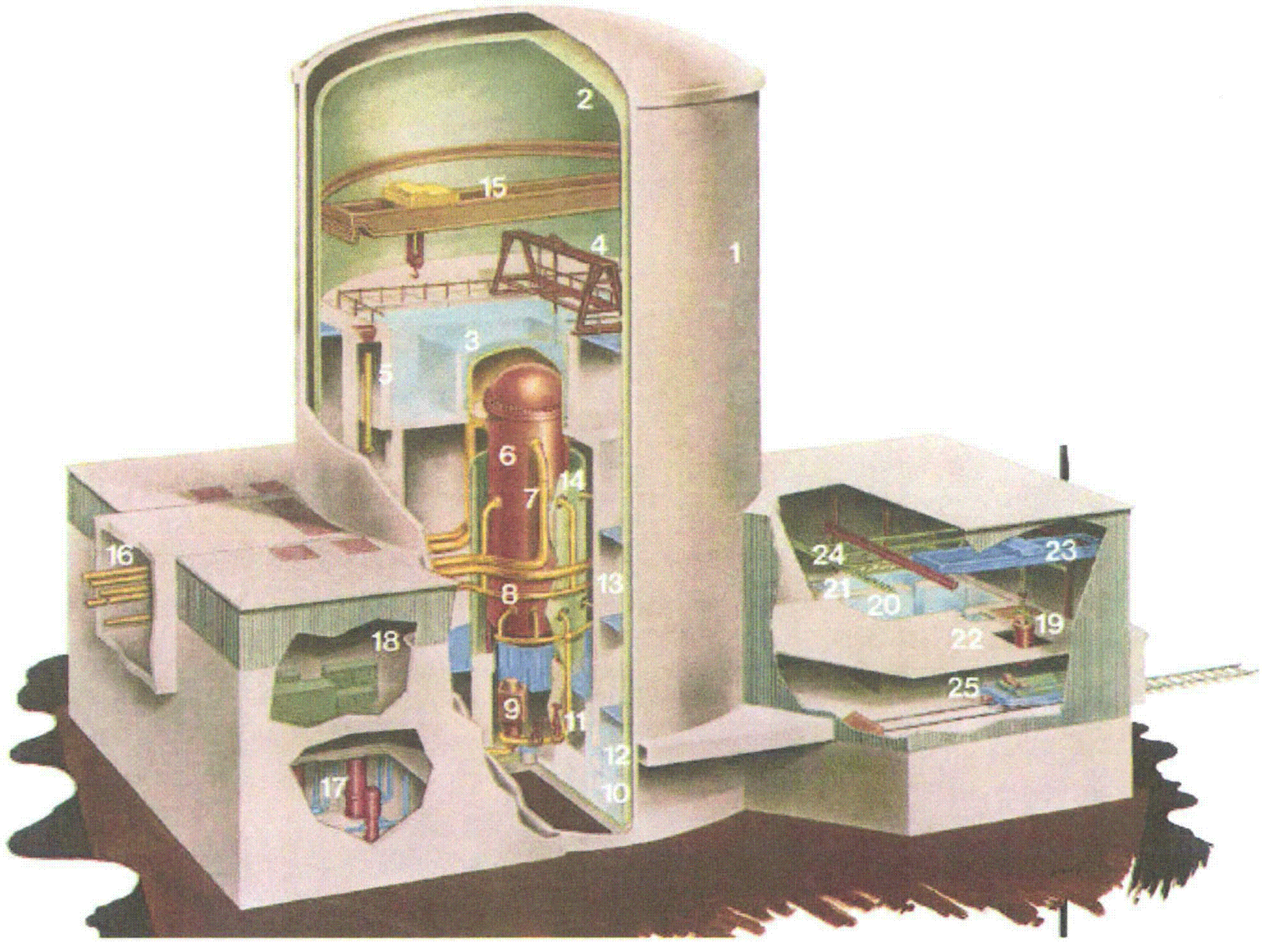


Mark I Containment

BWR Mark II Containment Building



BWR Mark III Containment Building



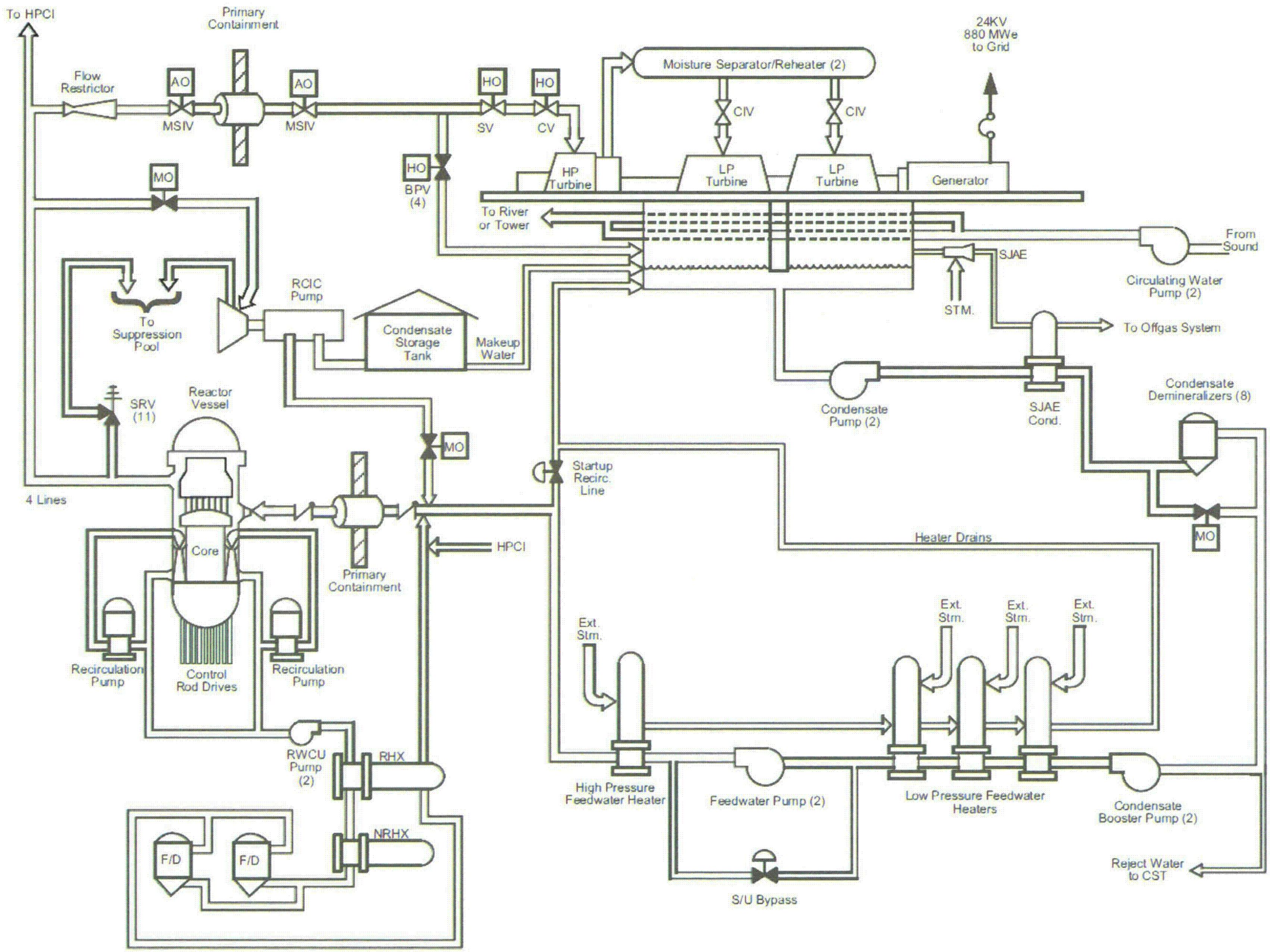
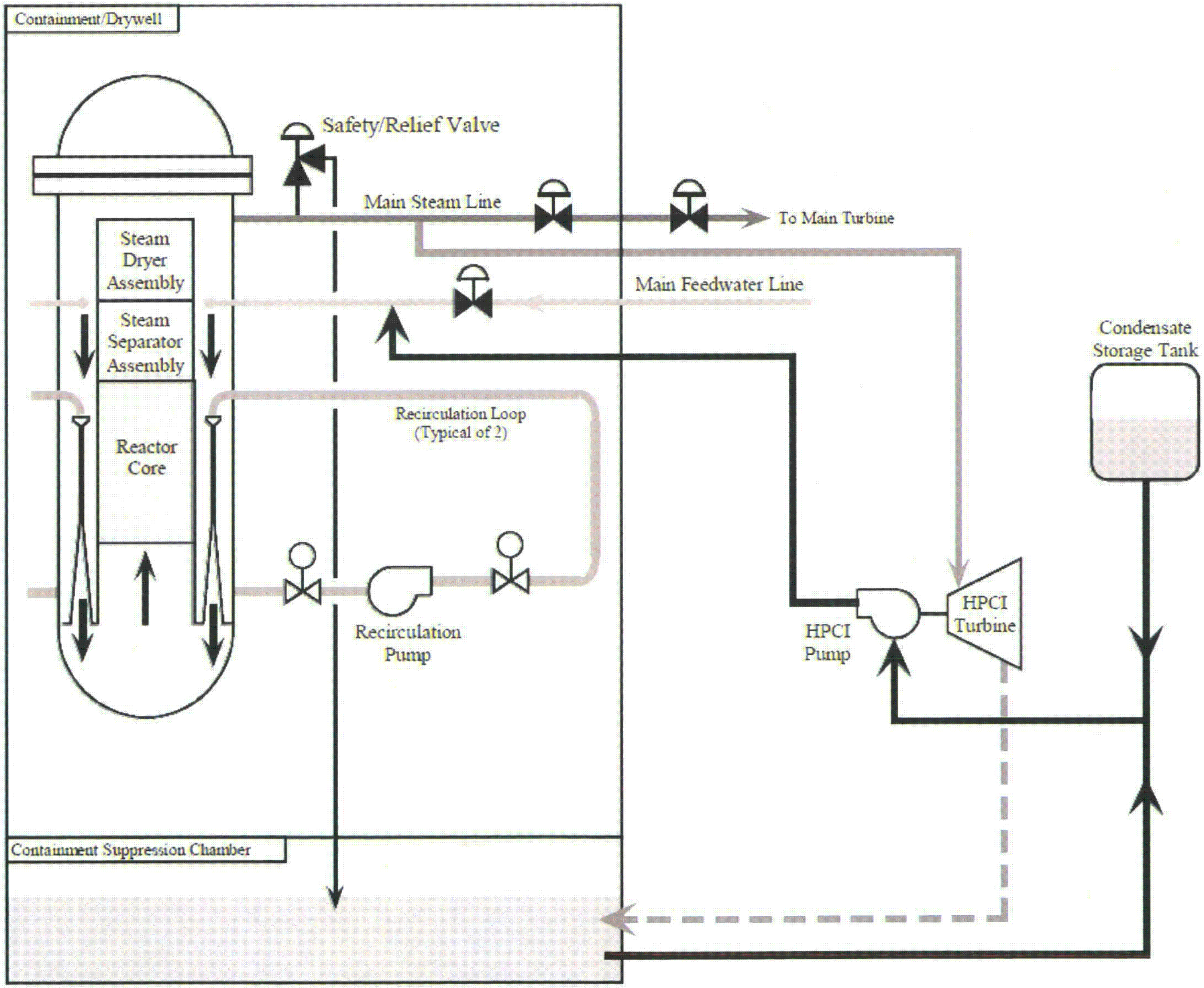


Figure 2.0-1 Simplified BWR Primary and Auxiliary Systems

Emergency Core Cooling Systems

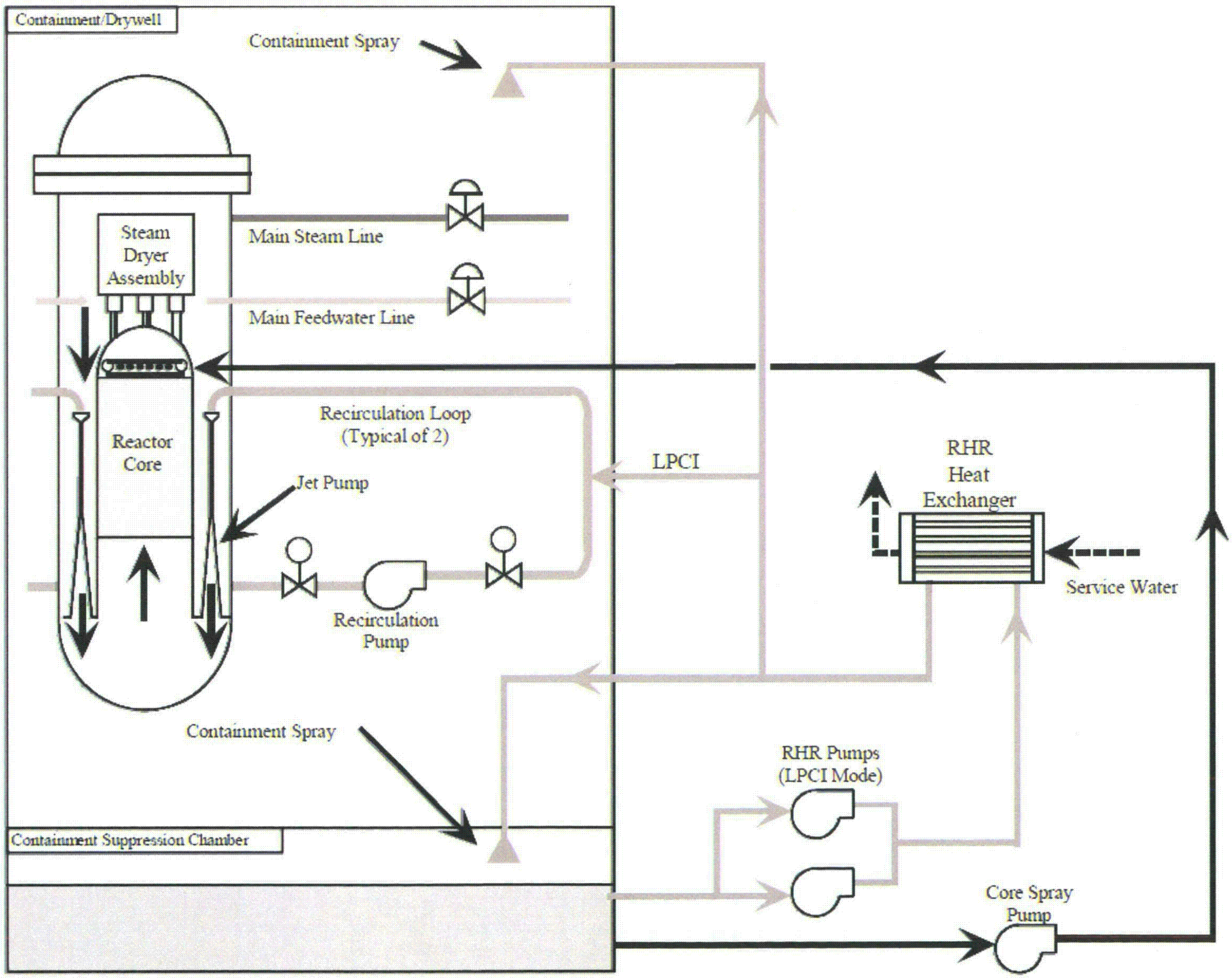
- Provide core cooling under loss of coolant accident conditions to limit fuel cladding damage
  - 2 High Pressure
    - High Pressure Coolant Injection (HPCI)
    - Automatic Depressurization System (ADS)
  - 2 Low Pressure
    - Low Pressure Coolant Injection (LPCI) or Residual Heat Removal System (RHR)
    - Core Spray System (CS)

HPCI



Containment/Drywell
Safety/Relief Valve
Main Steam Line
To Main Turbine
Steam Dryer Assembly
Main Feedwater Line
Steam Separator Assembly
Condensate Storage Tank
Recirculation Loop (Typical of 2)
Reactor Core
HPCI Turbine
Recirculation Pump
HPCI Pump
Containment Suppression Chamber

LPCI



Containment/Drywell
Containment Spray
Steam
Dryer
Assembly
Main Steam Line
Main Feedwater Line
Recirculation Loop
(Typical of 2)
Reactor
Core
Jet Pump
LPCI
RHR
Heat
Exchanger
Service Water
Recirculation
Pump
Containment Spray
RHR Pumps
(LPCI Mode)
Containment Suppression Chamber
Core Spray
Pump

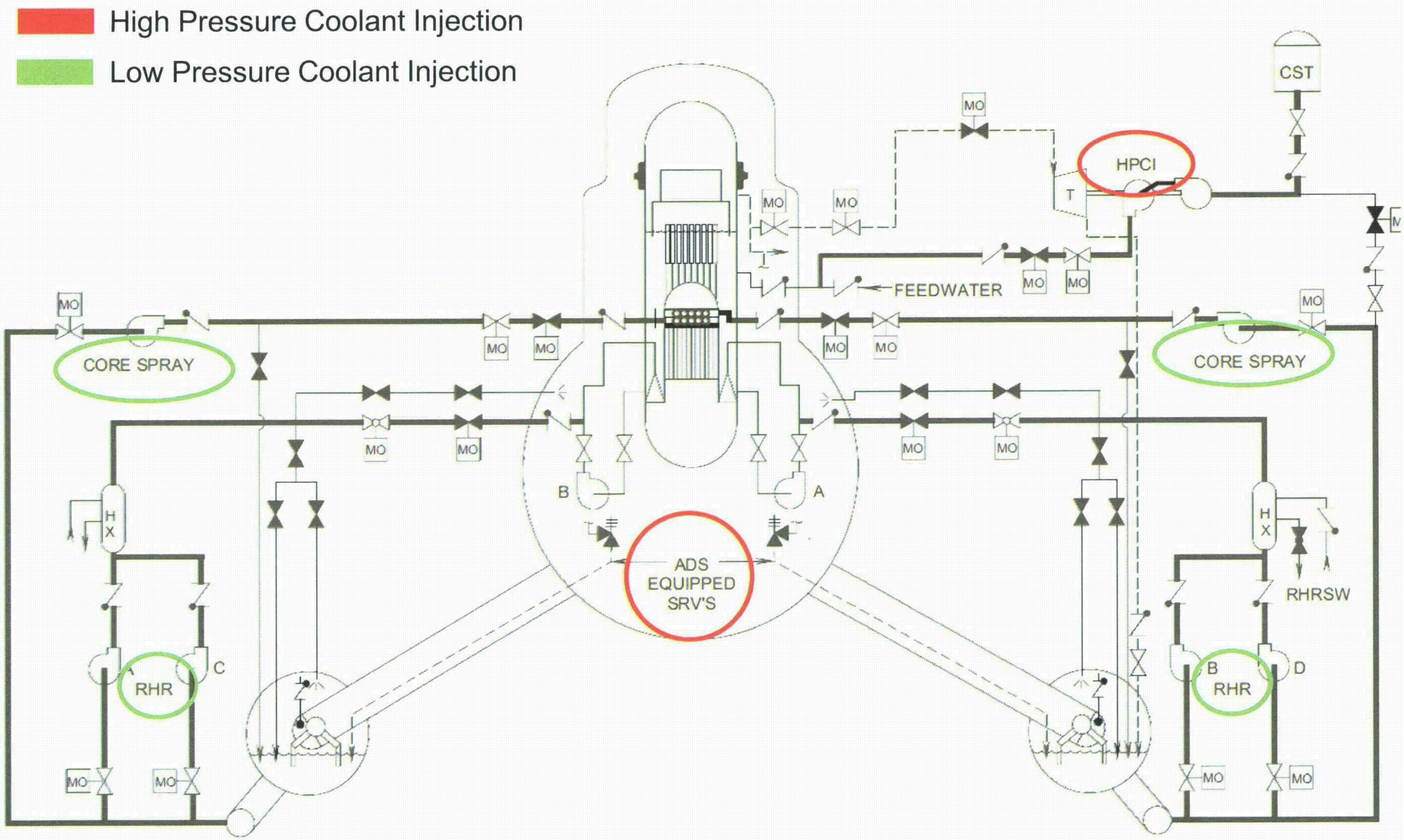
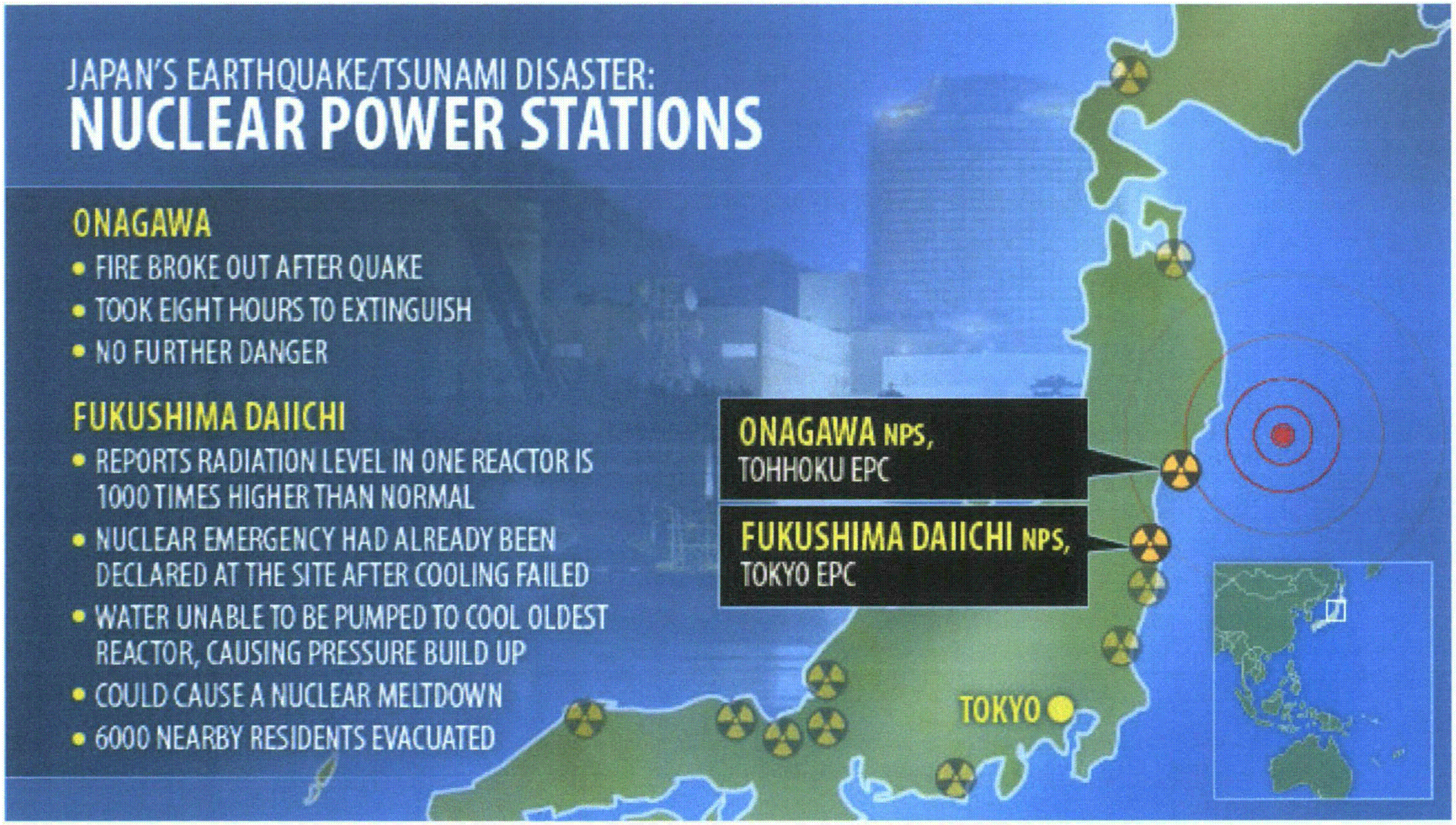
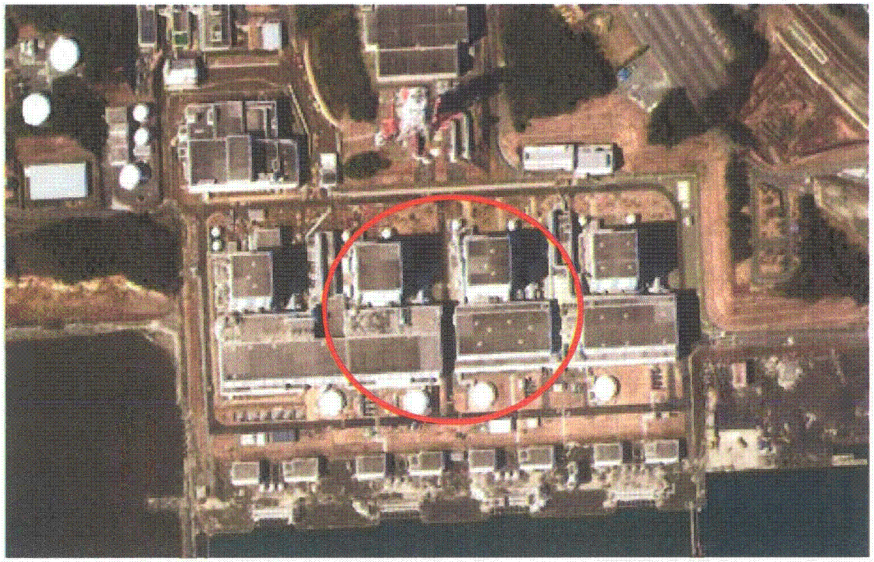


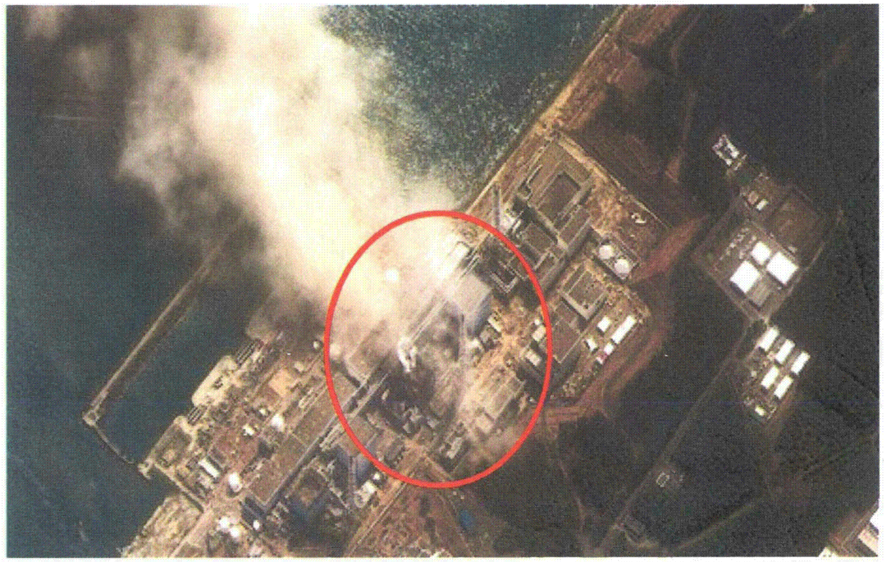
Figure 1.11-1 Emergency Core Cooling System

Japan Earthquake Effect on Nuclear Plants



Fukushima Nuclear Power Plant





Before Earthquake

After Earthquake

Unit 4 Fukushima,
03/15/2011

Status of nuclear power plants in Fukushima as of 19:00 March 16 (Estimated by JAIF)

Power Station	Fukushima #1 Nuclear Power Station					
Unit	1	2	3	4	5	6
Electric / Thermal Power output (MW)	460 / 1380	784 / 2381				1100 /3293
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
Operation Status at the earthquake occurred	Service	Service	Service	Outage	Outage	Outage
Core and Fuel Integrity	Damaged	Damaged	Damaged	No fuel rods	Not Damaged	Not Damaged
Containment Integrity	Not Damaged	Damage Suspected	Damage Suspected	Not Damaged	Not Damaged	Not Damaged
Core cooling requiring AC power	Not Functional	Not Functional	Not Functional	Not necessary	Not necessary	Not necessary
Core cooling not requiring AC power	Not Functional	Not Functional	Not Functional	Not necessary	Not necessary	Not necessary
Building Integrity	Severely Damaged	Slightly Damaged	Severely Damaged	Severely Damaged	Not Damaged	Not Damaged
water level of the pressure vessel	Around half of the Fuel	Recovering after Dried-up	Around half of the Fuel	Safe	Safe	Safe
pressure of the pressure vessel	Stable	Fluctuating	Stable	Safe	Safe	Safe
Containment pressure	Stable	D/W: Unknown, S/P: Atmosphere	Stable	Safe	Safe	Safe
Water injection to core (Accident Management)	Continuing (Seawater)	Continuing(Seawater)	Continuing(Seawater)	Not necessary	Not necessary	Not necessary
Water injection to Containment Vessel (AM)	Continuing(Seawater)	to be decided(Seawater)	to be decided(Seawater)	Not necessary	Not necessary	Not necessary
Containment venting (AM)	Continuing(Seawater)	Preparing(Seawater)	Continuing(Seawater)	Not necessary	Not necessary	Not necessary
Fuel Integrity in the spent fuel pool	(No info)	(No info)	Level Low, Preparing Water Injection	Level Low, Preparing Water Injection Damage to Fuel Rods Suspected	Pool Temp. Increasing	Pool Temp. Increasing
Environmental effect	NPS border: 1937 μSv/h at 14:30, Mar. 16					
Evacuation Area	20km from NPS * People who live between 20km to 30km from the Fukushima #1NPS are to stay indoors.					
Remarks	A fire broke on the 4th floor of the Unit-4 Reactor Building around 6AM, Mar. 15, and the radiation monitor readings increased outside of the building: 30mSv between Unit-2 and Unit-3, 400mSv beside Unit-3, 100mSv beside Unit-4 at 10:22, Mar. 15. It is estimated that spent fuels stored in the spent fuel pit heated and hydrogen was generated from these fuels, resulting in explosion. TEPCO later announced the fire was been burned out. Another fire was observed at 5:45, Mar. 16, and then disappeared later. Other staff and workers than fifty TEPCO employees who are engaged in water injection operation have been evacuated. White smoke was seen rising from the vicinity of Unit-3 at around 8:30, Mar. 16. TEPCO estimates that failing to cool the SFP has resulted in evaporation of pool water, generating steam.					

Power Station	Fukushima #2 Nuclear Power Station			
Unit	1	2	3	4
Electric / Thermal Power output (MW)	1100 / 3293			
Type of Reactor	BWR-5	BWR-5	BWR-5	BWR-5
Operation Status at the earthquake occurred	Service	Service	Service	Service
Core and Fuel Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
Containment Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
Core cooling requiring AC power	Functioning	Functioning	Functioning	Functioning
Core cooling not requiring AC power	Not necessary	Not necessary	Not necessary	Not necessary
Building Integrity	Not Damaged	Not Damaged	Not Damaged	Not Damaged
water level of the pressure vessel	(No info)	(No info)	(No info)	(No info)
pressure of the pressure vessel	(No info)	(No info)	(No info)	(No info)
Containment pressure	(No info)	(No info)	(No info)	(No info)
Water injection to core (Accident Management)	Not necessary	Not necessary	Not necessary	Not necessary
Water injection to Containment Vessel (AM)	Not necessary	Not necessary	Not necessary	Not necessary
Containment venting (AM)	Not necessary	Not necessary	Not necessary	Not necessary
Fuel Integrity in the spent fuel pool	(No Info)	(No Info)	(No Info)	(No Info)
Environmental effect	NPS border: 29.4 μSv/h at 12:00, Mar. 16			
Evacuation Area	10km from NPS			
Remarks	All the units are in cold shutdown.			

[Source]

Governmental Emergency Headquarters: News Release (3/16 7:00), Press conference (3/14 11:45, 16:15, 3/15 8:00, 11:00, 16:25, 3/16 11:15)

NISA: News Release (3/14 7:30), Press conference (3/16 12:00)

TEPCO: Press Release (3/14 16:00, 17:35, 3/15 6:00, 12:00, 16:30, 23:35, 3/16 0:00),
Press Conference (3/14 12:10, 20:00, 3/15 8:00, 8:30, 3/16 early morning)

[Abbreviations]

INES: International Nuclear Event Scale
NISA: Nuclear and Industrial Safety Agency
SFP: spent fuel pool
TEPCO: Tokyo Electric Power Company, Inc.

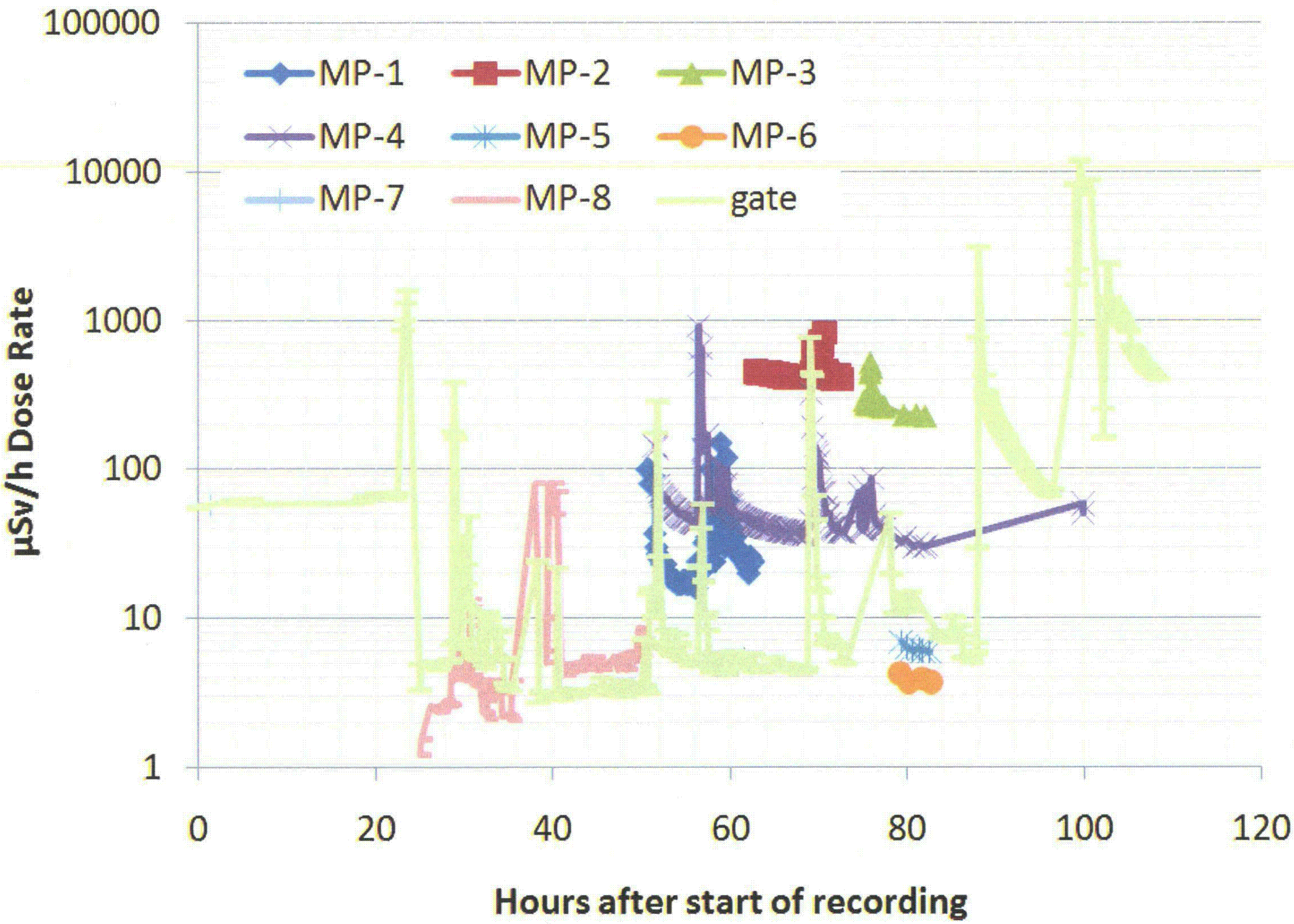
[Significance judged by JAIF]

: low

: high

: severe

Radiation Level



Nuclear Power Plants Status

- Fukushima
  - Primary Containment Vessel Unit 3: possible damage
  - Unit 2 core damage < 5% (03/14)
  - Spent Fuel Pool Empty in Unit 4 and Unit 3 might be losing water too.
  - Radiation level is falling

NRC Status

- DG 1258 “Tsunami Hazard Assessment for Design of Nuclear Power Plants”
- OPS Center – operating in a 24 hours basis
- NRC employees in Japan:
  - 2 BWR experts
  - 6 Engineers
  - 3 OIP staff
  - Looking for volunteers for a two weeks rotation

Laur, Steven

From:	Cheok, Michael NRR
Sent:	Thursday, March 17, 2011 8:34 AM
To:	Harrison, Donnie; Klein, Alex; Laur, Steven; Rodriguez, Veronica; Tate, Travis
Cc:	Lee, Samson
Subject:	FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN
Attachments:	SecureZIP Attachments.zip
Importance:	High

FYI – flexibility in work hour schedules (CWS & New Flex) and biweekly salary cap for staff tasked to work in the Ops Center. I will pass on details when we get them.

From: RidsNrrOd Resource NRR
Sent: Thursday, March 17, 2011 8:24 AM
To: Ruland, William; Bahadur, Sher; Thomas, Brian; Lubinski, John; McGinty, Tim; Blount, Tom; Quay, Theodore; Brown, Frederick; Giitter, Joseph; Nelson, Robert; Howe, Allen; Holian, Brian; Galloway, Melanie; Cheok, Michael; Lee, Samson; Hiland, Patrick; Skeen, David; Givvines, Mary; Ferrell, Kimberly
Subject: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN
Importance: High

From: Khan, Charline HR
Sent: Thursday, March 17, 2011 7:29 AM
To: RidsAcrsAcnw_MailCTR Resource; RidsAslbpManagement Resource; RidsOgcMailCenter Resource; RidsOcaaMailCenter Resource; RidsOcfoMailCenter Resource; RidsOigMailCenter Resource; RidsOipMailCenter Resource; RidsOcaMailCenter Resource; RidsOpaMail Resource; RidsSecyMailCenter Resource; RidsSecyCorrespondenceMCTR Resource; RidsEdoMailCenter Resource; RidsAdmMailCenter Resource; RidsCsoMailCenter Resource; RidsOeMailCenter Resource; RidsFsmeOd Resource; RidsOiMailCenter Resource; RidsOIS Resource; RidsHrMailCenter Resource; RidsNroOd Resource; RidsNroMailCenter Resource; RidsNmssOd Resource; RidsNrrOd Resource; RidsNrrMailCenter Resource; RidsResOd Resource; RidsResPmdaMail Resource; RidsSbcrMailCenter Resource; RidsNsirOd Resource; RidsNsirMailCenter Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource
Cc: Davidson, Lawrence; Buchholz, Jeri; Johns, Nancy
Subject: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

MEMORANDUM TO: Those on the Attached List

FROM: Miriam L. Cohen, Director**/RA by J. Buchholz for/**
Office of Human Resources

DATED: March 16, 2011

SUBJECT: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

ADAMS Accession No. ML11075A003 refers

NOTE: Electronic distribution only

H-52

Charline Khan
Administrative Assistant (Rotation)
U.S. NUCLEAR REGULATORY COMMISSION
Office of Human Resources
P:301-492-2318
Charline.Khan@nrc.gov

March 16, 2011

MEMORANDUM TO: Those on the Attached List

FROM: Miriam L. Cohen, Director**/RA by J. Buchholz for/**
Office of Human Resources

SUBJECT: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

I have approved a waiver of the U.S. Nuclear Regulatory Commission (NRC) work schedule rules, as well as a waiver of the biweekly cap on combined salary plus premium pay, for NRC employees serving in and supporting the NRC Operations Center, as well as NRC employees working in Japan, in response to the current, serious nuclear power plant issues in that country.

Work Schedule Limitations

NRC permits a variety of types of work schedules, including 5-4/9 compressed work schedules (CWS) and NEWFlex flexible work schedules that include limitations on permissible workdays and working clock hours. Other types of work schedules, including Expanded-Compressed work schedules (E-CWS) in emergency situations, and First-40 work schedules in unusual situations, do not contain such limitations. A summary of work schedule options may be found on the intranet at http://www.internal.nrc.gov/HR/work-schedule.html.

I have approved a waiver of limitations on permissible workdays and working clock hours for NRC employees working in response to these events. As a result, employees on 5-4/9 CWS may work weekends, employees on NEWFlex may work Sundays, and employees on both types of work schedules may work any clock hours, as appropriate (an exception to the 11.25 hour maximum limitation on NEWFlex workdays is not possible).

Biweekly Cap

As a matter of Federal-wide law and regulations, employees who are exempt from the Fair Labor Standards Act (most NRC employees are exempt) normally are subject to a biweekly cap on combined salary plus premium pay. This year, the cap is equal to the salary for GG-15 step 10. Premium pay includes the following categories: night premium pay, Sunday premium pay, holiday premium pay, overtime premium pay, and "regular" compensatory time off (not religious compensatory time off or Special Compensatory Time Off for Travel).

For further details, please see the February 3, 2011, NRC Announcement entitled "Employee Resources: 2011 Cap on Combined Salary Plus Premium Pay," available on the intranet at http://www.internal.nrc.gov/announcements/items/7625.html.

Annual Cap

Federal law and regulations permit agencies to waive the biweekly cap and to adopt an annual cap on combined salary plus premium pay when, among other reasons, an employee receives premium pay for work directly related to resolving or coping with an emergency (or its immediate aftermath) that involves a direct threat to life or property.

I have approved a waiver of the biweekly cap and adoption of an annual cap for NRC employees working in response to these events.

Procedures

Note that employees who are responding to these events will be provided a document summarizing their work schedule options as well as their entitlements to premium pay.

Employees should consult with their time and attendance officials about any necessary changes to their Human Resources Management System workgroups.

Management should advise Jackie Jones, Financial Services Branch, Office of the Chief Financial Officer, of the names of employees who perform emergency-related premium work as well as the dates of such work. Please submit this information to Ms. Jones via a memorandum mailed to T-9 E2, or via e-mail to Jackie.Jones@nrc.gov. It is important to provide Ms. Jones this information as soon as practicable after the work begins to avoid difficulties processing the appropriate payments as the annual cap will be made effective at the beginning of the pay period in which the work was performed.

