From:	Shea, James
To:	Coffin, Stephanie
Cc:	Reckley, William; Ruland, William
Subject:	RE: quick Summary of the Hongshu earthquake in Japan
Date:	Friday, March 11, 2011 11:40:29 AM

I saw that they seemed to have lost their emergency eclectic DGs, off-site power, and therefore by definition all active ECCS system. If they had Iso-Cond they would have about an hour or two Cooling which would get them to about 1% thermal power 45mwth after shutdown, they would only need about 50 gpm to keep the core covered(feed and bleed). If they got diesel fire pumps that would be easy but it would not be high quality water. I read where they have battery pumps for cooling but that does not make sense.

I saw on Fox that they were showing an explosion of an oil refinery and calling it a nuclear plant. Should not the Agency get ahead of this or at least catch up to what is really going on?
Did we get the OPS Center manned?

I would be happy to lend my BWR expertise if needed on this event.

Jim

Unit Type First Criticality Electric Power Fukushima I - 1 BWR March 26, 1971 460 MW Fukushima I - 2 BWR July 18, 1974 784 MW Fukushima I - 3 BWR March 27, 1976 784 MW Fukushima I - 4 BWR October 12, 1978 784 MW Fukushima I - 5 BWR April 18, 1978 784 MW Fukushima I - 6 BWR October 24, 1979 1100 MW Fukushima I - 7 (planned) ABWR October, 2013 1380 MW Fukushima I - 8 (planned) ABWR October, 2014 1380 MW

From: Coffin, Stephanie
Sent: Friday, March 11, 2011 8:52 AM
To: Araguas, Christian; Boyle, Thomas; Briggs, Christine; Carlson, Donald; Costa, Arlon; Cranston, Gregory; DeGange, Jonathan; Goodwin, Cameron; Held, Wesley; Humberstone, Matthew; James, Deonna; Jones (NRO), Mike; Kenyon, Thomas; Kevern, Thomas; Magruder, Stewart; Malave, Yanely; Mazza, Jan; Moore, Ross; Powell, Tamara; Reckley, William; RobinsonII, Richard; Shaikh, Samina; Shea, James; Smith, John; Starefos, Joelle; StPeters, Courtney; Stutzcage, Edward; Tello, Linda; Williams, Joseph
Cc: Mayfield, Michael
Subject: FW: quick Summary of the Hongshu earthquake in Japan

From: Johnson, Michael
Sent: Friday, March 11, 2011 8:50 AM
To: NRO_SES Distribution
Subject: FW: quick Summary of the Hongshu earthquake in Japan

FYI.

From: Chokshi, Nilesh

Sent: Friday, March 11, 2011 8:41 AM
To: Flanders, Scott; Johnson, Michael; Holahan, Gary
Subject: FW: quick Summary of the Hongshu earthquake in Japan

Will you keep informed.

From: Li, Yong
Sent: Friday, March 11, 2011 8:22 AM
To: Chokshi, Nilesh; Munson, Clifford
Cc: Cook, Christopher; Karas, Rebecca
Subject: quick Summary of the Hongshu earthquake in Japan

From: Boger, Bruce NRR
To: Leeds, Eric; Grobe, Jack; Brown, Frederick; McGinty, Tim; Hiland, Patrick; Skeen, David; Ruland, William; Giitter, Joseph; Thorp, John; Virgilio, Martin; Wittick, Brian
Subject: Fw: HOO HIGHLIGHT - DIABLO CANYON UNUSUAL EVENT
Date: Friday, March 11, 2011 5:32:18 AM

West coast landfall estimated to be around 11:00 am EST. An update call will take place at 8:00 am EST. NRR should call into the Ops Center at that time, perhaps as group from O-13D20?

From: HOO Hoc NSIR
To: HOO Hoc
Sent: Fri Mar 11 05:09:33 2011
Subject: HOO HIGHLIGHT - DIABLO CANYON UNUSUAL EVENT

Diablo Canyon declared a Notice of Unusual Event at 0123 PST due to a Tsunami Warning for the coastal areas of California as a result of a 8.9 magnitude earthquake off the coast of Japan. The Agency remains in the NORMAL response mode as of 0452 EST.

Joe O'Hara
Headquarters Operations Officer
U.S. Nuclear Regulatory Commission
Phone: 301-816-5100
Fax: 301-816-5151
email: hoo.hoc@nrc.gov
secure e-mail: hoo1@nrc.sgov.gov

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

From:	Kammerer, Annie
To:	RES DE SGSEB; Case, Michael; Richards, Stuart; Chokshi, Nilesh; Munson, Clifford; Karas, Rebecca; Markley, Michael; Manoly, Kamal; Sheron, Brian; Uhle, Jennifer; Cook, Christopher; Bagchi, Goutam; Khanna, Meena
Subject:	FW: M8.9 NEAR THE EAST COAST OF HONSHU, JAPAN
Date:	Friday, March 11, 2011 7:33:47 AM
Attachments:	ISSC Notification Report.pdf

FYI. This is from the working version of our beta ShakeCAST system

From: ISSC-Notification@iaea.org [mailto:ISSC-Notification@iaea.org]
Sent: Friday, March 11, 2011 4:38 AM
To: ISSC-Notification@iaea.org
Cc: Kammerer, Annie
Subject: M8.9 NEAR THE EAST COAST OF HONSHU, JAPAN

The following New Earthquake occurred:

Location	NEAR THE EAST COAST OF HONSHU, JAPAN
Magnitude	8.9
Time	2011-03-11 06:46:23
Lat	38.322
Lon	142.369

ISSC ShakeCast Notification System
IAEA

======

U/3

ShakeCast Report

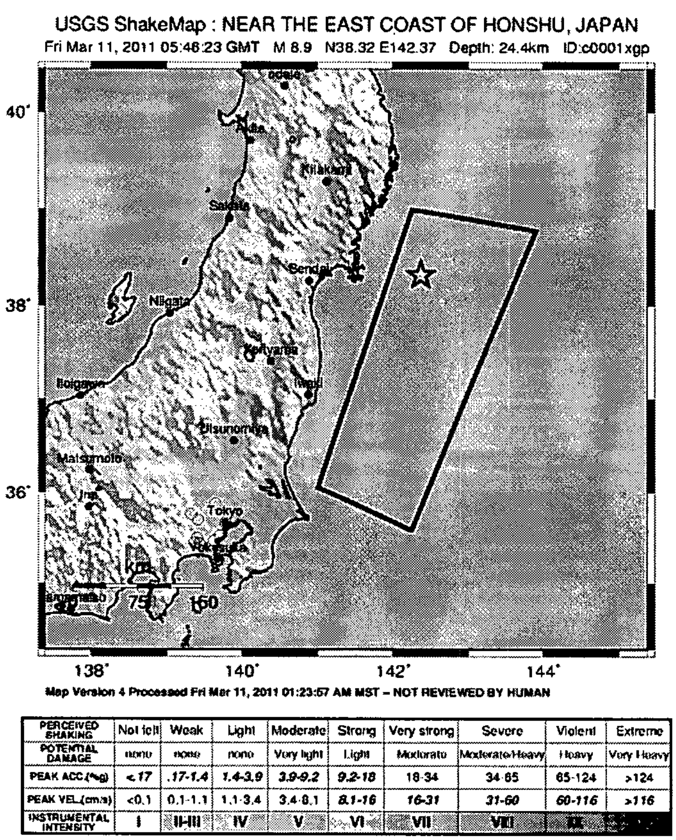
IAEA.org International Atomic Energy Agency — USGS science for a changing world