Should you have any questions on this matter, please contact me or have a member of your staff contact Larry Davidson at (301) 492-2286 or Lawrence.davidson@nrc.gov.

MEMORANDUM TO THOSE ON THE ATTACHED LIST DATED: March 16, 2011

SUBJECT: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

Edwin M. Hackett, Executive Director, Advisory Committee on Reactor Safeguards	RidsAcrsAcnw_MailCTR Resource
E. Roy Hawkens, Chief Administrative Judge, Atomic Safety and Licensing Board Panel	RidsAslbpManagement Resource
Stephen G. Burns, General Counsel	RidsOgcMailCenter Resource
Brooke D. Poole, Director, Office of Commission Appellate Adjudication	RidsOcaaMailCenter Resource
James E. Dyer, Chief Financial Officer	RidsOcfoMailCenter Resource
Hubert T. Bell, Inspector General	RidsOigMailCenter Resource
Margaret M. Doane, Director, Office of International Programs	RidsOipMailCenter Resource
Rebecca L. Schmidt, Director, Office of Congressional Affairs	RidsOcaMailCenter Resource
Eliot B. Brenner, Director, Office of Public Affairs	RidsOpaMail Resource
Annette Vietti-Cook, Secretary of the Commission	RidsSecyMailCenter Resource RidsSecyCorrespondenceMCTR Resource
R. William Borchardt, Executive Director for Operations	RidsEdoMailCenter Resource
Michael F. Weber, Deputy Executive Director for Materials, Waste, Research, State, Tribal, and Compliance Programs, OEDO	RidsEdoMailCenter Resource
Darren B. Ash, Deputy Executive Director for Corporate Management, OEDO	RidsEdoMailCenter Resource
Martin J. Virgilio, Deputy Executive Director for Reactor and Preparedness Programs, OEDO	RidsEdoMailCenter Resource
Mary C. Muessle, Acting Assistant for Operations, OEDO	RidsEdoMailCenter Resource
Kathryn O. Greene, Director, Office of Administration	RidsAdmMailCenter Resource
Patrick D. Howard, Director, Computer Security Office	RidsCsoMailCenter Resource
Roy P. Zimmerman, Director, Office of Enforcement	RidsOeMailCenter Resource
Charles L. Miller, Director, Office of Federal and State Materials and Environmental Management Programs	RidsFsmeOd Resource
Cheryl L. McCrary, Director, Office of Investigations	RidsOiMailCenter Resource
Thomas M. Boyce, Director, Office of Information Services	RidsOis Resource
Miriam L. Cohen, Director, Office of Human Resources	RidsHRMailCenter Resource
Michael R. Johnson, Director, Office of New Reactors	RidsNroOd Resource RidsNroMailCenter Resource
Catherine Haney, Director, Office of Nuclear Material Safety and Safeguards	RidsNmssOd Resource
Eric J. Leeds, Director, Office of Nuclear Reactor Regulation	RidsNrrOd Resource RidsNrrMailCenter Resource
Brian W. Sheron, Director, Office of Nuclear Regulatory Research	RidsResOd Resource RidsResPmdaMail Resource
Corenthis B. Kelley, Director, Office of Small Business and Civil Rights	RidsSbcrMailCenter Resource
James T. Wiggins, Director, Office of Nuclear Security and Incident Response	RidsNsirOd Resource RidsNsirMailCenter Resource
William M. Dean, Regional Administrator, Region I	RidsRgn1MailCenter Resource
Victor M. McCree, Regional Administrator, Region II	RidsRgn2MailCenter Resource
Mark A. Satorius, Regional Administrator, Region III	RidsRgn3MailCenter Resource
Elmo E. Collins, Jr., Regional Administrator, Region IV	RidsRgn4MailCenter Resource

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Should you have any questions on this matter, please contact me or have a member of your staff contact Larry Davidson at (301) 492-2286 or Lawrence.davidson@nrc.gov.

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NAME	LDavidson	NJohns LDavidson for	JBuchholz	GTracy JBuchholz for	MCohen JBuchholz for
DATE	3/16/2011	3/16/2011	3/16/2011	3/16/2011	3/16/2011

OFFICIAL RECORD COPY

Raione, Richard

From: Jones, Henry
Sent: Friday, March 18, 2011 12:57 PM
To: Chokshi, Nilesh
Cc: Raione, Richard
Subject: NRO PPT BRIEFING ON TSUNAMI HAZARDS
Attachments: NRO_TSUNAMI HAZARDS_REV2.ppt

E3-H

Nilesh,

Unfinished PPT attached. I need to complete the new reactor section.

Henry

Henry Jones, Ph.D.
Hydrologist
Hydrologic Engineering Branch, Office of New Reactors
U.S. Nuclear Regulatory Commission
Mail Stop: T-7E18
11545 Rockville Pike, Rockville, MD 20852
Tel: (301) 415-1463
E-mail: Henry.Jones@nrc.gov (NEW)

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

TSUNAMI HAZARDS

Regulatory Perspective

Hydrologic Engineering Branch

March 23, 2011

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Tsunami Definition & Description

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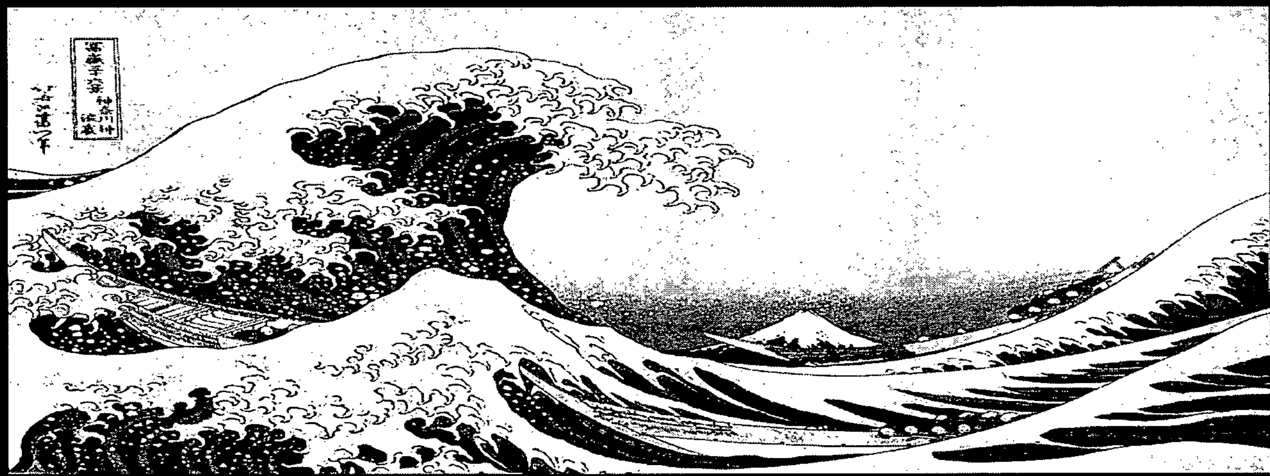
Tsunami Definition



- Ocean wave
- Generated by an undersea geologic event, such as a great earthquake, terrestrial landslide, asteroid, volcanic explosion, or underwater landslide
- “Tsunami” in Japanese means “harbor wave”
- Tsunamis are *not* “tidal waves”

Describing Ocean Waves

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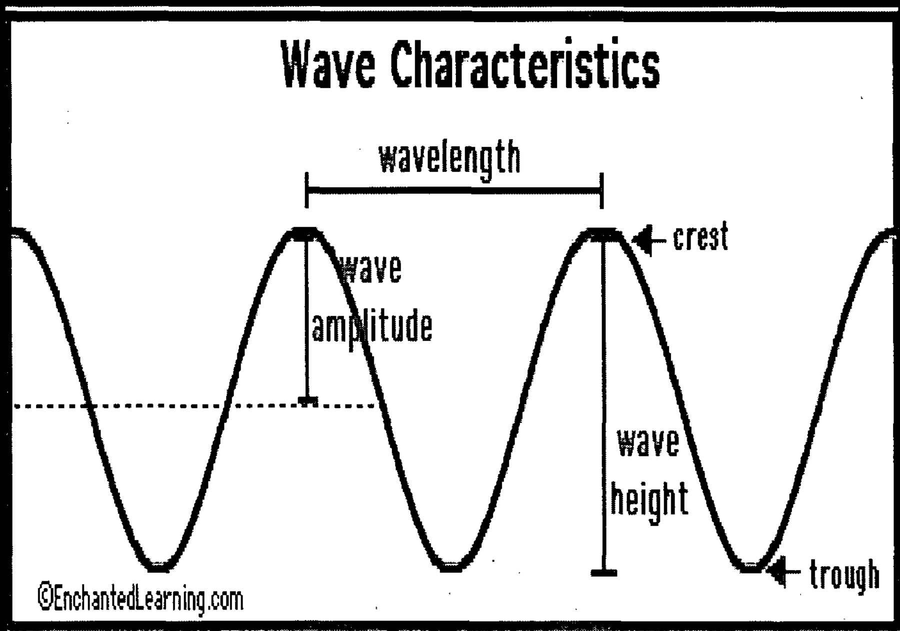
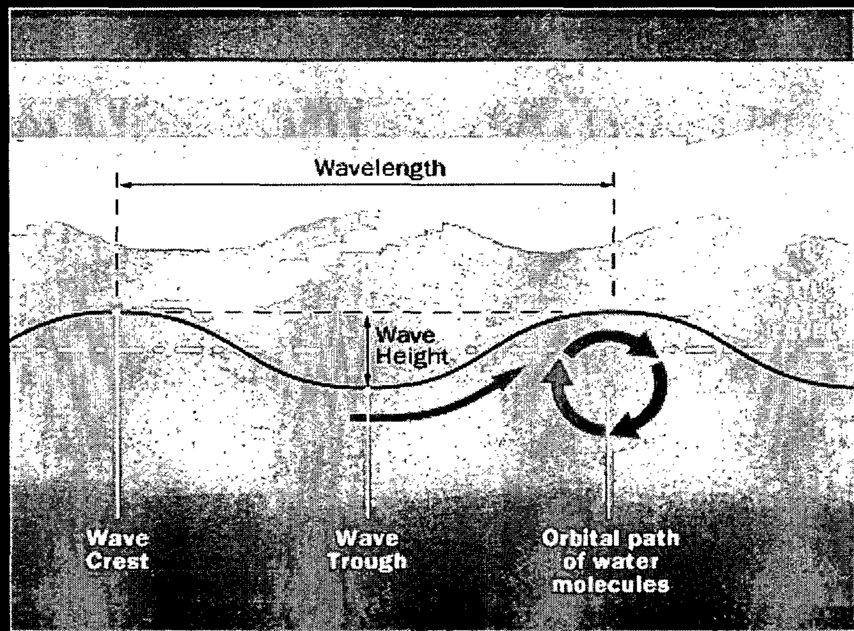
- Ocean waves are deformations of the sea surface.
- Wavelength: distance between crests (λ)
- Wave height: vertical distance between crest and trough
- Period: time between 2 successive crests to pass (T)





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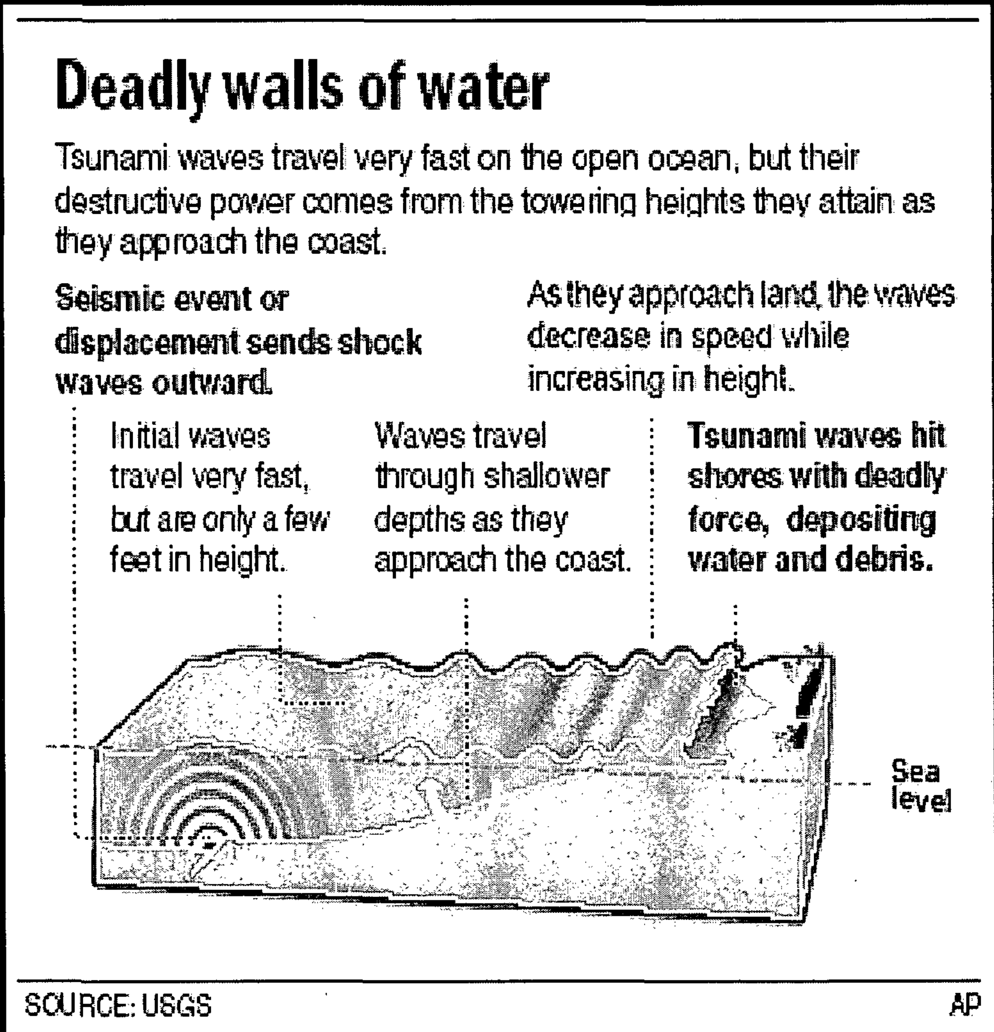
Tsunami Characteristics



- Move at high speeds (~ 500 mph)
- Wavelength > 20 times water depth (shallow water wave)
- Can travel enormous distances with little energy loss
- Can cause damage thousands of miles from its origin
- May be <u>several hours</u> or <u>minutes</u> between its creation and its impact on the coast

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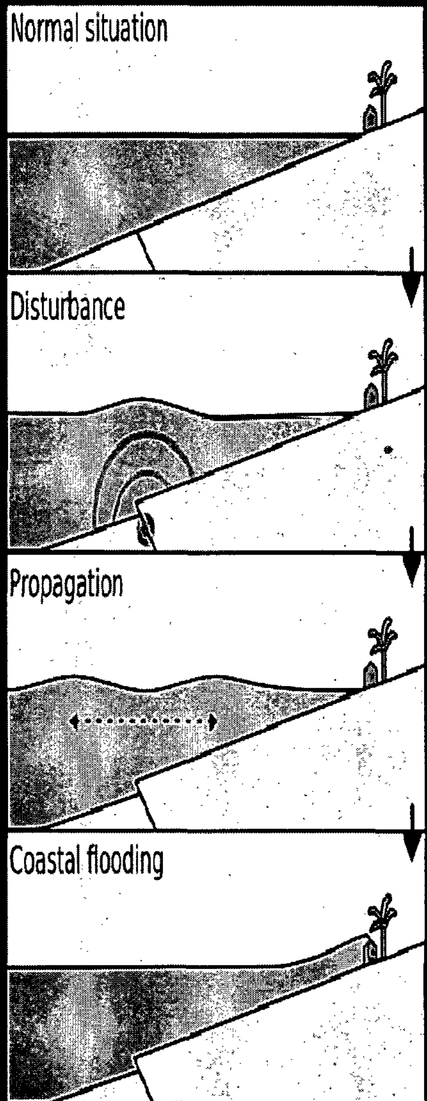
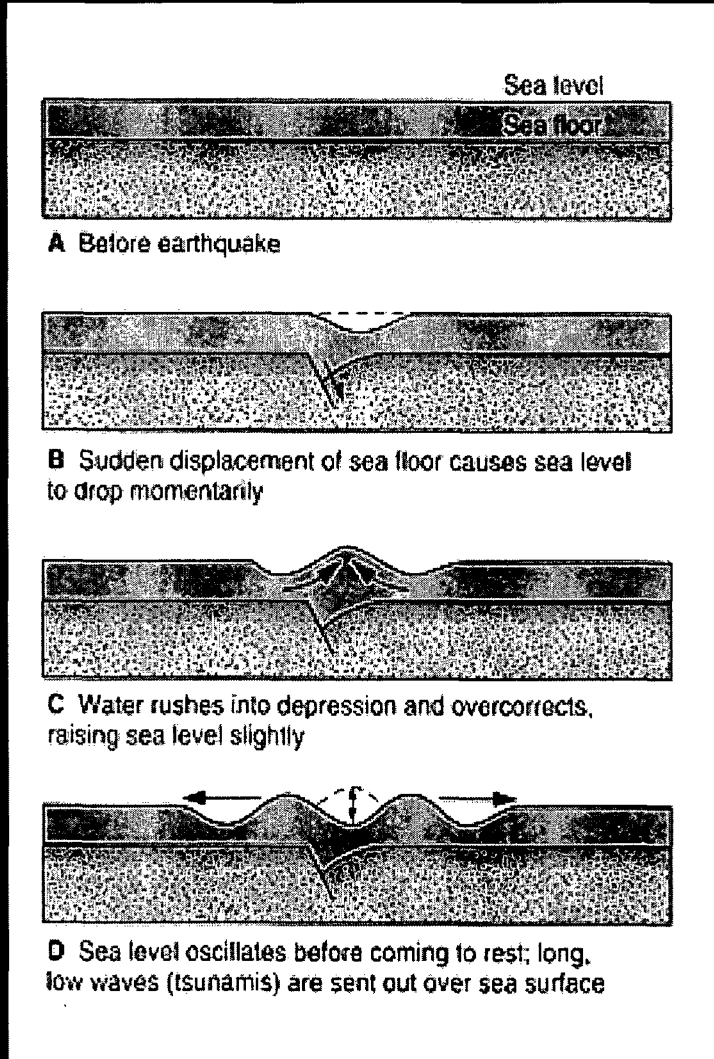
Tsunami Generation Sources

Tsunami (Underwater Disturbance)

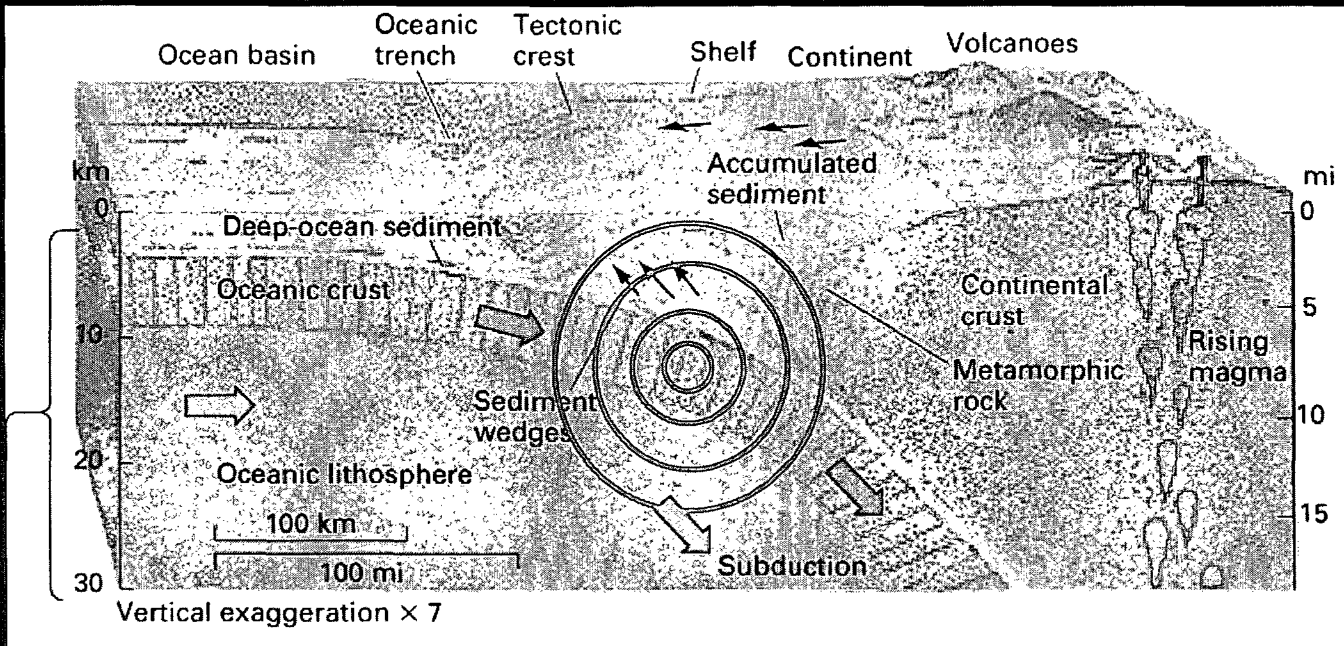


Tsunamis are created when:

- Seafloor quickly changes shape
- Water is displaced
- Waves are formed as the displaced water mass, which is affected gravity, tries to move back



Subduction Zone Earthquake



- Oceanic crust collides with continental crust and is forced downward
- Compression forces build until rock fractures and an earthquake occurs

Subduction Zone Earthquake

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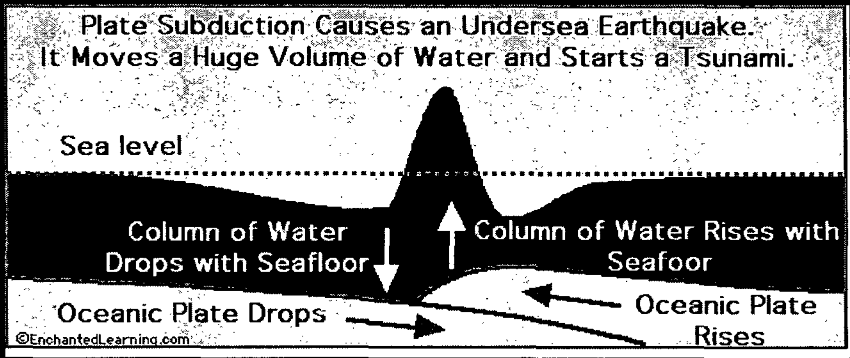
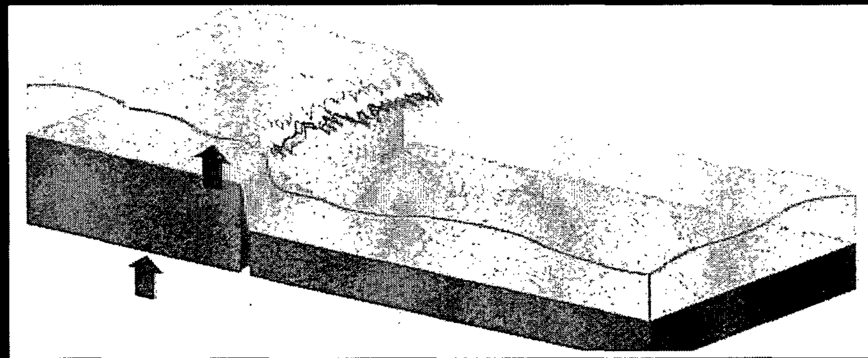
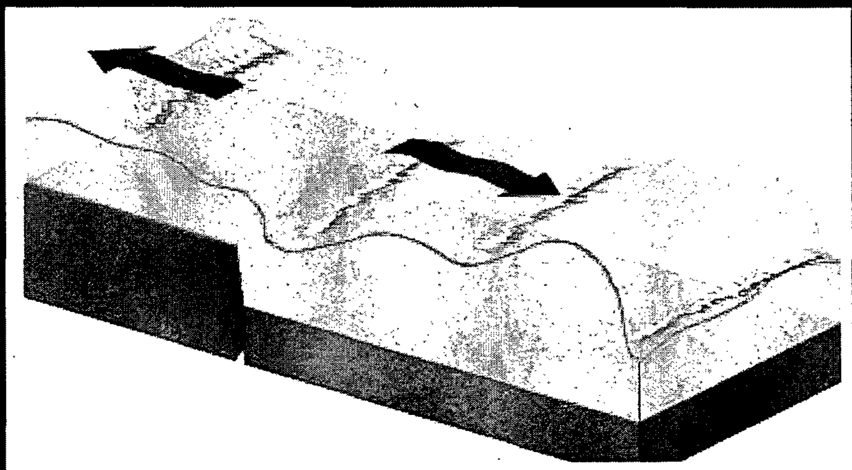
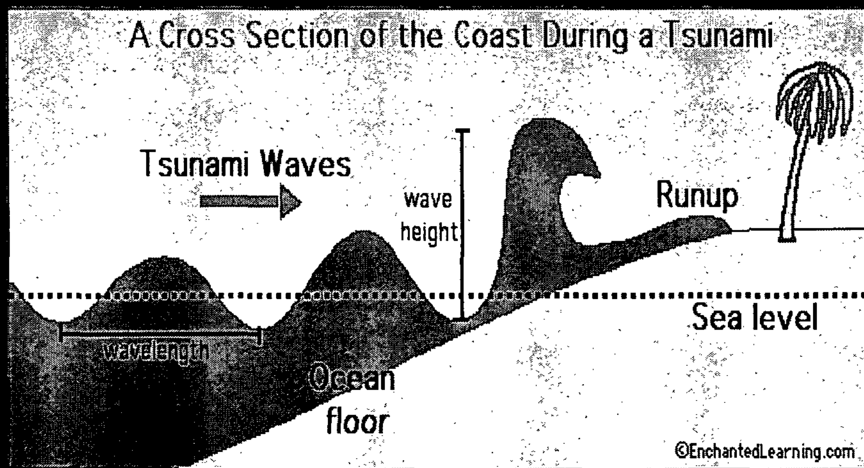
An earthquake causes a vertical movement of the seafloor, which displaces the sea water.





Large waves then radiate from the epicenter in all directions.





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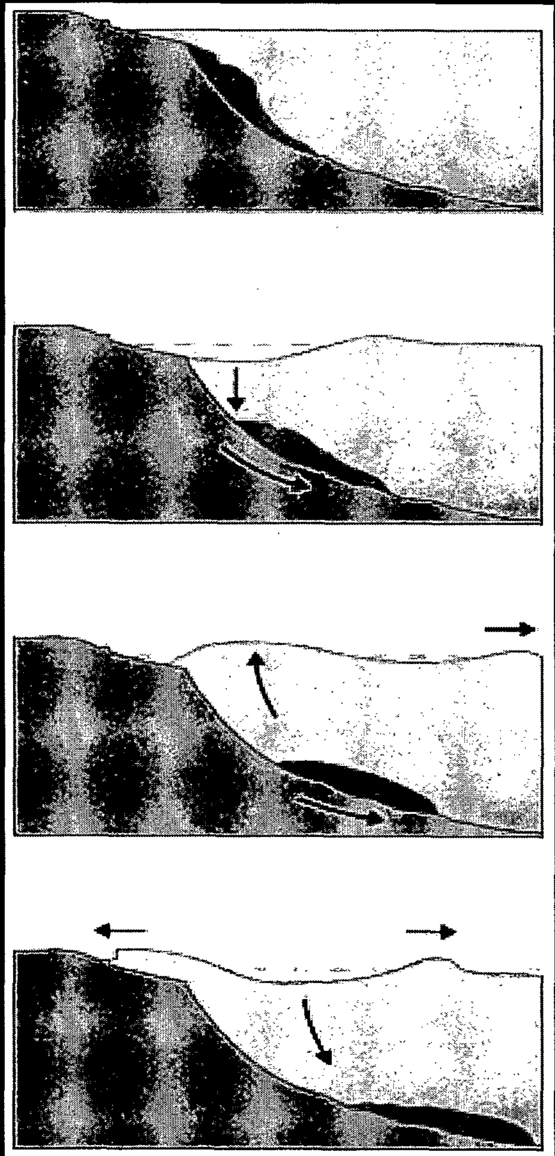
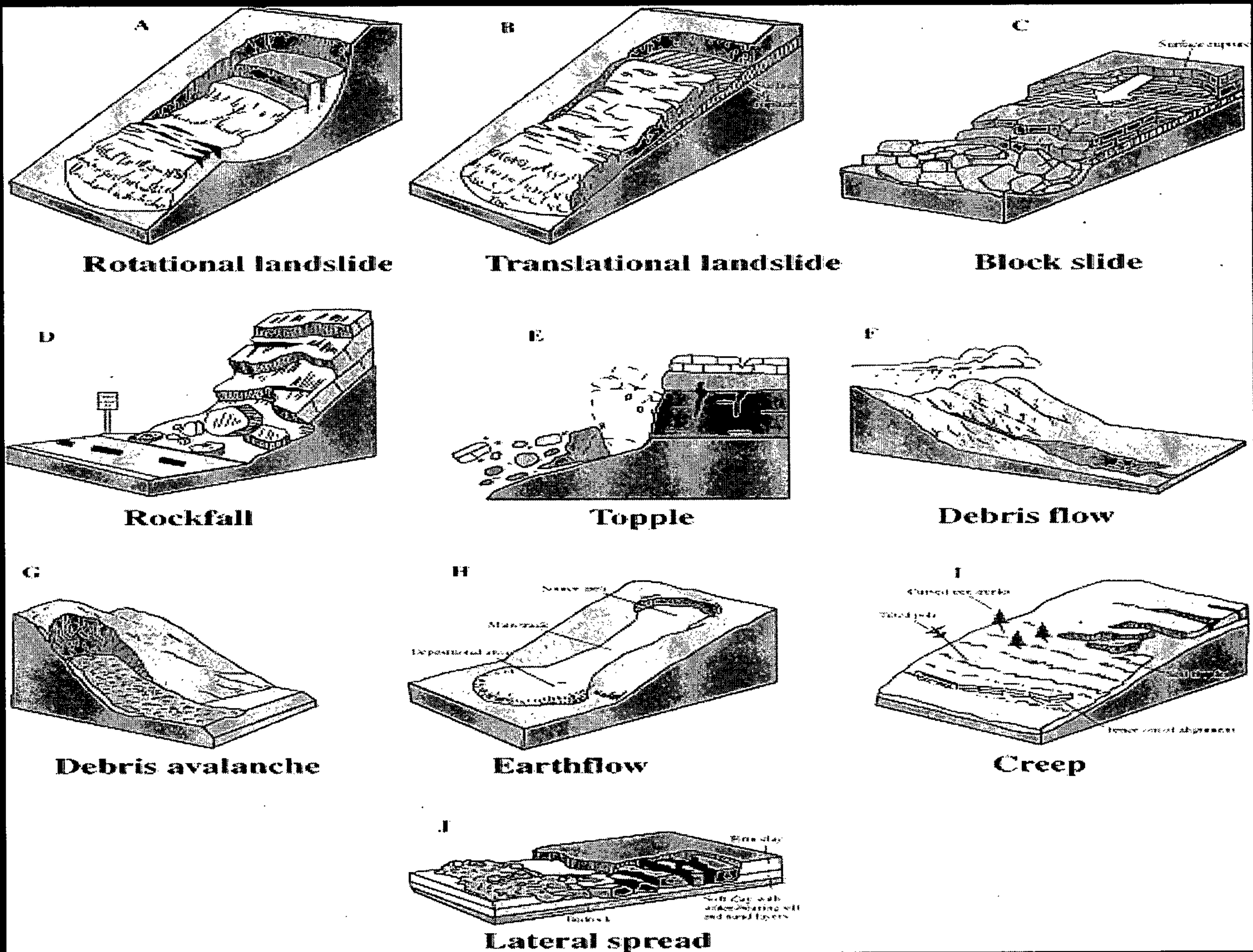
Undersea Landslide or Slump



- Body of sediment slumps downward along a continental shelf
- Can be triggered by an earthquake
- Water drops at head of slump, rises at toe to create a wave
- Wave moves outward as a tsunami

Landslides or Slump



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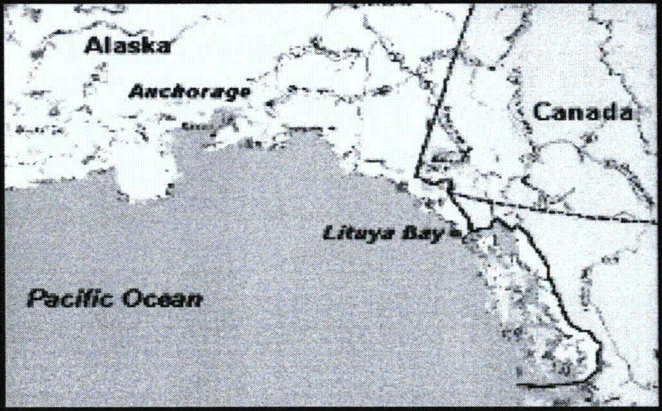
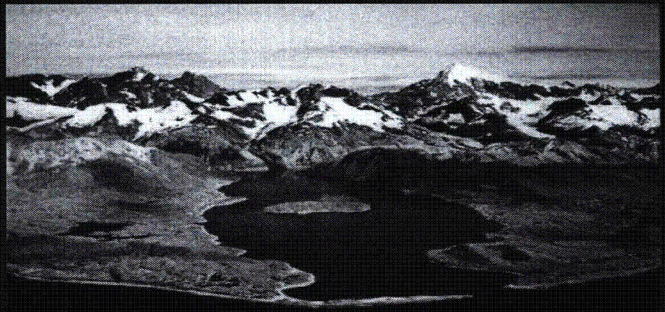
On July 9, 1958, a large earthquake along the Fairweather Fault struck Southeastern Alaska. A combination of disturbances triggered by the earthquake generated a mega-tsunami wave that rose to a maximum height of 1,720 feet (516 m) at the head of Lituya Bay.

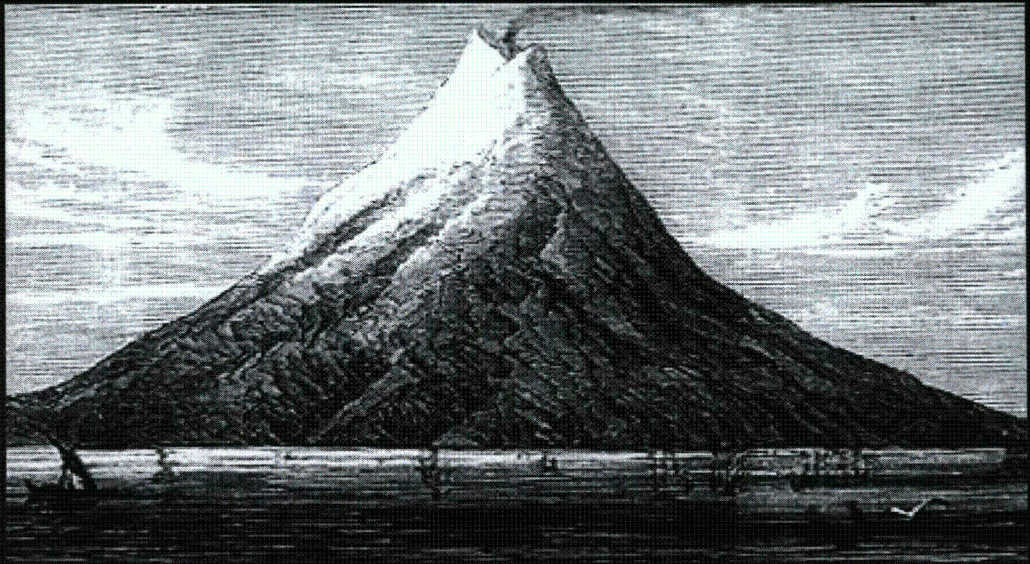


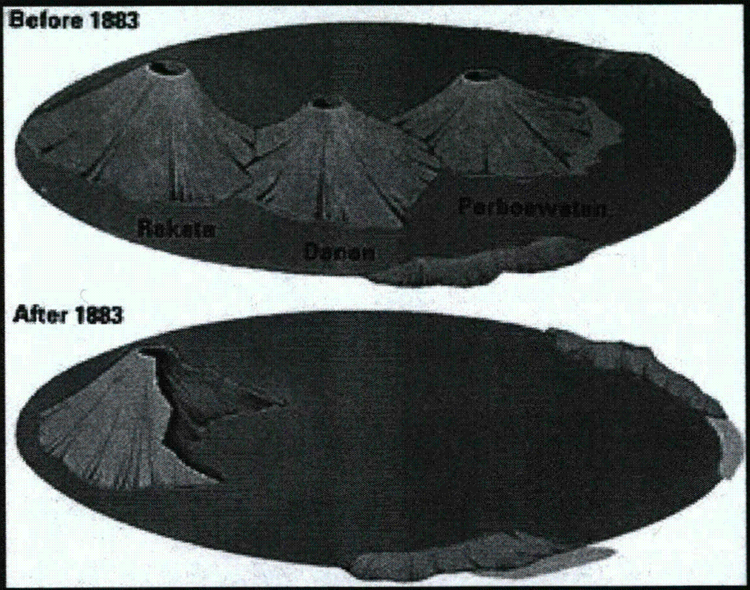


The giant wave runup of 1,720 feet (524 m.) at the head of the Bay and the subsequent huge wave along the main body of Lituya Bay which occurred on July 9, 1958, were caused primarily by an enormous subaerial rockfall into Gilbert Inlet at the head of Lituya Bay, triggered by dynamic earthquake ground motions along the Fairweather Fault.

Volcanic Explosion

Most volcanic tsunami waves have been produced by extremely energetic explosive volcanic eruptions in or near water, or by flow of voluminous pyroclastic flows or debris avalanches into the sea





The explosive eruption of Krakatau in August 1883 created a tsunami that claimed more than 36,000 lives

Regulatory Basis & Guidance

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Regulatory Basis

10 CFR Part 100.23, 100.20, 100.21, 100.23

Part 100.20(c)(3) - The maximum probable flood along with the potential for seismically induced floods discussed in Part 100.23 (d)(3) must be estimated using historical data.

Part 100.21(d) - The physical characteristics of the site, including hydrology must be evaluated and site parameters established such that potential threats from such physical characteristics will pose no undue risk to the type of facility proposed to be located at the site.

Part 100.23(d)(3) - Determination of design bases for seismically induced floods and water waves. The size of seismically induced floods and water waves that could affect a site from either locally or distantly generated seismic activity must be determined.

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Regulatory Basis

10 CFR Part 50 (Appendix A) General Design Criterion 2
10 CFR Part 52.17, 52.79

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, requires COL applicants to consider the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

10 CFR Part 52.17(a)(1)(vi), for ESP applications, and 10 CFR 52.79(a)(1)(iii), for COL applications, as they relate to identifying hydrologic site characteristics with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

Regulatory Guidance

RG 1.102 – Flood Protection for Nuclear Power Plants, Rev. 1 1976

Describes types of flood protection acceptable to the NRC staff

Exterior Barriers (e.g.)

Levee – embankment to protect land from inundation

Seawall or floodwall – a structure separating land and water areas, primarily to prevent erosion and other damages due to wave action

Bulkhead – similar to seawall, purpose is to restrain the land area

Incorporated Barriers - **Protection provided by specially designed walls and penetration closures. Walls are usually reinforced concrete designed to resist static and dynamic forces of a Design Basis Flood Level of a Probable Maximum Flood.**

RG 1.59 – Design Basis Floods for Nuclear Power Plants, Rev. 2. 1977

The most severe seismically induced floods reasonably possible should be considered for each site.

Tsunami requires consideration of seismic events of the severity of the Safe Shutdown Earthquake occurring at the location that would produce the worst such flood at the nuclear power plant site.

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Regulatory Guidance

RG 1.206 – Combined License Applications for Nuclear Power Plants, 2007

Historical tsunami record, source generator characteristics, tsunami analysis , tsunami water levels, hydrographic and harbor or breakwater influences and effects on safety-related facilities

---

US NRC, Standard Review Plan, "Probable Maximum Tsunami Flooding," Section 2.4.6, Rev. 2

Areas of Review

- Probable maximum tsunami postulated for a site should include wave runup and drawdown
- Hydrologic characteristics of maximum locally and distantly generated tsunami (e.g., volcanoes, landslides)
- Geological and seismic characteristics of potential tsunami faults (e.g., magnitude, focal depth, source dimensions, fault orientation, and vertical displacement)

Regulatory Guidance

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Currently the US NRC has a tsunami research program that is focused on developing modern hazard assessment techniques and additional guidance through cooperation with the National Oceanic and Atmospheric Administration and the United States Geological Survey.

This has already lead to several technical reports and an update to NUREG 0-800. The NOAA and USGS contractors are also assisting with NRO reviews of tsunami hazard. A new regulatory guide on tsunami hazard assessment is currently planned in the office of research, although it is not expected to be available in draft form until 2012.

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Safety Evaluation Reviews (New Reactors)

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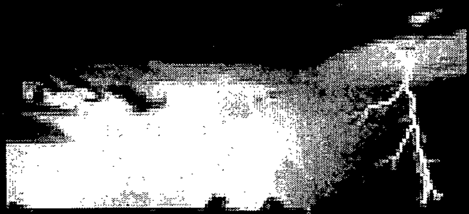
Hydrology Safety Review Areas


Precipitation

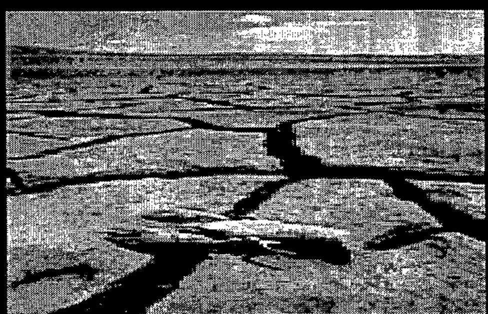

Streams & Rivers

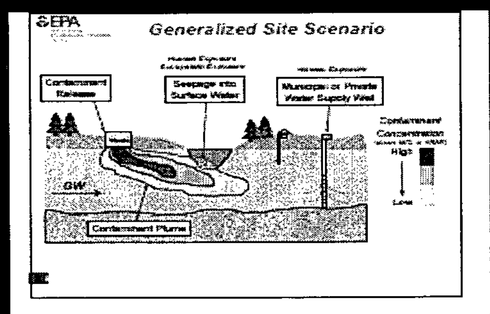

Potential Dam Failures


Storm Surge & Seiche


Tsunami


Ice Effects


Channel Diversions



Groundwater/Accidental Releases

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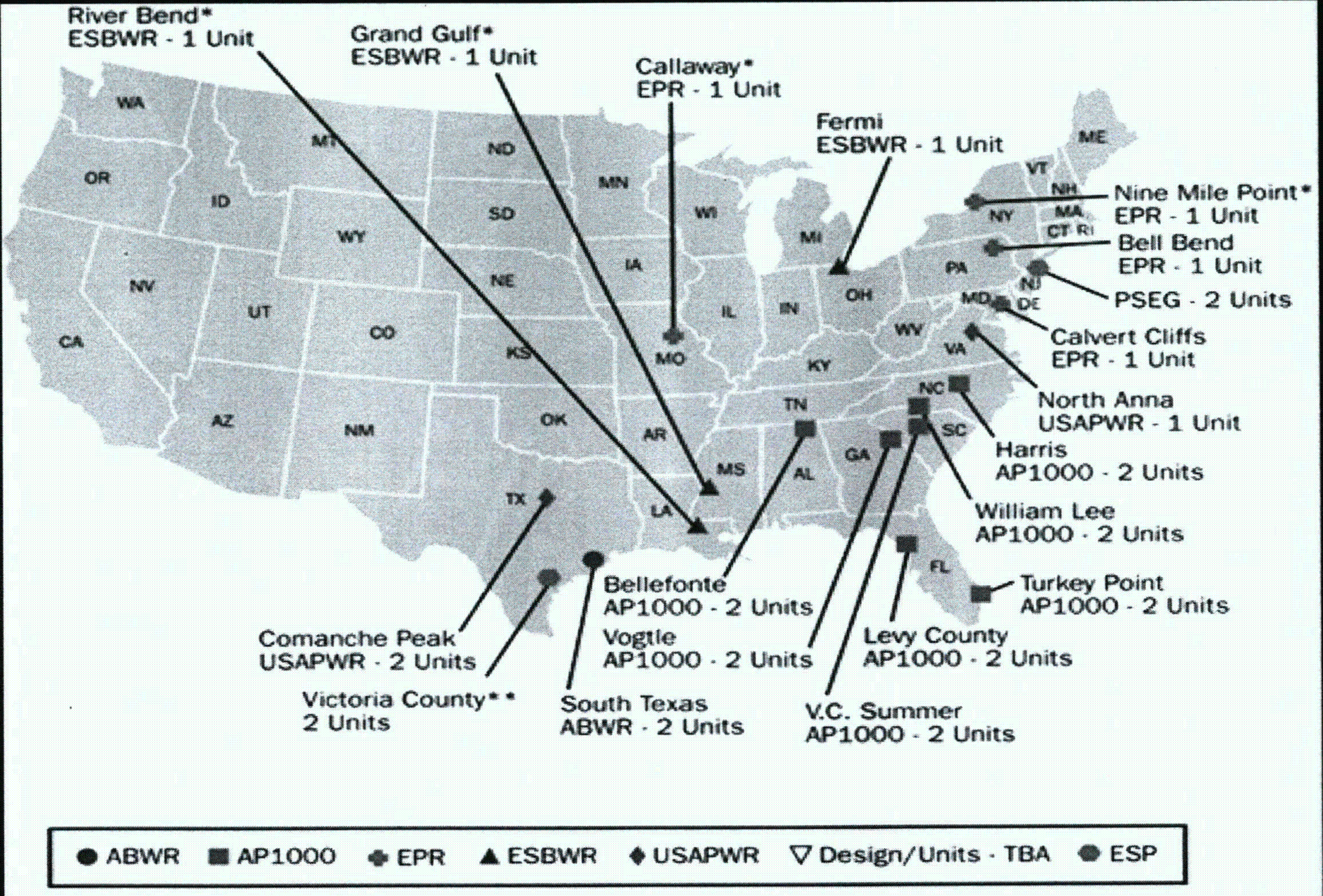
NRC Standard Review Plan – NUREG-00800

Section 2.4.6 Tsunami Hazards

1. Historical Tsunami Data
2. Probable Maximum Tsunami (PMT) - **The staff also reviews source mechanisms, source parameters, propagation models, and near-shore inundation models.**
3. Tsunami Propagation Models
4. Wave Runup, Inundation, and Drawdown
5. Hydrostatic and Hydrodynamic Forces
6. Debris and Water-Borne Projectiles
7. Effects of Sediment Erosion and Deposition

New Reactor Applications



*Review Suspended by Applicant

** COL Application Amended by Applicant to ESP on 03/25/2010

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New Reactor Applications

- Like seismic hazard, the level of tsunami that each plant is designed for is site-specific and is appropriate for what may occur at each location
  - Many proposed plants are located in coastal areas that could potentially be affected by tsunami.
  - There are two plants on the Gulf Coast, South Texas, Victoria County and Levy County.
  - Proposed plants on the Atlantic Coast that could be impacted by a tsunami include Turkey Point, Calvert Cliffs and Salem/Hope Creek (PSEG).
  - Tsunami on the Gulf and Atlantic Coasts occur, but are very rare. Generally the flooding anticipated from hurricane storm surge exceeds the flooding expected from a tsunami for plants on the Atlantic and Gulf Coast.

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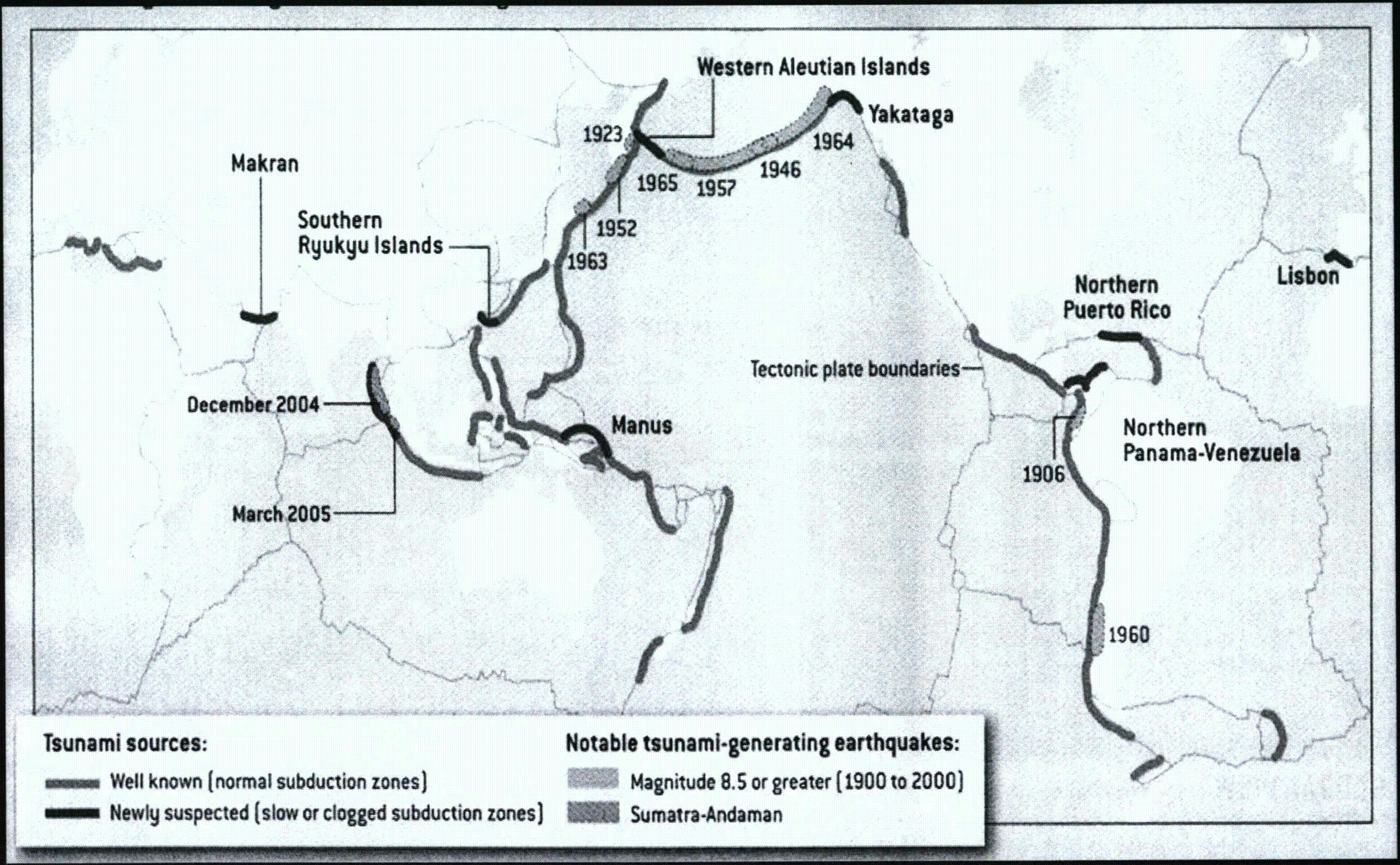
Tsunami-generating EQs and sources



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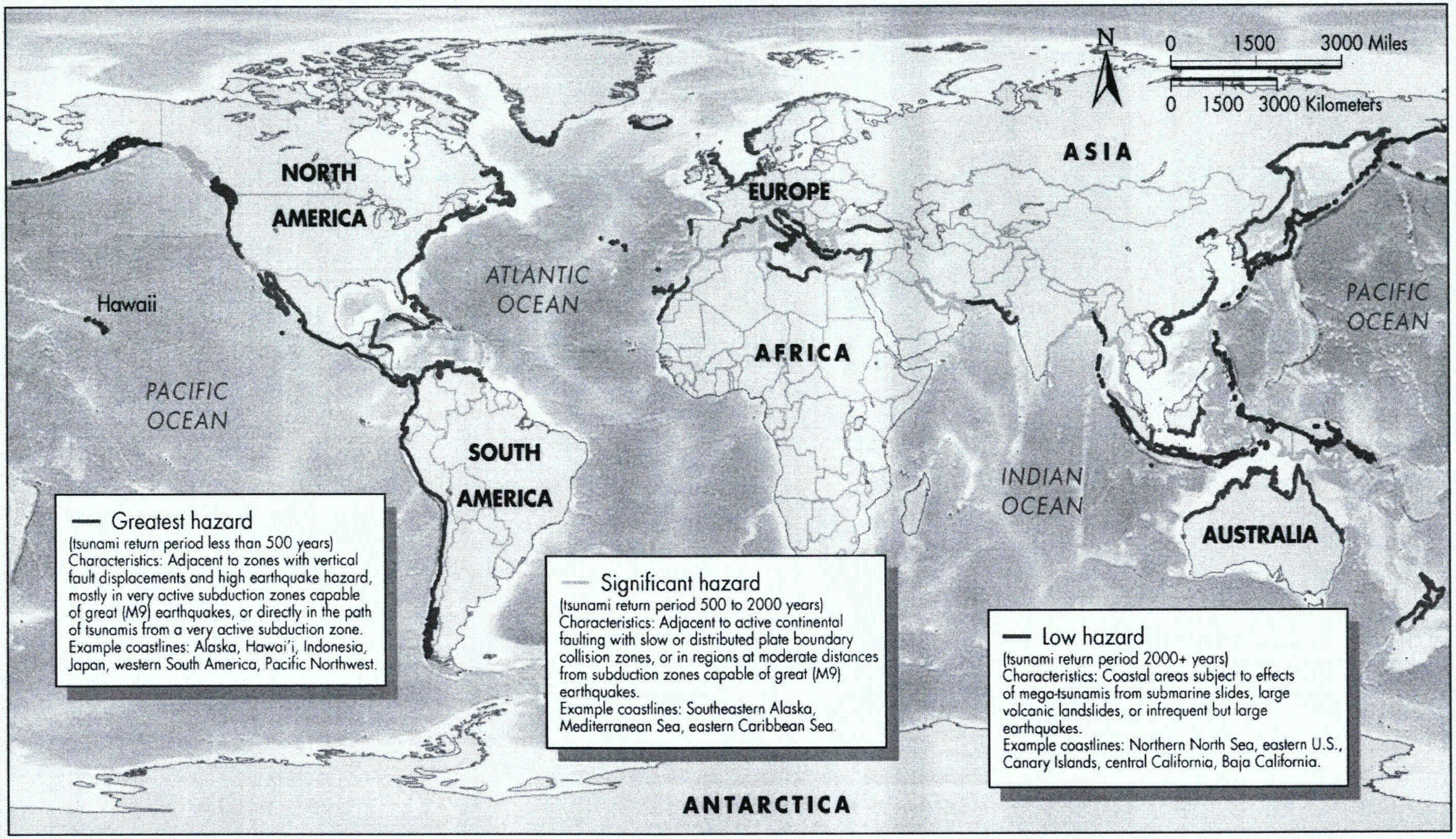
Tsunami Hazard



Dion, Jeanne

From: Milligan, Patricia
Sent: Friday, March 18, 2011 12:55 AM
To: Dion, Jeanne
Subject: FW: Commission brief March 21.docx
Attachments: Commission brief March 21.docx

EP bullet and talking points

H-54

- The emergency preparedness planning basis for nuclear power plants is valid.

NRC continues to conduct studies to determine the vulnerability of nuclear power plants and the adequacy of licensee programs to protect public health and safety. Whether the initiating event is a severe earthquake, a terrorist based event, or a nuclear accident, the EP planning basis provides reasonable assurance that the public health and safety will be protected. EP plans have always been based on a range of postulated events that would result in a radiological release, including the most severe.

To facilitate a preplanned strategy for protective actions during an emergency, there are two emergency planning zones (EPZs) around each nuclear power plant. The exact size and shape of each EPZ is a result of detailed planning which includes consideration of the specific conditions at each site, unique geographical features of the area, and demographic information.

This preplanned strategy for an EPZ provides a substantial basis to support activity beyond the planning zone in the extremely unlikely event it would be needed.

Dion, Jeanne

From: Scott, Michael
Sent: Friday, March 18, 2011 8:29 AM
To: Coyne, Kevin; Santiago, Patricia; Dion, Jeanne
Cc: Gibson, Kathy; Armstrong, Kenneth
Subject: RE: Q&A to support OCM Brief on Japan

Kevin:

Do you have /should we have some Qs and As on L-3 for the same meeting? What would those look like?

Mike

From: Coyne, Kevin
Sent: Thursday, March 17, 2011 7:31 PM
To: Santiago, Patricia; Scott, Michael; Dion, Jeanne
Cc: Gibson, Kathy; Armstrong, Kenneth
Subject: RE: Q&A to support OCM Brief on Japan

Pat –

The only comment I have is with the inclusion of the DRA dynamic PRA work, the rest of the write-up is a bit confusing since it refers to "this study". Perhaps changing the title of the last two questions to explicitly refer to SOARCA would reduce this confusion. Also, since I don't have the entire context of the question, I'd leave it to you guys to decide if our dynamic MELCOR-based PRA work fits into this Q&A...

Kevin

From: Santiago, Patricia
Sent: Thursday, March 17, 2011 7:25 PM
To: Scott, Michael; Dion, Jeanne
Cc: Gibson, Kathy; Armstrong, Kenneth; Coyne, Kevin
Subject: Q&A to support OCM Brief on Japan

Attached are a few Qs&As....the first one is a general one on what severe accident research we are doing. I coordinated with Kevin
Other questions are from the SOARCA communication plan and can be removed.

If NRR continues to need support on SAMGs, I will talk to Tina at 9am. The last set of Qs&As from NRR did have a sentence in the document.

Thanks,

Pat

Patricia A. Santiago
Chief, Special Projects Branch
Division of Systems Analysis
Office of Nuclear Regulatory Research
Phone- 301-251-7982
Fax- 301-251-7426
Patricia.Santiago@nrc.gov

H-55

Dion, Jeanne

From: Flory, Shirley
Sent: Friday, March 18, 2011 8:51 AM
To: Scott, Michael; Gibson, Kathy; Dion, Jeanne
Subject: FW: COMMISSION MEETING: JAPAN EVENT

Importance: High

From: Flory, Shirley
Sent: Thursday, March 17, 2011 5:49 PM
To: Bavol, Rochelle
Cc: Sheron, Brian; Uhle, Jennifer
Subject: COMMISSION MEETING: JAPAN EVENT
Importance: High

Rochelle:

I was just speaking with Brian and he asked me to find out what I could about the Commission Meeting re Japan Event. I have it tentatively on our calendar for Monday morning.

His specific questions are:

Will there be reserved seating for Office Directors/Deputies?

Do you have an agenda?

Who will be making the presentations?

Are we (RES) supposed to be preparing any materials?

Any info/guidance you can give us would be greatly appreciated.

Thanks much – Shirley Flory 301-251-7400

H-56

Dion, Jeanne

From: Beasley, Benjamin
Sent: Friday, March 18, 2011 10:12 AM
To: Dion, Jeanne
Subject: FW: Eric Leeds Remarks.docx

One more comment.

From: Kauffman, John
Sent: Friday, March 18, 2011 7:25 AM
To: Beasley, Benjamin
Subject: RE: Eric Leeds Remarks.docx

Ben,

I only have one comment. The write-up contains a typo for the GL associated with hardened vents. It should be GL 89-16 not GL 89-10. JVK

H-57

Dion, Jeanne

From: Scott, Michael
Sent: Friday, March 18, 2011 10:31 AM
To: Zigh, Ghani
Cc: Navarro, Carlos; Dion, Jeanne; Gibson, Kathy; Tinkler, Charles
Subject: RE: Overview of Japanese Event (Meeting Slides)

Ghani:

Thanks. I think we may need something more general. Jeanne will look you up to discuss.

Mike

From: Zigh, Ghani
Sent: Friday, March 18, 2011 8:54 AM
To: Scott, Michael
Cc: Navarro, Carlos; Dion, Jeanne; Santiago, Patricia; Gibson, Kathy; Tinkler, Charles
Subject: RE: Overview of Japanese Event (Meeting Slides)

Mike,
Here is my question (in red) concerning zirc fire for the commissioner's public briefing on Monday regarding the Japanese event and US response.

MELCOR is used to perform Spent Fuel severe accident analysis including the possibility of Zirc fire under a complete loss of water. Is MELCOR validated to perform this kind of scenario?

From: Scott, Michael
Sent: Thursday, March 17, 2011 2:03 PM
To: Navarro, Carlos; Zigh, Ghani; Dion, Jeanne; Santiago, Patricia
Subject: FW: Overview of Japanese Event (Meeting Slides)

From: Thorpe, April
Sent: Thursday, March 17, 2011 2:00 PM
To: Scott, Michael; Bajwa, Chris; Milligan, Patricia
Subject: Overview of Japanese Event (Meeting Slides)

Good Day:

Attached is a completed copy of meeting slides regarding the Japanese Event.

If you should have any questions, please feel free to contact me at your earliest convenience.

Thank you,

April R. Thorpe
Contract Secretary
Region II Plant Licensing Branches
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation
Phone 301-415-2024 Fax 301-415-1222
April.Thorpe@nrc.gov

H-58

Dion, Jeanne

From:	Coyne, Kevin
Sent:	Friday, March 18, 2011 10:53 AM
To:	Scott, Michael
Cc:	Dion, Jeanne; Gibson, Kathy; Santiago, Patricia; Coe, Doug; Correia, Richard
Subject:	FW: Draft Q&A
Importance:	High

Mike –

Please add the below Q&A to your list – to underscore this item, it came up in an interview this morning with OPA and Marty Stutzke.

Please let me know if you have any question or need more info –

Kevin

From: Hudson, Daniel
Sent: Friday, March 18, 2011 10:41 AM
To: Coyne, Kevin
Subject: Draft Q&A

Kevin,

How do you feel about the below Q&A?

Question:
Does the NRC intend to revisit previous risk studies?

Answer:
The last NRC-sponsored Level 3 probabilistic risk assessment (PRA) studies to estimate the integrated risk to the public from severe nuclear reactor accidents were conducted in the late 1980s with the results published in a collection of reports and a corresponding summary document, NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants." Based on advances in both nuclear power plant safety and PRA technology since NUREG-1150 was published, the NRC staff is considering conducting new Level 3 PRA studies to update its understanding of the integrated risk to the public from accidents involving nuclear power plant sites. The NRC staff is currently conducting a scoping study to develop various options for proceeding with Level 3 PRA activities, and plans to provide the Commission with these potential options and a specific recommendation for proceeding by July 2011.

Thanks,
Dan

Daniel W. Hudson
Technical Assistant
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Division of Risk Analysis
Daniel.Hudson@nrc.gov
301-251-7919

H-59

Dion, Jeanne

From: Scott, Michael
Sent: Friday, March 18, 2011 10:54 AM
To: Flory, Shirley; Gibson, Kathy; Dion, Jeanne; Sheron, Brian; Uhle, Jennifer
Subject: RE: COMMISSION MEETING: JAPAN EVENT

Brian:

I have not yet been able to run question 1 by OEDO. Partial answers:

1. I will validate the seating question.

2. I will forward the agenda (scheduling note) to you.

3. Current plan is only the EDO will speak.

4. We RES have a small role in the presentation. We have facilitated developing a slide for consequences, working with the OPCEN, and we are developing Qs and As for various subjects, including zirc fires, SOARCA, seismic, etc.

   F/U EDO dry run for slide show is 3:15 today. I will be there.

Since you can't read slide shows well on BB, here are the words for the bullets (last two are what we provided) and the talking points. EDO requested the talking points be brief one-liners.

EVENT OVERVIEW

- Discuss initiating events
- Current status of reactors
- Current status of spent fuel pools
- NRC Incident Response Center evaluating potential dose impacts within 50 miles of site
- Also collaborating with DOE to support evaluation of potential impacts on U.S.

Talking points:

- The Protective Measures Team has been attempting to model potential offsite doses based on fragmented plant status information and recent very limited field measurements.
- One of the tools available to the PMT is the RASCAL code, which assumes modeled characteristics for the facilities and meteorology to predict potential off-site doses out to 50 miles.
- PMT is collaborating with Federal counterparts including DOE's National Atmospheric Release Advisory Center, which can project doses beyond 50 miles.

From: Flory, Shirley
Sent: Friday, March 18, 2011 8:51 AM
To: Scott, Michael; Gibson, Kathy; Dion, Jeanne
Subject: FW: COMMISSION MEETING: JAPAN EVENT
Importance: High

H-60

From: Flory, Shirley
Sent: Thursday, March 17, 2011 5:49 PM
To: Bavol, Rochelle
Cc: Sheron, Brian; Uhle, Jennifer
Subject: COMMISSION MEETING: JAPAN EVENT
Importance: High

Rochelle:

I was just speaking with Brian and he asked me to find out what I could about the Commission Meeting re Japan Event. I have it tentatively on our calendar for Monday morning.

His specific questions are:

> Will there be reserved seating for Office Directors/Deputies?
>
> Do you have an agenda?
>
> Who will be making the presentations?
>
> Are we (RES) supposed to be preparing any materials?

Any info/guidance you can give us would be greatly appreciated.

Thanks much – Shirley Flory 301-251-7400

Dion, Jeanne

From: Santiago, Patricia
Sent: Friday, March 18, 2011 10:57 AM
To: Tinkler, Charles
Cc: Scott, Michael; Dion, Jeanne
Subject: Support to OCM brief on Japanese Events

Charlie
Once you are done with your teleconference, I need to ask you to develop a Q&A on zirc fire in SFP.

Also you have been asked to attend the Monday 9am OCM meeting to support Brian if he asks you to respond on questions related to SOARCA or zirc fire in SFP.

I am asking Jean to share any slides and Qs&As that DSA has supported with you so that you have the overall awareness of this meeting.

Thanks,

Pat

Patricia A. Santiago
Chief, Special Projects Branch
Division of Systems Analysis
Office of Nuclear Regulatory Research
Phone- 301-251-7982
Fax- 301-251-7426
Patricia.Santiago@nrc.gov

H-61

Dion, Jeanne

From: Hoc, PMT12
Sent: Friday, March 18, 2011 11:11 AM
To: Dion, Jeanne
Subject: RE: URGENT: Support for Commission Briefing 3/21

This slide looks fine to me. I have the Q&As done, but they have to be vetted by my director. I just reminded him to review them.

From: Dion, Jeanne
Sent: Friday, March 18, 2011 10:47 AM
To: Hoc, PMT12
Subject: RE: URGENT: Support for Commission Briefing 3/21

Thanks for the quick turnaround.

The attached is an overview slide with the PMT input (last 2 bullets plus talking points). Let me know if there are any inaccuracies- otherwise this is what's being used for the Bill Borchardt's presentation Monday.

I'll standby for the Q&A.

Thanks again,
Jeanne
251-7482

From: Hoc, PMT12
Sent: Friday, March 18, 2011 9:03 AM
To: Dion, Jeanne
Subject: RE: URGENT: Support for Commission Briefing 3/21

ACTION:
Task 1: Provide brief high level talking points about monitoring activities in the Op Center to predict the potential consequence in the US.
Helpful information could be explaining what the RASCAL code is (at a high level). **Provide draft of talking points to me by 8am Friday 3/18 morning.**

Talking Points for PMT and RASCAL:

- The Op Center incident response teams have been staffed around the clock since last Friday and have been actively monitoring events.
- The Protective Measures Team has been attempting to model potential offsite doses based on fragmented plant status information and recent very limited field measurements.
- One of the tools available to the PMT is the RASCAL code, which assumes modeled characteristics for the reactor core, spent fuel pool, containment, and meteorology to predict potential off-site doses. Because of limitations in receiving/determining actual plant conditions at Fukushima 1 reactors, some broad assumptions have been used. RASCAL has the ability to calculate offsite dose out to 50 miles.
- The PMT has been actively collaborating and sharing information with the NNSA and NARAC (DOE) as well as DTRA (DOD) and NOAA.
- NARAC has the capability to project doses using NRC generated source terms beyond RASCALs 50 mile limit.

H-62

- **Task 2**: Provide a technical liaison to support the commission meeting to answer questions about radiological consequences. This liaison will need to report to OWFN at 7:30am on Monday for a dry run and will be expected to step up to a microphone and answer questions as needed during the briefing. This person does not need to have been in the Op center- but must be someone technically qualified with strong oral communication skills and who can answer technical question in an accurate and concise manner. **Provide, name, title, and short bio of technical liaison by noon Friday.**

    1. Trish Milligan

I'll work on some Q&As and get them to you.

Kathy Brock

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 4:51 PM
To: Hoc, PMT12
Subject: URGENT: Support for Commission Briefing 3/21
Importance: High

Hello,
The EDO will be briefing the commission on Monday 3/21 at 9am. See the attached draft scheduling note.

Bill Borchardt will be giving the entire presentation and needs several talking points (one liners) regarding the potential consequence in the United States based on the monitoring activities in the Ops Center.

ACTION:
Task 1: Provide brief high level talking points about monitoring activities in the Op Center to predict the potential consequence in the US.
Helpful information could be explaining what the RASCAL code is (at a high level). **Provide draft of talking points to me by 8am Friday 3/18 morning.**

Task 2: provide a list of Q&A regarding the potential consequences- based on what's happening in the Ops Center. **Provide Q&A to me by noon Friday 3/18.**

Task 2: Provide a technical liaison to support the commission meeting to answer questions about radiological consequences. This liaison will need to report to OWFN at 7:30am on Monday for a dry run and will be expected to step up to a microphone and answer questions as needed during the briefing. This person does not need to have been in the Op center- but must be someone technically qualified with strong oral communication skills and who can answer technical question in an accurate and concise manner. **Provide, name, title, and short bio of technical liaison by noon Friday.**

Let me know if you any further questions.

Jeanne Dion
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Jeanne.dion@nrc.gov
301-251-7482

Event Overview

- [Discuss initiating events]
- [Current status of reactors]
- [Current status of spent fuel pools]
- NRC Incident Response Center evaluating potential dose impacts within 50 miles of site
- Also collaborating with DOE to support evaluation of potential impacts on U.S.

1

•The Protective Measures Team has been attempting to model potential offsite doses based on fragmented plant status information and recent very limited field measurements.

•One of the tools available to the PMT is the RASCAL code, which assumes modeled characteristics for the facilities and meteorology to predict potential off-site doses out to 50 miles.

• PMT is collaborating with Federal counterparts including DOE's National Atmospheric Release Advisory Center, which can project doses beyond 50 miles.

Dion, Jeanne

From: Nosek, Andrew
Sent: Friday, March 18, 2011 11:46 AM
To: Widrevitz, Dan; Mills, Daniel; Wagner, Brian; Davidson, Evan; Dion, Jeanne; Bernard, Matthew; Whitman, Josh; Killian, Lauren
Subject: RE: BWR Mark I

http://www.jaif.or.jp/english/news_images/pdf/ENGNEWS01_1300433768P.pdf

All the 3 reactors are currently have uncovered (exposed) fuel, and all the spent fuel pools are questionable, including at least one giving off hydrogen.

AJ Nosek
U.S. Nuclear Regulatory Commission
Division of Systems Analysis
(301)251-7476

From: Nosek, Andrew
Sent: Friday, March 18, 2011 11:36 AM
To: Widrevitz, Dan; Mills, Daniel; Wagner, Brian; Davidson, Evan; Dion, Jeanne; Bernard, Matthew; Whitman, Josh
Subject: BWR Mark I

Interesting quote:

http://www.nytimes.com/cwire/2011/03/18/18climatewire-us-nuclear-plants-to-get-new-safety-reviews-79912.html
General Electric Co. has defended its Mark 1 reactor -- the design at the crippled Japanese complex -- as a reliable industry workhorse. Tom Cochran, a nuclear physicist and senior scientist with the Natural Resources Defense Council calls the design "demonstrably deficient." He says "the diesel generators are in the basement and spent fuel is in the attic. It should have been the other way around."

In other news, I understand everyone in the agency is getting their emails (regarding Japan's accidents) FOIA'ed by the associated press. This should be fun.

AJ Nosek
U.S. Nuclear Regulatory Commission
Division of Systems Analysis
(301)251-7476

H-63

Dion, Jeanne

From: Hoc, PMT12
Sent: Friday, March 18, 2011 12:02 PM
To: Dion, Jeanne
Subject: RE: URGENT: Support for Commission Briefing 3/21

Jeanne...please review for tech editing...we did this quickly and I can't be positive all responses are in full sentences. Please let me know if you have questions.

-
- Q: Should U.S. residents be using KI? A: It is the responsibility of the individual States to decide on the use of KI. It is EPAs responsibility to inform states of projected doses. Due to the extremely low levels of radioactivity expected on the U.S. West coast and Pacific States/territories, the NRC staff does not recommend use of KI.
- Q: The news report that other countries are moving embassies out of Tokyo. Is the US planning to move Americans out of Tokyo? Q: The staff continues to develop realistic modeling scenarios based on current information for Tokyo to help inform protective actions in Tokyo.
- Q: What is the relationship between the modeling being done by NRC and the modeling being done by DOE? A: This is a coordinated effort between NRC and DOE. NRC has expertise in developing source terms and dose assessments up to 50 miles. DOE supports estimates beyond 50 miles that are then used by DOE to develop analysis for dose projections for the United States.
- Q: What types of data does NRC/PMT have access to? A: The NRC is now receiving aerial monitoring dose data from DOE, information from the NRC DART team, recently getting real time meteorological data from the site, some limited onsite dose and meteorological data from Japanese officials.
- Q: What areas of the US will have dose assessments per the DOE analysis? The DOE has the lead for dose estimates in the US. The NRC has the responsibility for dose estimates for US people within Japan.
- Q: Earlier this week the Federal government, with input from the NRC, recommended that the emergency planning zone for evacuation around the Japanese reactors be expanded to 50 miles, which is different from the 20 km evacuation zone recommended by the Japanese. Based on aerial flight measurements, on 3/18/11 the DOE supported the Japanese protective measures of 20 km evacuation and 30 km sheltering . Will the NRC change their recommendation to evacuate to 50 miles? A: NRC policy is to not change protective action recommendations after they have been developed while the event is still in progress. Based on the information that NRC had at the time, we believed that the recommendation to expand the evacuation zone to 50 miles was appropriate. Since that time, NRC has been established as the lead for providing recommendations to the embassy in Japan. Given the current situation at the plant, the NRC currently supports the protective measures recommendation currently in place.
- Q: Will personnel currently in Japan be monitored for radioactive contamination before they return to the US? A: Personnel outside the 50 mile evacuation area are not expected to be subject to radioactive contamination. Data indicate that levels of contamination in these areas are at or below minimum detectable levels and special screening for radioactive contaminants is not warranted.
- Q: We understand that the Navy is evacuating Navy civilians, military personnel and their dependents from Japan. This seems to be in conflict with the NRC protective action recommendation to evacuate only out to 50 miles. A: The NRC developed its PAR as it would for any domestic event using available information incorporating conservative assumptions and assumptions for event progression. We understand the Navy did a used the same plant data to develop their PAR, however they may have used a different set of assumptions which led them to a different recommendation for their bases.

From: Dion, Jeanne
Sent: Friday, March 18, 2011 10:47 AM

H-64

To: Hoc, PMT12
Subject: RE: URGENT: Support for Commission Briefing 3/21

Thanks for the quick turnaround.

The attached is an overview slide with the PMT input (last 2 bullets plus talking points). Let me know if there are any inaccuracies- otherwise this is what's being used for the Bill Borchardt's presentation Monday.

I'll standby for the Q&A.

Thanks again,
Jeanne
251-7482

From: Hoc, PMT12
Sent: Friday, March 18, 2011 9:03 AM
To: Dion, Jeanne
Subject: RE: URGENT: Support for Commission Briefing 3/21

ACTION:
Task 1: Provide brief high level talking points about monitoring activities in the Op Center to predict the potential consequence in the US.
Helpful information could be explaining what the RASCAL code is (at a high level). **Provide draft of talking points to me by 8am Friday 3/18 morning.**

Talking Points for PMT and RASCAL:

- The Op Center incident response teams have been staffed around the clock since last Friday and have been actively monitoring events.
- The Protective Measures Team has been attempting to model potential offsite doses based on fragmented plant status information and recent very limited field measurements.
- One of the tools available to the PMT is the RASCAL code, which assumes modeled characteristics for the reactor core, spent fuel pool, containment, and meteorology to predict potential off-site doses. Because of limitations in receiving/determining actual plant conditions at Fukushima 1 reactors, some broad assumptions have been used. RASCAL has the ability to calculate offsite dose out to 50 miles.
- The PMT has been actively collaborating and sharing information with the NNSA and NARAC (DOE) as well as DTRA (DOD) and NOAA.
- NARAC has the capability to project doses using NRC generated source terms beyond RASCALs 50 mile limit.

- **Task 2**: Provide a technical liaison to support the commission meeting to answer questions about radiological consequences. This liaison will need to report to OWFN at 7:30am on Monday for a dry run and will be expected to step up to a microphone and answer questions as needed during the briefing. This person does not need to have been in the Op center- but must be someone technically qualified with strong oral communication skills and who can answer technical question in an accurate and concise manner. **Provide, name, title, and short bio of technical liaison by noon Friday.**

    1. Trish Milligan

I'll work on some Q&As and get them to you.

Kathy Brock

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 4:51 PM
To: Hoc, PMT12
Subject: URGENT: Support for Commission Briefing 3/21
Importance: High

Hello,
The EDO will be briefing the commission on Monday 3/21 at 9am. See the attached draft scheduling note.

Bill Borchardt will be giving the entire presentation and needs several talking points (one liners) regarding the potential consequence in the United States based on the monitoring activities in the Ops Center.

ACTION:
Task 1: Provide brief high level talking points about monitoring activities in the Op Center to predict the potential consequence in the US.
Helpful information could be explaining what the RASCAL code is (at a high level). **Provide draft of talking points to me by 8am Friday 3/18 morning.**

Task 2: provide a list of Q&A regarding the potential consequences- based on what's happening in the Ops Center. **Provide Q&A to me by noon Friday 3/18.**

Task 2: Provide a technical liaison to support the commission meeting to answer questions about radiological consequences. This liaison will need to report to OWFN at 7:30am on Monday for a dry run and will be expected to step up to a microphone and answer questions as needed during the briefing. This person does not need to have been in the Op center- but must be someone technically qualified with strong oral communication skills and who can answer technical question in an accurate and concise manner. **Provide, name, title, and short bio of technical liaison by noon Friday.**

Let me know if you any further questions.

Jeanne Dion
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Jeanne.dion@nrc.gov
301-251-7482

Dion, Jeanne

From: Waterman, Michael
Sent: Friday, March 18, 2011 1:25 PM
To: Betancourt, Luis; RES_DE_DICB
Subject: RE: Status of Japan's Nuclear Power Plants

Luis

Here is some radionuclide information that might give you a feel for some of the radionuclides that are being released.

Radionuclide	U-235 Fission Yield (%)	Half-Life (years)	β^- Decay Yield (MeV)	γ Decay Yield (MeV)
^{60}Co	17.7	5.272	0.318	1.3325, 1.1732, . . .
^{85}Kr	1.33	10.730	0.687	0.514
^{90}Sr	5.9	29.000	0.546, 2.29, . . .	1.761
^{106}Ru	0.39	1.01	0.0394, 3.54, . . .	0.5118, 0.622, 0.328
^{134}Cs	7.19	2.060	0.658, 0.089	0.6047, 0.7358, 0.2427, 1.365
^{137}Cs	6.23	30.100	0.512, 1.173	0.6616
^{144}Ce	5.45	0.78	0.316, 0.182	0.0336, 0.1335, 0.6964
^{147}Pm	2.26	2.6234	0.225, . . .	0.1212, . . .

These are some of the nastier radionuclides because their half-lives coupled with their fission yields means they are highly radioactive and there is a lot of each one available for release. In other words, these radionuclides decay fast enough to produce a lot of gamma radiation while they are around, but do not decay fast enough to decay away in a short time. In five half lives, an element will decay to about 0.7% of its original mass. Assuming the fuel rods in the spent fuel pools are the primary source of leakage, the radionuclides that are likely to be producing energy in abundance are ^{60}Co, ^{85}Kr, ^{90}Sr, and ^{137}Cs because the spent fuel rods are likely less than 10 years old. At that age, the mass of these radionuclides are at least half their original mass or more.

The other nuclides in the list are there because of their fission yield values and their half lives. For example, while the ^{134}Cs will decay to half its original mass in 2 years, there is so much of it that the remaining mass is still significant.

I hope this helps

Mike

From: Betancourt, Luis
Sent: Thursday, March 17, 2011 3:28 PM
To: RES_DE_DICB; NRO_DE_ICE1 Distribution; NRO_DE_ICE2 Distribution; NRR_DE_EICB Distribution
Subject: Status of Japan's Nuclear Power Plants

H-65

Folks,

The attachment gives an informative, up-to-date summary of the status of the ten Fukushima Boiling Water Reactors. It is provided by the Japan Atomic Industrial Forum (JAIF) and I believe it is updated from time to time at http://www.jaif.or.jp/english/. The attachment also provides the latest radiation readings at the site boundary. What is lacking is information on what radionuclides are causing that dose rate.

Enjoy!

Luis D. Betancourt, EIT
Digital I&C Engineer
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Digital Instrumentation and Control Branch
21 Church Street, Rockville MD, 20850, USA
C-2A07M
301-251-7409
301-251-7422
Luis.Betancourt@nrc.gov
"We are what we believe we are" - C.S. Lewis
Please consider the environment before printing this e-mail

Dion, Jeanne

From: Kanney, Joseph
Sent: Friday, March 18, 2011 4:46 PM
To: See, Kenneth; Nicholson, Thomas; Dion, Jeanne; Cook, Christopher
Cc: Randall, John; Ott, William; Chokshi, Nilesh; Raione, Richard
Subject: RE: Revision to PMP Narrative

A reasonable question that an observer of the tsunami in Japan might have goes something like this: I observed the tremendous amount of debris being carried along with the water. Are NPPs in the US sufficiently protected from flood-associated debris flow?

Joe

From: See, Kenneth
Sent: Friday, March 18, 2011 4:34 PM
To: Kanney, Joseph; Nicholson, Thomas; Dion, Jeanne; Cook, Christopher
Cc: Randall, John; Ott, William; Chokshi, Nilesh; Raione, Richard
Subject: RE: Revision to PMP Narrative

I agree. I think the term "most" of the existing plants were designed for the PMP/PMF is applicable, but not all.

Ken

From: Kanney, Joseph
Sent: Friday, March 18, 2011 4:26 PM
To: Nicholson, Thomas; See, Kenneth; Dion, Jeanne
Cc: Randall, John; Ott, William; Chokshi, Nilesh; Raione, Richard
Subject: RE: Revision to PMP Narrative

I think perhaps we are getting carried away with our focus on PMP. PMP is only one part of the flooding analysis and probably the not weakest link. Recall that the design basis floods for many of the existing plants were determined from area-discharge envelope curves, not from an analysis that routed the PMP through the basin and down to the site. I'm more comfortable with the level of conservatism in PMP than I am with the level of conservatism in the envelope curve approach.

-- Joe

Joseph Kanney, Ph.D.
Hydrogeologist
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U.S. Nuclear Regulatory Commission
Mail Stop CSB-2A07M
11555 Rockville Pike
Rockville, MD 20852-2738

joseph.kanney@nrc.gov
Phone: 301-251-7600
Fax: 301-251-7422

H-66

From: Nicholson, Thomas
Sent: Friday, March 18, 2011 4:01 PM
To: See, Kenneth; Dion, Jeanne
Cc: Randall, John; Kanney, Joseph; Ott, William; Chokshi, Nilesh; Raione, Richard
Subject: Revision to PMP Narrative

Ken:

I just spoke to John England, U.S. Bureau of Reclamation concerning our response to the NRO information request. He would like a one-word addition to the narrative to say the Southeast U.S. rather than just the U.S.

This is his suggested wording:

Some of the Reports from the National Weather Service used to estimate the design precipitation are 30-40 years old. Are these estimates still valid?

The NRC has funded research by the U.S. Bureau of Reclamation to review the information and methods developed by the National Weather Service and the U.S. Army Corps of Engineers (HMR 51), focusing on South and North Carolina. To date, reviews of precipitation records from extreme storm events (e.g., tropical storms, hurricanes) since the publication of HMR 51 does not indicate any exceedance or potential for exceedance of those precipitation (PMP) estimates in this region. We have not seen any information or data that would indicate that HMR precipitation (PMP) estimates for the **Southeast** U.S. have been exceeded.

Please make whatever changes are possible at this time.