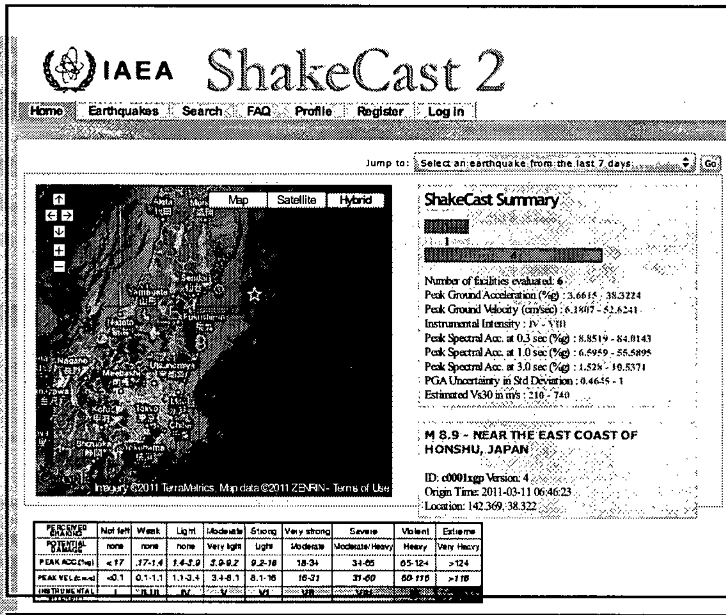
Magnitude 8.9 - NEAR THE EAST COAST OF HONSHU, JAPAN — Version 4

Time: 2011-03-11 05:46:23 GMT
Location: 38.32 N/ 142.37 E
Depth: 24.4 km

Created: 2011-03-11 09:37:54 GMT
For more information and latest version see http://earthquake.usgs.gov/shakemap

These results are from an automated system and users should consider the preliminary nature of this information when making decisions relating to public safety. ShakeCast results are often updated as addtional or more accurate earthquake information is reported or derived.





Recent significant earthquakes in the region

- M7.7 Miyagi-Oki, Japan at 6/12/1978 8:14
- M7.4 NEAR THE EAST COAST OF HONSHU, JAPAN at 11/1/1989 18:25
- M7.2 Miyagi-Oki, Japan at 8/16/2005 2:46
- M7 NEAR THE EAST COAST OF HONSHU, JAPAN at 1/18/1981 18:11
- M7 Miyagi-Oki, Japan at 5/26/2003 9:24

FACILITY_TYPE	FACILITY_ID	FACILITY_NAME	LATITUDE	LONGITUDE	DAMAGE_LEVEL	MMI	PGA	PGV	PSA03	PSA10	PSA30
NPP	JPN1	Fukushima Daiichi	37.4215	141.034	RED	7.72	25.8708	35.5119	57.8466	37.5128	7.4042
NPP	JPN2	Fukushima Daini	37.3163	141.025	RED	7.76	26.6768	36.4785	59.5783	38.5339	7.5874
NPP	JPN10	Onagawa	38.3998	141.501	RED	7.34	23.483	27.6412	52.4778	29.1987	5.7565
NPP	JPN4	Hamaoka	34.6242	138.14	GREEN	4.96	6.5016	10.322	15.3754	10.9036	2.4143
NPP	JPN7	Kashiwazaki - Kariwa	37.4317	138.598	YELLOW	5.53	8.5166	13.0735	19.9327	13.8102	2.9935
NPP	JPN15	Tokai	36.4654	140.607	RED	7.72	25.8298	35.4623	57.7583	37.4606	7.3948

* - MMI level extends beyond map boundary, actual population exposure may be much larger

** - Some facilities may not appear on the map due to space restriction

From:	Sheron, Brian
To:	Bonaccorso, Amy; Calvo, Antony; Case, Michael; Coe, Doug; Correia, Richard; Dion, Jeanne; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Rini, Brett; Sangimino, Donna-Marie; Uhle, Jennifer; Valentin, Andrea
Subject:	FW: Press Release: NRC Monitors Notice of Unusual Event at Diablo Canyon Power Plant, Tusnami Issues
Date:	Friday, March 11, 2011 2:29:06 PM
Attachments:	11-042.docx

From: OPA Resource
Sent: Friday, March 11, 2011 11:59 AM
To: Ash, Darren; Barkley, Richard; Batkin, Joshua; Bell, Hubert; Belmore, Nancy; Bergman, Thomas; Bollwerk, Paul; Bonaccorso, Amy; Borchardt, Bill; Bozin, Sunny; Brenner, Eliot; Brock, Terry; Brown, Boris; Bubar, Patrice; Burnell, Scott; Burns, Stephen; Carpenter, Cynthia; Chandrathil, Prema; Clark, Theresa; Collins, Elmo; Couret, Ivonne; Crawford, Carrie; Cutler, Iris; Dacus, Eugene; Dapas, Marc; Davis, Roger; Dean, Bill; Decker, David; Dricks, Victor; Droggitis, Spiros; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Haney, Catherine; Hannah, Roger; Harbuck, Craig; Harrington, Holly; Hasan, Nasreen; Hayden, Elizabeth; Holahan, Gary; Holahan, Patricia; Holian, Brian; Jacobssen, Patricia; Jaczko, Gregory; Jasinski, Robert; Jenkins, Verlyn; Johnson, Michael; Jones, Andrea; Kock, Andrea; Kotzalas, Margie; Ledford, Joey; Lee, Samson; Leeds, Eric; Lepre, Janet; Lew, David; Lewis, Antoinette; Loyd, Susan; Magwood, William; McCrary, Cheryl; McGrady-Finneran, Patricia; McIntyre, David; Mensah, Tanya; Mitlyng, Viktoria; Monninger, John; Montes, David; Nieh, Ho; Ordaz, Vonna; Ostendorff, William; Owen, Lucy; Powell, Amy; Quesenberry, Jeannette; Reddick, Darani; Regan, Christopher; Reyes, Luis; Riddick, Nicole; RidsSecyMailCenter Resource; Riley (OCA), Timothy; Rohrer, Shirley; Samuel, Olive; Satorius, Mark; Schaaf, Robert; Schmidt, Rebecca; Scott, Catherine; Screnci, Diane; Shaffer, Vered; Shane, Raeann; Sharkey, Jeffry; Sheehan, Neil; Sheron, Brian; Siurano-Perez, Osiris; Steger (Tucci), Christine; Svinicki, Kristine; Tabatabai, Omid; Tannenbaum, Anita; Taylor, Renee; Temp, WDM; Thomas, Ann; Uhle, Jennifer; Uselding, Lara; Vietti-Cook, Annette; Virgilio, Martin; Virgilio, Rosetta; Walker-Smith, Antoinette; Weaver, Doug; Weber, Michael; Weil, Jenny; Werner, Greg; Wiggins, Jim; Williams, Evelyn; Zimmerman, Roy; Zorn, Jason
Subject: Press Release: NRC Monitors Notice of Unusual Event at Diablo Canyon Power Plant, Tusnami Issues

Attached for immediate posting and release.

Office of Public Affairs
US Nuclear Regulatory Commission
301-415-8200
opa.resource@nrc.gov

V/4

NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION
Office of Public Affairs Telephone: 301/415-8200
Washington, D.C. 20555-0001
E-mail: opa.resource@nrc.gov Site: www.nrc.gov
Blog: http://public-blog.nrc-gateway.gov

No. 11-042 March 11, 2011

NRC MONITORS NOTICE OF UNUSUAL EVENT AT DIABLO CANYON POWER PLANT, TSUNAMI ISSUES

The U.S. Nuclear Regulatory Commission, through its regional office in Arlington, Tex., is monitoring a notice of unusual event (NOUE) at the Diablo Canyon Power Plant, located near San Luis Obispo, Calif. Senior NRC officials are working at the agency's Rockville, Md., headquarters to coordinate NRC activities with respect to the Japanese earthquake and subsequent tsunami.

"The NRC is closely monitoring this situation as it unfolds with respect to nuclear facilities within the United States. NRC staff is working closely with its resident inspectors who are on site to ensure safe operations," said NRC Chairman Gregory Jaczko.

Pacific Gas and Electric Co. (PG&E), operator of the Diablo Canyon two-reactor plant, declared a precautionary NOUE Unusual Event at 4:23 a.m. EST today after receiving a tsunami warning from the West California Emergency Management Agency. The tsunami warning was generated after an estimated 8.9 magnitude earthquake occurred off the eastern Japanese coast.

The licensee reported the Diablo Canyon plant is stable and both units remain on line. The plant is well protected against tsunami conditions as required by NRC regulations. The NRC has staff at the plant keeping track of the plant's response.

Nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area.

In addition to the Diablo Canyon plant, the NRC is also monitoring the San Onofre nuclear power plant, the Humboldt Bay spent fuel storage site and NRC-regulated nuclear materials sites in Hawaii and Alaska to name a few. Site personnel have informed the NRC they are prepared for possible tsunami effects.

###

From:	Sheron, Brian
To:	Bonaccorso, Amy; Calvo, Antony; Case, Michael; Coe, Doug; Correia, Richard; Dion, Jeanne; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Rini, Brett; Sangimino, Donna-Marie; Uhle, Jennifer; Valentin, Andrea
Subject:	FW: Press Release: NRC Continues to Track Earthquake and Tsunami Issues
Date:	Friday, March 11, 2011 4:27:11 PM
Attachments:	11-043.docx

From: OPA Resource
Sent: Friday, March 11, 2011 4:26 PM
To: Ash, Darren; Barkley, Richard; Batkin, Joshua; Bell, Hubert; Belmore, Nancy; Bergman, Thomas; Bollwerk, Paul; Bonaccorso, Amy; Borchardt, Bill; Bozin, Sunny; Brenner, Eliot; Brock, Terry; Brown, Boris; Bubar, Patrice; Burnell, Scott; Burns, Stephen; Carpenter, Cynthia; Chandrathil, Prema; Clark, Theresa; Collins, Elmo; Couret, Ivonne; Crawford, Carrie; Cutler, Iris; Dacus, Eugene; Dapas, Marc; Davis, Roger; Dean, Bill; Decker, David; Dricks, Victor; Droggitis, Spiros; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Haney, Catherine; Hannah, Roger; Harbuck, Craig; Harrington, Holly; Hasan, Nasreen; Hayden, Elizabeth; Holahan, Gary; Holahan, Patricia; Holian, Brian; Jacobssen, Patricia; Jaczko, Gregory; Jasinski, Robert; Jenkins, Verlyn; Johnson, Michael; Jones, Andrea; Kock, Andrea; Kotzalas, Margie; Ledford, Joey; Lee, Samson; Leeds, Eric; Lepre, Janet; Lew, David; Lewis, Antoinette; Loyd, Susan; Magwood, William; McCrary, Cheryl; McGrady-Finneran, Patricia; McIntyre, David; Mensah, Tanya; Mitlyng, Viktoria; Monninger, John; Montes, David; Nieh, Ho; Ordaz, Vonna; Ostendorff, William; Owen, Lucy; Powell, Amy; Quesenberry, Jeannette; Reddick, Darani; Regan, Christopher; Reyes, Luis; Riddick, Nicole; RidsSecyMailCenter Resource; Riley (OCA), Timothy; Rohrer, Shirley; Samuel, Olive; Satorius, Mark; Schaaf, Robert; Schmidt, Rebecca; Scott, Catherine; Screnci, Diane; Shaffer, Vered; Shane, Raeann; Sharkey, Jeffry; Sheehan, Neil; Sheron, Brian; Siurano-Perez, Osiris; Steger (Tucci), Christine; Svinicki, Kristine; Tabatabai, Omid; Tannenbaum, Anita; Taylor, Renee; Temp, WDM; Thomas, Ann; Uhle, Jennifer; Uselding, Lara; Vietti-Cook, Annette; Virgilio, Martin; Virgilio, Rosetta; Walker-Smith, Antoinette; Weaver, Doug; Weber, Michael; Weil, Jenny; Werner, Greg; Wiggins, Jim; Williams, Evelyn; Zimmerman, Roy; Zorn, Jason
Subject: Press Release: NRC Continues to Track Earthquake and Tsunami Issues

The attached to be issued and posted in approximately 15 minutes.

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US Nuclear Regulatory Commission
301-415-8200
opa.resource@nrc.gov

1/5

NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION

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Washington, D.C. 20555-0001
E-mail: opa.resource@nrc.gov Site: www.nrc.gov
Blog: http://public-blog.nrc-gateway.gov

No. 11-043 March 11, 2011

NRC CONTINUES TO TRACK EARTHQUAKE AND TSUNAMI ISSUES

Senior officials at U.S. Nuclear Regulatory Commission headquarters in Rockville, Md., are following events related to the Japanese earthquake and subsequent tsunami. In addition, the agency's regional office in Arlington, Texas, will continue to monitor the Diablo Canyon Power Plant's handling of a notice of unusual event (NOUE) at the site, near San Luis Obispo, Calif., for the duration of the event.

"We offer our condolences to all those in Japan affected by these tragedies," said NRC Chairman Gregory Jaczko. "The NRC is ready to provide whatever assistance we can to our Japanese counterparts, should there be a specific request. We're closely coordinating with other federal agencies."

Friday's tsunami warning, issued after an estimated 8.9 magnitude earthquake occurred off the eastern Japanese coast, prompted Pacific Gas and Electric Co. (PG&E), operator of the Diablo Canyon two-reactor plant, to declare a precautionary NOUE at 4:23 a.m. EST Friday. PG&E has reported both reactors have remained online throughout the event. While PG&E has reported only minor tsunami-related effects, the plant is well-protected against tsunami conditions as required by NRC regulations. NRC staff at the plant are keeping track of the plant's response during the event and remain in close contact with plant operators.

Nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area.

In addition to the Diablo Canyon plant, the NRC is following events at the San Onofre nuclear power plant, the Humboldt Bay spent fuel storage site and NRC-regulated nuclear materials sites in Hawaii and Alaska to name a few. Personnel at all those sites have informed the NRC conditions remain safe.

###

From: Scott, Michael
To: Case, Michael; Richards, Stuart
Subject: FW: RECOMMENDED ATTENDANCE AT NGNP ANNUAL R&D MEETING - ALBUQUERQUE
Date: Friday, March 11, 2011 8:28:04 AM

Mike and Stu:

Please let me know if you have any concerns with the below. Coordinated at the BC level.

Thanks

Brian and Jennifer:

We are planning for travel to support the subject meeting, scheduled for 4/26-4/28/11 in Albuquerque. The travel, with exception of my own, will be paid by DOE reimbursable funds. DOE wants staff involved with NGNP to attend this meeting. Still, based on the funding issues with NGNP, we are cutting back from the 13 people I'm told we sent last year. The list has been discussed and coordinated with all three technical divisions.

With exception of me, all proposed attendees below are either are presenting, or are technical leads for subjects under discussion at the meeting. I propose to attend both in my role as overall NGNP lead for RES, and my need to get educated to support my role as NRC's rep for the HTTR/LOFC project.

Scott (NRC funds)
S. Rubin (DOE funds)
Kelly (DOE funds)
Basu (DOE funds)
Srinivasan (DOE funds)
Malik (DOE funds)
Lee (DOE funds)
Aissa (DOE funds)
Nosek (DOE funds)

DE has proposed one additional attendee (Amy Hull), while DSA has proposed two (Mike Rubin and Kimberly Tene). Because of the funding considerations and less direct involvement in the subjects under discussion at the meeting, we are not proposing to send those folks.

Please let me know if you have concerns with the above.

Thanks

Mike

U/6

From:	Sheron, Brian
To:	Weber, Michael; Martin Brechbeil; Leeds, Eric; Borchardt, Bill; Wiggins, Jim; Haney, Catherine; Miller, Charles; Dean, Bill; McCree, Victor; Satorius, Mark; Collins, Elmo
Cc:	Case, Michael; Richards, Stuart
Subject:	FW: [Yama] Situation now - Japan NPPs - ECCS mode
Date:	Friday, March 11, 2011 7:21:13 AM

FYI.