Thanks .... Tom

****

Thomas J. Nicholson, Senior Technical Advisor
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Mail Stop CSB 2-A07
11555 Rockville Pike
Rockville, MD 20852
Tel: (301) 251-7498
Fax: (301) 251-7422
E-mail: Thomas.Nicholson@nrc.gov
****

From: Platts Energy Week TV
To: Golla, Joe , NRR
Subject: Japan"s Tragedy Prompts New Look at Nuclear Energy
Date: Friday, March 18, 2011 4:35:05 PM

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With the disaster in Japan, nuclear energy is coming under close scrutiny again as a safe and reliable power source for the U.S. Even pro-nuclear lawmakers are raising questions with the Nuclear Regulatory Commission and the Department of Energy. Among them is **Representative Ed Whitfield, chairman of the House Energy and Power Subcommittee**, who tells Bill what Washington should do — and not do — when it comes to nuclear energy.

Could Another Nuclear Disaster Hit the U.S.?

How does nuclear technology and regulation in Japan and the U.S. compare? And is the U.S., 32 years after the Three Mile Island accident, any different when it comes to the potential for

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another nuclear meltdown? The **director of Idaho National Laboratory and former nuclear submarine commander, John Grossenbacher**, gives Bill his insight.

Whither the Nuclear Renaissance?

With applications pending for 20 new reactors in the U.S., and more on the drawing board, the nuclear power industry has been anticipating a renewal. But will financing become more difficult in light of the nuclear catastrophe in Japan? **Dmitri Nikas, with Standard & Poor's utilities and infrastructure unit, and Benjamin Salisbury, with FBR Capital Markets**, offer Bill some answers.

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Vandana Hari, Platts senior editorial director for Asia, discusses with Bill how Japan is making up for losses in nuclear power, and what it means for markets in liquefied natural gas, coal and oil.

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Despite lessons learned last year, there are only a couple of remedies for containing another offshore deep-water oil rig blowout. Hear from **Helix Energy's CEO, Owen Kratz,** about his company's solution to any future disasters in the U.S. Gulf

EWTV Market Spotlight

bill@plattsenergyweektv.com

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Table of Hourly Weather Observations (Today/Yesterday)

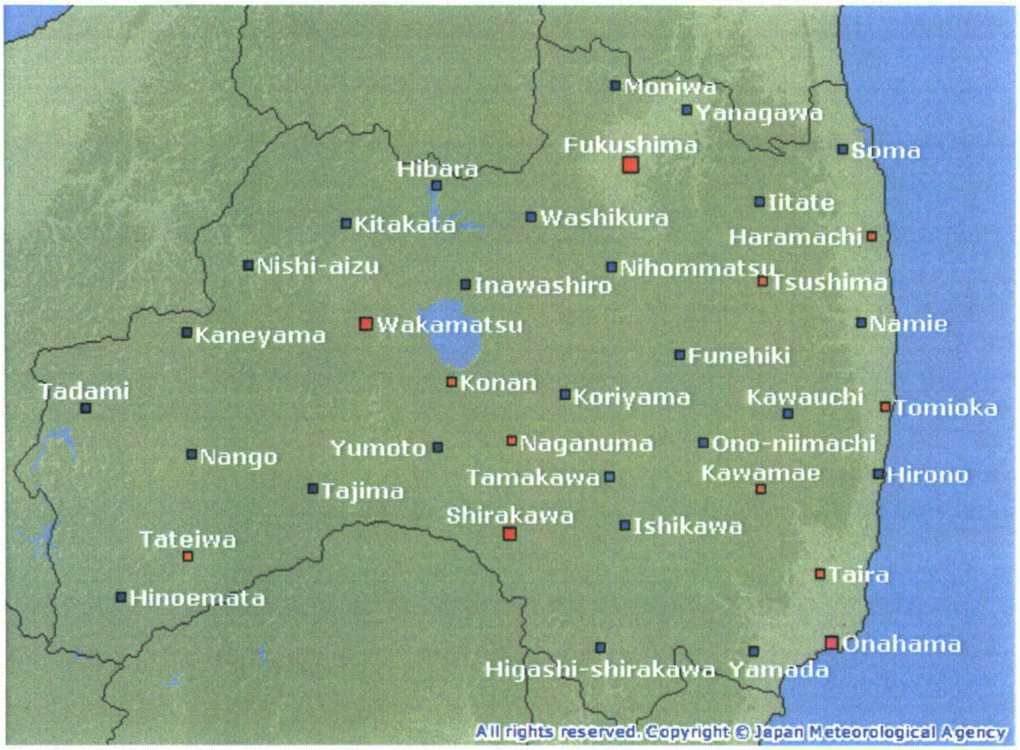

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Table of Hourly Weather Observations (Today/Yesterday)

Reeves, Rosemary

From: Platts Energy Week TV [ann_forte@platts.com]
Sent: Friday, March 18, 2011 4:35 PM
To: Reeves, Rosemary
Subject: Japan's Tragedy Prompts New Look at Nuclear Energy

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H-69

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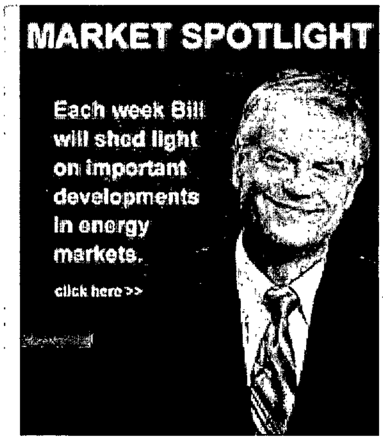

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Dion, Jeanne

From: Scott, Michael
Sent: Saturday, March 19, 2011 10:30 AM
To: Dion, Jeanne
Subject: FW: Q'S AND A'S FOR ZIRC FIRES IN SFP

Should have copied you. All Qs and As now complete and submitted. Thanks for your great work on this!

P.S. I'm outa here on Tuesday.

From: Scott, Michael
Sent: Saturday, March 19, 2011 10:29 AM
To: Mahoney, Michael; Gratton, Christopher; Howe, Allen
Cc: Gibson, Kathy; Santiago, Patricia
Subject: Q'S AND A'S FOR ZIRC FIRES IN SFP

1. What do we know about the potential for and consequences of a zirconium fire in the spent fuel pool?

Spent fuel pools contain large amounts of water to keep the fuel cooled, and no fire can result as long as the water covers the fuel. Should the pool not be cooled for a substantial amount of time (on the order of days), the water in the pool may boil off. Should that continue and the fuel be exposed, the fuel could overheat. In the worst case, the zirconium cladding could oxidize and burn. The result of such a fire would be significant damage to the fuel, also the fire has the potential to propagate to the other assemblies, as well as release of hydrogen gas and volatile radioactive materials.

2. Can a zirconium fuel fire be prevented by wide spacing of spent fuel assemblies in the spent fuel pool?

Wider spacing would help in preventing a fire. Preventing a fire requires coolability in absence of water submersion. This depends on the heat and the assembly arrangement in the pool. A checkerboard arrangement (no two assemblies in adjacent locations) is coolable in about one third the time needed for a fully loaded (no open locations) pool. Other arrangements can also mitigate the potential of the onset of zirconium fires.

H-70

Dion, Jeanne

From: Santiago, Patricia
Sent: Saturday, March 19, 2011 10:30 AM
To: Dion, Jeanne
Subject: FW: Q'S AND A'S FOR ZIRC FIRES IN SFP

fyi since i think you were tracking questions

From: Scott, Michael
Sent: Saturday, March 19, 2011 10:28 AM
To: Mahoney, Michael; Gratton, Christopher; Howe, Allen
Cc: Gibson, Kathy; Santiago, Patricia
Subject: Q'S AND A'S FOR ZIRC FIRES IN SFP

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Rathbun, Howard

From:	Leeds, Eric
Sent:	Sunday, March 20, 2011 11:41 AM
To:	Rathbun, Howard
Cc:	Grobe, Jack; Hiland, Patrick; Lubinski, John; Skeen, David; Thomas, Brian
Subject:	RE: Looking forward...

Thanks, Howard! I'm including folks on this email that oversee our efforts in that technical area.

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-1270

From: Rathbun, Howard
Sent: Sunday, March 20, 2011 11:17 AM
To: Leeds, Eric
Subject: Looking forward...

Hi Eric,

Just checking in - I'm sure you're busy so I'll keep this short. When we met a couple of weeks ago, you mentioned the possibility of a rotation to NRR. I imagine that the agency will likely be taking another close look at analysis of pressure vessels, piping and components under various types of load, for example, seismic loading. When I worked for Terence Chan in the Piping and Pipe Supports Section of the Mechanical Engineering Branch, NRR/DE, I did work in this area. For example, I was the primary technical contact for U.S. NRC Information Notice 95-09, "Use of Inappropriate Guidelines and Criteria for Nuclear Piping and Pipe Support Evaluation," which identified that the industry was, at the time, inappropriately attempting to use reduced margin for piping under seismic load. In addition, I performed some unclassified work on seismic loading for components while at Lawrence Livermore National Lab. More recently, I've been analyzing piping systems under thermal transient and shock loading, as well as weld residual stress evaluation.

The point here is that I think that my skills could be put to use resolving many of these issues and fulfilling our mission in the coming months. Feel free to contact me at any time, I can be reached at 301-251-7647.

Best regards,

Howard J. Rathbun, Ph.D., P.E.

Mechanical Engineer, Office of Nuclear Regulatory Research

U.S. Nuclear Regulatory Commission

H-72

Ali, Syed

From: Ali, Syed
Sent: Sunday, March 20, 2011 3:47 PM
To: Pires, Jose
Subject: RE: Spreadsheets

Thanks. The following website has some very good info:

http://www.iaea.org/newscenter/news/tsunamiupdate01.html

According to this, the temp at the Unit 4 SFP on March 14 was 84 C, but no info since then. Unit 5 and 6 SFP temps have gone down significantly.

From: Pires, Jose
Sent: Saturday, March 19, 2011 3:38 PM
To: Ali, Syed
Subject: Spreadsheets

Attached are the spreadsheet on Mark I pool data (summary) and another with high level summary on sand vs concrete for putting off the fire and sealing.

H-73

Reading of environmental radioactivity level in fallout by prefecture
(3.20.9AM～3.21.9AM)

2011/3/21 19:00 (MBq/km2)

	Prefecture(City)	Fallout		
		I−131	Cs−137	Remarks
1	Hokkaido(Sapporo)	Not Detectable	Not Detectable	
2	Aomori(Aomori)	Not Detectable	Not Detectable	
3	Iwate(Morioka)	7,800	690	
4	Miyagi	−	−	Not be measured because of the earthquake disaster damage
5	Akita(Akita)	24	Not Detectable	
6	Yamagata(Yamagata)	58,000	4,300	
7	Fukushima	−	−	Not be measured because of dealing with the earthquake disaster
8	Ibaraki(Hitachinaka)	93,000	13,000	
9	Tochigi(Utsunomiya)	5,300	250	
10	Gunma(Maebashi)	990	87	
11	Saitama(Saitama)	7,200	790	
12	Chiba(Ichihara)	1,100	110	
13	Tokyo(Shinjuku)	2,900	560	
14	Kanagawa(Chigasaki)	750	210	Measurements arrived, though delayed due to earthquake disaster response.
15	Niigata(Niigata)	47	Not Detectable	
16	Toyama(Imizu)	Not Detectable	Not Detectable	
17	Ishikawa(Kanazawa)	Not Detectable	Not Detectable	
18	Fukui(Fukui)	Not Detectable	Not Detectable	
19	Yamanashi(Kofu)	Not Detectable	Not Detectable	
20	Ngano(Nagano)	Not Detectable	Not Detectable	
21	Gifu(Kakamigahara)	Not Detectable	Not Detectable	
22	Shizuoka(Omaezaki)	Not Detectable	Not Detectable	
23	Aichi(Nagoya)	Not Detectable	Not Detectable	
24	Mie(Yokkaichi)	Not Detectable	Not Detectable	
25	Shiga(Otsu)	Not Detectable	Not Detectable	
26	Kyoto(Kyoto)	Not Detectable	Not Detectable	
27	Osaka(Osaka)	Not Detectable	Not Detectable	
28	Hyogo(Kobe)	Not Detectable	Not Detectable	
29	Nara	−	−	On Setting up the equipment
30	Wakayama(Wakayama)	Not Detectable	Not Detectable	
31	Tottori(Tohhaku)	Not Detectable	Not Detectable	
32	Shimane(Matsue)	Not Detectable	Not Detectable	
33	Okayama(Okayama)	Not Detectable	Not Detectable	
34	Hiroshima(Hiroshima)	Not Detectable	Not Detectable	
35	Yamaguchi(Yamaguchi)	Not Detectable	Not Detectable	
36	Tokushima(Tokushima)	Not Detectable	Not Detectable	
37	Kagawa(Takamatsu)	Not Detectable	Not Detectable	
38	Ehime(Yawatahama)	Not Detectable	Not Detectable	
39	Kochi(Kochi)	Not Detectable	Not Detectable	
40	Fukuoka(Dazaifu)	Not Detectable	Not Detectable	
41	Saga(Saga)	Not Detectable	Not Detectable	
42	Nagasaki(Ohmura)	Not Detectable	Not Detectable	
43	Kumamoto(Uto)	Not Detectable	Not Detectable	
44	Oita(Oita)	Not Detectable	Not Detectable	
45	Miyazaki(Miyazaki)	Not Detectable	Not Detectable	
46	Kagoshima(Kagoshima)	Not Detectable	Not Detectable	
47	Okinawa(Nanjo)	Not Detectable	Not Detectable	

*The table was made by MEXT, based on the reports from prefectures

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Reading of environmental radioactivity level in fallout by prefecture
(3.21.9AM～3.22.9AM)

2011/3/22 19:00 (MBq/km2)

	Prefecture(City)	Fallout		
		I－131	Cs－137	Remarks
1	Hokkaido(Sapporo)	Not Detectable	Not Detectable	
2	Aomori(Aomori)	Not Detectable	Not Detectable	
3	Iwate(Morioka)	Not Detectable	Not Detectable	
4	Miyagi	－	－	Not be measured because of the earthquake disaster damage
5	Akita(Akita)	3.9	Not Detectable	
6	Yamagata(Yamagata)	590	140	
7	Fukushima	－	－	Not be measured because of dealing with the earthquake disaster
8	Ibaraki(Hitachinaka)	85,000	12,000	
9	Tochigi(Utsunomiya)	25,000	440	
10	Gunma(Maebashi)	1,500	72	
11	Saitama(Saitama)	22,000	1,600	
12	Chiba(Ichihara)	14,000	2,800	
13	Tokyo(Shinjuku)	32,000	5,300	
14	Kanagawa(Chigasaki)	340	110	
15	Niigata(Niigata)	Not Detectable	Not Detectable	
16	Toyama(Imizu)	Not Detectable	Not Detectable	
17	Ishikawa(Kanazawa)	Not Detectable	Not Detectable	
18	Fukui(Fukui)	Not Detectable	Not Detectable	
19	Yamanashi(Kofu)	4,400	400	
20	Ngano(Nagano)	Not Detectable	Not Detectable	
21	Gifu(Kakamigahara)	Not Detectable	Not Detectable	
22	Shizuoka(Omaezaki)	200	72	
23	Aichi(Nagoya)	Not Detectable	Not Detectable	
24	Mie(Yokkaichi)	Not Detectable	Not Detectable	
25	Shiga(Otsu)	Not Detectable	Not Detectable	
26	Kyoto(Kyoto)	Not Detectable	Not Detectable	
27	Osaka(Osaka)	Not Detectable	Not Detectable	
28	Hyogo(Kobe)	Not Detectable	Not Detectable	
29	Nara	－	－	On Setting up the equipment
30	Wakayama(Wakayama)	Not Detectable	Not Detectable	
31	Tottori(Tohhaku)	Not Detectable	Not Detectable	
32	Shimane(Matsue)	Not Detectable	Not Detectable	
33	Okayama(Okayama)	Not Detectable	Not Detectable	
34	Hiroshima(Hiroshima)	Not Detectable	Not Detectable	
35	Yamaguchi(Yamaguchi)	Not Detectable	Not Detectable	
36	Tokushima(Tokushima)	Not Detectable	Not Detectable	
37	Kagawa(Takamatsu)	Not Detectable	Not Detectable	
38	Ehime(Yawatahama)	Not Detectable	Not Detectable	
39	Kochi(Kochi)	Not Detectable	Not Detectable	
40	Fukuoka(Dazaifu)	Not Detectable	Not Detectable	
41	Saga(Saga)	Not Detectable	Not Detectable	
42	Nagasaki(Ohmura)	Not Detectable	Not Detectable	
43	Kumamoto(Uto)	Not Detectable	Not Detectable	
44	Oita(Oita)	Not Detectable	Not Detectable	
45	Miyazaki(Miyazaki)	Not Detectable	Not Detectable	
46	Kagoshima(Kagoshima)	Not Detectable	Not Detectable	
47	Okinawa(Nanjo)	Not Detectable	Not Detectable	

*The table was made by MEXT, based on the reports from prefectures

Dion, Jeanne

From: Dion, Jeanne
Sent: Monday, March 21, 2011 8:47 AM
To: RES Distribution
Subject: Staff Slides for March 21 Meeting Rev 1.pptx
Attachments: Staff Slides for March 21 Meeting Rev 1.pptx

Attached are slides for this morning's Commission meeting. There will be hard copies available in the Church St. conference rooms where the meeting will be VTC'd.

Jeanne Dion
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Jeanne.dion@nrc.gov
301-251-7482

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

Overview of Japanese Event and U.S. Response

Bill Borchardt
Executive Director for Operations

March 21, 2011

Agenda

- Event Overview
- Immediate NRC Response
- Continuing NRC Response
- Assessment of Domestic Reactor Safety
- Planned NRC Activities
- Impact on Current NRC Activities

Event Overview

- Discuss initiating events
- Current status of reactors
- Current status of spent fuel pools

Immediate NRC Response

- Placed Operations Center in monitoring mode
- Sent 2 NRC experts to Japan on March 11^{th}
- Consulted with U.S. Embassy
- Sent 8 more NRC personnel on March 14^{th}
- Active outreach to stakeholders (Congressional Staffs, etc)

Continuing NRC Response

- Keep Operations Center manned 24/7
- Support NRC personnel in Japan, including rotations as necessary
- Evaluate need for generic communication to licensees
- Provide assistance as requested

Potential Consequences

- Release estimates from Japanese event
- Plume tracking
- Consequences for the U.S.

Assessment of Domestic Reactor Safety

- **Design basis is to cope with natural disasters expected for their locale**
- **All reactors must be able to cope with station blackout for a designated time period**
- **Plans exist to cope with Beyond-Design-Basis events (Severe Accident Management Guidelines, B.5.b plans for terrorist attacks**

Assessment of Domestic Reactor Safety (Cont.)

- INPO and industry will respond to assist a licensee
- Improvements have been made since initial licensing
- U.S. plants continue to be safe

Planned NRC Activities

- Consider how to evaluate lessons learned
- Review panels may be a joint Federal effort
- Lessons learned and recommendations will be developed
- Regulatory actions will be considered

Impact on Current NRC Activities

- Communication activities have increased
- Certain licensing actions will be reviewed
- Routine meetings will continue as scheduled
- License renewals will continue as scheduled

Dion, Jeanne

From: Howe, Allen
Sent: Monday, March 21, 2011 12:15 PM
To: Boska, John; Gratton, Christopher; Tully, Bridin; Sola, Clara; Miller, Ed; Mahoney, Michael; Andersen, James; Wittick, Susan; Deegan, George; Scott, Michael; Williams, Kevin; Milligan, Patricia; Wilson, George; Bowman, Eric; Thomas, Eric; Collins, Timothy; Harrison, Donnie; Salley, MarkHenry; Kammerer, Annie; Ramsey, Jack; Hall, Randy; Thadani, Mohan; Khanna, Meena; Dion, Jeanne; Shropshire, Alan; Williams, Donna; Bajwa, Chris; VandenBerghe, John; Johnson, Don; Patterson, Malcolm; Kahler, Robert; Anderson, Joseph; Tam, Peter; Pickett, Douglas; Martin, Robert; Sullivan, Randy; Norris, Michael; Kahler, Robert; Ellmers, Glenn
Cc: Brenner, Eliot; Holahan, Gary; Uhle, Jennifer; Piccone, Josephine; Doane, Margaret; Leeds, Eric; Grobe, Jack; Boger, Bruce; Ruland, William; Brown, Frederick; Holian, Brian; Westreich, Barry; Lee, Samson; Cheok, Michael; Harrington, Holly; Uhle, Jennifer; Sheron, Brian; Borchardt, Bill
Subject: MANY, MANY THANKS

Folks – the Commission meeting on the Japan event was an extremely high profile, short turnaround request. You all exemplified the best of what this agency is all about: outstanding cooperation, teamwork, and excellence in this effort. The focus and help was tremendous and many worked long hours including through the weekend to support this accomplishment. My sincere thanks to all of you for your hard work and dedication in making this meeting a success.

Thank you -

Allen Howe, Deputy Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

P.S. many folks worked on this – apologies if I missed someone. Please forward to anyone that I may have missed.

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Ali, Syed

From: Ali, Syed
Sent: Monday, March 21, 2011 1:55 PM
To: Way, Ralph; Sheikh, Abdul
Cc: Holahan, Patricia; Wiggins, Jim
Subject: RE: PRE-DEPLOYMENT MEETING

Hello Ralph:

Not a bad idea. We can either do it in person and by telephone. With everything going on, and me being located at Church Street, a Telecon might be more feasible.

Thanks,
Syed Ali

From: Way, Ralph
Sent: Monday, March 21, 2011 1:21 PM
To: Ali, Syed; Sheikh, Abdul
Cc: Holahan, Patricia; Wiggins, Jim
Subject: PRE-DEPLOYMENT MEETING

Greeting Gentlemen,

I understand we will be working together in Japan. Would it be possible for us to get together before we leave to discuss what we believe the issue(s) are we will be asked to address?

Thx,

R

Ralph Way, Ph.D.
Senior Technical Advisor
U.S. Nuclear Regulatory Commission
Phone (V) Unclass 301 415 6825
Phone (V) Secure 301 415 6961
FAX (Unclass) 301 415 6661

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ひと、くらし、みらいのために
厚生労働省
Ministry of Health, Labour and Welfare

Press Release

Press Release (This is provisional translation. Please refer to the original text written in Japanese.)

March 21, 2011
Water Supply Division,
Health Service Bureau

To Press and those whom may concern,

Information on radioactive materials detected in tap water in Fukushima prefecture (including Iitate-mura (village)) (2nd announcement)

This is an announcement that we have obtained the following information on radioactive materials found in tap water in Fukushima prefecture (Including Iitate-mura (village)).

On March 21st 2011, we acquired information on radioactive materials detected in the tap water of the small-scale water supply utility located in Iitate-mura Village, Fukushima prefecture (Attachment 1) and 7 locations within the prefecture including Kawamata-machi (town) (Attachment 2), measured by the Fukushima branch office of the Environmental Radioactivity Monitoring Center of Fukushima.

At the small-scale water supply utility in Iitate-mura (village), the amount of radioactive iodine found in tap water decreased from 965 Bq (Becquerel)/kg (as of 12:30 on March 20th) to 492 Bq/kg (as of 8:30 on March 21st).

The data on the 7 places, including Kawamata-machi (town), is a partial addition to the measurement results officially announced on March 19th. Except for the data on Kawamata-machi (town) measured on March 17th (already officially announced), all the data fall below the "Index values for the restriction of food and beverages intake" (Reference 1).

Please note that the possibility that the health risk posed by the short period of tap water intake exceeding those index values is extremely low. It is not intended to restrict drink ing water in case you have no access to alternative drinking water. You can use the tap water for washing hands and bathing at home without any concern.

We will continue to request that Fukushima prefecture take appropriate responses (Reference 2) and obtain measurement data on tap water in the prefecture in order for us to properly deal with the issue.

(Reference 1) Index values for the restrictions on the intake of food and beverages set out by the Nuclear Safety Commission
Radioactive iodine in drinking water: 300 Bq (Becquerel)/kg

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(Note) The concept of the "Index values for the restrictions on the intake of food and beverages"
The index values were established by the Nuclear Safety Commission by foodstuff category (drinking water, food, etc.) taking into account such factors as the amount of Japanese foodstuff intake, based on the radiation protection standards recommended by the International Committee on Radiological Protection (ICRP) (effective dose of radiation iodine is 50 millisieverts (mSv)).

(Reference 2) "Measures to be taken against water supply associated with the accident in the Fukushima No.1 and No.2 nuclear power plants" (issued by Water Supply Division, Health Service Bureau, Ministry of Health, Labour and Welfare on March 19th, 2011)
Measures to be taken against tap water in case radiation measured in the tap water exceeds in connection with the nuclear power plant accident: Water Supply Division, Health Service Bureau notified heads of departments in charge of water supply administration in each prefecture and water supply utilities:

1) To refrain from intake of tap water exceeding the index values;
2) That you can use the tap water for domestic use without any concern;
3) That it is not intended to restrict drinking water in case you have no access to alternative drinking water;

   and such.

<u>Attachment 1</u>
<u>Attachment 2</u>

achment 1

Name of Water Supply Utility	Name of Intake Facility	Location of Intake Facility	Type of Raw Water
itate-mura Small Scale Water Supply Utility	Takishita Drinking Water Treatment Plant (Takishita River)	Takishita, Iitoi	Surface Water

three significant figures

mpling Date	Time	Unit	Nuclide Concentration												
			^{51}Cr	^{54}Mn	^{58}Co	^{59}Fe	^{60}Co	^{95}Zr	^{95}Nb	^{106}Ru	^{134}Cs	^{137}Cs	^{144}Ce	^{131}I	^{132}I
20/03/2011	12:30	Bq/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	965	153
21/03/2011	8:30	Bq/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	492	54.1

nderlined portions are subjunction from the last publication (March 20)□

chiment 2

three significant figures

Name of Water Supply Utility	Name of Intake Facility	Location of Intake Facility	Type of Raw Water	Sampling Date	Time	Unit	Nuclide Concentration												
							^{51}Cr	^{54}Mn	^{58}Co	^{59}Fe	^{60}Co	^{95}Zr	^{95}Nb	^{106}Ru	^{134}Cs	^{137}Cs	^{144}Ce	^{131}I	^{132}I
Kawamata-town Water Supply Utility	No.1 Water Resource (Nagataki River)	Kotsunagi, Kawamata-town	Surface Water (Natural Flow)	17/03/2011	18:18	Bq/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	308	74.2
				18/03/2011	14:57		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	155	ND
				19/03/2011	10:05		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	123	ND
Fukushima Region Bulk Water Supply Utility	Surikami River Dam	Aza- Nataburi, Moniwa, Iizaka-town, Fukushima-city	Direct from Dam	17/03/2011	17:20		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	59.1	ND
				18/03/2011	15:10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14.7	ND
				19/03/2011	11:15		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	29.9	ND
Koriyama-city Water Supply Utility	Otakine River, Abukuma Water System (Impounded Water of Miharu Dam)	Soto, 263-5, Aza-Mukaiyama, Oaza-Nishikata, Miharu-town, Tamura-district	Direct from Dam	17/03/2011	18:40		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	17.2	ND
				18/03/2011	11:30		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
				19/03/2011	9:30		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Shirakawa Region Bulk Water Supply Utility	Horikawa Dam	1-25, Aza-Yatsuta, Oaza-Odakura, Nishigou-town, Nishishirakawa-district	Direct from Dam	17/03/2011	18:00		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	21.6	ND
				18/03/2011	15:40		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	29.7	ND
				19/03/2011	11:00		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	19.6	ND
Aizuwakamatsu Region Bulk Water Supply Utility	Water Resource (Okawa Dam)	706, Aza-Shimokawara, Homa, Aizu Misato-town	Discharge from Dam	17/03/2011	17:40		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
				18/03/2011	13:00		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
				19/03/2011	9:39		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iwaki-city Water Supply Utility	Taira Drinking Water Treatment Plant (Natsui River, Natsui Water System)	9, Aza-Hikaridaira,Uwadaira, Odawa-town, Iwaki-town	Surface Water (Natural Flow)	17/03/2011	17:40		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	43.0	ND
				18/03/2011	11:30		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	68.0	ND
				19/03/2011	8:55		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	99.2	ND
Soma Extensive Region Water Supply Utility	Mano Dam	Aza-Matsugadaira, Okura, Iitate-town, Souma-district	Discharge from Dam	17/03/2011	18:10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	87.0	ND
				18/03/2011	12:30		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	72.8	ND
				19/03/2011	8:10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	64.0	ND

nderlined portions are subjunction from the last publication (March 19)□

Ali, Syed

From: Ali, Syed
Sent: Monday, March 21, 2011 4:31 PM
To: Tegeler, Bret; Pires, Jose
Subject: SFP Issues

Bret, Jose:

Some questions have come up regarding the integrity of the SFP liner, e.g., welding of plates at corners etc. Do have any typical drawings or specs of those details or can we get those? Also, is Hernando including the liner in his model or is it feasible to include it?

Thanks,
Syed Ali

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News Release

経済産業省
Ministry of Economy, Trade and Industry

March 21, 2011
Nuclear and Industrial Safety Agency

Seismic Damage Information (the 40th Release)
(As of 21:00 March 21st, 2011)

Nuclear and Industrial Safety Agency (NISA) confirmed the current situation of Onagawa NPS, Tohoku Electric Power Co. Inc.; Fukushima Dai-ichi and Fukushima Dai-ni NPSs, Tokyo Electric Power Co. Inc. (TEPCO); Tokai Dai-ni NPS, Japan Atomic Power Co. Inc. as follows:

Major updates are as follows.

1. Nuclear Power Stations (NPS)

- Fukushima Dai-ichi NPS
  - White smoke generated from Unit 2 (18:22 March 21st).
  - Grayish smoke generated from Unit 3 (At around 15:55 March 21st). Thereafter the smoke was confirmed to be died down (17:55 March 21st).

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(Attached sheet)

1. The state of operation at NPS (Number of automatic shutdown units: 10)

- Fukushima Dai-ichi NPS, TEPCO
  (Okuma Town and FutabaTown, Futaba County, Fukushima Prefecture)

(1) The state of operation

Unit 1 (460MWe):	automatic shutdown
Unit 2 (784MWe):	automatic shutdown
Unit 3 (784MWe):	automatic shutdown
Unit 4 (784MWe):	in periodic inspection outage
Unit 5 (784MWe):	in periodic inspection outage, cold shutdown at 14:30 March 20th
Unit 6 (1,100MWe):	in periodic inspection outage, cold shutdown at 19:27 March 20th

(2) Major Plant Parameters (17:00 March 21st)

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Reactor Pressure*1 [MPa]	0.299(A) 0.272(B)	0.078(A) 0.076(B)	0.013(C) 0.146(B)	–	0.108	0.104
CV Pressure (D/W) [kPa]	160	120	110	–	–	–
Reactor Water Level*2 [mm]	−1,750(A) −1,750(B)	−1,350(A) Not available(B)	−1,550(A) −2,025(B)	–	2,069	1,560
Suppression Pool Water Temperature (S/C) [℃]	–	–	–	–	–	–
Suppression Pool Pressure (S/C) [kPa]	155	down scale	down scale	–	–	–
Spent Fuel Pool Water Temperature [℃]	–	50	–	Not available*3	42.3	36.5
Time of Measurement	14:25 March 21st	14:25 March 21st	14:55 March 21st		17:00 March 21st	17:00 March 21st

*1: Converted from reading value to absolute pressure

*2: Distance from the top of fuel
*3: As of 04:08 March 14th, 84℃

(3) Situation of Each Unit

<Unit 1>

- TEPCO reported to NISA the event (Inability of water injection of the Emergency Core Cooling System) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (16:36 March 11th)
- Seawater injection to the Reactor Pressure Vessel (RPV) via the Fire Extinguish Line started. (20:20 March 12th)
  →Temporary interruption of the injection (01:10 March 14th)
- The sound of explosion in Unit 1 occurred. (15:36 March 12th)
- Seawater is being injected. (As of 12:00 March 19th)

<Unit 2>

- TEPCO reported to NISA the event (Inability of water injection of the Emergency Core Cooling System) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (16:36 March 11th)
- The Blow-out Panel of reactor building was opened due to the explosion in the reactor building of Unit 3. (After 11:00 March 14th)
- Reactor water level tended to decrease. (13:18 March 14th) TEPCO reported to NISA the event (Loss of reactor cooling functions) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (13:49 March 14th)
- Seawater injection to RPV via the Fire Extinguish line was ready. (19:20 March 14th)
- Water level in RPV tended to decrease. (22:50 March 14th)
- A sound of explosion was made in Unit 2. As the pressure in Suppression Chamber decreased (06:10 March 15th), there was a possibility that an incident occurred in the Chamber. (About 06:20 March 15th)
- Seawater injection to RPV continues. (As of 12:00 March 19th)
- Electric power receiving at the emergency power source transformer

from the external transmission line was completed. The work for laying the electric cable from the facility to the load side was carried out. (As of 13:30 March 19th)

- Injection of 40t of Seawater to the Spent Fuel Pool of Unit 2 was started.(from 15:00 till 17:20 March 20th)
- Power Center of Unit 2 received electricity (15:46 March 20th)
- White smoke generated from Unit 2. (18:22 March 21st)

<Unit 3>

- Fresh water started to be injected to RPV via the Fire Extinguish Line. (11:55 March 13th)
- Seawater started to be injected to RPV via the Fire Extinguish Line. (13:12 March 13th)
- Seawater injection for Units 1 and 3 was interrupted due to the lack of seawater in pit. (01:10 March 14th)
- Seawater injection to RPV for Unit 3 was restarted (03:20 March 14th)
- The pressure in Primary Containment Vessel (PCV) of Unit 3 rose unusually. (07:44 March 14th) TEPCO reported to NISA on the event falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (7:52 March 14th)
- In Unit 3, the explosion like Unit 1 occurred around the Reactor Building (11:01 March 14th)
- The white smoke like steam generated from Unit 3. (08:30 March 16th)
- Because of the possibility that PCV of Unit 3 was damaged, the workers evacuated from the main control room of Units 3 and 4 (common control room). (10:45 March 16th) Thereafter the operators returned to the room and restarted the operation of water injection. (11:30 March 16th)
- Seawater was discharged 4 times to Unit 3 by the helicopters of the Self-Defence Force. (9:48, 9:52, 9:58 and 10:01 March 17th)
- The riot police arrived at the site for the water spray from the grand. (16:10 March 17th)
- The Self-Defence Force started the water spray from 19:35 March 17th.
- The water spray from the ground was carried out by the riot police (From 19:05 till 19:13 March 17th)
- The water spray from the ground was carried out by the Self-Defense Force using 5 fire engines. (March 17th)

(The starting time of water spray by each engine: 19:35, 19:45, 19:53, 20:00 and 20:07 March 17th)

- The water spray from the ground using 6 fire engines (6 tons of water spray per engine) was carried out by the Self-Defence Force. (From before 14:00 till 14:38 March 18th)
- The water spray from the ground using a fire engine provided by the US Military was carried out. (Finished at 14:45 March 18th)
- Seawater is being injected to RPV. (As of 10:00 March 19th)
- Hyper Rescue Unit (14 vehicles) arrived at the Main Gate (23:10 March 18th) and 6 vehicles of them entered the NPS in order to spray water from the ground. (23:30 March 18th)
- Hyper Rescue Unit of Tokyo Fire Department carried out and completed the water spray. (Finished at 03:40 March 20th)
- The pressure in PCV of Unit 3 rose (320 kPa as of 11:00 March 20th). Preparation to lower the pressure was carried. Judging from the situation, immediate pressure relief was not required. Monitoring the pressure continues (120 kPa at 12:15 March 21st).
- On-site survey for leading electric cable (From 11:00 till 16:00 March 20th)
- Water spray over the Spent Fuel Pool of Unit 3 by Hyper Rescue Unit of Tokyo Fire Department was started at 21:39 March 20th and finished at 03:58 March 21st.
- Works for the recovery of external power supply is being carried out.
- Grayish smoke generated from Unit 3. (At around 15:55 March 21st)
- The smoke was confirmed to be died down. (17:55 March 21st)

<Unit 4>

- It was confirmed that a part of wall in the operation area of Unit 4 was damaged. (06:14 March 15th)
- The fire at Unit 4 occurred. (09:38 March 15th) TEPCO reported that the fire was extinguished spontaneously. (11:00 March 15th)
- The temperature of water in the Spent Fuel Pool at Unit 4 had increased. (84 ℃ as of 04:08 March 14th)
- The fire occurred at Unit 4. (5:45 March 15th) TEPCO reported that no fire could be confirmed on the ground.(06:15 March 16th)
- Because of the replacement work of the Shroud of RPV, no fuel was

inside the RPV.

- The Self-Defence Force started water spray over the Spent Fuel Pool of Unit 4 (09:43 March 20th).
- On-site survey for leading electric cable (From 11:00 till 16:00 March 20th)
- Water spray over the Spent Fuel Pool of Unit 4 by Self-Defence Force was started at around 18:30 March 20th and finished at 19:46 March 20th.
- Water spray over the Spent Fuel Pool by Self-Defence Force (13 fire engines) started at 06:37 March 21st and finished at 08:41 March 21st.
- Works for laying electricity cable to the Power Center was completed. (At around 15:00 March 21st).

<Units 5 and 6>

- Emergency Diesel Generator (1 unit) for Unit 6 is operable and supplying electricity to Units 5 and 6. Water injection to RPV and Spent Fuel Pool through the system of Make up Water Condensate (MUWC) is being carried.
- The second unit of Emergency Diesel Generator (A) for Unit 6 started up. (04:22 March 19th)
- The pumps for Residual Heat Removal (RHR) (C) for Unit 5 (05:00 March 19th) and RHR (B) for Unit 6 (22:14 March 19th) started up and recovered heat removal function. It cools Spent Fuel Storage Pool with priority. (Power supply : Emergency Diesel Generator for Unit 6) (05:00 March 19th)
- Unit 5 under cold shut down (14:30 March 20th)
- Unit 6 under cold shut down (19:27 March 20th)
- Receiving electricity reached to the transformer of starter. (19:52 March 20th)
- Power supply to Unit 5 was switched from the Emergency Diesel Generator to the External Power Supply. (11:36 March 21st)

<Common Spent Fuel Pool>

- It was confirmed that the water level of Spent Fuel Pool was maintained full at after 06:00 March 18th.
- As of 09:00 March 19th, the water temperature in the pool is 57℃.

- Water spray over the Common Spent Fuel Pool was started (10:37 March 21st)

- Fukushima Dai-ni NPS (TEPCO)
  (Naraha Town / Tomioka Town, Futaba County, Fukushima Prefecture.)

(1) The state of operation

Unit1 (1,100MWe): automatic shutdown, cold shut down at 17:00, March 14th

Unit2 (1,100MWe): automatic shutdown, cold shut down at 18:00, March 14th

Unit3 (1,100MWe): automatic shutdown, cold shut down at 12:15, March 12th

Unit4 (1,100MWe): automatic shutdown, cold shut down at 07:15, March 15th

(2) Major plant parameters (As of 18:00 March 21st)

	Unit	Unit 1	Unit 2	Unit 3	Unit 4
Reactor Pressure*1	MPa	0.15	0.12	0.12	0.15
Reactor water temperature	℃	33.2	29.5	34.5	31.5
Reactor water level*2	mm	8,196	10,246	8,169	8,785
Suppression pool water temperature	℃	25	24	26	29
Suppression pool pressure	kPa (abs)	127	107	104	112
Remarks		cold shutdown	cold shutdown	cold shutdown	cold shutdown

*1: Converted from reading value to absolute pressure

*2: Distance from the top of fuel

(3) Report concerning other incidents

- TEPCO reported to NISA the event in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency

Preparedness regarding Unit 1. (18:08 March 11th)

- TEPCO reported to NISA the events in accordance with the Article 10 regarding Units 1, 2 and 4. (18:33 March 11th)
- TEPCO reported to NISA the event (Loss of pressure suppression function) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 1. (5:22 March 12th)
- TEPCO reported to NISA the event (Loss of pressure suppression function) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 2. (5:32 March 12th)
- TEPCO reported to NISA the event (Loss of pressure suppression function) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 4 of Fukushima Dai-ni NPS. (6:07 March 12th)

● Onagawa NPS (Tohoku Electric Power Co. Inc.)
(Onagawa Town, Oga County and Ishinomaki City, Miyagi Prefecture)

(1) The state of operation

Unit 1 (524MWe):	automatic shutdown, cold shut down at 0:58, March 12th
Unit 2 (825MWe):	automatic shutdown, cold shut down at earthquake
Unit 3 (825MWe):	automatic shutdown, cold shut down at 1:17, March 12th

(2) Readings of monitoring post, etc.

MP2 (Monitoring at the North End of Site Boundary)
approx. 6,500 nGy/h (19:00 March 14th)
→approx. 5,400 nGy/h (19:00 March 15th)

(3) Report concerning other incidents

- Fire Smoke on the first basement of the Turbine Building was confirmed to be extinguished. (22:55 on March 11th)
- Tohoku Electric Power Co. reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (13:09 March 13th)

2. Action taken by NISA

(March 11th)

14:46 Set up of the NISA Emergency Preparedness Headquarters (Tokyo) immediately after the earthquake

15:42 TEPCO reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

16:36 TEPCO recognized the event (Inability of water injection of the Emergency Core Cooling System) in accordance with the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Units 1 and 2 of Fukushima Dai-ichi NPS. (Reported to NISA at 16:45)

18:08 Regarding Unit 1 of Fukushima Dai-ni NPS, TEPCO reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

18:33 Regarding Units 1, 2 and 4 of Fukushima Dai-ni NPS, TEPCO reported to NISA in accordance with the Article 10 of Act on Special Measures Concerning Nuclear Emergency Preparedness.

19:03 The Government declared the state of nuclear emergency. (Establishment of Government Nuclear Emergency Response Headquarters and Local Emergency Response Headquarters)

20:50 Fukushima Prefecture's Emergency Response Headquarters issued a direction for the residents within 2 km radius from Unit 1 of Fukushima Dai-ichi NPS to evacuate. (The population of this area is 1,864.)

21:23 Directives from Prime Minister to the Governor of Fukushima Prefecture, the Mayor of Okuma Town and the Mayor of Futaba Town were issued regarding the event occurred at Fukushima Dai-ichi NPS, TEPCO, in accordance with the Paragraph 3, the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness as follows:

- Direction for the residents within 3km radius from Unit 1 of Fukushima Dai-ichi NPS to evacuate
- Direction for the residents within 10km radius from Unit 1 of Fukushima Dai-ichi NPS to stay in-house

24:00 Vice Minister of Economy, Trade and Industry, Ikeda arrived at the Local Emergency Response Headquarters

(March12th)

05:22 Regarding Unit 1 of Fukushima Dai-ni NPS, TEPCO recognized the event (Loss of pressure suppression function) to fall under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (Reported to NISA at 06:27)

05:32 Regarding Unit 2 of Fukushima Dai-ni NPS, TEPCO recognized the event (Loss of pressure suppression function) to fall under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

05:44 Residents within 10km radius from Unit 1 of Fukushima Dai-ichi NPS shall evacuate by the Prime Minister Direction.