From: Lawrence.BURKHART@oecd.org [mailto:Lawrence.BURKHART@oecd.org]
Sent: Friday, March 11, 2011 5:51 AM
To: Leeds, Eric; Regan, Christopher; Sheron, Brian; Sangimino, Donna-Marie; Doane, Margaret; Cullingford, Michael; Johnson, Michael; Uhle, Jennifer; Schwartzman, Jennifer
Cc: Holahan, Gary; Williams, Donna; John.NAKOSKI@oecd.org; Diane.JACKSON@oecd.org
Subject: FW: [Yama] Situation now - Japan NPPs - ECCS mode

Dear all,

Greetings from Paris. Im sure you've heard about the earthquake in Japan and Im sure you may have your own information sources. But just wanted to pass on this is an email from a colleague (who used to work at NEA but recently returned to Japan).

Apparently all of the 15 Japanese Nuclear Power Plants shutdown successfully but there are some issues with Diesel Generators operating properly at the plants listed below.

I will send more info if it is relevant and if you would like.

Very Best Regards. Larry

From: Akihiro YAMAMOTO [mailto:a-yamamoto@houshasen.tsuruga.fukui.jp]
Sent: Friday, March 11, 2011 11:30
To: GAUVAIN Jean, NEA/SURN
Cc: REIG Javier, NEA/SURN; ECHAVARRI Luis, NEA; YOSHIMURA Uichiro, NEA/SRAN; GUYOT Lydie, NEA; PEYRAT Marie-Laure, NEA/SRAN; GAS Serge, NEA/RE; BREEST Axel, NEA/SURN; MAUNY Elisabeth, NEA/SURN; LAMARRE Greg, NEA/SURN; REHACEK Radomir, NEA/SURN; HUERTA Alejandro, NEA/SURN; JACKSON Diane, NEA/SURN; GAUVAIN Jean, NEA/SURN; NAKOSKI John, NEA/SURN; GRESS Philippe, NEA/SURN; BURKHART Lawrence, NEA/SURN; IANNOLO Nicolina, NEA/SURN; CHAUHAN Roopa, DAF/COMP; christele.tephanympania@oecd.org; LITTLE Aileen, NEA/ADMI; 'Carlo Vitanza'; AMRI Abdallah, NEA/SURN
Subject: [Yama] Situation now - ECCS mode

Dear all,

TEPCO (Tokyo Electric Power Company) declared the state of emergency of following NPPs:
Fukushima 1-1
Fukushima 1-2
Fukushima 1-3
Fukushima 2-1 **(ECCS mode now)**

I am trying to get information why DG can't start up (problem of intake sea water for the cooling DG system?)

U/7

There is a fire from turbine building (B1 floor) at Onagawa NPP unit 1 but the fire fighting was completely succeded.

http://www.yomiuri.co.jp/dy/national/20110311dy01.htm

A while ago, Fukui (my office located) had also earthquake (M4.1). We have 15 NPPs but no damage to the NPPs.

Yama

++++++++++++++++++++++++++++++++++++
Akihiro YAMAMOTO
Ageing Management Specialist,
Nuclear Safety Measurement Division
Fukui Prefectural Government

Telephone: +81 (0) 776 20 0314

E-mail: a-yamamoto@houshasen.tsuruga.fukui.jp
++++++++++++++++++++++++++++++++++++

From: Richards, Stuart
To: Hogan, Rosemary; Graves, Herman; Kammerer, Annie; Murphy, Andrew
Cc: Case, Michael; Uhle, Jennifer
Subject: Follow-up to the Japanese Earthquake/Tsunami
Date: Friday, March 11, 2011 6:12:11 PM

Brian wants us to be prepared to answer questions on the earthquake/tsunami, particularly as it is related to US plants.

For example:

- Was the ground motion at the Japanese sites beyond their design basis?

- Why do we have confidence that US nuclear power plants are adequately designed for earthquakes and tsunamis?

- If the earthquake in Japan was a larger magnitude than considered by plant design, why can't the same thing happen in the US?

- What would be the results of a tsunami generated off the coast of a US plant? (Or why are we confident that large tsunamis will not occur relatively close to US shores?)

Mike will likely get additional guidance on Monday morning.

Thanks
Stu

V/8

From: Csontos, Aladar
To: Case, Michael; Richards, Stuart
Subject: Fw: [Yama] Massive quake strikes northern Japan
Date: Friday, March 11, 2011 10:30:43 AM

Fyi on the Japanese quake from a Japanese colleague.

From: Akihiro YAMAMOTO <a-yamamoto@houshasen.tsuruga.fukui.jp>
To: 'Akihiro YAMAMOTO' <a-yamamoto@houshasen.tsuruga.fukui.jp>
Sent: Fri Mar 11 05:40:53 2011
Subject: [Yama] Massive quake strikes northern Japan

Unbelievable strong earthquake hit east part of Japan 3 hours ago.
This is the strongest earthquake in past 100 years at least, I believe.

TEPCO (Tokyo Electric Power Company) declared the state of emergency of following NPPs:
Fukushima 1-1
Fukushima 1-2
Fukushima 1-3
Fukushima 2-1 **(ECCS mode now)**

I am trying to get information why DG can't start up (problem of intake sea water for the cooling DG system?)

There is a fire from turbine building (B1 floor) at Onagawa NPP unit 1 but the fire fighting was completely succeeded.

http://www.yomiuri.co.jp/dy/national/20110311dy01.htm

Prime minister also declared the state of emergency.

- Many people died
- All the trains service disruption in Tokyo
- Tsunami destroyed many cars, houses...
- Fires occurred at Oil station
- Wide areas - blackout

I live in the west part of Japan and I haven't suffered any problems but I am really sorry for people who have affected by earthquakes...

Aftershocks are still continuing...

Yama

++++++++++++++++++++++++++++++++++++
Akihiro YAMAMOTO
Ageing Management Specialist,
Nuclear Safety Measurement Division
Fukui Prefectural Government

Telephone: +81 (0) 776 20 0314

E-mail: a-yamamoto@houshasen.tsuruga.fukui.jp
++++++++++++++++++++++++++++++++++++

V/9

From: Csontos, Aladar
To: Case, Michael; Richards, Stuart
Subject: Fw: [Yama] Situation at Fukushima NPPs
Date: Friday, March 11, 2011 10:57:09 AM

Fyi part 2

From: Akihiro YAMAMOTO <a-yamamoto@houshasen.tsuruga.fukui.jp>
To: Csontos, Aladar
Sent: Fri Mar 11 10:56:05 2011
Subject: [Yama] Situation at Fukushima NPPs

Dear Al,

Fukushima unit 1-1 and 1-2 (BWR) are still in serious situation.
Regarding the unit1-2, water level in the vessel has decreased from +5.6m to +3.6m (above the top of fuel assemblies).

The unit can't receive electric power from outside and also emergency diesel generators have not started due to problem occurred at sea water pump (Affected by Tsunami).
A special car equipped battery has arrived at the unit and the company is trying to connect it to the line.

We need to set up new project on reliability of emergency diesel generators in the future...

Yama

++++++++++++++++++++++++++++++++++++
Akihiro YAMAMOTO
Ageing Management Specialist,
Nuclear Safety Measurement Division
Fukui Prefectural Government

Telephone: +81 (0) 776 20 0314

E-mail: a-yamamoto@houshasen.tsuruga.fukui.jp
++++++++++++++++++++++++++++++++++++

From: Csontos, Aladar [mailto:Aladar.Csontos@nrc.gov]
Sent: Saturday, March 12, 2011 12:32 AM
To: Akihiro YAMAMOTO
Subject: RE: [Yama] Massive quake strikes northern Japan

Yama,

Thank you for the information. My thoughts and prayers go to you and the Japanese people. Take care and let me know if I can do anything for you.

Al

V/10

Aladar A. Csontos, Ph.D
Chief, Component Integrity Branch
Division of Engineering
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
21 Church Street M/S 0507M
Rockville, MD 20852

Office: (301) 251-7640
Fax: (301) 251-7425
Email: aladar.csontos@nrc.gov

From:	Breskovic, Clarence (OIP)
To:	Breskovic, Clarence
Subject:	Background Paper on BWR Reactors for non-Nuclear Engineers - Fukushima reactor schematics, containment, etc.
Date:	Friday, March 11, 2011 1:05:23 PM
Attachments:	ANSN BWR Paper.pdf

I attached a BWR reactor background paper developed by the Asian Nuclear Safety Network. This might help people who are not nuclear engineers understand the jargon and the problems being described.

V/11

Boiling Water Reactor Power Plant

This material was, for a purpose to be used in a nuclear education, compiled comprehensively with a caution on appropriateness and neutrality of information, based on references of neutral organizations, suh as NRC, Wikipedia and ATOMICA, and vendors' information especially on advanced reactors. At the end of this material, references are listed.

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Part 1. Descriptions of BWR Power plants

Chapter 1. BWR Development

1.1. General

Boiling water reactors (BWRs) are nuclear power reactors utilizing light water as the reactor coolant and moderator to generate electricity by directly boiling the light water in a reactor core to make steam that is delivered to a turbine generator. There are two operating BWR types, roughly speaking, i.e., BWRs and ABWRs (advanced boiling water reactors)

The outline of a BWR power plant is shown in Figure 1.

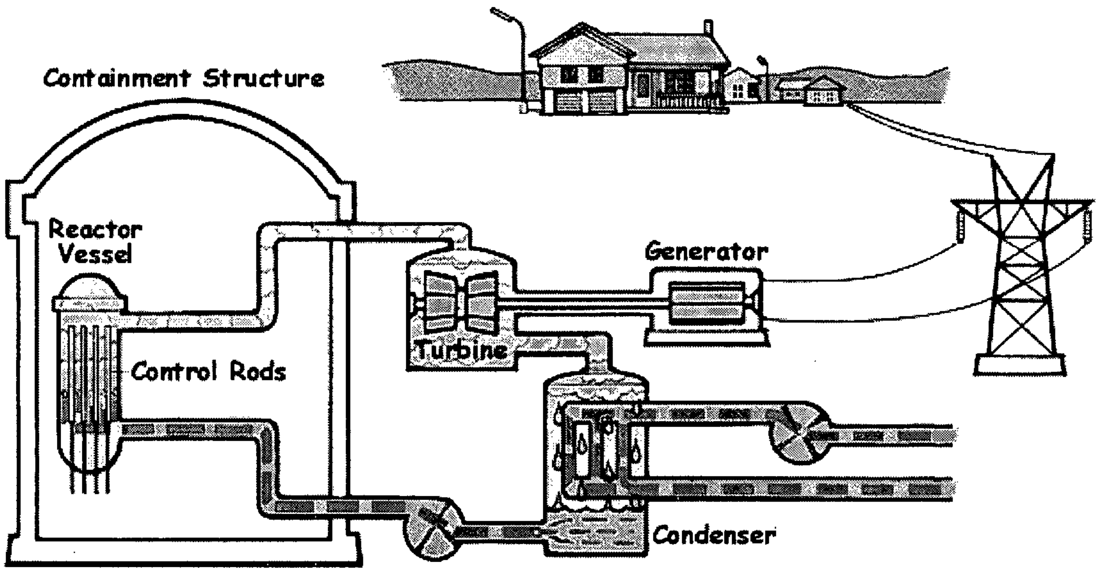


Figure 1. Outline of BWR Power Plant

More details on the System Outline of ABWR Power Plant

A pressurized water reactor (PWR) was the first type of light-water reactor developed because of its application to submarine propulsion. The civilian motivation for the BWR is reducing costs for commercial applications through design simplification and lower pressure components.

In contrast to the pressurized water reactors that utilize a primary and secondary loop, in civilian BWRs the steam going to the turbine that powers the electrical generator is produced in the reactor core rather than in steam generators or heat exchangers. There is just a single circuit in a civilian BWR in which the water is at lower pressure (about 75 times atmospheric pressure) so that it boils in the core at about 285°C.

BWRs have been originally developed by GE. GE started its development in 1950s as light water reactor type nuclear power reactors, and the Dresden Unit-1 (200,000 kWe) commissioned in July 1960 is the first BWR nuclear power station. After that, the GE company has supplied many BWRs, Siemens (KWU, Germany), ABB-Atom (Switzerland/Sweden) and Toshiba and Hitachi (Japan) also supplied many BWRS. In the following, features and types of BWRs, mainly of conventional BWRs, are explained and those of ABWRs are addressed in the next.

For BWRs, the steam void due to reactor coolant boiling has a negative-reactivity effect, which can suppress a power rise even if a positive reactivity is added. The reactor power can be controlled by two methods: reactor-coolant recirculation-flow control and control rod operation.

A BWR nuclear power plant consists of the reactor coolant recirculation system and main steam system that compose a nuclear reactor, engineered safety features that consist of the emergency core cooling system, reactor core isolation cooling system, containment cooling system and boric-acid injection system, turbine and generator equipment and other systems, such as the reactor coolant purification system, waste processing equipment, fuel handling equipment, other auxiliary equipment, etc.

1.2. BWR Type

Major reactor core parameters of BWR-2 to BWR-4, which are in operation in Japan are shown in Table 1.

Table 1 Main Parameters for BWR Core

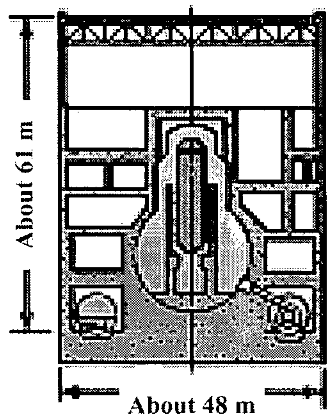
No	Item	Tsuruga Unit-1 (BWR-2)	Fukushima Unit-1 (BWR-3)	Hamaoka Unit-2 (BWR-4)	Tokai Unit-2 (BWR-5)	Kashiwazaki Unit-6 (ABWR)
(1)	Thermal output (MW)	1064	1380	2436	3293	3926
(2)	Electric output (MW)	357	460	840	1100	1356
(3)	Core equivalent dia. (m)	3.02	3.44	4.07	4.75	5.16
(4)	Core effective height (m)	3.66	3.66	3.71	3.71	3.71
(5)	Fuel assemblies (Number)	308	400	560	764	872
(6)	Control rod (Number)	73	97	137	185	205
(7)	Power density (kw/l)	About 40	About 40	About 50	About 50	About. 50

Improvement and history of BWR fuel in Japan are shown in Table 2. In 1960s, the development started including introduction of overseas technologies under license agreements, and the fuel type has been changed from 6x6 to 9x9 adopting many improvements resulting from nuclear and mechanical research and developments.

Table 2 BWR Fuel Improvement in Japan

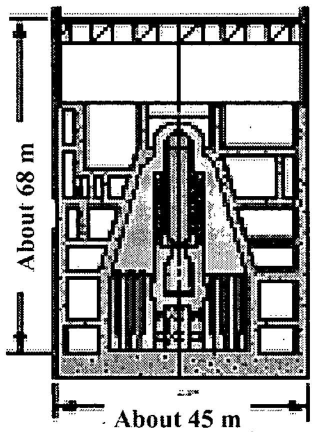
Year/Item	Objective	Major Improvement	Fuel Type	Reactor Type
1960	Development in general	Basic study on fuel material Fuel rod irradiation test Core design study Fuel manufacturing technologies	6x6 7x7	JPDR (BWR-1)
1970	Initial performance development	6x6 type fuel demonstration Domestic fuel performance demonstration 7x7 type fuel development (high power density and long fuel rod development)	7x7R	Tsuruga-1 (BWR-2) Fukushima I-1 (BWR-3)
1980	Reliability improvement	Reliability improvement Improved 7x7 type fuel development Preconditioning fuel operation 8x8 type fuel development	8x8 8x8 R	Fukushima I-2 (BWR-4) Tokai-2 (BWR-5) Fukushima II-2 (Improved BWR-5)
1990	Availability improvement	Re-evaluation of preconditioning fuel operation He pressurized fuel Two regional fuel reactivity design Controlled cell core	Liner 8x8 R High Burnup 8x8	
2000	High performance / high burnup fuel	Zirconium liner fuel High burnup fuel		Kashiwazaki-6 (ABWR)

Improvement of BWR containment is shown in Figure 2. Five types of containments were applied for Japanese BWRs. Typical design for each type of containment is illustrated with major dimensions. The design has attained significant improvement in the total volume per output, resulting in a large cost benefit.