06:07 Regarding of Unit 4 of Fukushima Dai-ni NPS, TEPCO recognized the event (Loss of pressure suppression function) to fall under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

06:50 In accordance with the Paragraph 3, the Article 64 of the Nuclear Regulation Act, the order was issued to control the internal pressure of PCV of Units 1 and 2 of Fukushima Dai-ichi NPS.

07:45 Directives from Prime Minister to the Governor of Fukushima Prefecture, the Mayors of Hirono Town, Naraha Town , Tomioka Town and Okuma Town were issued regarding the event occurred at Fukushima Dai-ni NPS, TEPCO, pursuant to the Paragraph 3, the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness as follows:

- Direction for the residents within 3km radius from Fukushima Dai-ni NPS to evacuate
- Direction for the residents within 10km radius from Fukushima Dai-ni NPS to stay in-house

17:00 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

17:39 Prime Minister directed evacuation of the residents within the 10 km radius from Fukushima Dai-ni NPS.

18:25 Prime Minister directed evacuation of the residents within the 20km radius from Fukushima Dai-ichi NPS.

19:55 Directives from Prime Minister was issued regarding seawater injection to Unit 1 of Fukushima Dai-ichi NPS.

20:05 Considering the Directives from Prime Minister and pursuant to the Paragraph 3, the Article 64 of the Nuclear Regulation Act, order was issued to inject seawater to Unit 1 of Fukushima Dai-ichi NPS and so on.

20:20 At Unit 1 of Fukushima Dai-ichi NPS, seawater injection started.

(March 13th)

05:38 TEPCO reported to NISA the event (Total loss of coolant injection function) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 3 of Fukushima Dai-ichi NPS. Recovering efforts by TEPCO of the power source and coolant injection function and the work on venting were under way.

09:01 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

09:08 Pressure suppression and fresh water injection started for Unit 3 of Fukushima Dai-ichi NPS.

09:20 The Pressure Vent Valve of Unit 3 of Fukushima Dai-ichi NPS was opened.

09:30 The order was issued for the Governor of Fukushima Prefecture, the Mayors of Okuma Town, Futaba Town, Tomioka Town and Namie Town in accordance with the Act on Special Measures Concerning Nuclear Emergency Preparedness on the contents of radioactivity decontamination screening.

09:38 TEPCO reported to NISA that Unit 1 of Fukushima Dai-ichi NPS reached a situation specified in the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

13:09 Tohoku Electric Power Co. reported to NISA that Onagawa NPS reached a situation specified in the Article 10 of the Act on Special

Measures Concerning Nuclear Emergency Preparedness.

13:12 Fresh water injection was switched to seawater injection for Unit 3 of Fukushima Dai-ichi NPS.

14:36 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

(March 14th)

01:10 Seawater injection for Units 1 and 3 of Fukushima Dai-ichi NPS were temporarily interrupted due to the lack of seawater in pit.

03:20 Seawater injection for Unit 3 of Fukushima Dai-ichi NPS was restarted.

04:40 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

05:38 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

07:52 TEPCO reported to NISA the event (Unusual rise of the pressure in PCV) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 3 of Fukushima Dai-ichi NPS.

13:25 Regarding Unit 2 of Fukushima Dai-ichi NPS, TEPCO recognised the event (Loss of reactor cooling function) to fall under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

22:13 TEPCO reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ni NPS.

22:35 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

(March 15th)

00:00: The acceptance of experts from IAEA was decided. NISA agreed to accept the offer of dispatching of the expert on NPS damage from IAEA considering the intention by Mr. Amano, Director General of IAEA. Therefore, the schedule of expert acceptance will be planned from now on according to the situation.

00:00: NISA also decided the acceptance of experts dispatched from NRC.

07:21 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

07:24 Incorporated Administration Agency, Japan Atomic Energy Agency (JAEA) reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Nuclear Fuel Cycle Engineering Laboratories, Tokai Research and Development Centre.

07:44 JAEA reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Nuclear Science Research Institute.

08:54 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

10:30 According to the Nuclear Regulation Act, Minister of Economy, Trade and Industry issued the directives as follows.

For Unit 4: To extinguish fire and to prevent the occurrence of re-criticality

For Unit 2: To inject water to reactor vessel promptly and to vent Drywell.

10:59 Considering the possibility of lingering situation, it was decided that the function of the Local Emergency Response Headquarter was moved to the Fukushima Prefectural Office.

11:00 Prime Minister directed the in-house stay area.

In-house stay was additionally directed to the residents in the area from 20 km to 30 km radius from Fukushima Dai-ichi NPS considering in-reactor situation.

16:30 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

22:00 According to the Nuclear Regulation Act, Minister of Economy, Trade and Industry issued the following directive.
For Unit 4: To implement the injection of water to the Spent Fuel Pool.

23:46 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

(March 18th)

13:00 Ministry of Education, Culture, Sports, Science and Technology decided to reinforce the nation-wide monitoring survey in the emergency of Fukushima Dai-ichi and Dai-ni NPS.

15:55 TEPCO reported to NISA on the accidents and failure at Units 1, 2, 3 and 4 of Fukushima Dai-ichi NPS (Leakage of the radioactive materials inside of the reactor buildings to non-controlled area of radiation) pursuant to the Article 62-3 of the Nuclear Regulation Act.

16:48 Japan Atomic Power Co. reported to NISA accidents and failures in Tokai NPS (Failure of the seawater pump motor of the emergency diesel generator 2C) pursuant to the Article 62-3 of the Nuclear Regulation Act.

(March 19th)

07:44 The second unit of Emergency Diesel Generator (A) for Unit 6 started up.
TEPCO reported to NISA that the pump for RHR (C) for Unit 5 started up and started to cooling Spent Fuel Storage Pool. (Power supply: Emergency Diesel Generator for Unit 6)

08:58 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

(March 20th)

23:30 The Directive from Local Emergency Response Headquarter to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village) was issued regarding the change of the reference value for the screening level for decontamination of radioactivity.

(March 21st)

07:45 The Directive titled as "Administration of the stable Iodine" from Local Emergency Response Headquarter to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village) was issued, which directs the above mentioned governor and the heads to administer stable Iodine under the direction of the headquarter and in the presence of medical experts, and not to administer it on personal judgements.

< Possibility on radiation exposure (As of 21:00 March 21st) >

<Exposure of residents>

(1) Including the about 60 evacuees from Futaba Public Welfare Hospital to Nihonmatsu City Fukushima Gender Equality Centre, as the result of measurement of 133 persons at the Centre, 23 persons counted more than 13,000 cpm were decontaminated.

(2) The 35 residents transferred from Futaba Public Welfare Hospital to Kawamata Town Saiseikai Kawamata Hospital by private bus arranged by Fukushima Prefecture were judged to be not contaminated by the Prefectural Response Centre.

(3) As for the about 100 residents in Futaba Town evacuated by bus, the

results of measurement for 9 of the 100 residents were as follows. The evacuees, moving outside the Prefecture (Miyagi Prefecture), were divided into two groups, which joined later to Nihonmatsu City Fukushima Gender Equality Centre.

No. of Counts	No. of Persons
18,000cpm	1
30,000-36,000cpm	1
40,000cpm	1
little less than 40,000cpm*	1
very small counts	5

*(These results were measured without shoes, though the first measurement exceeded 100,000cpm)

(4) The screening was started at the Off site Centre in Okuma Town from March 12th to 15th. 162 people received examination until now. At the beginning, the reference value was set at 6,000cpm. 110 people were at the level below 6,000 cpm and 41 people were at the level of 6,000 cpm or more. When the reference value was increased to 13,000 cpm afterward, 8 people were at the level below 13,000 cpm and 3 people are at the level of 13,000 cpm or more.

The 5 out of 162 people examined were transported to hospital after being decontaminated.

(5) The Fukushima Prefecture carried out the evacuation of patients and personnel of the hospitals located within 10km area. The screening of all the members showed that 3 persons have the high counting rate. These members were transported to the secondary medical institute of exposure. As a result of the screening on 60 fire fighting personnel involved in the transportation activities, the radioactivity higher than twice of the back ground was detected on 3 members. Therefore, all the 60 members were decontaminated.

<Exposure of workers>

(1) As for the 18 workers conducting operations in Fukushima Dai-ichi NPS, results of measurements are as follows;

One worker: At the level of exposure as 106.3 mSv, no risk of internal exposure and no medical treatment required.

Other workers: At the level of no risk for health but concrete numerical value is unknown.

(2) As for the 7 people working at the time of explosion at around the Unit 3 of Fukushima Dai-ichi NPS who were injured and conscious, 6 out of 7 people were decontaminated by an industrial doctor of the clinic in Fukushima Dai-ni NPS, and confirmed to have no risk. The other one is having a medical treatment at the clinic after decontaminated.

<Others>

(1) Fukushima Prefecture has started the screening from 13 March. It is carried out by rotating the evacuation sites and at the 12 places (set up permanently) such as health offices. The results of screening are being totalled up.

(2) 5 members of Self-Defence Force who worked for water supply in Fukushima Dai-ichi NPS were exposed. After the work (March 12th), 30,000 cpm was counted by the measurement at Off site Centre. The counts after decontamination were between 5,000 and 10,000 cpm. One member was transferred to National Institute of Radiological Science. No other exposure of the Self-Defence Force member was confirmed at the Ministry of Defence.

(3) As for policeman, the decontaminations of two policemen were confirmed by the National Police Agency. Nothing unusual was reported.

<Directive of screening levels for decontamination of radioactivity>

On March 20th, the Local Emergency Response Headquarter issued the directive to change the reference value for the screening level for decontamination of radioactivity as the following to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village).

Old : 40 Bq/cm^2 measured by a gamma-ray survey meter or 6,000 cpm

New : 1 μ Sv/hour (dose rate at 10cm distance) or 100,000cpm equivalent

<Directives of administrating stable Iodine during evacuation>

On March 16th, the Local Emergency Response Headquarter issued "the directive to administer the stable Iodine during evacuation from the evacuation area (20 km radius)" to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village).

On March 21st, the Local Emergency Response Headquarter issued the directive titled as "Administration of the stable Iodine" to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village), which directs the above mentioned governor and heads to administer stable Iodine under the direction of the headquarter and in the presence of medical experts, and not to administer it on personal judgements.

<Situation of the injured (As of 21:00 March 21st)>

1. Injury due to earthquake
   - Two employees (slightly)
   - Two subcontract employees (one fracture in both legs)
   - Two missing (TEPCO's employee, missing in the turbine building of Unit 4)
   - One emergency patient (According to the local prefecture, one patient of cerebral infarction was transported by the ambulance).
   - Ambulance was requested for one employee complaining the pain at left chest outside of control area (conscious).
   - Two employees complaining discomfort wearing full-face mask in the main control room were transported to Fukushima Dai-ni NPS for a consultation with an industrial doctor.

2. Injury due to the explosion of Unit 1 of Fukushima Dai-ichi NPS
   - Four employees were injured at the explosion and smoke of Unit 1 around turbine building (non-controlled area of radiation) and were examined by Kawauchi Clinic.

3. Injury due to the explosion of Unit 3 of Fukushima Dai-ichi NPS
   - Four TEPCO's employees
   - Three subcontractor employees
   - Four members of Self-Defence Force (one of them was transported to National Institute of Radiological Sciences considering internal possible exposure. The examination resulted in no internal exposure. The member was discharged from the institute on March 16th.)

4. Other injuries
   - A person who visited the clinic in Fukushima Dai-ni NPS from a transformer sub-station, claiming of a stomach ache, was transported to a clinic in Iwaki City, because the person was not contaminated.

<Situation of Resident Evacuation (As of 21:00 March 21st)>

At 11:00 March 15th, Prime Minister directed in-house stay to the residents in the area from 20 km to 30 km radius from Fukushima Dai-ichi NPS. The directive was conveyed to Fukushima Prefecture and related municipalities.

Regarding the evacuation as far as 20-km from Fukushima Dai-ichi NPS and 10-km from Fukushima Dai-ni NPS, necessary measures have already been taken.

- The in-house stay in the area from 20 km to 30 km from Fukushima Dai-ichi NPS is made fully known to the residents concerned.
- Cooperating with Fukushima Prefecture, livelihood support to the residents in the in-house stay area are implemented.

(Contact Person)
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Hornseth, Geoffrey

From: NMSSBOX Resource
Sent: Tuesday, March 22, 2011 11:39 AM
To: NMSS Distribution
Subject: Information on Japanese Events Can Be Found Here

The EDO's office reports that they've been getting a lot of inquiries on recent events and speeches.

The transcript and video of yesterday's commission meeting is on the web. Here's the link to the transcript.

http://www.nrc.gov/reading-rm/doc-collections/commission/tr/2011/20110321.pdf

The best source for up-to-date information is the "Japan Box" on the upper right hand corner of the public site, under "Key Topics."

H-81

UNITED STATES OF AMERICA

U.S. NUCLEAR REGULATORY COMMISSION

BRIEFING ON NRC RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

MARCH 21, 2011

9:00 A.M.

TRANSCRIPT OF PROCEEDINGS

Public Meeting

Before the U.S. Nuclear Regulatory Commission:

Gregory B. Jaczko, Chairman

Kristine L. Svinicki, Commissioner

George Apostolakis, Commissioner

William D. Magwood, IV, Commissioner

William C. Ostendorff, Commissioner

NRC Staff:

Bill Borchardt
Executive Director for Operations

PROCEEDINGS

CHAIRMAN JACZKO: Good morning everyone. The Commission meets today to discuss the tragic events in Japan and to begin to consider possible actions we may take to verify the safety of the nuclear facilities that we regulate here in the United States. People across the country and around the world who have been touched by the magnitude and the scale of this disaster are closely following the events in Japan and the repercussions in this country and many other countries.

Before we begin, I would like to offer my sincere condolences to all of those who have been affected by the earthquake and the tsunami in Japan. Our hearts go out to all who have been dealing with the aftermath of these natural disasters and we are mindful of the long and difficult road they will face in recovering. We know the people of Japan are resilient and strong and we have every confidence that they will come through this difficult time and move forward with resolve to rebuild their vibrant country. I believe I speak for all Americans when I say that we stand together with the people of Japan at this most difficult and challenging time.

The NRC is a relatively small agency with just about 4,000 staff, but we play a critical role in protecting the American people and the environment when it comes to the use of nuclear materials. We have our inspectors who work full time at every nuclear plant in the country and we are proud to have world-class scientists, engineers, and professionals representing nearly every discipline.

Since Friday, March 11, when the earthquake and tsunami struck, the NRC's headquarter operation center has been operating on a 24-hour basis to monitor and analyze events at nuclear power plants in Japan. At the request of the Japanese government and through the United States Agency for International Development, the NRC sent a team of its technical experts to provide an on the ground support, and we have been in continual contact with them since they deployed.

And within the United States, the NRC has been working closely with other federal agencies as part of the U.S. Government's response to the situation. Here in the United States we have an obligation to the American people to undertake a systematic and methodical review of the safety of our own domestic nuclear facilities in light of the natural disaster and resulting nuclear situation in Japan. Beginning to examine all available information is an essential part of our effort to analyze the event and understand its impacts on Japan and implications for the United States. Our focus will always be on keeping plants and radioactive materials in this country safe and secure.

As the immediate crisis in Japan comes to an end we will look at any information we can to gain experience from the event and see if there are any changes we need to make to further protect public health and safety. Together with my colleagues on the Commission, we will review the current status and identify the steps we will take to conduct that review. In the meantime we will continue to oversee and monitor plants to ensure that U.S. reactors remain safe.

On behalf of the Commission I want to thank all of our staff for maintaining their focus on our essential safety and security mission throughout these difficult days. I want to acknowledge their tireless efforts and their critical contributions to the U.S. response to assist Japan. In spite of the evolving situation, the long hours, and the intensity of efforts over the past week, the staff has approached their responsibilities with dedication, determination, and professionalism, and we are all incredibly proud of their efforts. The American people can also be proud of the commitment and dedication within the federal workforce, which is exemplified by our staff every day. And again, I want to reiterate certainly on behalf of the Commission and all of us here in this room our sympathy with the crisis and the difficult situation for our friends and colleagues in Japan, and we look forward to continuing our efforts to provide them with assistance as they continue to deal with a very challenging situation, not only with the nuclear facilities but with many of the other impacts from this natural disaster in Japan. I would like to offer Commissioner Svinicki an opportunity to make some comments.

COMMISSIONER SVINICKI: Thank you Mr. Chairman. I want to add my voice to that of others regarding the great sympathy we feel over the loss and devastation due to the earthquake and tsunami in Japan. The dramatic images of the events at Fukushima, images that have riveted so many of us over the course of the past week, have an added dimension for us as a community of nuclear safety professionals because for us these images are not an abstraction. Many of us have traveled to Japan; we have toured the facilities of our Japanese colleagues. We have worked alongside them in support of the shared goal of advancing nuclear safety. The sense of anguish we feel as we desire so desperately to do something, anything we can, to help our friends and colleagues in Japan has been co clearly evident on the faces of the men and women working here at NRC. We are heartsick over this tragedy. Some may characterize that our faith in this technology is shaken, but nuclear safety has not been and cannot be a matter of faith; it is and must continue to be a matter of fact. So today we continue the systematic evaluation of facts of what we know about what happened and what we don't know but will piece together in the coming months. Our objective is to confirm that our approach to the regulation of nuclear power in this country is comprehensive and correct while applying any lessons learned we can from these events. In taking the systematic and deliberate approach to this review that you have called for, Mister Chairman, I'm certain the Commission will achieve this objective. Thank you.

CHAIRMAN JACZKO: Thank you. Commissioner Apostolakis.

COMMISSIONER APOSTOLAKIS: I join the Chairman and Commissioner Svinicki in expressing my condolences to the people of Japan and I also second the Chairman's comments on commending the staff for its response to this accident. Thank you, Mr. Chairman.

CHAIRMAN JACZKO: Commissioner Magwood.

COMMISSIONER MAGWOOD: Thank you, Chairman. This is in many ways a very personal tragedy for me. I have many friends and colleagues in Japan. I have been in touch with several of them over the last week and a half. I've heard from friends in Tokyo worried about radiation and others in the North who are dealing with food shortages and gasoline shortages. Everyone in Japan is enduring continuing aftershocks, anxiety about the Fukushima and Daiichi plant, and difficulties in communicating with friends and neighbors, and a lot of uncertainty about what will happen next. I have one friend Emito who lost all her utilities for several days after the earthquake and is still waiting for water to be restored. But in the aftermath of the earthquake, she is making new friends as people bond together to help each other and comfort each other and make the best of a difficult situation. Fortunately she found a kind neighbor who has a well, and so she has been able to get water and take it to her apartment on a daily basis.

I'm sure there's thousands of examples of people who are reaching out to each other, bonding as a community, and showing the kind of resilience that is going to be necessary to move forward. The scale of the tragedy is staggering and the toll on life and property has been terrible, but Japan will recover. But Japan will not stand alone and has not stood alone over the last week and a half. We in the U.S. are close friends to the Japanese people and I'm very, very proud of how our country has responded to this crisis and particularly proud of how the Nuclear Regulatory Commission Staff has responded as well. The staff has demonstrated both the expertise and the selflessness over the last 10 days and I applaud their outstanding efforts.

Today the Commission will receive an update on the nuclear situation in Japan, our response and our efforts to understand what has happened. There will be important lessons learned from the events at the Fukushima/Daiichi plant. It's essential that we identify them correctly and respond to them effectively. This meeting, I expect, will be the first of many Commission meetings as we engage to understand the issues and address those issues to ensure the safety of U.S. nuclear power plants. And I look forward to working with my partners on the Commission to do so. Thank you.

CHAIRMAN JACZKO: Thank you, Commissioner Magwood. Commissioner Ostendorff.

COMMISSIONER OSTENDORFF: Thank you, Mr. Chairman. This is a vitally important meeting for the Commission and the country. I want to join my colleagues in extending my personal sympathies to the people of Japan. The consequences and loss of life in the earthquake and tsunami are simply devastating. Our thoughts and prayers are with all. I'd like to commend the Chairman, the Executive Director for Operations and the NRC staff for their efforts to date in supporting the NRC's monitoring assistance associated with these events. I appreciate the hard work ongoing 24/7 at the Op Center for the last 11 days. Along with my other colleagues here at this table, I've been very impressed with the technical competence and professionalism demonstrated by the NRC staff. I'm also grateful for the highly competent team of NRC detailees dispatched to Japan. While dismayed by this tragedy as a Commissioner, I am also extraordinarily proud of the commitment and professionalism of our team. The events that have unfolded at the Daiichi plant over the last 11 days are stark. On one hand, I believe that our existing licensing and oversight activities assure us that our commercial nuclear power plants in this country are safe. On the other hand, I know that we must, and that we most certainly will, conduct a thoughtful and rational examination of the NRC's regulatory framework with the information and lessons learned resulting from the incidence in Japan. As we head down this path together, I know this Commission will stay mindful of the challenges that face us. As stated by Chairman Jaczko several times in the last week and again today as echoed by the Commissioners, I fully support his call for a systematic and methodical review. We must also do this in a way that clearly communicates to the American people what this review means and what it implies for the safety of our existing nuclear power plants. Thank you.

CHAIRMAN JACZKO: Well thank you everyone. With that, we will turn it to Bill Borchardt, the Executive Director for Operations for the presentation.

MR. BORCHARDT: Thank you, and good morning. I would like to join in your expressions of condolences to the people of Japan. I and many of my colleagues on the NRC staff have had many years of very close and personal interaction with our regulatory counterparts and we would like to extend our condolences to them.

We are mindful of our primary responsibility to ensure the public health and safety of the American people. We have been very closely monitoring the activities in Japan and reviewing all available information to allow us to conclude that the U.S. plants continue to operate safely. There has been no reduction in the licensing or oversight function of the NRC as it relates to any of the U.S. licensees. Contributors to the conclusion that the current fleet of reactors and materials licensees continue to protect the public health and safety are based on a number of principles, including the Defense in Depth.

The fact that every reactor in this country is designed for natural events based upon the specific site that that reactor is located, that there are multiple fission product barriers, and that there are a wide range of diverse and redundant safety features in order to provide that public health and safety assurance. We have a long regulatory history of conservative decision-making. We've been intelligently using risk insights to help inform our regulatory process, and we have never stopped to make improvements to the plant design as we learn from operating experience over the more than 35 years of civilian nuclear power in this country. Some have been derived from lessons learned from previous significant events, such as Three Mile Island. We have severe accident management guidelines, revisions to the emergency operating procedures, procedures and processes for dealing with large fires and explosions, regardless of the cause. We have a station blackout rule. We have a hydrogen rule for reactors and many others which I'll go into in a little more detail later.

But all of these relate in one way or another to the tragic events in Japan. In addition to all that we've done in the NRC and over the last week and a half and over the many years as I alluded to on rulemaking type activities, the industry is also performing many verification activities at this time to verify that all of these processes and procedures and rules that have been implemented are still valid. From a very high level, the NRC response centered from the Operations Center here in Rockville as well as the NRC team that's in Japan focuses on three major areas. The first is to support the Japanese government and our regulatory counterpart, NISA. Second is to gather information and assess that information for implications on the U.S. facilities. And the third is to support the U.S. ambassador in Japan with a level of nuclear expertise that the NRC is perfectly positioned to do. We are in fact mobilized to support the US government in responding to this event.

Notwithstanding the very high level of support, we continue to maintain our focus on our domestic responsibilities. And finally as my last point of introduction, we do not expect the releases of radioactive material that have occurred in Japan to have any effect on the health and safety of the U.S. population.

The next slide shows the agenda for this meeting. Given the time constraints, it'll be a relatively high overview of activities but the room has a healthy number of NRC staff that are available to explore any questions and answers that you may have later. I'll now move to, let's say, a brief overview of the events.

On Friday, March 11th an earthquake hit Japan, resulting in the shutdown of more than 10 reactors. To our understanding, the reactors' response to the earthquake went according to design. There is no known problems to our knowledge with the response to that event. The ensuing tsunami, however, caused the loss of emergency AC power to six units at the Fukushima Daiichi site; and it's those six units that have received the majority of our attention since that time. Units One, Two, and Three, at that six unit site, were in operation at the time. Units Four, Five, and Six were in previously scheduled outages.

Immediately after the tsunami, there appeared that there was no injection capability into the reactor vessels on Units One, Two, and Three. On Saturday, March 12th, a hydrogen explosion occurred in Unit One; and then the following Monday, March 14th, a hydrogen explosion in Unit Three. On the 15th of March, on Tuesday, there were explosions in Unit Two and in Unit Four from hydrogen originating from, we believe, overheated fuel in the spent fuel pool.

At this time, it's our assessment that it's likely that Units One, Two, and Three have experienced some degree of core damage. Today, all three units appear to be in a stable condition, with seawater injection being used to keep the reactors cool. Containment integrity for all three units is also believed to have been -- is currently maintained. Grey smoke has emitted from Unit Three, which is the cause of the site evacuation that's been reported this morning. The source of that smoke is unknown, although there is indication that there's been no increase in temperature or in radioactivity.

On a sign of some promising news, TEPCO has been able to bring offsite power onto the site from a nearby transmission line. It is now essentially at the border of Units One and Two. There's early indications that there may be cabling problems -- electrical cabling problems within the units. So I understand that they're now in the process of laying some temporary cables to some of the pumps and valves inside of Units One and Two. Over the next day or two they'll be doing the same thing for Units Three and Four. There's two diesel generators that are currently running and supplying power to Units Five and Six.

Moving to the NRC response: Shortly after 4:00 in the morning on Friday, March 11th, the NRC Operations Center made the first call, informing NRC management of the earthquake and the potential impact on U.S. plants. We went into the monitoring mode at the Operations Center and the first concern for the NRC was possible impacts of the tsunami of U.S. plants on the West Coast.

On that same day, Friday, March 11th, we dispatched two experts to Japan to help at the embassy and begin interactions with our Japanese regulatory counterparts. By Monday, we had dispatched a total of 11 staff to Japan. As I said, the areas of focus for this team of 11 is to support the Japanese government and respond to requests from our regulatory counterpart, NISA, to support the U.S. ambassador and his understanding of the nuclear impacts of this event, and then third to help the information flow from Japan to the U.S. NRC so that we could assess the implications on the U.S. fleet in as timely a manner as possible.

We've had an extensive range of stakeholders that we've had constant interaction with, ranging from the White House, Congressional staff, our state regulatory counterparts, a wide range of other federal agencies, and of course the international regulatory bodies around the world.

Our ongoing NRC response is that the NRC Operations Center remains in a 24/7 posture. This has involved the efforts of over 250 NRC staff on a rotating basis. In addition to the people that are staffing the Operations Center, there is hardly a person amongst the 4,000 people in this agency that aren't in one way or another contributing to the response, whether it's through information technology needs for the people in Japan, or the Region IV staff in Texas, which is backing up for the operations officers in our Operations Center to help maintain an information flow on the currently operating reactors in this country. The entire agency is coordinating and pulling together in response to this event so that we can provide the assistance in Japan and not miss any of our normal activities regarding domestic responsibilities.

In addition, we remain aware of U.S. industry efforts to provide assistance with their counterparts in TEPCO in Japan.

The U.S. Government has an extensive network of radiation monitors across the country. EPA's system has not identified any radiation levels of concern in this country. In fact, natural background from things like the rock -- from 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.

I'd like to focus for a few more minutes on the factors that go into assuring us of domestic reactor safety. We have, since the beginning of the regulatory program in the United States, used a philosophy of Defense-in-Depth, which recognizes that the nuclear industry requires the highest standards of design, construction, oversight, and operation, but even with that we will not rely on any one level of protection for the entire purposes of protecting public health and safety. So the designs for every single reactor in this country take into account the specific site that that reactor is located and does a detailed evaluation for any natural event such as earthquakes, tornadoes, hurricanes, floods, tsunami, and many others.

In addition, there are multiple physical barriers to fission product release at every reactor design. And then in addition to that, there are both diverse and redundant safety systems that are required to be maintained operable and frequently tested by NRC regulations that ensure that the plant is in a high condition of readiness to respond to any scenario.

As I mentioned earlier, we've taken advantage of the lessons learned from previous operating experience, one of the most significant in this country, of course, being the Three Mile Island accident in the late 1970s. As a result of those lessons learned, we've significantly revised the emergency planning, the emergency operating procedures. Many human factors issues as it relates to how control room operators operate the plant. We added new requirements for hydrogen control to help prevent explosions inside of containment and we also created requirements for enhanced indication of pumps and valves.

We have a post-accident sampling system that requires -- or that allows -- for the monitoring of radioactive material release and possible fuel degradation. And of course one of the most significant changes is after Three Mile Island we created the Resident Inspector Program, which has at least two full time NRC inspectors on site that have unfettered access to all licensees' activities 24 hours a day, seven days a week.

Also as a result of operating experience and ongoing research programs, we have developed requirements for severe accident management guidelines. These are programs that perform the "what if" scenario. What if all of this careful design work, all of these important procedures and practices and instrumentation, what if that all failed? What procedures and policies and equipment should be in place to deal with the extremely unlikely scenario of a severe accident? Those have been in effect for many years and are frequently evaluated by the NRC inspection program.

As a result of the events of September 11, 2001, we did a similar evaluation, and identified important pieces of equipment that, if, regardless of the cause of a significant fire or explosion at a plant, we would have pre-staged equipment, procedures, and policies to help deal with that situation. All of these things are directly applicable to the kinds of very significant events that are taking place in Japan. Over the last 15 or 20 years, there's been a number of new rulemakings that directly relate to Japan. There's a station blackout rule that has required every plant in the country to analyze what the plant response would be if it were to lose all alternating current so that it could respond using batteries for a while, and then have procedures and arrangements in place in order to restore alternating current to the site, and provide cooling to the core.

As I mentioned earlier, there's a hydrogen rule, which requires modifications to reduce the impacts of hydrogen generated for beyond-design basis events and core damage. There's equipment qualification rules that require equipment, indication equipment, as well as pumps and valves, to remain operable under the kinds of environmental temperature, radiation conditions that you would see under a design basis accident. And then, going directly to the type of containment design that the plants in Japan of highest interest have, we've had a Mark I Containment Improvement Program since the very late 1980s, which had installed hardened vent systems for the containment cooling and fission product scrubbing for all BWR Mark I's, as well as enhanced reliability of the automatic depressurization system.

I also mentioned earlier that we have emergency preparedness and planning requirements that provide ongoing training, and testing, and evaluations of emergency preparedness programs, in coordination with our federal partner, FEMA. And that entails extensive interaction with state and local governments, as those programs are evaluated and tested on a yearly basis.

Over the near term, the NRC activities are -- we will -- concurrent with the event evaluation that we're doing through the Operations Center and the team that's in Japan, we will be enhancing inspection activities through temporary instructions to our inspection staff, including the resident inspectors and the region-based inspectors in our four Regional offices, to look at the readiness to deal with both the design basis accidents and the beyond-design basis accidents.

We've already issued an information notice to the licensees to make them aware of the events, and what kinds of activities we believe they should be engaged in, to verify their readiness. And then we, every single day, assess whether or not there is some additional regulatory action that needs to be taken immediately, in order to address the information that we have, to date. The temporary inspection I've referred to is verifying that the capabilities to mitigate conditions that result from severe accidents, including the loss of significant operational and safety systems, are in effect and operational. They're verifying the capability to mitigate a total loss of electric power to the nuclear plant. They're verifying the capability to mitigate problems associated with flooding, and the impact of floods on systems both inside and outside of the plant. And they're identifying the equipment that's needed for the potential loss of equipment due to seismic events appropriate for the site, because each site has its own unique seismic profiles.

The information that we gather from this temporary inspection will be used to evaluate the industry's readiness for similar events, and aid in our understanding of whether additional regulatory actions need to be taken in the immediate term. For a near term effort, we are beginning, very soon, a 90 day effort, that will evaluate all of the currently available information from the Japanese event, and look at it to evaluate our 104 operating reactors' ability to protect against natural disasters, to evaluate the response to station blackouts, severe accidents and spent fuel accident progression, look at radiological consequence analysis, and also look at severe accident management issues regarding equipment.

I expect that, coming out of this, we'll have the development of some recommendations for generic communications, either to make sure that the industry has a broad understanding of the events and the issues, as best we understand them. But also, as I mentioned earlier, that we would evaluate whether or not some regulatory action, perhaps in the framework of an order, would be required, in order to require the licensees to take some actions that they have not already done. I expect that this 90 day effort will include a Quick

Look 30 day report to the Commission, and of course we stand ready to brief the Commission as you desire.

In order to accomplish this Quick Look report, I think we will have limited stakeholder involvement in this activity, and that it will be done independent of industry efforts that might be ongoing. The idea is to just get a quick snapshot of the regulatory response and the condition of the U.S. fleet based on whatever information we have available. You know, I recognize that we have limited information now. More and more information will become available to us as we go along. But we wanted to do at least this Quick Look report, beginning very soon. And of course, consistent with the Commission's practices, the results of this report will be made public.

On the longer term, we'll be developing lessons learned that are somewhat dependent on when we begin to get a better understanding of the events and the results of the earthquake and tsunami in Japan. So, to some degree, it's difficult to precisely state when the start date for this longer-term review will begin. The review may include the involvement of other federal agencies, but it will certainly include interaction with those other federal agencies, because there's, obviously, the issue of emergency preparedness is a prime example of where we would interact with FEMA to have an effective review. And we would identify the lessons learned that need to be incorporated into any ongoing, long term agency action.

We'll evaluate all the technical and policy issues to identify additional research, or generic communications, changes to our reactor oversight program, potential new rulemakings, adjustments to the regulatory framework that should be conducted by the NRC. As I said, we'll evaluate inter-agency issues, and also look for applicability to non-operating reactor facilities. I expect this longer-term report to have substantial stakeholder involvement, and the outcomes are likely to be along the lines of generic letters, bulletins, and potential rulemakings. So, in conclusion, I want to make it clear that we continue to make our domestic responsibilities of licensing and oversight of the U.S. licensees our top priority. There is an immediate short term and long term evaluations that are beginning, and that they will be influenced by our understanding of the events in Japan. With that, that concludes my presentation. I'm ready to answer any questions.

CHAIRMAN JACZKO: Well, thank you, Bill, for that very thorough presentation. We have a proposal in front of the Commission now to consider the options for the short term and the long term reviews, so we'll take a look at that and provide response in fairly short order. I would, again, just want to reiterate my thanks to the work that you and your team have done over the last several days, to deal with this situation, and the -- emphasize the importance of a systematic and methodical review, so that we do make sure that we approach these issues, and really get the facts, and make sure that we don't move in a direction that is based on early information, which often tends to be confusing, and sometimes conflicting. So I appreciate the work that you've done to this point. And I don't have any specific questions, at this time, but I would turn to Commissioner Svinicki to begin with some questions and comments.

COMMISSIONER SVINICKI: Thank you, Mr. Chairman, and thank you, Bill. I second the Chairman's comments about the tremendous efforts that you and all of the NRC staff members have made in supporting the agency's reaction to this event. There is a lot that we don't yet know, and so that becomes a context, really, for the types of questions that we're able to ask about this event today. Very generally, I would ask you, in the staff's expert assessment, this morning, do you believe that the events occurring at Fukushima have stabilized, or is it reasonable to expect that events there will continue to be dynamic in the days and weeks to come?

MR. BORCHARDT: In my view, the fact that off-site power is close to being available for use of plant equipment is, perhaps, the first optimistic sign that we've had, that things could be turning around. We believe that the spent fuel pools on Units Three and Four, which had been two components that were of significant safety concern, that the situation there is stabilizing, that the containment in three, all three Units One, Two, and Three appear to be functional, and that there's water being injected into the reactor vessels in Units One, Two, and Three.

So I would say optimistically, things appear to be on the verge of stabilizing. This has been a very challenging event for us to understand the exact situation, because, as was alluded to, the information is sometimes conflicting, it's certainly not at the level that any engineer would like to have in order to do a thorough analysis, so we've spent a lot of the time trying to piece together our best understanding. But that would be my personal assessment of the situation on site now.

COMMISSIONER SVINICKI: Is it fair to say from that, then, that, based on what we understand now of the needs that most urgently need to be addressed there at the site, that those are being addressed, and that they have the status that you just described to me? Those are, of course, the items of highest interest. But it sounds also like, in the days and weeks to come, we will certainly discover other conditions and things at the site, of perhaps a lower level of priority that we just don't know about right now.

MR. BORCHARDT: Yes. The radiation releases and the dose rates that we've seen on site, I think, were primarily influenced by the condition of the Units Three and Four spent fuel pools. And the water inventory questions of whether or not there was some fuel that was uncovered in the spent fuel pool was of significant concern. TEPCO, the licensee, and the Government of Japan have been making a concerted effort to address those issues. So that we're aware of.

I don't believe we have anywhere near a clear understanding of what the plant conditions are like within the reactor buildings. So, what kinds of electrical cabling has been damaged, what kinds of pumps and valves remain operable, is a significant unknown right now.

COMMISSIONER SVINICKI: Okay, thank you. You gave a very high level chronology of the events that occurred, as we know them. And it really ends up being a narrative of three events that are related to each other. First, of course, being the earthquake, the seismic event. Second, the tsunami, or, as we might have it in the United States, a flood surge, or some other flooding event, followed by the loss of power.

In terms of what we know now, and given that there are these three events in succession, do you think that our regulatory focus right now, for the review we're doing, is where it needs to be?

MR. BORCHARDT: Yes, I'm quite confident. We've looked at all of the information that we're getting from Japan. We've looked at the design basis for the U.S. reactors. We continue with the inspection program, and we have a high degree of confidence that the 104 currently operating reactors, there's an adequate basis to assure adequate protection.

COMMISSIONER SVINICKI: Thank you. There's been some discussion of what we call Generic Safety Issue 199. And Generic Safety Issues, that's a program that we have at NRC for the continual evaluation of various safety-relevant issues. Could you talk a little bit about the ongoing nature, this is, Generic Safety Issue 199, was ongoing prior to the event in Japan. Could you talk about what was occurring there, and how the events in Japan may alter how we approach that generic safety issue, going forward?

MR. BORCHARDT: Occasionally, I think it's every five years or so, the USGS does a review of information which impacts the U.S. Government's understanding of seismic frequencies and issues associated with seismic. Recently they put out a report that talked about the seismic information for the East, the Central and Eastern United States. That information has been given to the industry. There's now both industry and NRC evaluation of that information to see if this new information, and in some places it's an increase in the frequency, expected frequency of a seismic event, would cause us to have to change the seismic design basis for the plants.

We did a, as we do every time we get any kind of new information, seismic or otherwise, we do a quick look to make sure that we don't believe there's any immediate information or any immediate need to take any regulatory action. If there was, we would certainly do that through the immediate imposition of new operating guidelines, or new systems, or potentially, even, requirement to shut the reactor down, until the issue was addressed.

In this case, we did that review. We found no reason to take any immediate regulatory action. And so this is an ongoing review. I don't believe that what we've learned from Japan would cause a different type of analysis. It certainly puts a broader, brighter spotlight on the work we're doing, and that follow-up. But I'm confident that the approach we've been on is the right approach.

COMMISSIONER SVINICKI: You described our role in the inter-agency response, and NRC-specific actions. Are we cognizant of, and working to understand and make sure that our efforts do not conflict with, any industry-to-industry systems that is going on? I'm not aware of Tokyo Electric Power reaching out to the U.S. nuclear industry, or nuclear utilities, since this is a technology that we have in the United States. Do we maintain a cognizance of that so that we can make sure that all efforts are coordinated?

MR. BORCHARDT: We are aware that the industry-to-industry interaction has been ongoing at one level. Of course, there's many vendors and companies in the United States that have had ongoing business relationships with TEPCO, and the other generating companies in Japan. So at the working level, it has been going on ever since the event, and prior to the event.

At a higher, coordinated industry-level, I would say we are still in the formulative stages of that interaction. We have had some discussions with the industry, U.S. industry, it's still evolving. So we're cognizant of what's going on, and trying to help, in a U.S. government role, facilitate the contacts, if you will, between the U.S. and the Japanese companies, in any way that we can. Because we think it would certainly be a potential benefit to TEPCO.

COMMISSIONER SVINICKI: Thank you. And my last question to you is that, you mentioned our ability to issue very rapidly various types of generic communications to the industry, and in your prepared remarks you talked about the fact that we had already issued, I believe last week, an information notice. Could you describe generally, in that notice, what are we alerting the U.S. reactors to?

MR. BORCHARDT: Well, the main purpose, from my perspective, and I might ask NRR to supplement my answer if I'm not quite complete, was to have a regulatory follow-up on the activities that we understand the industry has taken on their own to verify that the plant procedures and equipment for severe accidents, for the types of things I discussed that came out of the 9/11 event: that all of those pieces of equipment, temporary hoses, fittings, procedures, that all those things are, in fact, still in place, that the operators are cognizant of them, that they've been trained for whatever reason, to make sure that they haven't fallen into disuse because they haven't been used.

So it was really a regulatory verification that the industry's initiatives on this front have, in fact, been taken, and that we will be following up on the results of those assessments, and doing our own sampling check, as we always do.

COMMISSIONER SVINICKI: Okay, and so those were the items, based on what we know now, that we identified as being of the highest interest, at least in the immediate term, okay?

MR. BORCHARDT: Yes.

COMMISSIONER SVINICKI: Thank you. Thank you, Mr. Chairman.

CHAIRMAN JACZKO: Did you have any other questions? Commissioner Apostolakis.

COMMISSIONER APOSTOLAKIS: Thank you, Mr. Chairman. Bill, you mentioned that the -- well, first of all, we know that there is a number of Mark I BWRs in the United States, which is the same design as those in Fukushima. But you also said that in the recent past we hardened the venting valves of the containment. Have the Japanese done this?

MR. BORCHARDT: That, we're not clear on. I'm not sure; I can't really answer that question.

COMMISSIONER APOSTOLAKIS: I guess the question is, if they had done it, would that have affected the accident? And in what way?