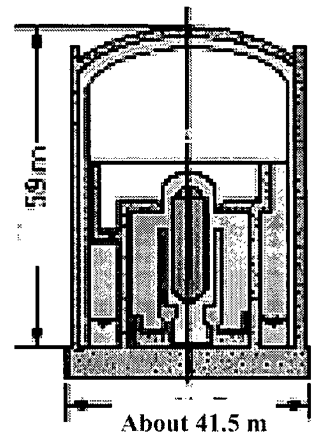
MARK-I

Licensed output: 500 MW class or less: Tsuruga-1, Fukushima I-1, Onagawa-1, Hamaoka-1
Licensed output: 800 MW class: Fukushima-I-2, 3, 4, and 5, Hamaoka-2,

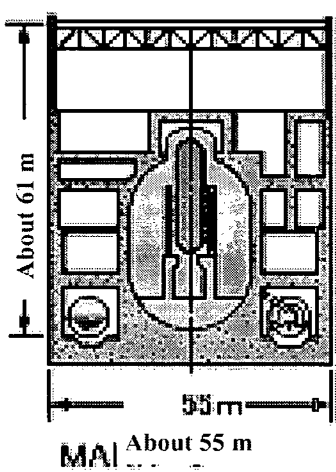


MARK-II

Licensed output: 1100 MW class: Fukushima II-1, Tokai-2, Kashiwazaki-1

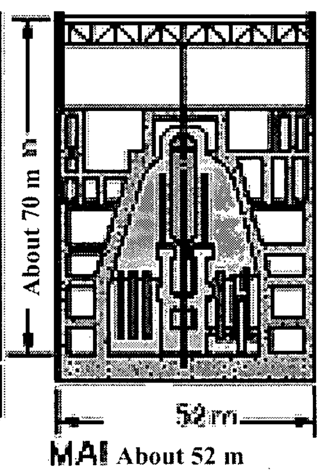


MARK-III



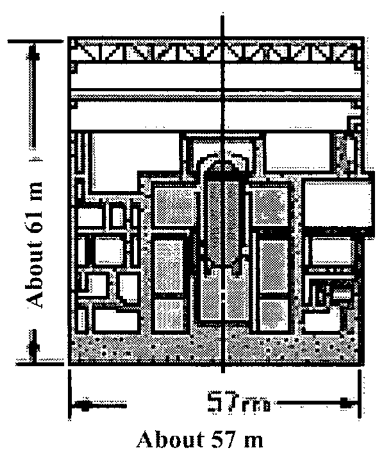
MARK-I Improved

Licensed output: 1100 MW class:
Tsuruga-1, Hamaoka-3, Shimane-2



MARK -II Improved

Licensed output: 1100 MW class:
Fukushima II-2, 3 and 4, Kashiwazaki-2, 5, 3 and 4



ABWR

Licensed output: 13500 MW class:
Kashiwazaki-6 and 7

Figure 2. History of BWR Containment

There are two operating BWR types, roughly speaking, i.e. BWRs including their modifications and ABWRs (advanced BWRs). The first commercial power reactor constructed in U.S. was the Dresden Unit-1 (full power operation in July 1960), which was the BWR-1 reactor. This BWR-1 reactor was dual cycle like a pressurized water reactor and adopted a dry type reactor containment vessel. The BWR-2 and the subsequent ones ware designed to increase the power density that results in a smaller core size, to simplify the system adopting a direct cycle with a steam drum provided inside a reactor vessel, to multiplex the emergency core cooling system (ECCS), and to reduce the containment vessel volume adopting a pressure-suppression-type pool, which led to the current operating BWR designs.

Chapter 2. BWR Technologies

2.1. Reactor Coolant Recirculation System and Main Steam System

Boiling water reactors (BWRs) are nuclear power reactors generating electricity by directly boiling the light water in a reactor pressure vessel to make steam that is delivered to a turbine generator. After driving a turbine, the steam is converted into water with a condenser (cooled by sea water in Japan), and pumped into the reactor vessel with feedwater pumps. A part of the water is sent into the reactor vessel after being pressurized with recirculation pumps installed outside of the vessel and fed into the reactor core from the bottom part of the reactor vessel with jet pumps.

Inside of a BWR reactor pressure vessel (RPV), feedwater enters through nozzles high on the vessel, well above the top of the nuclear fuel assemblies (these nuclear fuel assemblies constitute the "core") but below the water level. The feedwater is pumped into the RPV from the condensers located underneath the low pressure turbines and after going through feedwater heaters that raise its temperature using extraction steam from various turbine stages.

The feedwater enters into the downcomer region and combines with water exiting the water separators. The feedwater subcools the saturated water from the steam separators. This water now flows down the downcomer region, which is separated from the core by a tall shroud. The water then goes through either jet pumps or reactor internal pumps that provide additional pumping power (hydraulic head). The water now makes a 180 degree turn and moves up through the lower core plate into the nuclear core where the fuel elements heat the water. When the flow moves out of the core through the upper core plate, about 12–15% of the volume of the flow is saturated steam.

2.2. Structure of BWRs

(1) BWR reactor core and internals

Reactor core and internal structures of 1,100MWe class BWR reactor vessel are shown in Figure 3. In a reactor vessel, there are a reactor core that mainly consists of fuel assemblies and control rods in the center, equipment for generating steam for a turbine, such as a steam-water separator and a steam dryer in the upper part of the vessel, equipment for reactor-power control, such as control rod guide tubes and control rod drive housings in the lower part of the vessel, and a core shroud, jet pumps etc. that surrounds the reactor core and composes the coolant flow path in the periphery of reactor core.

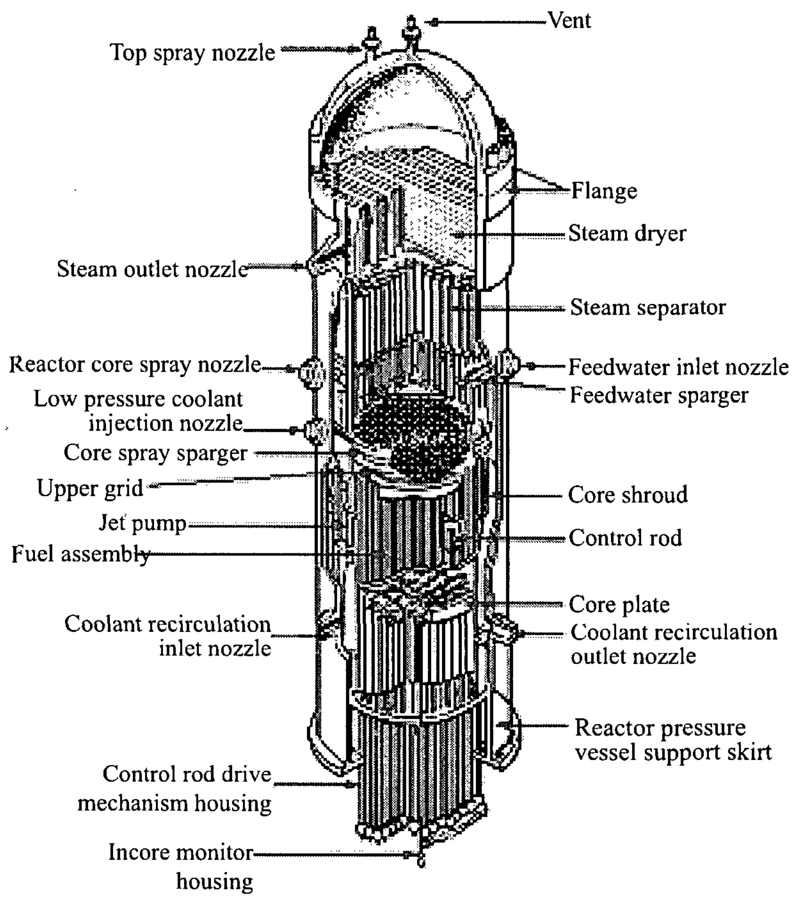


Figure 3. Internal Structure of BWR Reactor Vessel

(2) Nuclear fuel

BWR fuel assemblies, for an example of 8x8 type, consists of 64 rods: 62 fuel rods, one spacer holding water rod and one water rod, which are arranged to a tetragonal lattice of 8x8 and enclosed in a channel box made of zircaloy as shown in Figure 4. Fuel rods are structured to contain uranium-dioxide pellets, a plenum spring etc. in a zircaloy cladding tube, of which both ends are weld-sealed with end plugs after pressurized with helium gas. The plenum is a space provided so that the fission gas discharged from fuel pellets accompanying fuel burnup is accommodated and the fuel rod internal pressure does not become excessive.

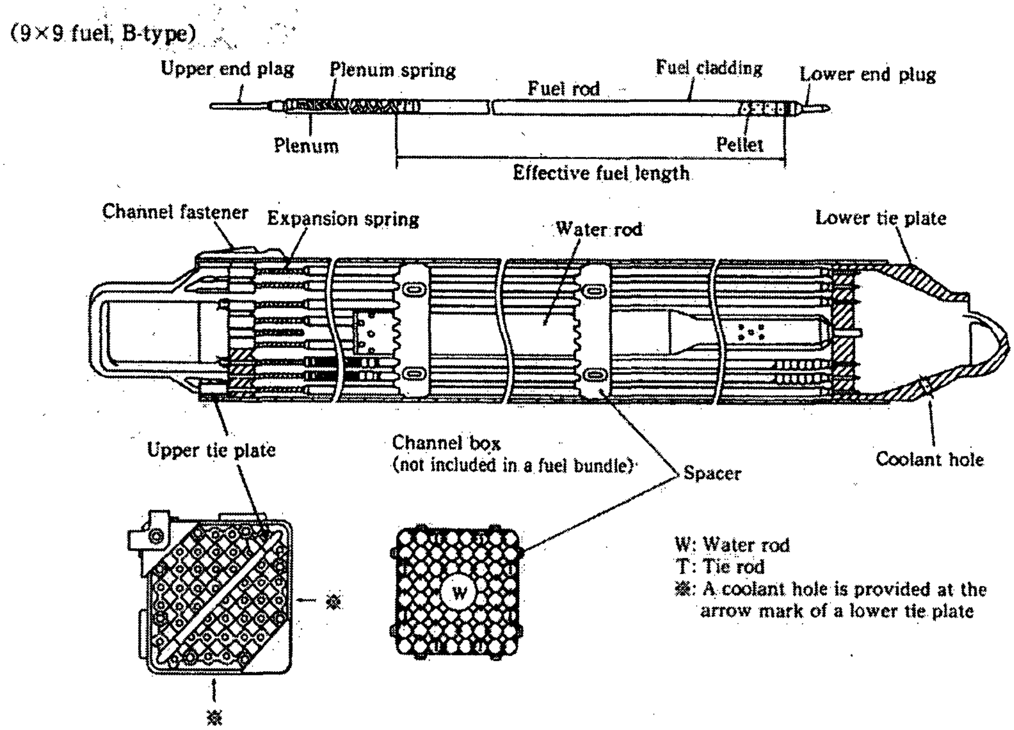


Figure 4. BWR Nuclear Fuel Structure

(3) Control rod and its drive mechanism

BWR control rods are composed of blades in a shape of cruciform in order to move through the gaps formed between four channels of fuel assemblies as shown in Figure 5. Types of control rods are, in terms of the absorber materials, boron carbide (B_4C), hafnium (Hf) and combination of these. A velocity limiter of an umbrella shape is provided at the lower portion of the control rod to slow down the dropping velocity in case of a control rod drop accident. Moreover, a connector to couple a control rod to a control rod drive mechanism is provided.

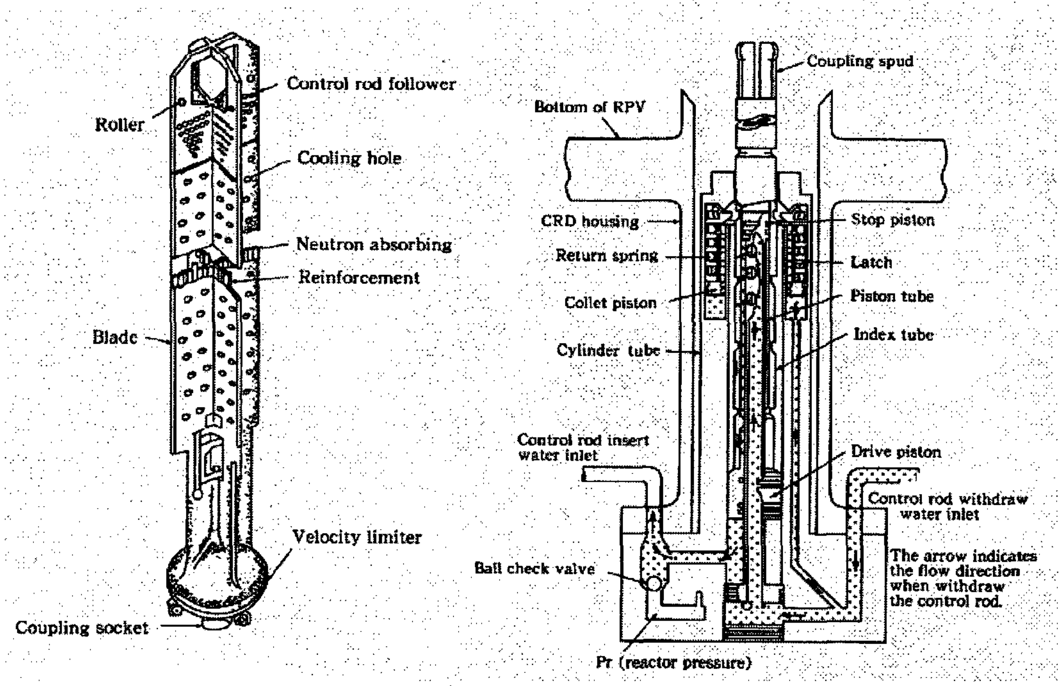


Figure 5. BWR Control Rod and its Drive Mechanism

There are two types of the control rod drive mechanism: hydraulic pressure drive and motor drive. Both types utilize the nitrogen-gas pressure stored in accumulators as driving power for fast insertion of control rods. When an anomaly occurs or could occur at a nuclear reactor, the fast insertion of all control rods into a reactor core is carried out all at once from the lower part of reactor core to shutdown nuclear reactor operation (it is called that a nuclear reactor is scrammed.) The boric acid solution injection system is provided to inject a neutron absorber material into the reactor core to stop reactor operation when the control rods cannot be inserted and the nuclear reactor cannot be placed in low-temperature shutdown mode.

2.3. Engineered Safety Feature

(1) Emergency core cooling system

At an abnormal event of a BWR, actuation of the reactor shutdown system (a part of the safety protection system) stops the nuclear reactor operation securely. The emergency core cooling system (ECCS) is provided for the case when a break accident occurs to reactor coolant system piping etc. and the reactor coolant is lost from a reactor core (loss of coolant accident, LOCA). This system consists of one high pressure core cooling system, one low pressure core cooling system, and three low pressure core injection (reflooder) systems.