MR. BORCHARDT: Well, it would not have affected the loss of off-site power, which is, right, the initiator. The hydrogen explosion aspect, though, possibly, is where the hardened vent would happen. There's two vent paths off of the U.S. Mark I containments. The preferred vent path takes suction, if you will, or has a release path from the airspace above a pool of water that's in the basement, it's in the torus of the Mark I containment, and that would allow for the steam that went into the torus to be scrubbed of fission products, so you would have a release; it would relieve the pressure, which is the main objective of the vent, is, you want to maintain the containment integrity. And it's preferable to vent it on purpose to get the pressure so that you don't have a catastrophic failure of the containment.

And so that release path is exterior to the plant. So it's at least my belief that you wouldn't have the hydrogen accumulation in the upper levels of the reactor building, which we believe is the cause of the explosions. Now, the spent fuel pools on these designs are also on that same level, on the upper level of the reactor building. So it's, the hardened vent wouldn't do anything to help hydrogen that came from the spent fuel pool

COMMISSIONER APOSTOLAKIS: I see, okay. Now you also mentioned that we have extra equipment for beyond-design basis accidents that were installed, so-called B.5.b that were installed after the September 11 attacks. Did the Japanese have any of those?

MR. BORCHARDT: Again, I'm not sure. I -- really, we're trying to get information, but I am not personally aware of the situation in Japan.

COMMISSIONER APOSTOLAKIS: Okay. Thank you. Some people are asking why did the Germans shut down their plants, or some plants, after the accident, and we did not? Are we less prudent than the Germans?

MR. BORCHARDT: No, I am not aware of the basis for the German decision to do that. I'm 100 percent confident in the review that we've done, and we continue to do every single day, that we have a sufficient basis to believe, to conclude that the U.S. plants continue to operate safely. So I -- we've asked ourselves the question every single day: Should we take a regulatory action based upon the latest information? And, because of the kinds of things that I outlined in my presentation, we have not reached the conclusion.

COMMISSIONER APOSTOLAKIS: Thank you. Now, of course, the seismic risk is at the forefront of the news. And we hear that -- well, first of all, our press releases emphasize that the seismic design is based on the horizontal ground acceleration at the plant. But, of course, most people think in terms of the Richter scale. And also we hear that the earthquake of magnitude 9 at Fukushima had not been anticipated.

Now, we say that in the United States, we design the plants by looking at the historical record, and then by, we add margins. Now I understand, or believe, that the strongest earthquakes in the United States have occurred east of the Rocky Mountains in the 1800s, and the magnitude was between 7 and 7.7 on the Richter scale, something like that. So immediately you get the question, then, yeah, okay, you design against those, but look at Japan: What if you had an earthquake of magnitude 9? How does one answer that question? I mean, you can always ask, what if an earthquake of 9 and a half occurred. I mean, is there a rational way of addressing that?

MR. BORCHARDT: Well, my explanation is one that I know you understand this, but we look at faults around the U.S., we have that information. We look at the historical record, look at what the maximum earthquake has been, and then, as with everything we do, we add margins. But we also look at the specific location in relation to the fault, and consider the kinds of soil and rock formations that are between the fault location and the site, and do an analysis to see what is the ground motion that would actually be seen at this site. And we design for an earthquake of a certain size, or a, you know, I'm falling into the trap of saying "an earthquake of a certain size", of a ground motion of a certain magnitude.

But then, having said that, all of these other things: severe accident management guidelines, the B.5.b procedures, we have programs in place, equipment in place, that says, even if we were wrong, and the plants suffered this kind of serious event, we have, in fact, the activities, the equipment, ready, and practiced to respond to protect public health and safety. So I don't know if I should throw a seismic lifeline here, if you wanted to get into any more detail on seismic issues.

CHAIRMAN JACZKO: And just say your name.

ANNIE KAMMERER: Thank you. My name is Dr. Annie Kammerer, I'm in the Office of Research. I think I'd like to make a couple of points. The first point is related to the ground motion in Japan. Recently, starting in 2006, the Japanese regulatory agency performed a study in which they looked at increased hazard, perception of hazard at the plants. And recently themselves did a reevaluation of the impact that potential increased hazard at the facilities, and actually were in the middle of this when this event occurred. As a result, a number of modifications were made to the plants.

At this point, it's not clear exactly what modifications the Fukushima plant had already had implemented. However, the ground motions for which the plant was reevaluated, is about .62G; the original design basis was about .37G. Based on the preliminary information that we have, .62G is in the range of the ground motions that were actually experienced by the plant, although they came from a different earthquake than was anticipated. The ground motions that, for which the plant was assessed, was a 7.1, very close to the plant. That's what produced the ground motions of 6.2.

So, one thing that we believe is that the ground motions at the plant, even though it was a different event, were not out of the range that they had already considered. It's less clear with regard to the tsunami. Currently, the Japanese Society of Civil Engineers is finalizing guidance, probabilistic tsunami hazard assessment guidance for Japan. And it was anticipated that the Japanese regulator would do a similar study for a tsunami hazard assessment at the plants once that was completed. Unfortunately, because the guidance has not yet completed, it's not believed that they initiated that work.

So just to clarify, that even though this particular event was larger on the subduction zone than was anticipated, it probably didn't greatly exceed the ground motions. The one exception to that may be in the long period range. Because if you have a larger amount farther away, you get more long period content than would be anticipated from a 7.1 close in. The second question, or the second point is in regard to a seismic hazard in the United States. As was mentioned, we are undertaking a program, Generic Issue 199, which is looking at the potential impact to assess risk, given a perceived increase in the ground motion hazard in the Central and Eastern U.S., which was initiated by the new USGS seismic hazard mapping work that was done. And it's important to note that when the modern analysis techniques that are used are probabilistic techniques, those are the basis of the maps, and they account for basically all sources and the potential for all the different magnitudes that are capable of those sources, up to and including maximum magnitude events which, in many cases, exceed that which we have seen in the historic record. It was mentioned that the largest, the most widely-felt earthquakes in the U.S. were the 1811-1812 New Madrid events, which we currently believe were about a magnitude 7. And yet, we do look at, particularly in portions of the crust of a potential for exceeding that. Of course, we also account for the likelihood that that event occurs. And that also accounts for background seismicity, which is common in the east, which is seismicity which cannot be attributed to a specific fault.

In fact, it's important to note that seismicity in the Central and Eastern U.S. tends to be in what we call seismic zones, which are not directly attributable to a fault. And we account for all of the hazard in the seismic zones. One of the questions which has come up repeatedly is, how many plants are near faults? Or, how many plants are in moderate or high seismicity regions? And that's a very challenging question to answer, because these seismic zones are not well-defined boundaries. The faults that were the causative faults in the 1811 and 1812 earthquakes have never been identified, in part because they're under a very deep -- the very deep sediments in the Mississippi region. And so we have to account for the uncertainty in the location, we have to account for the uncertainty involved in the maximum magnitudes. And all of that is incorporated in the hazard analyses that we undertake.

The Generic Issue Program is using the most state-of-the-art types of analyses, which do look at earthquakes, and include earthquakes beyond the design basis. So, in that way, we directly account for those potential sources and those potential earthquakes, which are not under our current licensing basis. And we're currently assessing the risk from the possible beyond-design basis events.

CHAIRMAN JACZKO: Well, thank you for that, Annie. Commissioner Apostolakis, did you have additional comments or questions?

COMMISSIONER APOSTOLAKIS: Yeah, I'd like to make one comment and then ask my last question. Annie mentioned several times, probabilities, even after we do the probabilistic analysis, we still have Defense in Depth in mind, which is the current way of looking at things. So it's not just, what is the most likely event that we anticipate, we always ask that question that Mr. Borchardt mentioned: what if we are wrong? And we take additional measures.

So I think that's very important, for people to understand it. Because, you know, probabilities, sometimes, are easy to attack.

One last question, thank you Annie. As you mentioned, the damage in Fukushima was not really caused by the earthquake; it was the tsunami that came afterwards. So the question now is: when we license our plants here, are we considering this one-two punch? Are we considering an earthquake followed by a tsunami, as appropriate? Or a major fire, or a flood, because tanks holding water fail? Because this secondary event seems to be, now, very important, and we have to account for it. So how are we approaching this issue in the United States?

MR. BORCHARDT: Well, the design basis includes many different analyses. I would just say one thing about the earthquake in Japan. We don't know what the impacts of the earthquake are inside of the reactor buildings, specifically, that's where most of the equipment of interest to us would be located. It may have survived perfectly well, and stayed perfectly functional, or there may be damage that we just don't know about. So we need to see what the inspection results are, once they have access to the plant.

But our reviews for the U.S. include, it's always very site-specific. So, you know, for earthquakes, if they are in a very soft soil environment, there's not a very challenging review that's required, or analysis that's required on earthquakes. But it might be that you need a storm surge for a hurricane, or a storm surge for a tsunami. But there are multiple -- you don't take every possible current event and pile them all together into one event. So it's done more on an event by event basis, so I don't know if --

COMMISSIONER APOSTOLAKIS: [inaudible] or something else?

CHAIRMAN JACZKO: Well, I think that, and Eric, maybe you could just answer the question. I think it's, more generally, how do we -- do we consider separate design basis events -- do we consider design basis events separately, or do we consider all design basis events simultaneously on a plant?

MR. LEEDS: Eric Leeds, Director of the Office of Nuclear Reactor Regulation. As Bill mentioned, we take into account whatever natural phenomena could occur at a particular site, whether it's a hurricane, a tsunami, an earthquake, a tornado, what have you. And we have them analyzed site-specifically. Now, I'm not exactly sure if I understand the question directly. Are you asking, a seismic event followed by a tsunami? Well, I know that we analyzed for a tsunami, we analyzed for the maximum storm surge, as Mr. Borchardt mentioned, and also what kind of a run-out would happen. Typically, tsunamis are triggered by an earthquake. So, one or the other, we would analyze for that. And we've done that for our plants on the coast.

COMMISSIONER APOSTOLAKIS: Thank you, Mr. Chairman.

CHAIRMAN JACZKO: And I would just echo, I think, Bill's comments. We are at a very early stage now, too, and detailed information, it's probably going to be some time until we have it. And so exactly the impacts of the tsunami and/or the earthquake and what their effects on the plant were will probably still take some time to understand. Commissioner Magwood?

COMMISSIONER MAGWOOD: Thank you. Good morning, Bill.

MR. BORCHARDT: Good morning.

COMMISSIONER MAGWOOD: Did you get some sleep this weekend.

MR. BORCHARDT: Not much.

COMMISSIONER MAGWOOD: Not much? I'm sorry. You'll get there at some point. There's been a lot of discussion in the media about -- that compares what's happening in Japan to Three Mile Island. And I, as I look at this, and again, we're so early in this, I tend not to think as much about Three Mile Island as I do 9/11. And one reason I think about that is because it seems to me that there are, certainly, a lot of lessons learned, a lot of technical details we'll have to sort out over time. But I wondered, also, whether, as in the case of 9/11, is there a major conceptual "Ah-ha!" that's sitting out there in front of us? And I want to make sure we don't miss that forest while we're looking at all these trees.

And in the case of 9/11, it wasn't just simply, you know, that we need to do a better job protecting, you know, airplane cockpits, and lots of other security upgrades. It was a conceptual "Ah-ha!" that the threat is a lot different than we thought it was. Do you, as you look at this at this early stage, do you see a bigger message out there that we should be thinking about?

MR. BORCHARDT: I don't see a significant weakness now, but that's why we need to do this Quick Look review. And my personal view is that what we need to do is take some very experienced people that are both within the staff, and maybe take some even recently retired people that have expertise in the broad areas of design review and licensing, and let them just focus on the question of, is there something here that causes us to question these, the way we've applied Defense in Depth, and being risk-informed, and the various barriers of radiation release protection, and those kinds of things, and evaluate whether or not there's something different that needs to be done.

It hasn't actually occurred to me, if anything, it's given me a bit of a confidence, if you will, that all of those redundancies, and all of our processes, are paying off. I mean, it was maybe in the view of some stakeholders overly conservative, the way we've approached it, but I think we're seeing the value and the benefit of that approach that we've used for the last 35 years.

COMMISSIONER MAGWOOD: I appreciate that, and I agree with it. Let me give you some, just sort of, thoughts about where I think there might be some larger issues to think about. And that is, in looking at, as we've described them, again, we don't know all the details yet. But we do have the sense that the plant seemed to survive the earthquake. And we do have the sense that the tsunami's disabling of the backup power systems led to the situation that followed. But even beyond that, there's the fact that there was so much difficulty in bringing resources to the plant to recover from that situation.

When you look at our plants, we certainly have done things in B.5.b and other things to upgrade our ability to recover from site blackout; and we're going to be looking at those issues. But if you lose a lot of infrastructure, if you lose the ability to get to a site, if you lose hundreds of miles of transmission line, if you lose the ability to have rail transport, to move equipment around, that's something I don't know that there's been a lot of thought about.

And I wonder if you could reflect on that for a moment, because when I look at this event, I see a significant struggle over -- especially over the early part of this, to get the right resources to the plant to be able to recover from this accident. And even today, we still are struggling to hook up the AC power to Units One and Two, as you've described. When you think about this, and again we'll look at this in great detail as we go forward, do we even have the regulatory scope to cover all the ground that needs to be covered, to assure that the infrastructure's in place to be able to recover from an accident like this?

MR. BORCHARDT: I think there's a couple levels that maybe I'd like to touch on in response to that question. The first is, and I have no idea what the situation is in Japan regarding their regulations and what they have in place, so I'm not implying whether they had it or didn't have these kind of things. But in the United States, I mentioned the station blackout rule, which is a rule that requires an analysis of what would happen at a plant and its coping strategy for dealing with a complete loss of all AC power. So that assumes that the diesels don't -- that you'd lose the transmission lines and the diesels don't start, and then they have to do an evaluation and it's a coping study, how they would be able to restore the plant. That has resulted in various approaches at different sites. Some have a gas turbine that is on the site that could be very quickly hooked up into the grid -- not into the grid, into the plant. There's others that have non-safety-related diesel generators. There are plants that have diesel fire-pumps so that there is a backup to a backup to a backup way to inject water into the core and into the spent fuel pool. So there's a regulatory construct that's required and mandated that type of activity.

From a U.S. Government perspective, coming out of 9/11, we had the Department of Homeland Security, which is positioned to orchestrate the entire federal response to an event of magnitude that, you know, you might be suggesting, that would happen so that the full resources of the U.S. Government would be able to use different resources to get temporary equipment to a site in order to provide electrical power, temporary diesel generators, that kind of thing.

And then the backstop for all of that, and I'm now leaving the kind of federal regulatory requirement perspective, is that the U.S. industry, I think, is unique in the world, but also within industry in this country in that while on the one hand they're competitors, on the other hand they share operating experience, they have programs that they all contribute to, and they have an inventory of spare parts and equipment that can be very quickly brought to bear in responding to this kind of an event. So this is outside the regulatory purview, I want to make clear, but that is yet another backstop that would help a site that had a similar kind of problem respond to it in a quick and effective manner.

COMMISSIONER MAGWOOD: I appreciate that, and let me also echo your somewhat positive words about the industry. I think in this particular instance, actually, I think the industry in the U.S. and internationally has responded very, very well to this. I particularly congratulate INPO's efforts, through WANO, to work with international partners and also to take positive action here in the United States. I think they've done a good job, and I think NEI and others have worked together and I think individual companies have done a lot, so I congratulate the industry for reacting that way.

Let me move on to a little bit different subject. We've talked a little bit about hydrogen already this morning, and the measures we have to deal with hydrogen. Is it your understanding that all the hydrogen that led to the explosions came from the spent fuel?

MR. BORCHARDT: I wouldn't want to hazard a guess. It was certainly a likely source; whether it was all of it or not, I couldn't guess.

COMMISIONER MAGWOOD: You've talked about this a little bit, but I want to give you a chance to sort of give a little bit more of a holistic response to this. What measures are in place to prevent hydrogen from collecting and exploding in U.S. plants? Mark I's or others.

MR. BORCHARDT: Well, the hardened vent, of course -- the U.S. design approach is to protect the containment. It's to ensure the integrity of the containment, and if you can do that, even if you have fuel damage, then you can prevent the uncontrolled release of radioactive materials into the environment. And so this is -- Three Mile Island, for example, had core damage, a significant amount of core damage, yet the radiological releases were very limited from Three Mile Island, so there was negligible health effect from that accident. So hardened vents will allow the primary containment to stay intact and that's probably the single most important thing.

The other thing to maintain the containment is, for this particular design of containment, we've required, I think since the late 80s again, inerting of the containment. So it's filled with nitrogen, so if you don't have oxygen in the containment, even if you did have hydrogen in there, you're not going to have an explosion or a fire. So I think those are the two, probably the biggest ones, and I don't know if there's anything that we need to add.

COMMISSIONER MAGWOOD: Appreciate that. One more question, Mr. Chairman. Also to just give you a chance to clarify. I know there's a lot of chatter in the press over the weekend about the impact of 50-mile evacuation zones around U.S. nuclear plants. Could you sort of give the NRC's position on what the emergency planning requirements are, and why we're confident in what we have today? Can you please elaborate?

MR. BORCHARDT: We have, as part of the emergency preparedness construct in this country, a 10-mile emergency planning zone that completely encircles every reactor plant in the country. That, in coordination with FEMA, who has an offsite emergency-preparedness role throughout the country, is routinely practiced. We have models that would do an analysis of what the release paths are; we take into account the meteorological conditions; and the NRC, I should be clear, the NRC does not make the recommendations regarding evacuation or any other protective action guidelines; that's the responsibility of the state government, so it would be the governor that would ultimately be making that decision. But we're in a position to provide independent assessment and advice to the governor in those kinds of circumstances.

The situation that led to the 50-mile guidance in Japan was based upon what we understood and still believe had existed, that there was degraded conditions in two spent fuel pools at the site, and in all likelihood some core damage in three of the reactor units. Based on the situation as we understood it at that time, we thought it was prudent to provide the recommendation to the ambassador to evacuate out to 50 miles in Japan. It was not based on the existing radiological conditions, but what at that time was a possibility. And so we thought it was the prudent, conservative suggestion. If those conditions existed in the United States, we would have made the exact same recommendation. But the idea that there might be some misunderstanding, that because we have a 10-mile EPZ, that would be the extent for what we would consider and what our emergency planning recommendations would be limited to, is not true at all. We would have done the exact same kind of analysis and gone through the same thought process to consider extending evacuation or whatever protective measures we thought were appropriate.

COMMISSIONER MAGWOOD: Thank you. Thank you, Mr. Chairman.

CHAIRMAN JACZKO: Commissioner Ostendorff.

COMMISSIONER OSTENDORFF: Thank you, Mr. Chairman. Bill, again I thank you for your leadership in this effort, and for the hard work and professionalism of your teams. It was helpful in your opening statement, where you talked about the history of the NRC post-Three Mile Island, post-9/11, as to what steps or additional measures were considered or in fact implemented; and so I think that history is very relevant to the near-term and longer-term efforts. Certainly there's Hurricanes: Andrew, Katrina that this country has faced. Also provide data points for various steps taken, whether they be specific to the nuclear field or external to the nuclear field. Does any of the experience from your career at NRC, do you have any significant lessons learned from the process, not the substantive technical details, but the process that was employed following these other significant events that would help inform the task force execution of its mission?

MR. BORCHARDT: Well I think it's very important that the task force keep the broad perspective of the regulatory framework that exists within the NRC, and the legal framework that exists within the United States. Because there is a temptation to, I think, try to pile in every good idea that exists into something that becomes unmanageable, and in the ultimate could actually end up being counterproductive to safety.

There was a degree of that, in my opinion -- this is only speaking my personal opinion -- after Three Mile Island, because when I started with the agency in 1983, we were still in the midst of following up the actions from the

Three Mile Island action plan. It was a NUREG-0737, and anybody who started in the NRC has that number burned into their brain because we spent enormous amounts of resources following up on those activities. Some of those fixes that I alluded to were absolutely instrumental in improving the safety in this country. Some were, I believe, if we had carried them all out, might have actually been counterproductive in a way, just not contributed to safety. They might have been a good idea in somebody's mind. So there needs to be -- after you go through the brainstorming and identification of all possible things to change, I think there needs to be a good evaluation, thorough evaluation, of what's the right thing to do, and in what kind of sequence and in what kind of timing.

COMMISSIONER OSTENDORFF: Okay. Well I'll just make two comments on that. One thing, just for information, you may be aware of this, but about a year ago the National Academies undertook a significant study for about 9 or 10 federal agencies, to look at disaster resilience in this country, specifically from the context of inter-agency coordination, roles and responsibilities. But nothing there was, or to my knowledge is currently nuclear-specific. The extent of interagency coordination for various types of events in this country is a prime subject of that study. There may be some value in looking at that.

And refer to Commissioner Magwood's questioning on the transportation logistics support, which I completely agree have been issues here so far, in this particular response. One might take note of the Department of Defense's efforts, since the loss of the U.S.S. Thresher back in 1963. There's been a very operationally ready deep-submergence rescue vehicle, DSRV, on standby close to airplanes on the East and West Coast of the United States to provide a response. So other agencies, the point is, have gone through similar analogues in looking at how they might deal with particular responses, and that's something just to note.

Also, kind of maybe staying a little bit on the big-picture historical nature of some of the prior NRC responses to these big events, it also strikes me that perhaps the audience or the recipients of these reports will be representing a broader cross-section than typical Commission meetings. Certainly we have nuclear industry, we have many of the same stakeholders from issue to issue, but in my personal opinion is that this is one where how we communicate to John Q. Public, the person that doesn't have a stake in the industry or is not part of one of the normal stakeholder groups, but also deserves and needs to receive a reply that they can understand, is really essential. Is there anything from your prior experience here at the NRC, either 9/11 or Davis-Besse or the 2003 blackout, that you think would be in your initial thoughts on how we communicate so that people in the American public understand what the results are of these near-term and longer-term efforts?

MR. BORCHARDT: Well, and again this is just my view, my assessment, I think that especially in the long-term review that we do, we need to build in a meaningful engagement with all the stakeholders. They have an enormous capability to understand the most technical issues. Sometimes we think that capability doesn't exist, but it's in fact not true. And we have had enormously valuable input from a wide range of stakeholders. This is a little bit off of event response, but when we established the reactor oversight program -- we did it 10 or 12 years ago -- we used just that kind of an approach. We brought in all kinds of different stakeholders from all different perspectives, and it was a very impressive end result that had everyone's buy-in. People who came from pro-nuclear, anti-nuclear, and they all agreed that this was a good approach to perform regulatory oversight. I think the same kind of mindset is important to enter into this long-term activity, and start at the beginning. Where we get into trouble as a regulator is when we have our mind made up, or even if we don't have our mind made up, there's a perception we already have our mind made up, and then we begin the engagement. So I think we need to do it right from the very beginning, have it be a very open and transparent process.

COMMISSIONER OSTENDORFF: Thank you. I know as the Chairman indicated in his comments earlier, there's much we don't know. There'll be significant periods of time before we have full granularity, a lot of the details of what happened at Fukushima, but there's one area, if you'll just bear with me, that I do want to ask you about. I've been here not quite one year; I've spent very little time looking at spent fuel pools. When I go visit a plant, I'll go see the pool, and on some of these visits -- I've probably seen four, I think, in the last year. But I certainly don't have much background at all in the spent fuel pools. And recognizing that's been the focus of a lot of the concerns over the last 10 days, and that perhaps compared to our discussions, we have an emergency core cooling systems and GSI-191 and other issues that we don't spend a lot of time, as a Commission, really talking about that.

Is there any initial area of U.S. reactor plant spent-fuel configuration or operation that comes to your mind as warranting particular exploration in this task force?

MR. BORCHARDT: Well clearly, it's a very simple problem. All you have to do is keep water in the pool. The pool is an open vessel, and the only objective is to keep water in it. Even if, in a bad situation, it were to heat up and you had boiling in there, as long as you kept the fuel covered with water, you're going to prevent the high radiological release. So I think what the task force needs to do is to go down the specifics of what happened in Japan, and then evaluate that to make sure that in fact, these things that we put into place after 9/11, for example, really would work under that scenario.

We have thought about things like making sure that the equipment you're going to use wouldn't be damaged in the event that caused the first problem, so you can't have everything staged exactly where it's ready to be used. There has to be some staging areas. But for example, on the tsunami or a flooding issue you wouldn't want the equipment now stored outside, right? Because it would be swept away. So you know, it's yet another "what if" to really help us explore and probe what the various scenarios are being, and make sure we have the highest probability of success. I think that's really the box we need people to be thinking in.

COMMISSIONER OSTENDORFF: That's very helpful. Thank you. Thank you, Mr. Chairman.

CHAIRMAN JACZKO: I'd ask at this point if there are any other questions that any of my colleagues have.

MR. BORCHARDT: Well at this point, can I just --

CHAIRMAN JACZKO: Sure, Bill.

MR. BORCHARDT: Can I just -- I'm not going to ask you a question.

[laughter]

CHAIRMAN JACZKO: I'm not sure I'd have answered it for you if you did.

[laughter]

MR. BORCHARDT: I do want to just take a moment and thank all the NRC staff that have responded to this event, all the people that are in the Ops Center -- we're doing our best to have a rotation of people in and out of there, but they're working very hard, very long hours. They're still doing their real job too, like I said, that's got to be our first priority. But I want to just make special note of the team of people that volunteered to go to Japan on no notice, that have been there working incredibly long, hard hours, working in a way that there is no operating procedure to operate. They have had to develop it on the go. So Chuck Casto happens to be the team leader, but there are many people that have worked very hard. We have sent another person over to help Chuck in that team-leader role, and there is the next wave of NRC employees that have volunteered, and they'll be leaving beginning, I think it's tomorrow. And then the last element of that group on Thursday. So I just want to make special note of their commitment and professionalism. Thank you.

CHAIRMAN JACZKO: Well thanks for that, Bill. I appreciate that, and your work as well, I think, as I've noted. At this point I would just offer that we do have a proposal that's been circulated that I think captures at a high level some of these ideas for a path forward, and I would certainly encourage that we move on that as promptly as possible. But I thought I'd offer at this time an opportunity, if anybody wants to make comments on that or any of the other issues that we have in front of us. Commissioner Ostendorff?

COMMISSIONER OSTENDORFF: I just thank you for convening this meeting today. I think it's been very helpful, and I know that we're all ready to move forward to take the actions we need to take.

CHAIRMAN JACZKO: Okay. Well again I want to thank everybody for their efforts so far, and again, I just want to reiterate as we close that as many people on this side of the table have indicated, we have had, many of us, very close and personal relationships with colleagues in Japan, and our hearts go out to them as they continue to deal with this very difficult event, and we will continue to work to provide our colleagues and counterparts in Japan with assistance as they need it, to deal with the situation. And I think as Commissioner Magwood indicated, this is likely the first of many discussions we will have on this topic, and I look forward to continuing the discussion and continuing our focus on our important health and safety mission. With that, we are adjourned. Thank you.

[Whereupon the proceedings were concluded]

Dion, Jeanne

From: Bowman, Gregory
Sent: Tuesday, March 22, 2011 8:21 AM
To: Dion, Jeanne
Subject: RE: Commission Meeting on Japanese Events

Sorry - I meant to delete all those e-mails back and forth between Alan and George before I sent this to Brian, but I guess I forgot. I realize that last week you were volunteering to help with answering questions at yesterday's Commission meeting, not take the lead for a separate Commission meeting.

-----Original Message-----
From: Dion, Jeanne
Sent: Tuesday, March 22, 2011 8:11 AM
To: Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael
Cc: Bush-Goddard, Stephanie; Rini, Brett; Armstrong, Kenneth; Bowman, Gregory
Subject: RE: Commission Meeting on Japanese Events

Brian,
RES involvement with the commission meeting (monday 3/21) was as a pass-thru for information from the PMT in the Op center. I provided talking points and Q&A on potential consequences (all information coming from the Op center).

Jeanne

From: Bowman, Gregory
Sent: Tuesday, March 22, 2011 7:51 AM
To: Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael
Cc: Bush-Goddard, Stephanie; Rini, Brett; Dion, Jeanne; Armstrong, Kenneth
Subject: Commission Meeting on Japanese Events

I just learned that we're working towards scheduling a near-term meeting on the events in Japan, with a focus on radiological consequences and potential health effects. The current thinking is that RES would have the lead for this meeting, which will most likely take place on April 14.

The meeting would involve discussion of (1) status of the event (maybe led by NRR), (2) radiological impacts, and (3) radiological significance. The external panel might involve other Federal agencies (e.g., EPA, DOE), HPS, industry, and/or a representative from one of the labs, although it could end up being a challenge to get participation given the timeframe. We would just need to give SECY suggestions and let them take care of the invitations.

Alan Frazier put together the attached draft scheduling note, but it will need to be revised. My understanding is the SECY will likely need a revised scheduling note back today to get to the Commission. Please let me know as soon as you can if you think the lead for this meeting should be assigned to a different office (if that's the case, we'll need to circle back with Mike).

Greg

From: Frazier, Alan
Sent: Monday, March 21, 2011 4:47 PM
To: Bowman, Gregory
Cc: Brock, Kathryn; Andersen, James; Wittick, Brian; Merzke, Daniel

H-82

Subject: RE: ACTION: Draft Scheduling Note for New Commission Meeting

Greg,

FSME tells me that last week RES agreed to take the lead in any discussion of rad consequences or health affects if those topics had come up during today's Commission meeting. The Commission would now like to have a Commission meeting in April focused on rad consequences and health effects.

Could you please confirm with RES tomorrow that they should have the lead for the April Commission meeting? Note that it was Jeanne Dion that agreed RES should have the lead last week (see attached email) but I am not aware of any front office interaction on this.

Alan

From: Deegan, George
Sent: Monday, March 21, 2011 4:29 PM
To: Frazier, Alan
Cc: Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel
Subject: RE: ACTION: Draft Scheduling Note for New Commission Meeting

Alan- Thanks for forwarding Jim Andersen's email.

When Allen Howe's Working Group was assembled last week to construct an outline for today's Commission briefing, the rad consequences/health effects issue was identified as originally marked as an FSME potential topic, but we later determined that RES would be better to take lead (with SOARCA etc.). I'd think they'd be the best ones to lead any new Commission briefing in April on this topic. I'll forward you that email chain separately.

From: Frazier, Alan
Sent: Monday, March 21, 2011 3:42 PM
To: Deegan, George
Cc: Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel
Subject: ACTION: Draft Scheduling Note for New Commission Meeting

George,

Please take a look at Jim's note below from today's agenda planning meeting which was held immediately after the Commission meeting.

Note in particular the highlighted new Commission meeting in April on the Japan event with additional focus on radiological consequence / health effects (probably around 4/14). FSME will have the lead for this new Commission meeting. Additionally, I got some feedback from Jim that you should consider having the following elements in the scheduling note.

- Status of event
- Radiological Impacts
- Radiological significance
- External panel

ACTION: In cooperation with NRR and NSIR (and any other offices you feel should be involved) please take the lead for developing a scheduling note. I have attached a initial draft to help get you started.

I do not know when this action will be due but I wanted to give you a head-start. We are still waiting for SECY's official summary of the meeting, which usually contains due dates for the draft scheduling notes.

Please let me know if you have any questions.

Regards,

Alan L. Frazier
Executive Technical Assistant
Office of the Executive Director for Operations U.S. Nuclear Regulatory Commission
301-415-1763

From: Andersen, James
Sent: Monday, March 21, 2011 1:35 PM
To: EDO_TBPM Distribution
Cc: Muessle, Mary; Weber, Michael; Virgilio, Martin; Ash, Darren; Landau, Mindy
Subject: Agenda Planning Meeting

ETAs,

The Commission held an Agenda Planning Meeting this morning. SECY will provide the formal summary, but I wanted to let you know a couple things as quickly as possible:

- The 10CFR50.46(a) Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Bill Ruland was informed)

- The SMR Commission meeting on 3/29 is still on (Mike Mayfield was informed)

- The Source Security Commission meeting on 4/19 is still on (Josie Piccone was informed)

- The ITAAC Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Mike Mayfield was informed)

- The EEO/Human Capital Commission meeting was moved to June 2 (Kris – please advise HR and SBCR)

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- The AARM Commission meeting on 5/27 is still on (Brian please advice NRR)

- The Emergency Planning Final Rule Commission meeting was moved up to May 12 (left Bob Kahler a message)

- The ACRS meeting on 6/6 is still on

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Several new meetings were added:

- 30, 60, and 90 day status meetings regarding the Near-Term NRC Review Effort (task group?); probably around 5/3, 6/16, 7/18 (Jim A lead for scheduling note)

- Status meeting on the Japanese event with additional focus on radiological consequence / health effects; probably around 4/14 (Brian lead for scheduling note)

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- Stakeholder meeting on the staff's 90 day status report; probably around 7/25 (Jim A lead for scheduling note)

Dion, Jeanne

From: Bush-Goddard, Stephanie
Sent: Tuesday, March 22, 2011 11:38 AM
To: Dion, Jeanne
Subject: RE: Commission Meeting on Japanese Events

Jeanne,

Can you forward that email to me. I would like to see what was discussed from the PMT team.

I am a member and thinking of future RES research centered around dose and radiological consequences.

Thanks
-Steph

-----Original Message-----
From: Dion, Jeanne
Sent: Tuesday, March 22, 2011 8:11 AM
To: Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael
Cc: Bush-Goddard, Stephanie; Rini, Brett; Armstrong, Kenneth; Bowman, Gregory
Subject: RE: Commission Meeting on Japanese Events

Brian,
RES involvement with the commission meeting (monday 3/21) was as a pass-thru for information from the PMT in the Op center. I provided talking points and Q&A on potential consequences (all information coming from the Op center).

Jeanne

From: Bowman, Gregory
Sent: Tuesday, March 22, 2011 7:51 AM
To: Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael
Cc: Bush-Goddard, Stephanie; Rini, Brett; Dion, Jeanne; Armstrong, Kenneth
Subject: Commission Meeting on Japanese Events

I just learned that we're working towards scheduling a near-term meeting on the events in Japan, with a focus on radiological consequences and potential health effects. The current thinking is that RES would have the lead for this meeting, which will most likely take place on April 14.

The meeting would involve discussion of (1) status of the event (maybe led by NRR), (2) radiological impacts, and (3) radiological significance. The external panel might involve other Federal agencies (e.g., EPA, DOE), HPS, industry, and/or a representative from one of the labs, although it could end up being a challenge to get participation given the timeframe. We would just need to give SECY suggestions and let them take care of the invitations.

Alan Frazier put together the attached draft scheduling note, but it will need to be revised. My understanding is the SECY will likely need a revised scheduling note back today to get to the Commission. Please let me know as soon as you can if you think the lead for this meeting should be assigned to a different office (if that's the case, we'll need to circle back with Mike).

Greg

H-83

From: Frazier, Alan
Sent: Monday, March 21, 2011 4:47 PM
To: Bowman, Gregory
Cc: Brock, Kathryn; Andersen, James; Wittick, Brian; Merzke, Daniel
Subject: RE: ACTION: Draft Scheduling Note for New Commission Meeting

Greg,

FSME tells me that last week RES agreed to take the lead in any discussion of rad consequences or health affects if those topics had come up during today's Commission meeting. The Commission would now like to have a Commission meeting in April focused on rad consequences and health effects.

Could you please confirm with RES tomorrow that they should have the lead for the April Commission meeting? Note that it was Jeanne Dion that agreed RES should have the lead last week (see attached email) but I am not aware of any front office interaction on this.

Alan

From: Deegan, George
Sent: Monday, March 21, 2011 4:29 PM
To: Frazier, Alan
Cc: Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel
Subject: RE: ACTION: Draft Scheduling Note for New Commission Meeting

Alan- Thanks for forwarding Jim Andersen's email.

When Allen Howe's Working Group was assembled last week to construct an outline for today's Commission briefing, the rad consequences/health effects issue was identified as originally marked as an FSME potential topic, but we later determined that RES would be better to take lead (with SOARCA etc.). I'd think they'd be the best ones to lead any new Commission briefing in April on this topic. I'll forward you that email chain separately.

From: Frazier, Alan
Sent: Monday, March 21, 2011 3:42 PM
To: Deegan, George
Cc: Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel
Subject: ACTION: Draft Scheduling Note for New Commission Meeting

George,

Please take a look at Jim's note below from today's agenda planning meeting which was held immediately after the Commission meeting.

Note in particular the highlighted new Commission meeting in April on the Japan event with additional focus on radiological consequence / health effects (probably around 4/14). FSME will have the lead for this new Commission meeting. Additionally, I got some feedback from Jim that you should consider having the following elements in the scheduling note.

- Status of event

- Radiological Impacts

- Radiological significance

- External panel

ACTION: In cooperation with NRR and NSIR (and any other offices you feel should be involved) please take the lead for developing a scheduling note. I have attached a initial draft to help get you started.

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Dion, Jeanne

From: Rini, Brett
Sent: Tuesday, March 22, 2011 11:48 AM
To: Dion, Jeanne
Subject: FW: Commission Meeting on Japanese Events

It seems like RES is on board with taking the lead. Here's the e-mail exchange from this morning that Greg just forwarded to me.

From: Bowman, Gregory
Sent: Tuesday, March 22, 2011 11:42 AM
To: Rini, Brett
Subject: FW: Commission Meeting on Japanese Events

From: Sheron, Brian
Sent: Tuesday, March 22, 2011 8:38 AM
To: Gibson, Kathy; Elkins, Scott; Bowman, Gregory
Cc: Uhle, Jennifer
Subject: RE: Commission Meeting on Japanese Events

I would Imagine EDO would introduce staff, and then appropriate staff would do the bulk of the briefing.

When will you be in the office so we can discuss?

From: Gibson, Kathy
Sent: Tuesday, March 22, 2011 8:35 AM
To: Sheron, Brian; Elkins, Scott; Bowman, Gregory
Cc: Uhle, Jennifer
Subject: Re: Commission Meeting on Japanese Events

Ok - do we know who is doing the briefing? Will it be EDO - just trying to determine level of detail.

Also, Greg, please pass on contacts in other offices if and as you get them. Thanks!

From: Sheron, Brian
To: Gibson, Kathy; Elkins, Scott
Cc: Uhle, Jennifer
Sent: Tue Mar 22 08:19:55 2011
Subject: FW: Commission Meeting on Japanese Events

See below, you got it.

From: Bowman, Gregory
Sent: Tuesday, March 22, 2011 8:17 AM
To: Sheron, Brian
Subject: RE: Commission Meeting on Japanese Events

It's on the schedule, and if you don't object to taking the lead, you've got it (for what it's worth, I saw an e-mail from Mike over the weekend indicating that he thought it belonged with RES, with coordination from the other offices).

H-84

From: Sheron, Brian
Sent: Tuesday, March 22, 2011 8:11 AM
To: Bowman, Gregory
Subject: FW: Commission Meeting on Japanese Events

Greg, see below. I need to know ASAP if this is a go and that RES has the lead.

From: Gibson, Kathy
Sent: Tuesday, March 22, 2011 8:07 AM
To: Sheron, Brian; Uhle, Jennifer; Scott, Michael; Bush-Goddard, Stephanie
Cc: Elkins, Scott
Subject: Re: Commission Meeting on Japanese Events

Yes we should lead (with NSIR/Ops Center support) and we can be ready. As soon as you tell me to launch, I will put a team together to work it.

From: Sheron, Brian
To: Uhle, Jennifer; Gibson, Kathy; Scott, Michael; Bush-Goddard, Stephanie
Sent: Tue Mar 22 07:56:32 2011
Subject: FW: Commission Meeting on Japanese Events

See below. Can we be ready to do this by 4/14? Should we be the lead?

From: Bowman, Gregory
Sent: Tuesday, March 22, 2011 7:51 AM
To: Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael
Cc: Bush-Goddard, Stephanie; Rini, Brett; Dion, Jeanne; Armstrong, Kenneth
Subject: Commission Meeting on Japanese Events
Importance: High

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301-415-1763

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- Stakeholder meeting on the staff's 90 day status report; probably around 7/25 **(Jim A lead for scheduling note)**

Dion, Jeanne

From: Bush-Goddard, Stephanie
Sent: Tuesday, March 22, 2011 12:27 PM
To: Dion, Jeanne
Subject: RE: URGENT: Support for Commission Briefing 3/21

Thanks....this helps

-----Original Message-----
From: Dion, Jeanne
Sent: Tuesday, March 22, 2011 11:49 AM
To: Bush-Goddard, Stephanie
Subject: FW: URGENT: Support for Commission Briefing 3/21

Since the 3/21 comm brief was a public meeting all information we collected was very high level. See below are Q&As and below- talking points.
I cleaned it up and provided it to the Alan Howe who was leading the commission brief on Monday.

From: Hoc, PMT12
Sent: Friday, March 18, 2011 12:01 PM
To: Dion, Jeanne
Subject: RE: URGENT: Support for Commission Briefing 3/21

Jeanne...please review for tech editing...we did this quickly and I can't be positive all responses are in full sentences. Please let me know if you have questions.

- Q: Should U.S. residents be using KI? A: It is the responsibility of the individual States to decide on the use of KI. It is EPAs responsibility to inform states of projected doses. Due to the extremely low levels of radioactivity expected on the U.S. West coast and Pacific States/territories, the NRC staff does not recommend use of KI.

- Q: The news report that other countries are moving embassies out of Tokyo. Is the US planning to move Americans out of Tokyo? Q: The staff continues to develop realistic modeling scenarios based on current information for Tokyo to help inform protective actions in Tokyo.

- Q: What is the relationship between the modeling being done by NRC and the modeling being done by DOE? A: This is a coordinated effort between NRC and DOE. NRC has expertise in developing source terms and dose assessments up to 50 miles. DOE supports estimates beyond 50 miles that are then used by DOE to develop analysis for dose projections for the United States.

- Q: What types of data does NRC/PMT have access to? A: The NRC is now receiving aerial monitoring dose data from DOE, information from the NRC DART team, recently getting real time meteorological data from the site, some limited onsite dose and meteorological data from Japanese officials.

- Q: What areas of the US will have dose assessments per the DOE analysis? The DOE has the lead for dose estimates in the US. The NRC has the responsibility for dose estimates for US people within Japan.

H-85

· Q: Earlier this week the Federal government, with input from the NRC, recommended that the emergency planning zone for evacuation around the Japanese reactors be expanded to 50 miles, which is different from the 20 km evacuation zone recommended by the Japanese. Based on aerial flight measurements, on 3/18/11 the DOE supported the Japanese protective measures of 20 km evacuation and 30 km sheltering . Will the NRC change their recommendation to evacuate to 50 miles? A: NRC policy is to not change protective action recommendations after they have been developed while the event is still in progress. Based on the information that NRC had at the time, we believed that the recommendation to expand the evacuation zone to 50 miles was appropriate. Since that time, NRC has been established as the lead for providing recommendations to the embassy in Japan. Given the current situation at the plant, the NRC currently supports the protective measures recommendation currently in place.

· Q: Will personnel currently in Japan be monitored for radioactive contamination before they return to the US? A: Personnel outside the 50 mile evacuation area are not expected to be subject to radioactive contamination. Data indicate that levels of contamination in these areas are at or below minimum detectable levels and special screening for radioactive contaminants is not warranted.

· Q: We understand that the Navy is evacuating Navy civilians, military personnel and their dependents from Japan. This seems to be in conflict with the NRC protective action recommendation to evacuate only out to 50 miles. A: The NRC developed its PAR as it would for any domestic event using available information incorporating conservative assumptions and assumptions for event progression. We understand the Navy did a used the same plant data to develop their PAR, however they may have used a different set of assumptions which led them to a different recommendation for their bases.

From: Dion, Jeanne
Sent: Friday, March 18, 2011 10:47 AM
To: Hoc, PMT12
Subject: RE: URGENT: Support for Commission Briefing 3/21

Thanks for the quick turnaround.

The attached is an overview slide with the PMT input (last 2 bullets plus talking points). Let me know if there are any inaccuracies- otherwise this is what's being used for the Bill Borchardt's presentation Monday.

I'll standby for the Q&A.

Thanks again,
Jeanne
251-7482

From: Hoc, PMT12
Sent: Friday, March 18, 2011 9:03 AM
To: Dion, Jeanne
Subject: RE: URGENT: Support for Commission Briefing 3/21

ACTION:
Task 1: Provide brief high level talking points about monitoring activities in the Op Center to predict the potential consequence in the US.
Helpful information could be explaining what the RASCAL code is (at a high level). Provide draft of talking points to me by 8am Friday 3/18 morning.

Talking Points for PMT and RASCAL:

· The Op Center incident response teams have been staffed around the clock since last Friday and have been actively monitoring events.

· The Protective Measures Team has been attempting to model potential offsite doses based on fragmented plant status information and recent very limited field measurements.

· One of the tools available to the PMT is the RASCAL code, which assumes modeled characteristics for the reactor core, spent fuel pool, containment, and meteorology to predict potential off-site doses. Because of limitations in receiving/determining actual plant conditions at Fukushima 1 reactors, some broad assumptions have been used. RASCAL has the ability to calculate offsite dose out to 50 miles.

· The PMT has been actively collaborating and sharing information with the NNSA and NARAC (DOE) as well as DTRA (DOD) and NOAA.

· NARAC has the capability to project doses using NRC generated source terms beyond RASCALs 50 mile limit.

· Task 2: Provide a technical liaison to support the commission meeting to answer questions about radiological consequences. This liaison will need to report to OWFN at 7:30am on Monday for a dry run and will be expected to step up to a microphone and answer questions as needed during the briefing. This person does not need to have been in the Op center- but must be someone technically qualified with strong oral communication skills and who can answer technical question in an accurate and concise manner. Provide, name, title, and short bio of technical liaison by noon Friday.

1. Trish Milligan

I'll work on some Q&As and get them to you.

Kathy Brock

From: Dion, Jeanne
Sent: Thursday, March 17, 2011 4:51 PM
To: Hoc, PMT12
Subject: URGENT: Support for Commission Briefing 3/21
Importance: High

Hello,
The EDO will be briefing the commission on Monday 3/21 at 9am. See the attached draft scheduling note.

Bill Borchardt will be giving the entire presentation and needs several talking points (one liners) regarding the potential consequence in the United States based on the monitoring activities in the Ops Center.

ACTION:
Task 1: Provide brief high level talking points about monitoring activities in the Op Center to predict the potential consequence in the US.
Helpful information could be explaining what the RASCAL code is (at a high level). Provide draft of talking points to me by 8am Friday 3/18 morning.

Task 2: provide a list of Q&A regarding the potential consequences- based on what's happening in the Ops Center. Provide Q&A to me by noon Friday 3/18.

Task 2: Provide a technical liaison to support the commission meeting to answer questions about radiological consequences. This liaison will need to report to OWFN at 7:30am on Monday for a dry run and will be expected to step up to a microphone and answer questions as needed during the briefing. This person does not need to have been in the Op center- but must be someone technically qualified with strong oral communication skills and who can answer technical question in an accurate and concise manner. Provide, name, title, and short bio of technical liaison by noon Friday.

Let me know if you any further questions.

Jeanne Dion
Technical Assistant (Acting)
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Jeanne.dion@nrc.gov<mailto:Jeanne.dion@nrc.gov>
301-251-7482

Ali, Syed

From: Ali, Syed
Sent: Wednesday, March 23, 2011 3:52 PM
To: Fragoyannis, Nancy
Subject: RE: rollout

I do not recall a second briefing and am not aware if they requested the presentation material.

Thanks,
Syed Ali

From: Fragoyannis, Nancy
Sent: Wednesday, March 23, 2011 2:55 PM
To: Ali, Syed
Cc: Emche, Danielle; Young, Francis
Subject: RE: rollout

Syed, sorry to keep bothering you. Another question (s), do you recall briefing the Japanese a second time with a different group? and Do you recall if they requested the presentation be sent to them after the briefing.

Skip is cc'd on here as well so maybe he recalls any of this.

Thanks.
Nancy

From: Ali, Syed
Sent: Wednesday, March 23, 2011 12:39 PM
To: Fragoyannis, Nancy
Subject: RE: rollout

Japanese rollout.was on 5-8-08. From my memory, it was SGI. Skip Young may have more details.

Thanks,
Syed Ali

From: Fragoyannis, Nancy
Sent: Wednesday, March 23, 2011 12:35 PM
To: Ali, Syed
Subject: rollout

Syed,

Did you give the Japanese the aircraft presentation? If so, was it SGI?

Thanks
Nancy

Nancy Fragoyannis
Senior Level Advisor for Nonproliferation and
International Nuclear Security
Office of International Programs

H-86

Tohoku Pacific Earthquake and the seismic damage to the NPSs

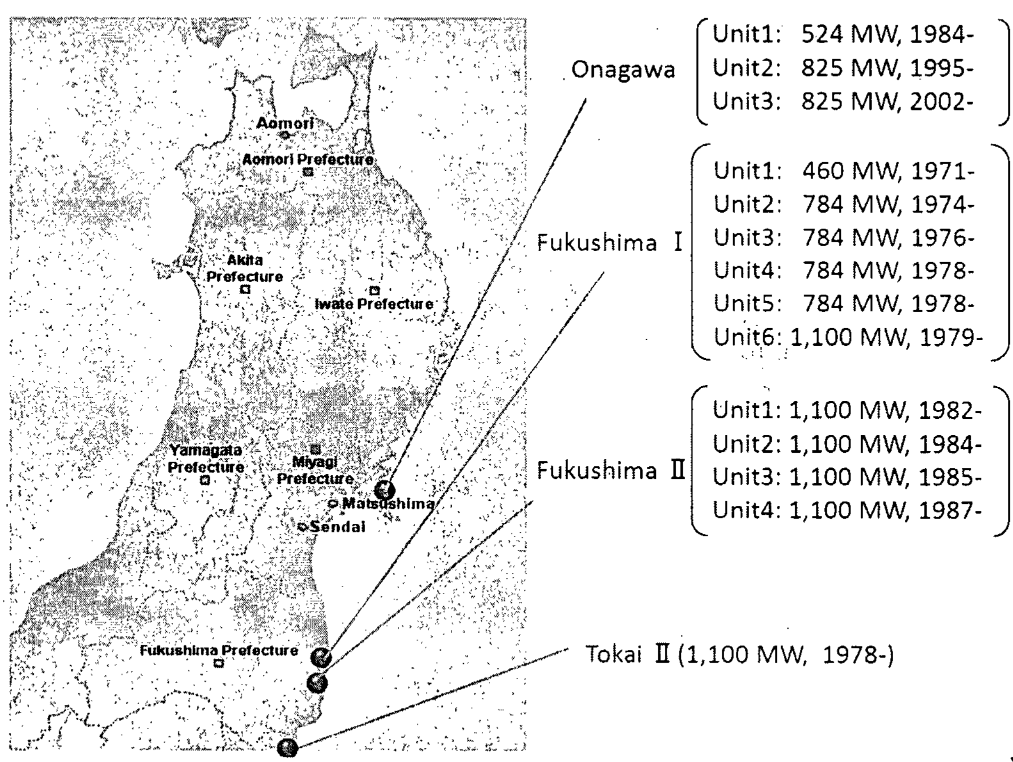
As of 8:00am March 23rd, 2011 (JST)
Ministry of Economy, Trade and industry

Earthquake and automatic shut-down of nuclear reactors

The Tohoku Pacific Earthquake of historic magnitude 9.0 struck the northeastern part of Japan at 14:46 on March 11th, 2011.

At the time of the earthquake occurrence, 3 reactors (Units 4, 5 and 6 at Fukushima Dai-ichi (I) Nuclear Power Station of Tokyo Electric Power Co. Inc.(TEPCO)) were under periodic inspection outage, and 11 reactors (Units 1, 2 and 3 at Onagawa Nuclear Power Station of Tohoku Electric Power Co. Ltd.; Units 1, 2 and 3 at Fukushima Dai-ichi (I) Nuclear Power Station of TEPCO; Units 1, 2, 3 and 4 of Fukushima-Dai-ni (II) Nuclear Power Station of TEPCO; and an unit of Tokai Dai-ni (II) Nuclear Power Station of Japan Atomic Power Co. Ltd.) were automatically shut-down.

After the automatic shut-down, Units 1, 2 and 3 at Onagawa, Unit 3 at Fukushima II, and the Unit at Tokai II have been cold shut down safely. As for the Units 1, 2 and 4 at Fukushima II, TEPCO operator of the station reported the nuclear emergency situation to Nuclear and Industrial Safety Agency (NISA), but afterward the three units have been cold shut down.



H-87

Tsunami damaged the cooling systems at the Fukushima Dai-ichi (I)

Since the external power supply was cut off upon the earthquake occurrence at 14:46 on March 11th, the emergency diesel power generators at Fukushima I automatically started generating electricity and the cooling systems began their operation. Then, the massive earthquake triggered the devastating Tsunami wiping away houses, buildings, cars along the widespread areas of the northeast coast.

The emergency diesel power generators and the pumps supplying seawater to the cooling system were halted at 15:41 due to the Tsunami estimated more than 10 meters high from the seawater level. Fukushima I lost the AC power sources for Unit 1, 2, and 3 other function necessary for cooling down the reactor cores and spent fuel kept in the pools inside reactor buildings. Consequently, the pressure and temperature of reactor cores and the water temperature of spent fuel pools went up.

For counter measures, seawater is being injected into the reactor pressure vessels of Units 1, 2 and 3. At the same time, police, fire brigade and the Self Defense Force are attempting to pour water into the spent fuel pool of Unit 3 and Unit 4 by spraying seawater from helicopters, water cannon trucks and fire engine. Further, TEPCO engineers are working to restore external power supply by installing the electricity cable connecting to the transmission line of Tohoku Electric Power Co. Ltd. and other transmission route.

Report concerning incidents at the Fukushima Dai-ichi (I)

Unit 1 Seawater is being injected into the reactor pressure vessel as of 8:00am March 23rd.

- After the reactor was automatically shut-down and the Tsunami disabled the equipments, the temperature of the reactor core went up and the water level inside the pressure vessel dropped and the reaction of cladding metal of fuel and water generated hydrogen. The hydrogen leaked outside of the containment vessel and caused the explosion at the upper-part of a concrete building housing at 15:36 on March 12.

- There is no risk of a hydrogen explosion in the containment vessel because there is no oxygen in it. There is no high probability of leaking large amount of radioactive material currently.

- Seawater is being injected into the reactor pressure vessel as of 8:00am March 23rd. The amount of injected water to the reactor core was increased by utilizing feedwater line in addition to the fire extinguish line at 2:33am on March 23rd.

Unit 2 Seawater is being injected into the reactor pressure vessel as of 8:00am March23rd.

- After the automatic shut-down of the reactor, the water injection function was sustained, but the reactor water level tended to decrease.

- At 6:10am on March 15th, TEPCO reported that there was an explosion sound at Unit 2. Given the fact that the pressure in the suppression chamber of Unit 2 decreased. It is presumed that the possibility of certain damage on the suppression chamber.

- Electric power receiving at the emergency power source transformer from the external transmission line was completed. And the work for laying the electricity cable from the facility to the load side was carried out as of 13:30 on March 19th. The power center of Unit 2 received electricity at 15:46 on Match 20th.

- Seawater is being injected into the reactor pressure vessel as of 18:00 March 22nd. Injection of 40 tons and 18 tons of seawater to the spent fuel pool of Unit 2 was started (from 15:00 till 17:20 March 20th and from 16:07 till 17:01 March 22nd).

- White smoke generated from Unit 2 at 18:22 on March 21st died down and became almost invisible as of 7:11am on March 22nd.

Unit 3 Seawater is being injected into the reactor pressure vessel as of 8:00am March 23rd. Several counter measures are being used to cool down the spent fuel pool of Unit 3.

- After the automatic shut-down of the reactor, fresh water and subsequently seawater were injected into the reactor pressure vessel through the fire extinguishing system line. However, the pressure in the primary containment vessel rose up unusually and the explosion took place around the reactor building of Unit 3 at 11:01am on March 14th.

- At 8:30am on March 16th, white smoke like steam was generated from Unit 3. Because of the possibility that the primary containment vessel of Unit 3 was damaged, the operators evacuated from the main control room of Unit 3 and 4 at 10:45am on March 16th. Thereafter, the operators returned to the room and restarted the operation for water injection into the reactor pressure vessel at 11:30am on March 16th.

- For counter measures, seawater is being injected into the reactor pressure vessel. At the same time, to pour water into the spent fuel pool, helicopters and water cannon trucks of Self Defense Forces discharge water to Unit 3 from sky and ground. Riot Police and Hyper Rescue Unit of Tokyo Fire Department sprayed water.

- The pressure in the primary containment vessel of Unit 3 rose (320 kPa as of 11:00 March 20th). Preparation to relieve the pressure had started. But afterward, judging from the situation, immediate pressure relief was not required, and monitoring of the pressure continues (120 kPa as of 12:15 March 21st).

- Works for the recovery of external power supply is being carried out.

  Grayish smoke generated from Unit 3 around 15:55 on March 21st changed to be whitish and seems to be ceasing as of 7:11am March 22nd.

- Lighting in the main control room was recovered at 22:43 on March 23rd.

Unit 1, 2 &3

- As a small amount of radioactive material was detected, it was believed that a part of nuclear fuel was damaged.

Unit 4 Water spray over the spent fuel pool of Unit 4 by Self-Defence Force is continued as of March 22nd.

- The temperature of water in the spent fuel pool went up. At 4:08am on March 14th, the temperature in the spent fuel pool of Unit 4 was 84 degree centigrade.

- It was confirmed that a part of wall of the operation floor of the reactor building of Unit 4 was damaged at 6:14am on March 15th. A fire took place at Unit 4 at 9:38am on March 15th, but the fire was extinguished spontaneously as of 11:00am March 15th.

- At 5:45am on March 16th, it was reported that a fire occurred at Unit 4; however, no fire was confirmed by TEPCO staff on the ground at 6:15am on March 16th.

- There is no fuel in the reactor pressure vessel due to replacement work of a shroud.

- Water spray over the spent fuel pool of Unit 4 by Self-Defence Force was started at 9:43am March 20th, and restarted from 18:30 to 19:46 March 20th, and continued from 6:37am to 8:41am March 21st. And water spray using a concrete pump truck was carried out from 17:17 till 20:32 March 22nd.

- Works for laying the electricity cable to the power center was completed around 15:00 on March 21st. The power center received electricity as of 10:35am March 22nd.

Unit 5&6 Unit 5 & 6 is under cold shut down as of March 20th.

- Fresh water is being injected into reactor pressure vessels and spent fuel pools by Make-Up Water Condensate system.

- The temperature of water in the spent fuel pool of Unit 5 and Unit 6 were 36.6 degree centigrade and 21.0 degree centigrade, respectively as of 6:00am March 23rd.

- The pump for Residual Heat Removal (RHR) (C) for Unit 5 (5:00am March 19th) and RHR (B) for Unit 6 (22:14 March 19th) started up and recovered heat removal function. It cools spent fuel pool with priority.

- Unit 5 was under cold shut down at 14:30 March 20th and Unit 6 was under cold shut down at 19:27 March 20th.

- Unit 5 and Unit 6 received electricity reached to the starting transformer at 19:52 March 20th. The power supply of Unit 5 and Unit 6 was switched from the emergency diesel generator to the external power supply at 11:36am on March 21st and 19:17 on March 22nd.

Common Spent Fuel Pool

- It was confirmed that the water level of the spent fuel pool was maintained full at after 6:00am March 18th.

- As of 9:00am March 19th, the water temperature in the pool is 57 degree centigrade.

- Water injection into the Common Spent Fuel Pool was done from 10:37am to 15:30 on March 21st.

- The water temperature in the pool was approximately 61 degree centigrade at 16:30 on March 21st.

Current Situation

- Evacuation as far as 20 kilometers from Fukushima I NPS and 10 kilometers from Fukushima II was almost completed (see the diagram below). The residents in the areas from 20 kilometers to 30 kilometers radius from Fukushima I NPS are directed to stay in-house.

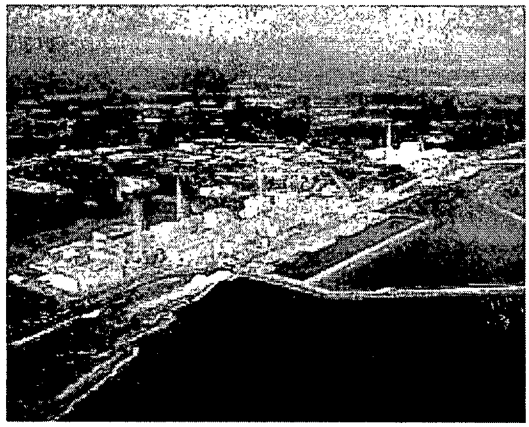
- On March 16th, the Local Emergency Response Headquarter issued "the direction to administer the stable Iodine during evacuation from the evacuation area (20 km radius)" to the Prefecture Governors and the heads of cities, towns and villages.

Monitoring Data

1) The data of Monitoring Post out of 20 kilometers zone of Fukushima I NPS is available on the following website:
http://www.mext.go.jp/a_menu/saigaijohou/syousai/1303726.htm

2) The real-time radiation data collected via the System for Prediction of Environment Emergency Dose Information (SPEEDI) is available on the following website:
http://www.bousai.ne.jp/eng/

Outline of the Fukushima I Nuclear Power Station



(Fukushima Dai-ichi nuclear power station)

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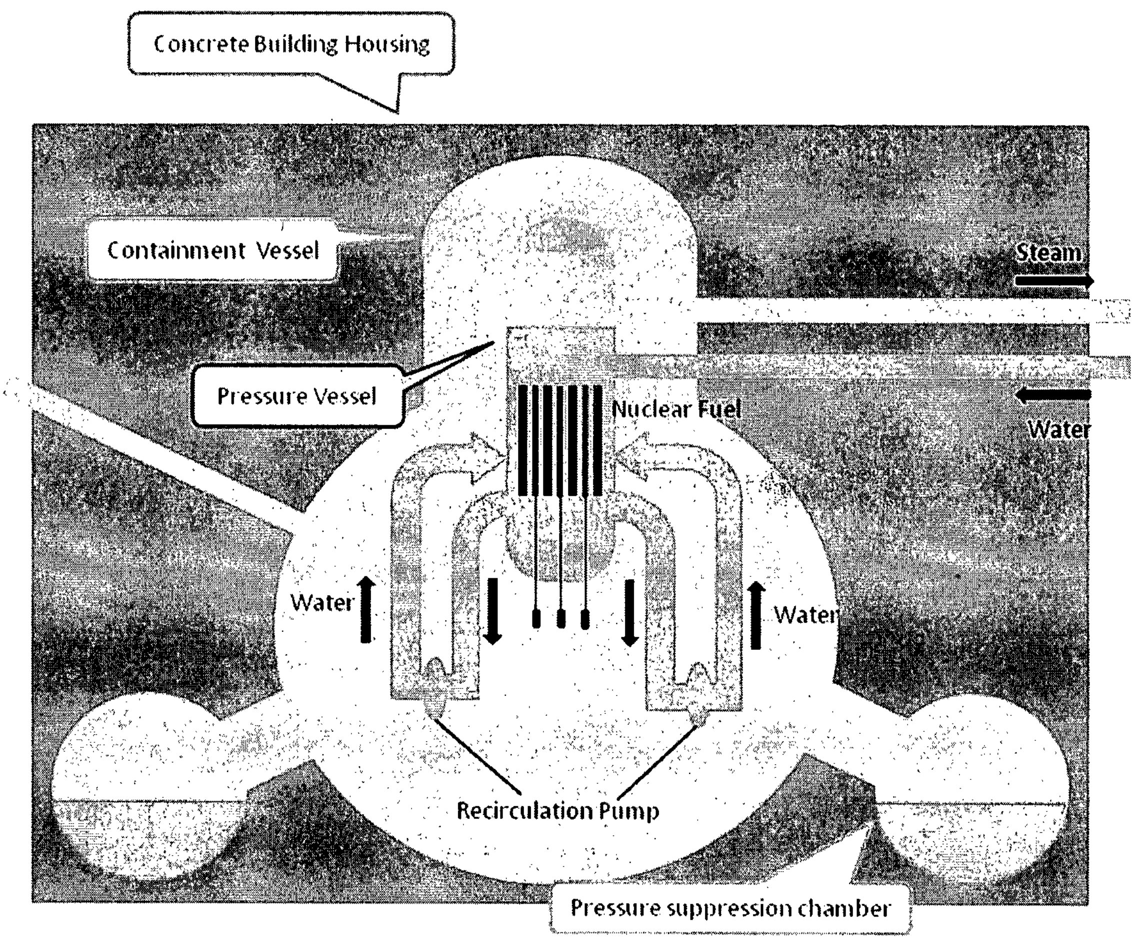
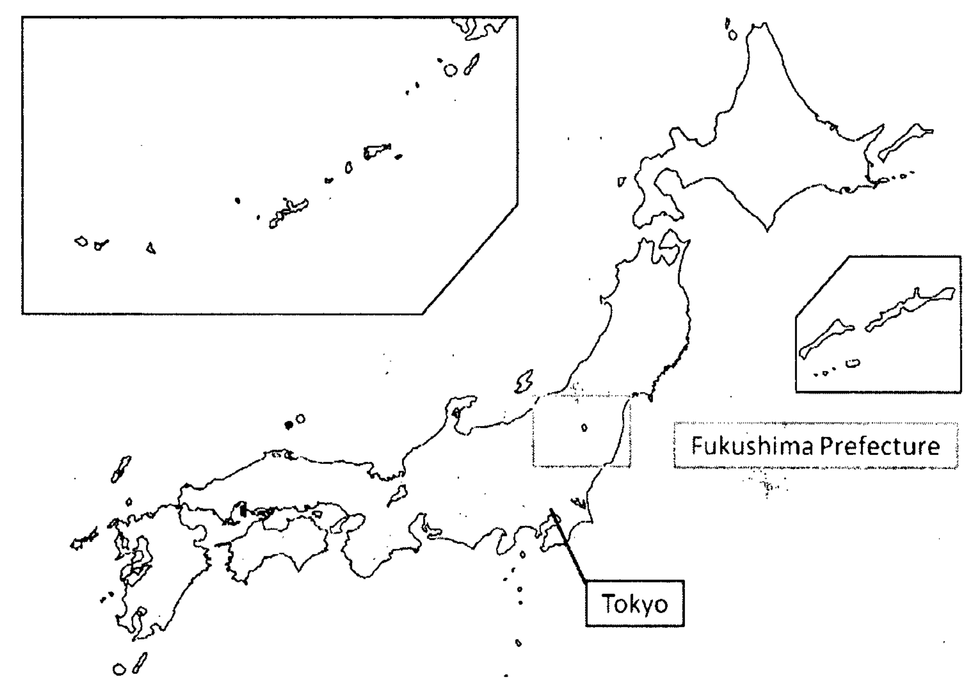
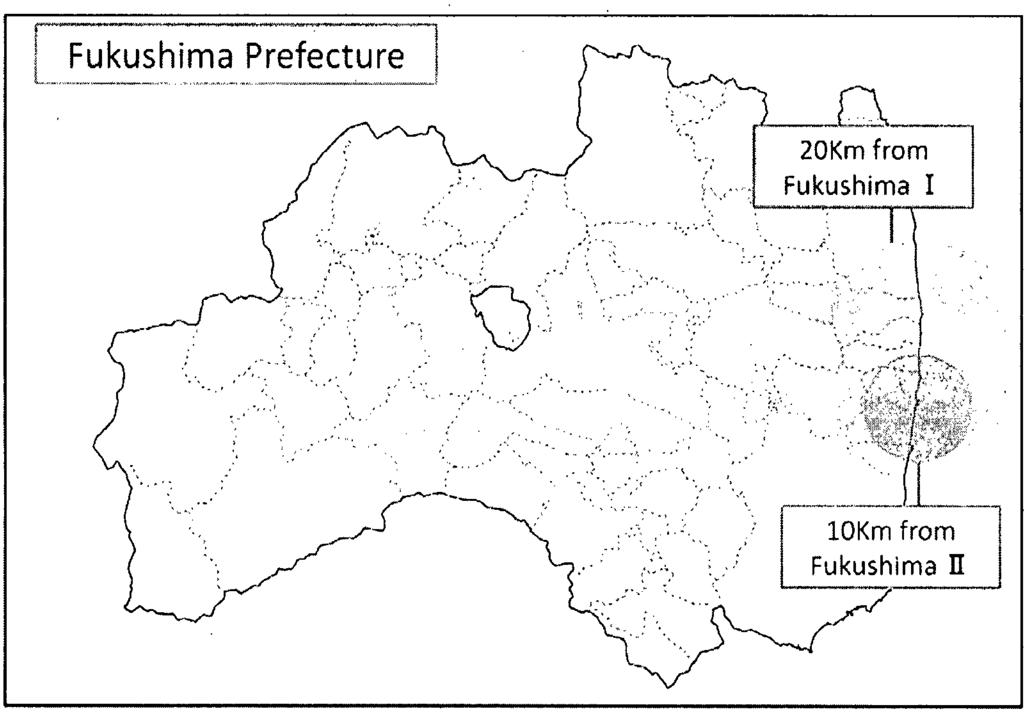


(Structure of BWR)

Location of Fukushima I and II in Japan





News Release

Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP

As of 19:00 March 23, 2011
Ministry of Education, Culture, Sports, Science and Technology (MEXT)

1. Monitoring Outputs by MEXT ***Boldface and underlined readings are new.**

＊1 measured by Geiger-Müller counter
＊2 measured by ionization chamber type survey meter
＊3 measured by NaI scintillator detector

Monitoring Post (length from NPP)	Monitoring Time	Reading (unit : μSv / h)	Weather	Reading by
Reading Point 【1】 (About60KmNorthWest)	2011/3/23 9:40	4.0 *2	Rain	MEXT
Reading Point 【2】 (About55KmNorthWest)	2011/3/23 13:50	7.0 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【2】 (About55KmNorthWest)	2011/3/23 10:09	6.5 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【3】 (About45KmNorthWest)	2011/3/23 13:25	5.5 *2	No Rain	MEXT
Reading Point 【3】 (About45KmNorthWest)	2011/3/23 10:36	5.5 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【4】 (About50KmNorthWest)	2011/3/23 10:26	2.8 *2	No Rain	MEXT
Reading Point 【5】 (About45KmNorth)	2011/3/23 11:28	1.0 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【6】 (About45KmNorth)	2011/3/23 11:53	2.0 *2	No Rain	MEXT
Reading Point 【7】 (About45KmNorth)	2011/3/23 12:06	1.3 *2	No Rain	MEXT
Reading Point 【10】 (About40KmNorthWest)	2011/3/23 10:50	2.6 *2	No Rain	MEXT
Reading Point 【11】 (About40KmNorthWest)	2011/3/23 11:04	2.8 *2	No Rain	MEXT
Reading Point 【12】 (About40KmWest)	2011/3/23 11:42	0.8 *2	No Rain	MEXT
Reading Point 【13】 (About40KmWest)	2011/3/23 12:16	1.0 *2	No Rain	MEXT

H-22

＊1 measured by Geiger–Müller counter
＊2 measured by ionization chamber type survey meter
＊3 measured by NaI scintillator detector

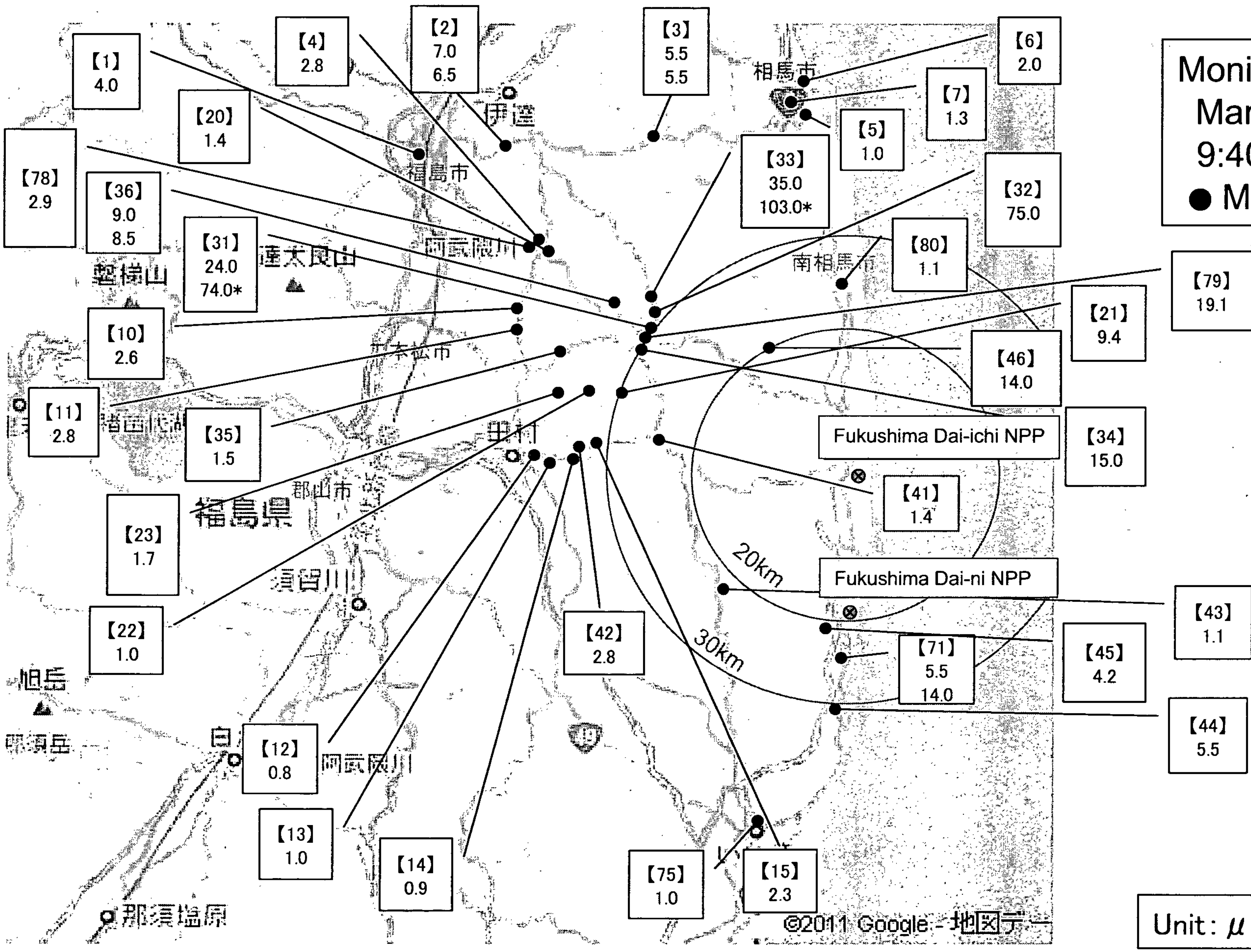
Monitoring Post (length from NPP)	Monitoring Time	Reading (unit : μSv / h)	Weather	Reading by
Reading Point 【14】 (About35KmWest)	2011/3/23 12:20	0.9 *2	No Rain	MEXT
Reading Point 【15】 (About35KmWest)	2011/3/23 12:35	2.3 *2	Rain	MEXT
Reading Point 【20】 (About45KmNorthWest)	2011/3/23 15:11	1.4 *2	Rain	MEXT
Reading Point 【21】 (About30KmWestNorthWest)	2011/3/23 13:51	9.4 *2	Rain	MEXT
Reading Point 【22】 (About30KmWestNorthWest)	2011/3/23 14:44	1.0 *2	No Rain	MEXT
Reading Point 【23】 (About30KmWestNorthWest)	2011/3/23 14:57	1.7 *2	No Rain	MEXT
Reading Point 【31】 (About30KmWestNorthWest)	2011/3/23 11:43	24.0 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【31】 (About30KmWestNorthWest)	2011/3/23 10:08	74.0 *2	Rain	Police (counter NBC operations unit)
Reading Point 【32】 (About26KmNorthWest)	2011/3/23 12:14	75.0 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【33】 (About30KmNorthWest)	2011/3/23 12:32	35.0 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【33】 (About30KmNorthWest)	2011/3/23 9:30	103.0 *2	No Rain	Police (counter NBC operations unit)
Reading Point 【34】 (About30KmNorthWest)	2011/3/23 13:08	15.0 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【35】 (About35KmNorthWest)	2011/3/23 13:38	1.5 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【36】 (About40KmNorthWest)	2011/3/23 14:37	9.0 *2	Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【36】 (About40KmNorthWest)	2011/3/23 10:45	8.5 *2	No Rain	JAEA (Japan Atomic Energy Agency)
Reading Point 【41】 (About20KmWest)	2011/3/23 10:52	1.4 *2	Rain	Kansai Electric Power Co., Inc.
Reading Point 【42】 (About30KmWest)	2011/3/23 10:15	2.8 *2	Rain	Kansai Electric Power Co., Inc.

＊1 measured by Geiger–Müller counter
＊2 measured by ionization chamber type survey meter
＊3 measured by NaI scintillator detector

Monitoring Post (length from NPP)	Monitoring Time	Reading (unit : μSv / h)	Weather	Reading by
Reading Point 【43】 (About20KmSouthWest)	2011/3/23 10:50	1.1 *2	No Rain	JNFL(Japan Nuclear Fuel Ltd.)
Reading Point 【44】 (About30KmSouth)	2011/3/23 10:13	5.5 *2	No Rain	Shikoku Electric Power Co., Inc.
Reading Point 【45】 (About20KmSouth)	2011/3/23 10:00	4.2 *2	No Rain	Kyushu Electric Power Co., Inc.
Reading Point 【46】 (About20KmNorthWest)	2011/3/23 11:10	14.0 *2	Rain	CHUBU Electric Power Co., Inc.
Reading Point 【71】 (About25KmSouth)	2011/3/23 10:29	5.5 *2	No Rain	Police (counter NBC operations unit)
Reading Point 【71】 (About25KmSouth)	2011/3/23 10:20	14.0 *2	No Rain	Police (counter NBC operations unit)
Reading Point 【75】 (About45KmSouth)	2011/3/23 7:50	1.0 *2	No Rain	Police (counter NBC operations unit)
Reading Point 【78】 (About45KmNorthWest)	2011/3/23 8:18	2.9 *2	No Rain	Police (counter NBC operations unit)
Reading Point 【79】 (About30KmNorthWest)	2011/3/23 9:14	19.1 *2	No Rain	Police (counter NBC operations unit)
Reading Point 【80】 (About25KmNorth)	2011/3/23 12:36	1.1 *2	No Rain	Police (counter NBC operations unit)

2. Under construction, Reading by Ministry of Defense

Readings at Monitoring Post out of Fukushima Dai-ichi NPP



Monitoring Time
March 23,
9:40~18:00
● Monitoring Post

Unit : μ Sv per hour

* Measured By Police (counter NBC operations unit)

2011/3/23 19:00 (μSv/h)

	Prefecture(City)	2011/3/22							2011/3/23							
		17-18	18-19	19-20	20-21	21-22	22-23	23-24	0-1	1-2	2-3	3-4	4-5	5-6	6-7	Usual Value Band
1	Hokkaido(Sappro)	0.028	0.028	0.028	0.028	0.028	0.029	0.029	0.029	0.028	0.028	0.028	0.028	0.028	0.028	0.02～0.105
2	Aomori(Aomori)	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.017～0.102
3	Iwate(Morioka)	0.033	0.033	0.033	0.033	0.033	0.033	0.034	0.033	0.032	0.032	0.033	0.033	0.032	0.032	0.014～0.084
4	Miyagi(Sendai)															0.0176～0.0513
5	Akita(Akita)	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.022～0.086
6	Yamagata(Yamagata)	0.095	0.095	0.095	0.095	0.093	0.091	0.089	0.087	0.086	0.085	0.085	0.086	0.086	0.086	0.025～0.082
7	Fukushima(Futaba)															0.037～0.071
8	Ibaraki(Mito)	0.363	0.356	0.378	0.389	0.361	0.345	0.339	0.334	0.330	0.330	0.328	0.325	0.324	0.323	0.036～0.056
9	Tochigi(Utsunomiya)	0.145	0.144	0.147	0.156	0.158	0.154	0.151	0.150	0.149	0.149	0.148	0.147	0.147	0.146	0.030～0.067
10	Gunma(Maebashi)	0.111	0.112	0.112	0.113	0.113	0.113	0.112	0.109	0.109	0.108	0.107	0.107	0.105	0.104	0.017～0.045
11	Saitama(Saitama)	0.114			0.127	0.127	0.126	0.126	0.133	0.134	0.133	0.128	0.126	0.125	0.125	0.031～0.060
12	Chiba(Ishihara)	0.104	0.112	0.125	0.125	0.122	0.112	0.107	0.105	0.100	0.099	0.103	0.102	0.101	0.098	0.022～0.044
13	Tokyo(Shinjyuku)	0.138	0.140	0.141	0.155	0.151	0.151	0.154	0.154	0.152	0.152	0.149	0.148	0.147	0.147	0.028～0.079
14	Kanagawa(Chigasaki)	0.094	0.095	0.095	0.096	0.096	0.098	0.098	0.101	0.107	0.105	0.103	0.103	0.102	0.101	0.035～0.069
15	Niigata(Niigata)	0.047	0.047	0.047	0.047	0.047	0.048	0.049	0.049	0.049	0.048	0.050	0.049	0.048	0.047	0.031～0.153
16	Toyama(Imizu)	0.053	0.052	0.056	0.057	0.061	0.057	0.053	0.050	0.048	0.048	0.052	0.050	0.048	0.047	0.029～0.147
17	Ishikawa(Kanazawa)	0.049	0.053	0.051	0.051	0.051	0.053	0.056	0.054	0.052	0.050	0.050	0.049	0.048	0.047	0.0291～0.1275
18	Fukui(Fukui)	0.045	0.045	0.046	0.046	0.049	0.050	0.049	0.048	0.048	0.051	0.050	0.048	0.047	0.045	0.032～0.097
19	Yamanashi(Kohu)	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.048	0.047	0.046	0.047	0.046	0.046	0.046	0.040～0.064
20	Nagano(Nagano)	0.054	0.055	0.060	0.059	0.056	0.055	0.054	0.054	0.054	0.054	0.054	0.053	0.053	0.054	0.0299～0.0974
21	Gifu(Kakamigahara)	0.060	0.061	0.060	0.060	0.060	0.060	0.060	0.060	0.061	0.060	0.060	0.060	0.060	0.060	0.057～0.110
22	Shizuoka(Shizuoka)	0.049	0.049	0.050	0.050	0.050	0.050	0.050	0.050	0.049	0.050	0.050	0.050	0.049	0.049	0.0281～0.0765
23	Aichi(Nagoya)	0.039	0.040	0.040	0.040	0.039	0.039	0.039	0.039	0.040	0.039	0.039	0.039	0.039	0.039	0.035～0.074
24	Mie(Yokkaichi)	0.046	0.047	0.047	0.047	0.046	0.046	0.046	0.046	0.046	0.047	0.046	0.046	0.046	0.046	0.0416～0.0789
25	Shiga(Otsu)	0.036	0.036	0.033	0.033	0.032	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.032	0.031～0.061
26	Kyoto(Kyoto)	0.040	0.039	0.038	0.038	0.037	0.037	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.033～0.087
27	Osaka(Osaka)	0.043	0.042	0.042	0.042	0.042	0.042	0.042	0.043	0.042	0.043	0.042	0.042	0.042	0.042	0.042～0.061
28	Hyogo(Kobe)	0.037	0.036	0.036	0.036	0.036	0.036	0.037	0.037	0.037	0.037	0.037	0.037	0.036	0.036	0.035～0.076
29	Nara(Nara)	0.048	0.048	0.048	0.047	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.046～0.08
30	Wakayama(Wakayama	0.032	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.032	0.032	0.031	0.032	0.032	0.031	0.031～0.056
31	Tottori(Tohhaku)	0.064	0.063	0.065	0.064	0.063	0.063	0.063	0.063	0.062	0.063	0.063	0.063	0.063	0.063	0.036～0.11
32	Shimane(Matsue)	0.038	0.037	0.037	0.036	0.036	0.036	0.036	0.036	0.037	0.037	0.038	0.037	0.037	0.037	0.033～0.079
33	Okayama(Okayama)	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.049	0.049	0.049	0.050	0.043～0.104
34	Hiroshima(Hiroshima)	0.047	0.046	0.046	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.048	0.048	0.049	0.048	0.035～0.069
35	Yamaguchi(Yamaguchi	0.092	0.092	0.091	0.091	0.090	0.090	0.091	0.091	0.091	0.092	0.092	0.093	0.094	0.095	0.084～0.128
36	Tokushima(Tokushima	0.038	0.038	0.038	0.037	0.038	0.037	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.037～0.067
37	Kagawa(Takamastu)	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.053	0.052	0.052	0.051～0.077
38	Ehime(Matsuyama)	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.049	0.049	0.050	0.045～0.074
39	Kochi(Kochi)	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.023～0.076
40	Fukuoka(Dazaifu)	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.037	0.037	0.037	0.037	0.037	0.034～0.079
41	Saga(Saga)	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.041	0.037～0.086
42	Nagasaki(Ohmura)	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.030	0.030	0.027～0.069
43	Kumamoto(Uto)	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.028	0.028	0.028	0.028	0.029	0.021～0.067
44	Oita(Oita)	0.050	0.050	0.049	0.049	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.049	0.049	0.050	0.048～0.085
45	Miyazaki(Miyazaki)	0.026	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.0243～0.0664
46	Kagoshima(Kagoshima	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.0306～0.0943
47	Okinawa(Uruma)	0.022	0.021	0.022	0.021	0.022	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.0133～0.0575

*The figures in Miyagi are not measured because monitoring point has risk of collapsing. The monitoring result of Miyagi is available on the website of Miyagi Pref. (http://www.pref.miyagi.jp/gentai/Press/PressH230315.html)

*Refer to other title "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP" for the datas in Fukushima. It could not be measured by Monitoring Post since the radiation level around it is so high.

*Blanks are caused by device maintenance, but the area was measured by Monitoring Posts.

*These figures are estimated as 1 μGy/h=1 μSv/h.

*The table was made by MEXT, based on the reports from prefectures.

Reading of environmental radioactivity level by prefecture

2011/3/23 19:00 (μ Sv/h)

	Prefecture(City)	2011/3/23										
		7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	Usual Value Band
1	Hokkaido(Sappro)	0.028	0.028	0.028	0.028	0.028	0.028	0.029	0.029	0.028	0.029	0.02～0.105
2	Aomori(Aomori)	0.024	0.023	0.024	0.024	0.025	0.024	0.024	0.027	0.025	0.023	0.017～0.102
3	Iwate(Morioka)	0.032	0.032	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.014～0.084
4	Miyagi(Sendai)											0.0176～0.0513
5	Akita(Akita)	0.034	0.035	0.034	0.035	0.036	0.037	0.036	0.036	0.035	0.035	0.022～0.086
6	Yamagata(Yamagata)	0.086	0.086	0.085	0.085	0.085	0.084	0.084	0.084	0.084	0.084	0.025～0.082
7	Fukushima(Futaba)											0.037～0.071
8	Ibaraki(Mito)	0.322	0.322	0.321	0.320	0.330	0.361	0.350	0.357	0.348	0.343	0.036～0.056
9	Tochigi(Utsunomiya)	0.145	0.145	0.144	0.144	0.143	0.144	0.143	0.142	0.142	0.141	0.030～0.067
10	Gunma(Maebashi)	0.103	0.102	0.101	0.100	0.099	0.098	0.097	0.097	0.096	0.096	0.017～0.045
11	Saitama(Saitama)	0.124	0.123	0.123	0.122	0.122	0.121	0.121	0.120			0.031～0.060
12	Chiba(Ishihara)	0.100	0.097	0.097	0.097	0.097	0.096	0.097	0.101	0.104	0.104	0.022～0.044
13	Tokyo(Shinjyuku)	0.146	0.146	0.146	0.145	0.145	0.144	0.144	0.143	0.143	0.146	0.028～0.079
14	Kanagawa(Chigasaki)	0.101	0.099	0.099	0.098	0.098	0.097	0.097	0.097	0.097	0.097	0.035～0.069
15	Niigata(Niigata)	0.047	0.046	0.046	0.046	0.046	0.046	0.046	0.047	0.048	0.048	0.031～0.153
16	Toyama(Imizu)	0.047	0.047	0.047	0.048	0.049	0.048	0.049	0.050	0.049	0.048	0.029～0.147
17	Ishikawa(Kanazawa)	0.047	0.047	0.046	0.046	0.047	0.047	0.047	0.046	0.045	0.046	0.0291～0.1275
18	Fukui(Fukui)	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.044	0.044	0.032～0.097
19	Yamanashi(Kohu)	0.046	0.046	0.045	0.046	0.046	0.046	0.046	0.045	0.046	0.047	0.040～0.064
20	Nagano(Nagano)	0.053	0.053	0.052	0.053	0.053	0.052	0.052	0.052	0.052	0.052	0.0299～0.0974
21	Gifu(Kakamigahara)	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.057～0.110
22	Shizuoka(Shizuoka)	0.049	0.049	0.049	0.051	0.051	0.051	0.050	0.050	0.048	0.048	0.0281～0.0765
23	Aichi(Nagoya)	0.039	0.039	0.039	0.039	0.038	0.039	0.039	0.039	0.039	0.039	0.035～0.074
24	Mie(Yokkaichi)	0.046	0.046	0.045	0.045	0.045	0.045	0.045	0.045	0.046	0.046	0.0416～0.0789
25	Shiga(Otsu)	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.033	0.033	0.031～0.061
26	Kyoto(Kyoto)	0.038	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.033～0.087
27	Osaka(Osaka)	0.043	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042～0.061
28	Hyogo(Kobe)	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.035～0.076
29	Nara(Nara)	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.046～0.08
30	Wakayama(Wakayama	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031～0.056
31	Tottori(Tohhaku)	0.063	0.062	0.063	0.062	0.063	0.062	0.063	0.063	0.063	0.063	0.036～0.11
32	Shimane(Matsue)	0.037	0.037	0.037	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.033～0.079
33	Okayama(Okayama)	0.050	0.049	0.049	0.049	0.048	0.048	0.048	0.048	0.048	0.048	0.043～0.104
34	Hiroshima(Hiroshima)	0.049	0.048	0.047	0.047	0.047	0.047	0.046	0.047	0.047	0.047	0.035～0.069
35	Yamaguchi(Yamaguchi	0.095	0.095	0.092	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.084～0.128
36	Tokushima(Tokushima	0.038	0.037	0.037	0.037	0.038	0.037	0.038	0.038	0.037	0.038	0.037～0.067
37	Kagawa(Takamastu)	0.052	0.052	0.052	0.053	0.052	0.052	0.052	0.053	0.053	0.052	0.051～0.077
38	Ehime(Matsuyama)	0.050	0.049	0.048	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.045～0.074
39	Kochi(Kochi)	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.023～0.076
40	Fukuoka(Dazaifu)	0.037	0.038	0.037	0.036	0.036	0.037	0.036	0.036	0.036	0.036	0.034～0.079
41	Saga(Saga)	0.041	0.040	0.040	0.040	0.039	0.039	0.039	0.039	0.039	0.039	0.037～0.086
42	Nagasaki(Ohmura)	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.027～0.069
43	Kumamoto(Uto)	0.029	0.029	0.028	0.027	0.027	0.027	0.027	0.027	0.027	0.026	0.021～0.067
44	Oita(Oita)	0.050	0.050	0.050	0.050	0.049	0.049	0.049	0.049	0.050	0.049	0.048～0.085
45	Miyazaki(Miyazaki)	0.027	0.027	0.027	0.026	0.027	0.026	0.026	0.026	0.026	0.026	0.0243～0.0664
46	Kagoshima(Kagoshima	0.035	0.035	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.0306～0.0943
47	Okinawa(Uruma)	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.0133～0.0575

*The figures in Miyagi are not measured because monitoring point has risk of collapsing. The monitoring result of Miyagi is available on the website of Miyagi Pre (http://www.pref.miyagi.jp/gentai/Press/PressH230315.html)

*Refer to other title "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP" for the datas in Fukushima. It could not be measured by Mor level around it is so high.

*Blanks are caused by device maintenance, but the area was measured by Monitoring Posts.

*These figures are estimated as 1 μ Gy/h=1 μ Sv/h.

*The table was made by MEXT, based on the reports from prefectures.

Monitoring data at Ibaraki prefecture

MEXT

2011/3/23 19:00 μSv/h

Date and Time	JAEA nuclear science research institute (Tokai-village in Ibaraki-prefecture)	JAEA Nuclear fuel cycle engineering laboratory (Tokai-village in Ibaraki-prefecture)	Yayoi in Tokyo University (Tokai-village in Ibaraki-prefecture)
2011/3/23			
0:00	2.61	1.60	2.27
0:30	2.60	1.60	2.34
1:00	2.59	1.60	2.30
1:30	2.58	1.60	2.25
2:00	2.57	1.60	2.26
2:30	2.57	1.60	2.29
3:00	2.56	1.60	2.22
3:30	2.55	1.60	2.23
4:00	2.55	1.60	2.35
4:30	2.54	1.60	2.28
5:00	2.53	1.60	2.21
5:30	2.52	1.60	2.25
6:00	2.52	1.60	2.11
6:30	2.51	1.60	2.13
7:00	2.51	1.60	2.20
7:30	2.51	1.50	2.25
8:00	2.50	1.50	2.24
8:30	2.49	1.50	2.27
9:00	2.48	1.50	2.10
9:30	2.48	1.50	2.16
10:00	2.47	1.50	2.10
10:30	2.46	1.50	2.09
11:00	2.48	1.60	2.20
11:30	2.56	1.60	2.20
12:00	2.60	1.70	2.39
12:30	2.60	1.60	2.16
13:00	2.58	1.60	2.29
13:30	2.57	1.60	2.25
14:00	2.58	1.60	2.31
14:30	2.56	1.60	2.20
15:00	2.55	1.60	2.36
15:30	2.53	1.60	2.22
16:00	2.52	1.60	2.12
16:30	2.53	1.60	
17:00	2.50	1.60	
17:30	2.49	1.60	
18:00	2.48	1.60	

Reading of environmental radioactivity level in fallout by prefecture
(3.22.9AM～3.23.9AM)

2011/3/23 19:00 (MBq/km2)

	Prefecture	Fallout		
		I−131	Cs−137	Remarks
1	Hokkaido(Sapporo)	Not Detectable	Not Detectable	
2	Aomori(Aomori)	Not Detectable	Not Detectable	
3	Iwate(Morioka)	23	13	
4	Miyagi	−	−	Not be measured because of the earthquake disaster damage
5	Akita(Akita)	2.0	1.8	
6	Yamagata(Yamagata)	2,100	1,900	
7	Fukushima	−	−	Not be measured because of dealing with the earthquake disaster
8	Ibaraki(Hitachinaka)	27,000	420	
9	Tochigi(Utsunomiya)	23,000	99	
10	Gunma(Maebashi)	310	Not Detectable	
11	Saitama(Saitama)	22,000	320	
12	Chiba(Ichihara)	22,000	360	
13	Tokyo(Shinjuku)	36,000	340	
14	Kanagawa(Chigasaki)	1,300	64	
15	Niigata(Niigata)	Not Detectable	Not Detectable	
16	Toyama(Imizu)	Not Detectable	Not Detectable	
17	Ishikawa(Kanazawa)	Not Detectable	Not Detectable	
18	Fukui(Fukui)	Not Detectable	Not Detectable	
19	Yamanashi(Kofu)	110	26	
20	Ngano(Nagano)	190	Not Detectable	
21	Gifu(Kakamigahara)	Not Detectable	Not Detectable	
22	Shizuoka(Omaezaki)	150	25	
23	Aichi(Nagoya)	Not Detectable	Not Detectable	
24	Mie(Yokkaichi)	Not Detectable	Not Detectable	
25	Shiga(Otsu)	Not Detectable	Not Detectable	
26	Kyoto(Kyoto)	Not Detectable	Not Detectable	
27	Osaka(Osaka)	Not Detectable	Not Detectable	
28	Hyogo(Kobe)	Not Detectable	Not Detectable	
29	Nara	Not Detectable	Not Detectable	
30	Wakayama(Wakayama)	Not Detectable	Not Detectable	
31	Tottori(Tohhaku)	Not Detectable	Not Detectable	
32	Shimane(Matsue)	Not Detectable	Not Detectable	
33	Okayama(Okayama)	Not Detectable	Not Detectable	
34	Hiroshima(Hiroshima)	Not Detectable	Not Detectable	
35	Yamaguchi(Yamaguchi)	Not Detectable	Not Detectable	
36	Tokushima(Tokushima)	Not Detectable	Not Detectable	
37	Kagawa(Takamatsu)	Not Detectable	Not Detectable	
38	Ehime(Yawatahama)	Not Detectable	Not Detectable	
39	Kochi(Kochi)	Not Detectable	Not Detectable	
40	Fukuoka(Dazaifu)	Not Detectable	Not Detectable	
41	Saga(Saga)	Not Detectable	Not Detectable	
42	Nagasaki(Ohmura)	Not Detectable	Not Detectable	
43	Kumamoto(Uto)	Not Detectable	Not Detectable	
44	Oita(Oita)	−	−	On Setting up the equipment
45	Miyazaki(Miyazaki)	Not Detectable	Not Detectable	
46	Kagoshima(Kagoshima)	Not Detectable	Not Detectable	
47	Okinawa(Nanjo)	Not Detectable	Not Detectable	

*The table was made by MEXT, based on the reports from prefectures

Ali, Syed

From: Ali, Syed
Sent: Wednesday, March 23, 2011 4:33 PM
To: 'Petti, Jason P'
Subject: Off to Japan

Jason:

Sorry I missed your call yesterday. I have been put on the team that's going to Japan this week. My scheduled visit is Mar 24-April 7. I'll talk to you when I return.

Thanks,
Syed Ali

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News Release

経済産業省 Ministry of Economy, Trade and Industry

March 23, 2011
Nuclear and Industrial Safety Agency

Seismic Damage Information (the 45th Release)
(As of 12:30 March 23rd, 2011)

Nuclear and Industrial Safety Agency (NISA) confirmed the current situation of Onagawa NPS, Tohoku Electric Power Co. Inc.; Fukushima Dai-ichi and Fukushima Dai-ni NPSs, Tokyo Electric Power Co. Inc. (TEPCO); Tokai Dai-ni NPS, Japan Atomic Power Co. Inc. as follows:

Major updates are as follows.

1. Nuclear Power Stations (NPSs)
- Fukushima Dai-ichi NPS

<Situation of Water Injection and Water Spray>
- Water spray using Concrete Pump Truck (50t/h) to the Unit 4 was started. (10:00 March 23rd)

H-90

(Attached sheet)

1. The state of operation at NPS (Number of automatic shutdown units: 10)

- Fukushima Dai-ichi NPS, TEPCO
  (Okuma Town and FutabaTown, Futaba County, Fukushima Prefecture)

(1) The state of operation

Unit 1 (460MWe):	automatic shutdown
Unit 2 (784MWe):	automatic shutdown
Unit 3 (784MWe):	automatic shutdown
Unit 4 (784MWe):	in periodic inspection outage
Unit 5 (784MWe):	in periodic inspection outage, cold shutdown at 14:30 March 20th
Unit 6 (1,100MWe):	in periodic inspection outage, cold shutdown at 19:27 March 20th

(2) Major Plant Parameters (As of 12:00 March 23rd)

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Reactor Pressure*1 [MPa]	0.457(A) 0.420(B)	0.078(A) 0.078(B)	−0.003(C) 0.135(A)	−	0.108	0.109
CV Pressure (D/W) [kPa]	320	110	100	−	−	−
Reactor Water Level*2 [mm]	−1,750(A) −1,750(B)	−1,300(A) Not available(B)	−1,800(A) −2,300(B)	−	1,744	2,701
Suppression Pool Water Temperature (S/C) [℃]	−	−	−	−	−	−
Suppression Pool Pressure (S/C) [kPa]	300	down scale	down scale	−	−	−
Spent Fuel Pool Water Temperature [℃]	−	51*4	−	Not available*3	39.0	20.0
Time of Measurement	12:00 March 23rd	09:00 March 23rd	09:10 March 23rd		12:00 March 23rd	12:00 March 23rd

*1: Converted from reading value to absolute pressure
*2: Distance from the top of fuel
*3: As of 04:08 March 14th, 84℃
*4: As of 04:20 March 23rd

(3) Situation of Each Unit

<Unit 1>

- TEPCO reported to NISA the event (Inability of water injection of the Emergency Core Cooling System) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (16:36 March 11th)
- Seawater injection to the Reactor Pressure Vessel (RPV) via the Fire Extinguish Line started. (20:20 March 12th)
  →Temporary interruption of the injection (01:10 March 14th)
- The sound of explosion in Unit 1 occurred. (15:36 March 12th)
- Increase the amount of water injection ($2m^3/h \rightarrow 18m^3/h$) to the Reactor Core by using water supply system in addition to water extinction system.(02:33 March 23rd)
- Seawater is being injected. (As of <u>12:30 March 23rd</u>)

<Unit 2>

- TEPCO reported to NISA the event (Inability of water injection of the Emergency Core Cooling System) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (16:36 March 11th)
- The Blow-out Panel of reactor building was opened due to the explosion in the reactor building of Unit 3. (After 11:00 March 14th)
- Reactor water level tended to decrease. (13:18 March 14th) TEPCO reported to NISA the event (Loss of reactor cooling functions) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (13:49 March 14th)
- Seawater injection to RPV via the Fire Extinguish line was ready. (19:20 March 14th)
- Water level in RPV tended to decrease. (22:50 March 14th)
- A sound of explosion was made in Unit 2. As the pressure in

Suppression Chamber decreased (06:10 March 15th), there was a possibility that an incident occurred in the Chamber. (About 06:20 March 15th)

- Electric power receiving at the emergency power source transformer from the external transmission line was completed. The work for laying the electric cable from the facility to the load side was carried out. (As of 13:30 March 19th)
- Injection of 40t of Seawater to the Spent Fuel Pool was started.(from 15:00 till 17:20 March 20th)
- Power Center of Unit 2 received electricity (15:46 March 20th)
- White smoke generated from Unit 2. (18:22 March 21st)
- White smoke was died down and almost invisible. (As of 07:11 March 22nd)
- Injection of 18t of Seawater to the Spent Fuel Pool was carried out. (from 16:07 till 17:01 March 22nd)
- Seawater injection to RPV continues. (As of 12:30 March 23rd)

<Unit 3>

- Fresh water started to be injected to RPV via the Fire Extinguish Line. (11:55 March 13th)
- Seawater started to be injected to RPV via the Fire Extinguish Line. (13:12 March 13th)
- Seawater injection for Units 1 and 3 was interrupted due to the lack of seawater in pit. (01:10 March 14th)
- Seawater injection to RPV for Unit 3 was restarted. (03:20 March 14th)
- The pressure in Primary Containment Vessel (PCV) of Unit 3 rose unusually. (07:44 March 14th) TEPCO reported to NISA on the event falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (7:52 March 14th)
- In Unit 3, the explosion like Unit 1 occurred around the Reactor Building (11:01 March 14th)
- The white smoke like steam generated from Unit 3. (08:30 March 16th)
- Because of the possibility that PCV of Unit 3 was damaged, the workers evacuated from the main control room of Units 3 and 4 (common control room). (10:45 March 16th) Thereafter the operators returned to the room and restarted the operation of water injection. (11:30 March 16th)

- Seawater was discharged 4 times to Unit 3 by the helicopters of the Self-Defence Force. (9:48, 9:52, 9:58 and 10:01 March 17th)
- The riot police arrived at the site for the water spray from the grand. (16:10 March 17th)
- The Self-Defence Force started the water spray using a fire engine. (19:35 March 17th)
- The water spray from the ground was carried out by the riot police. (From 19:05 till 19:13 March 17th)
- The water spray from the ground was carried out by the Self-Defense Force using 5 fire engines. (19:35, 19:45, 19:53, 20:00 and 20:07 March 17th)
- The water spray from the ground using 6 fire engines (6 tons of water spray per engine) was carried out by the Self-Defence Force. (From before 14:00 till 14:38 March 18th)
- The water spray from the ground using a fire engine provided by the US Military was carried out. (Finished at 14:45 March 18th)
- Hyper Rescue Unit of Tokyo Fire Department (14 vehicles) arrived at the Main Gate (23:10 March 18th) and 6 vehicles of them entered the NPS in order to spray water from the ground. (23:30 March 18th)
- Hyper Rescue Unit of Tokyo Fire Department carried out the water spray. (Finished at 03:40 March 20th)
- The pressure in PCV of Unit 3 rose (320 kPa as of 11:00 March 20th). Preparation to lower the pressure was carried. Judging from the situation, immediate pressure relief was not required. Monitoring the pressure continues (120 kPa at 12:15 March 21st).
- On-site survey for leading electric cable (From 11:00 till 16:00 March 20th)
- Water spray over the Spent Fuel Pool of Unit 3 by Hyper Rescue Unit of Tokyo Fire Department was carried out (From 21:39 March 20th till 03:58 March 21st).
- Works for the recovery of external power supply is being carried out.
- Grayish smoke generated from Unit 3. (At around 15:55 March 21st)
- The smoke was confirmed to be died down. (17:55 March 21st)
- Grayish smoke changed to be whitish and seems to be ceasing. (As of 07:11 March 22nd)
- Water spray <u>(Around 180t)</u> by Hyper Rescue Unit of Tokyo Fire

Department was carried out. (from 15:10 till 15:59 March 22nd)

- Lighting was recovered in the Central Operation Room. (22:43 March 22nd)
- Seawater is being injected to RPV. (As of 12:30 March 23rd)

<Unit 4>

- Because of the replacement work of the Shroud of RPV, no fuel was inside the RPV.
- The temperature of water in the Spent Fuel Pool at Unit 4 had increased. (84 ℃ at 04:08 March 14th)
- It was confirmed that a part of wall in the operation area of Unit 4 was damaged. (06:14 March 15th)
- The fire at Unit 4 occurred. (09:38 March 15th) TEPCO reported that the fire was extinguished spontaneously. (11:00 March 15th)
- The fire occurred at Unit 4. (5:45 March 16th) TEPCO reported that no fire could be confirmed on the ground.(At around 06:15 March 16th)
- The Self-Defence Force started water spray over the Spent Fuel Pool of Unit 4 (09:43 March 20th).
- On-site survey for leading electric cable (From 11:00 till 16:00 March 20th)
- Water spray over the Spent Fuel Pool of Unit 4 by Self-Defence Force was started. (From around 18:30 till 19:46 March 20th).
- Water spray over the Spent Fuel Pool by Self-Defence Force using 13 fire engines was started (From 06:37 till 08:41 March 21st).
- Works for laying electricity cable to the Power Center was completed. (At around 15:00 March 21st)
- Power Center received electricity. (10:35 March 22nd)
- Spray of around 150 tons of water using Concrete Pump Truck (50t/h) was carried out. (from 17:17 till 20:32 March 22nd)
- Water spray using Concrete Pump Truck (50t/h) was started. (10:00 March 23rd)

<Units 5 and 6>

- The first unit of Emergency Diesel Generator (B) for Unit 6 is operating and supplying electricity. Water injection to RPV and the Spent Fuel Pool through the system of Make up Water Condensate (MUWC) is being carried out.

- The second unit of Emergency Diesel Generator (A) for Unit 6 started up. (04:22 March 19th)
- The pumps for Residual Heat Removal (RHR) (C) for Unit 5 (05:00 March 19th) and RHR (B) for Unit 6 (22:14 March 19th) started up and recovered heat removal function. It cools Spent Fuel Pool with priority. (Power supply : Emergency Diesel Generator for Unit 6) (05:00 March 19th)
- Unit 5 under cold shut down (14:30 March 20th)
- Unit 6 under cold shut down (19:27 March 20th)
- Receiving electricity reached to the transformer of starter. (19:52 March 20th)
- Power supply to Unit 5 was switched from the Emergency Diesel Generator to external power supply. (11:36 March 21st)
- Power supply to Unit 6 was switched from the Emergency Diesel Generator to external power supply. (19:17 March 22nd)

<Common Spent Fuel Pool>

- It was confirmed that the water level of Spent Fuel Pool was maintained full at after 06:00 March 18th.
- As of 09:00 March 19th, the water temperature in the pool is 57℃.
- Water spray over the Common Spent Fuel Pool was started (From 10:37 till 15:30 March 21st)
- As of 16:30 March 21st, water temperature of the pool was around 61℃.

● Fukushima Dai-ni NPS (TEPCO)
(Naraha Town / Tomioka Town, Futaba County, Fukushima Prefecture.)

(1) The state of operation

Unit1 (1,100MWe):	automatic shutdown, cold shut down at 17:00, March 14th
Unit2 (1,100MWe):	automatic shutdown, cold shut down at 18:00, March 14th
Unit3 (1,100MWe):	automatic shutdown, cold shut down at 12:15, March 12th
Unit4 (1,100MWe):	automatic shutdown, cold shut down at 07:15, March 15th

(2) Major plant parameters (As of 12:00 March 23rd)

	Unit	Unit 1	Unit 2	Unit 3	Unit 4
Reactor Pressure*1	MPa	0.15	0.12	0.11	0.15
Reactor water temperature	℃	31.0	28.5	33.8	30.3
Reactor water level*2	mm	9,146	10,296	8,394	8,785
Suppression pool water temperature	℃	25	24	26	25
Suppression pool pressure	kPa (abs)	108	106	104	105
Remarks		cold shutdown	cold shutdown	cold shutdown	cold shutdown

*1: Converted from reading value to absolute pressure

*2: Distance from the top of fuel

(3) Report concerning other incidents

- TEPCO reported to NISA the event in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 1. (18:08 March 11th)
- TEPCO reported to NISA the events in accordance with the Article 10 regarding Units 1, 2 and 4. (18:33 March 11th)
- TEPCO reported to NISA the event (Loss of pressure suppression function) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 1. (5:22 March 12th)
- TEPCO reported to NISA the event (Loss of pressure suppression function) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 2. (5:32 March 12th)
- TEPCO reported to NISA the event (Loss of pressure suppression function) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 4 of

Fukushima Dai-ni NPS. (6:07 March 12th)

- Onagawa NPS (Tohoku Electric Power Co. Inc.)
  (Onagawa Town, Oga County and Ishinomaki City, Miyagi Prefecture)

(1) The state of operation

Unit 1 (524MWe): automatic shutdown, cold shut down at 0:58, March 12th

Unit 2 (825MWe): automatic shutdown, cold shut down at earthquake

Unit 3 (825MWe): automatic shutdown, cold shut down at 1:17, March 12th

(2) Readings of monitoring post, etc.

MP2 (Monitoring at the North End of Site Boundary)
approx. 6,500 nGy/h (19:00 March 14th)
→approx. 5,400 nGy/h (19:00 March 15th)

(3) Report concerning other incidents

- Fire Smoke on the first basement of the Turbine Building was confirmed to be extinguished. (22:55 on March 11th)
- Tohoku Electric Power Co. reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (13:09 March 13th)

2. Action taken by NISA

(March 11th)

14:46 Set up of the NISA Emergency Preparedness Headquarters (Tokyo) immediately after the earthquake

15:42 TEPCO reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

16:36 TEPCO recognized the event (Inability of water injection of the Emergency Core Cooling System) in accordance with the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Units 1 and 2 of Fukushima Dai-ichi NPS. (Reported to NISA at 16:45)

18:08 Regarding Unit 1 of Fukushima Dai-ni NPS, TEPCO reported to

NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

18:33 Regarding Units 1, 2 and 4 of Fukushima Dai-ni NPS, TEPCO reported to NISA in accordance with the Article 10 of Act on Special Measures Concerning Nuclear Emergency Preparedness.

19:03 The Government declared the state of nuclear emergency. (Establishment of Government Nuclear Emergency Response Headquarters and Local Emergency Response Headquarters)

20:50 Fukushima Prefecture's Emergency Response Headquarters issued a direction for the residents within 2 km radius from Unit 1 of Fukushima Dai-ichi NPS to evacuate. (The population of this area is 1,864.)

21:23 Directives from Prime Minister to the Governor of Fukushima Prefecture, the Mayor of Okuma Town and the Mayor of Futaba Town were issued regarding the event occurred at Fukushima Dai-ichi NPS, TEPCO, in accordance with the Paragraph 3, the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness as follows:

- Direction for the residents within 3km radius from Unit 1 of Fukushima Dai-ichi NPS to evacuate
- Direction for the residents within 10km radius from Unit 1 of Fukushima Dai-ichi NPS to stay in-house

24:00 Vice Minister of Economy, Trade and Industry, Ikeda arrived at the Local Emergency Response Headquarters

(March12th)

05:22 Regarding Unit 1 of Fukushima Dai-ni NPS, TEPCO recognized the event (Loss of pressure suppression function) to fall under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. (Reported to NISA at 06:27)

05:32 Regarding Unit 2 of Fukushima Dai-ni NPS, TEPCO recognized the event (Loss of pressure suppression function) to fall under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

05:44 Residents within 10km radius from Unit 1 of Fukushima Dai-ichi NPS shall evacuate by the Prime Minister Directive.

06:07 Regarding of Unit 4 of Fukushima Dai-ni NPS, TEPCO recognized the event (Loss of pressure suppression function) to fall under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

06:50 In accordance with the Paragraph 3, the Article 64 of the Nuclear Regulation Act, the order was issued to control the internal pressure of PCV of Units 1 and 2 of Fukushima Dai-ichi NPS.

07:45 Directives from Prime Minister to the Governor of Fukushima Prefecture, the Mayors of Hirono Town, Naraha Town , Tomioka Town and Okuma Town were issued regarding the event occurred at Fukushima Dai-ni NPS, TEPCO, pursuant to the Paragraph 3, the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness as follows:

- Direction for the residents within 3km radius from Fukushima Dai-ni NPS to evacuate
- Direction for the residents within 10km radius from Fukushima Dai-ni NPS to stay in-house

17:00 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

17:39 Prime Minister directed evacuation of the residents within the 10 km radius from Fukushima Dai-ni NPS.

18:25 Prime Minister directed evacuation of the residents within the 20km radius from Fukushima Dai-ichi NPS.

19:55 Directives from Prime Minister was issued regarding seawater injection to Unit 1 of Fukushima Dai-ichi NPS.

20:05 Considering the Directives from Prime Minister and pursuant to the Paragraph 3, the Article 64 of the Nuclear Regulation Act, the order was issued to inject seawater to Unit 1 of Fukushima Dai-ichi NPS and so on.

20:20 At Unit 1 of Fukushima Dai-ichi NPS, seawater injection started.

(March 13th)

05:38 TEPCO reported to NISA the event (Total loss of coolant injection function) falling under the Article 15 of the Act on Special Measures

Concerning Nuclear Emergency Preparedness regarding Unit 3 of Fukushima Dai-ichi NPS. Recovering efforts by TEPCO of the power source and coolant injection function and the work on venting were under way.

09:01 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

09:08 Pressure suppression and fresh water injection started for Unit 3 of Fukushima Dai-ichi NPS.

09:20 The Pressure Vent Valve of Unit 3 of Fukushima Dai-ichi NPS was opened.

09:30 Directive was issued for the Governor of Fukushima Prefecture, the Mayors of Okuma Town, Futaba Town, Tomioka Town and Namie Town in accordance with the Act on Special Measures Concerning Nuclear Emergency Preparedness on the contents of radioactivity decontamination screening.

09:38 TEPCO reported to NISA that Unit 1 of Fukushima Dai-ichi NPS reached a situation specified in the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

13:09 Tohoku Electric Power Co. reported to NISA that Onagawa NPS reached a situation specified in the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

13:12 Fresh water injection was switched to seawater injection for Unit 3 of Fukushima Dai-ichi NPS.

14:36 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

(March 14th)

01:10 Seawater injection for Units 1 and 3 of Fukushima Dai-ichi NPS were temporarily interrupted due to the lack of seawater in pit.

03:20 Seawater injection for Unit 3 of Fukushima Dai-ichi NPS was restarted.

04:40 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

05:38 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

07:52 TEPCO reported to NISA the event (Unusual rise of the pressure in PCV) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Unit 3 of Fukushima Dai-ichi NPS.

13:25 Regarding Unit 2 of Fukushima Dai-ichi NPS, TEPCO recognised the event (Loss of reactor cooling function) to fall under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.

22:13 TEPCO reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ni NPS.

22:35 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

(March 15th)

00:00: The acceptance of experts from IAEA was decided. NISA agreed to accept the offer of dispatching of the expert on NPS damage from IAEA considering the intention by Mr. Amano, Director General of IAEA. Therefore, the schedule of expert acceptance will be planned from now on according to the situation.

00:00: NISA also decided the acceptance of experts dispatched from NRC.

07:21 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

07:24 Incorporated Administration Agency, Japan Atomic Energy Agency (JAEA) reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Nuclear Fuel Cycle Engineering Laboratories, Tokai Research and Development Centre.

07:44 JAEA reported to NISA in accordance with the Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Nuclear Science Research Institute.

08:54 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

10:30 According to the Nuclear Regulation Act, Minister of Economy, Trade and Industry issued the directions as follows.

For Unit 4: To extinguish fire and to prevent the occurrence of re-criticality

For Unit 2: To inject water to reactor vessel promptly and to vent Drywell.

10:59 Considering the possibility of lingering situation, it was decided that the function of the Local Emergency Response Headquarters was moved to the Fukushima Prefectural Office.

11:00 Prime Minister directed the in-house stay area.

In-house stay was additionally directed to the residents in the area from 20 km to 30 km radius from Fukushima Dai-ichi NPS considering in-reactor situation.

16:30 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

22:00 According to the Nuclear Regulation Act, Minister of Economy, Trade and Industry issued the following direction.

For Unit 4: To implement the injection of water to the Spent Fuel Pool.

23:46 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

(March 18th)

13:00 Ministry of Education, Culture, Sports, Science and Technology decided to reinforce the nation-wide monitoring survey in the emergency of Fukushima Dai-ichi and Dai-ni NPS.

15:55 TEPCO reported to NISA on the accidents and failure at Units 1, 2, 3 and 4 of Fukushima Dai-ichi NPS (Leakage of the radioactive materials inside of the reactor buildings to non-controlled area of radiation) pursuant to the Article 62-3 of the Nuclear Regulation Act.

16:48 Japan Atomic Power Co. reported to NISA accidents and failures in Tokai NPS (Failure of the seawater pump motor of the emergency diesel generator 2C) pursuant to the Article 62-3 of the Nuclear Regulation Act.

(March 19th)

07:44 The second unit of Emergency Diesel Generator (A) for Unit 6 started up.

TEPCO reported to NISA that the pump for RHR (C) for Unit 5 started up and started to cooling Spent Fuel Storage Pool. (Power supply: Emergency Diesel Generator for Unit 6)

08:58 TEPCO reported to NISA the event (Unusual increase of radiation dose at the site boundary) falling under the Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness regarding Fukushima Dai-ichi NPS.

(March 20th)

23:30 Directive from Local Emergency Response Headquarters to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village) was issued regarding the change of the reference value for the screening level for decontamination of radioactivity.

(March 21st)

07:45 Directive titled as "Administration of the stable Iodine" was issued from Local Emergency Response Headquarters to the Prefectural

Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village), which directs the above-mentioned governor and the heads to administer stable Iodine under the direction of the headquarters and in the presence of medical experts, and not to administer it on personal judgements.

16:45 Directive titled as "Ventilation for using heating equipments within the in-house evacuation zone" was issued from the Head of Local Emergency Response Headquarters to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village), which directs the above-mentioned governor and heads to publicly announce the guidance to the residents within the in-house evacuation zone, concerning the indoor use of heating equipments that require ventilation, in order to avoid poisoning from carbon monoxide and to reduce exposure.

17:50 Directive from the Head of Government Nuclear Emergency Response Headquarters to the Prefectural Governors of Fukushima, Ibaraki, Tochigi and Gunma was issued, which direct the above-mentioned governors to issue a request to relevant businesses and people to suspend shipment of spinach, *Kakina* (a green vegetable) and raw milk for the time being.

(March 22nd)

16:00 NISA received the response (Advice) from Nuclear Safety Commission Emergency Technical Advisory Body to the request for advice made by NISA, regarding the report from TEPCO titled as "The Results of Analysis of Seawater" dated March 22nd.

< Possibility on radiation exposure (As of <u>12:30 March 23rd</u>) >

1. Exposure of residents

(1) Including the about 60 evacuees from Futaba Public Welfare Hospital to Nihonmatsu City Fukushima Gender Equality Centre, as the result of measurement of 133 persons at the Centre, 23 persons counted more

than 13,000 cpm were decontaminated.

(2) The 35 residents transferred from Futaba Public Welfare Hospital to Kawamata Town Saiseikai Kawamata Hospital by private bus arranged by Fukushima Prefecture were judged to be not contaminated by the Prefectural Response Centre.

(3) As for the about 100 residents in Futaba Town evacuated by bus, the results of measurement for 9 of the 100 residents were as follows. The evacuees, moving outside the Prefecture (Miyagi Prefecture), were divided into two groups, which joined later to Nihonmatsu City Fukushima Gender Equality Centre.

No. of Counts	No. of Persons
18,000cpm	1
30,000-36,000cpm	1
40,000cpm	1
little less than 40,000cpm*	1
very small counts	5

*(These results were measured without shoes, though the first measurement exceeded 100,000cpm)

(4) The screening was started at the Off site Centre in Okuma Town from March 12th to 15th. 162 people received examination until now. At the beginning, the reference value was set at 6,000cpm. 110 people were at the level below 6,000 cpm and 41 people were at the level of 6,000 cpm or more. When the reference value was increased to 13,000 cpm afterward, 8 people were at the level below 13,000 cpm and 3 people are at the level of 13,000 cpm or more.

The 5 out of 162 people examined were transported to hospital after being decontaminated.

(5) The Fukushima Prefecture carried out the evacuation of patients and personnel of the hospitals located within 10km area. The screening of all the members showed that 3 persons have the high counting rate. These members were transported to the secondary medical institute of

exposure. As a result of the screening on 60 fire fighting personnel involved in the transportation activities, the radioactivity higher than twice of the back ground was detected on 3 members. Therefore, all the 60 members were decontaminated.

2. Exposure of workers

(1) As for the 18 workers conducting operations in Fukushima Dai-ichi NPS, results of measurements are as follows;

One worker: At the level of exposure as 106.3 mSv, no risk of internal exposure and no medical treatment required.

Other workers: At the level of no risk for health but concrete numerical value is unknown.

(2) As for the 7 people working at the time of explosion at around the Unit 3 of Fukushima Dai-ichi NPS who were injured and conscious, 6 out of 7 people were decontaminated by an industrial doctor of the clinic in Fukushima Dai-ni NPS, and confirmed to have no risk. The other one was decontaminated at the clinic and the medical treatment was completed.

3. Others

(1) Fukushima Prefecture has started the screening from 13 March. It is carried out by rotating the evacuation sites and at the 12 places (set up permanently) such as health offices. The results of screening are being totalled up.

(2) 5 members of Self-Defence Force who worked for water supply in Fukushima Dai-ichi NPS were exposed. After the work (March 12th), 30,000 cpm was counted by the measurement at Off site Centre. The counts after decontamination were between 5,000 and 10,000 cpm. One member was transferred to National Institute of Radiological Science. No other exposure of the Self-Defence Force member was confirmed at the Ministry of Defence.

(3) As for policeman, the decontaminations of two policemen were confirmed by the National Police Agency. Nothing unusual was reported.

<Directive of screening levels for decontamination of radioactivity>

(1) On March 20th, the Local Emergency Response Headquarters issued the directive to change the reference value for the screening level for

decontamination of radioactivity as the following to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village).

Old : 40 Bq/cm^2 measured by a gamma-ray survey meter or 6,000 cpm

New : 1 μ Sv/hour (dose rate at 10cm distance) or 100,000cpm equivalent

<Directives of administrating stable Iodine during evacuation>

(1) On March 16th, the Local Emergency Response Headquarters issued "Directive to administer the stable Iodine during evacuation from the evacuation area (20 km radius)" to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village).

(2) On March 21st, the Local Emergency Response Headquarters issued Directive titled as "Administration of the stable Iodine" to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village), which directs the above-mentioned governor and heads to administer stable Iodine under the direction of the headquarters and in the presence of medical experts, and not to administer it on personal judgements.

<Situation of the injured (As of 12:30 March 23rd)>

1. Injury due to earthquake
   - Two employees (slightly)
   - Two subcontract employees (one fracture in both legs)
   - Two missing (TEPCO's employee, missing in the turbine building of Unit 4)
   - One emergency patient (According to the local prefecture, one patient of cerebral infarction was transported by the ambulance).

- Ambulance was requested for one employee complaining the pain at left chest outside of control area (conscious).
- Two employees complaining discomfort wearing full-face mask in the main control room were transported to Fukushima Dai-ni NPS for a consultation with an industrial doctor.

2. Injury due to the explosion of Unit 1 of Fukushima Dai-ichi NPS
   - Four employees were injured at the explosion and smoke of Unit 1 around turbine building (non-controlled area of radiation) and were examined by Kawauchi Clinic.

3. Injury due to the explosion of Unit 3 of Fukushima Dai-ichi NPS
   - Four TEPCO's employees
   - Three subcontractor employees
   - Four members of Self-Defence Force (one of them was transported to National Institute of Radiological Sciences considering internal possible exposure. The examination resulted in no internal exposure. The member was discharged from the institute on March 16th.)

4. Other injuries
   - A person who visited the clinic in Fukushima Dai-ni NPS from a transformer sub-station, claiming of a stomach ache, was transported to a clinic in Iwaki City, because the person was not contaminated.

<Situation of resident evacuation (As of 12:30 March 23rd)>

At 11:00 March 15th, Prime Minister directed in-house stay to the residents in the area from 20 km to 30 km radius from Fukushima Dai-ichi NPS. The directive was conveyed to Fukushima Prefecture and related municipalities.

Regarding the evacuation as far as 20-km from Fukushima Dai-ichi NPS and 10-km from Fukushima Dai-ni NPS, necessary measures have already been taken.

- The in-house stay in the area from 20 km to 30 km from Fukushima Dai-ichi NPS is made fully known to the residents concerned.

- Cooperating with Fukushima Prefecture, livelihood support to the residents in the in-house stay area are implemented.

<Directive regarding foods and drinks>

On March 21st, Directive from the Head of Government Nuclear Emergency Response Headquarters to the Prefectural Governors of Fukushima, Ibaraki, Tochigi and Gunma was issued, which directs above-mentioned governors to issue a request to relevant businesses and people to suspend shipment of the following products (①, ②) for the time being.

① Spinach and *Kakina* (a green vegetable) produced in Fukushima, Ibaraki, Tochigi and Gunma Prefectures

② Raw milk produced in Fukushima Prefecture

<Directive regarding the ventilation when using heating equipments in the aria of indoor evacuation >

On March 21st, Directive titled as "Ventilation for using heating equipments within the in-house evacuation zone" from the Head of Local Emergency Response Headquarters to the Prefectural Governor and the heads of cities, towns and villages (Tomioka Town, Hutaba Town, Okuma Town, Namie Town, Kawauchi Village, Naraha Town, Minamisouma City, Tamura City, Kazurao Village, Hirono Town, Iwaki City and Iidate Village) was issued, which directs those governor and heads to publicly announce the guidance to the residents within the in-house evacuation zone, concerning the indoor use of heating equipments that require ventilation, in order to avoid poisoning from carbon monoxide and to reduce exposure.

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