More Details on Safety Design

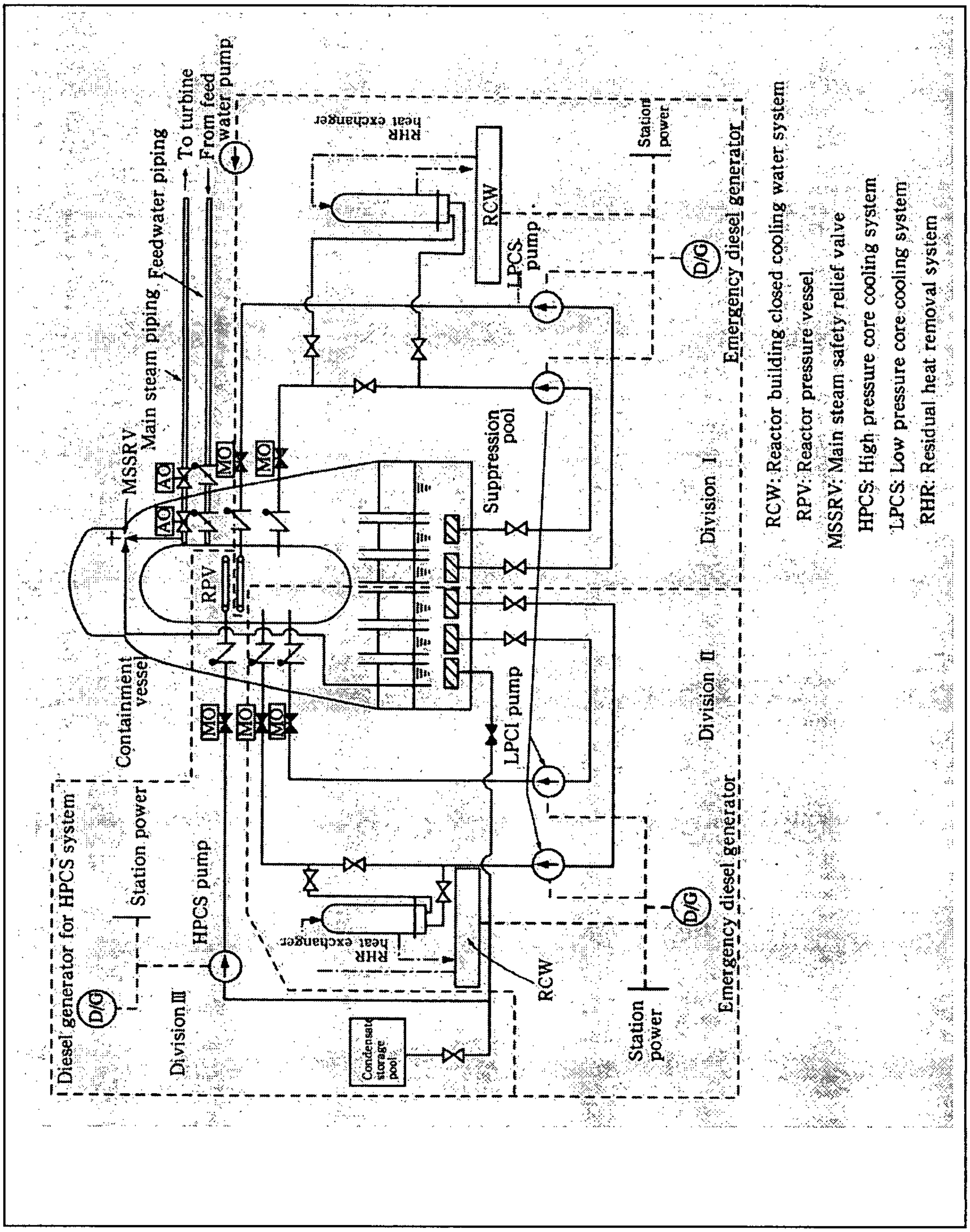


Figure 6. ECCS Network for BWR-5, 1100MWe

(2) Reactor containment

Radioactive materials are released into the high temperature and high pressure coolant when a fuel failure occurs. Therefore, a reactor containment is provided so that the coolant would not discharge to the outside (Figure 7). All BWR containments are pressure suppression (pressure suppression pool) type, and the steam discharged into the containment is led to the water pool of the pressure suppression chamber, cooled and condensed, and the pressure rise within the containment is suppressed as a result. Moreover, as the temperature and pressure of the containment rise due to the fuel decay heat in a long term after an accident, it is necessary to cool the inside of the containment. Furthermore, it is also necessary to remove radioactive materials such as iodine within the containment. For such purposes, the containment spray system is provided within the containment (drywell spray, pressure suppression chamber spray). Furthermore, the standby gas treatment system is provided in the reactor building so that the radioactive materials will not be released to the outside of the containment.

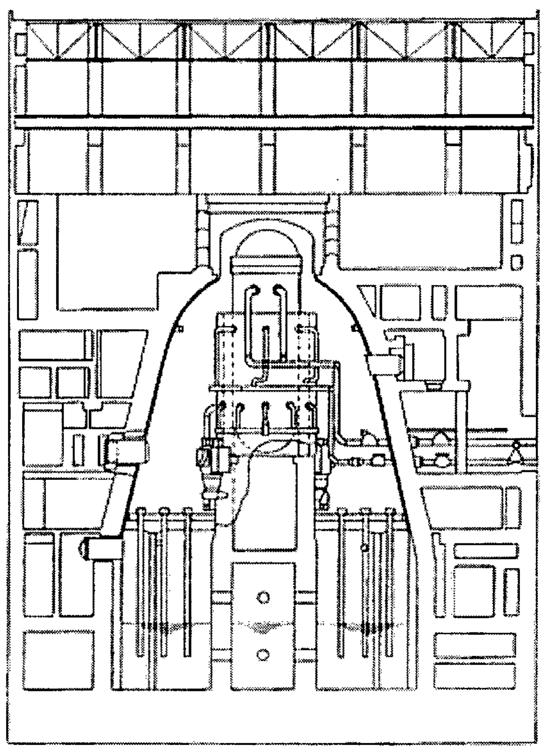


Figure 7. BWR Containment in the Reactor Building (Improved Mark-II)

In addition, following a loss of coolant accident, the temperature of fuel cladding could rise and hydrogen could be generated by a water-metal reaction, which could impair the containment integrity due to hydrogen gas combustion. In order to prevent such a case, BWR containments are kept inert with nitrogen gas (Mark-III type containment is designed not to use the nitrogen gas, but it is not adopted in Japan) during normal operation, and the flammability control system to prevent hydrogen combustion by recombining the generated hydrogen gas with oxygen gas.

2.4. Other Systems and Equipment

(1) Reactor coolant clean up system

The reactor coolant clean up system is provided to keep the coolant purity high, and consists of pumps, regenerative heat exchangers, non-regenerative heat exchangers, filter demineralizers, auxiliary equipment, etc.

The reactor coolant clean up system, together with the condensate cleanup system, keeps the coolant properties within the following values;

Electric conductivity (25 degrees C)	1 micro-S / cm or less
Cr	0.1 ppm or less
pH (25 degrees C)	5.6 - 8.6

(2) Reactor core isolation cooling system

The reactor core isolation cooling system is provided to inject the condensed water of residual heat removal system or condensate storage tank water, etc. into a reactor core with the turbine-driven pump using a part of the nuclear reactor steam to maintain the reactor water level, when supply of the condensate or feed water is stopped due to a certain cause after the reactor shutdown.

(3) Residual heat removal system

The residual heat removal system is provided for removal of the residual heat during a normal reactor shutdown and nuclear reactor isolation condition and for core cooling in case of a loss of coolant accident, etc.

The system consists of three independent loops, consisting of two sets of heat exchangers and three sets of pumps, which can be used in four modes by changing valve lineup. In addition, the system can cool the fuel pool using a connection line to the fuel pool cooling and cleanup system, when required.

(4) Waste processing system

Wastes generated in a plant are divided into gas, liquid and solid materials, and are processed separately. The gaseous waste, after attenuating the radioactivity to sufficiently low level with an activated-carbon-type noble gas hold-up device, is discharged from a vent stack monitoring the concentrations of radioactive materials. The liquid waste, after being collected from each generating source, is processed with a filter, a demineralizer and a waste evaporator, and is reused as make-up water or discharged. The liquid waste condensed with the waste evaporator is processed as a solid waste. The solid waste is processed by solidification, incineration, compression etc. corresponding to the type and canned in a drum for storage in a storage facility. In the solidification method, there are bituminization, plastic solidification and cement solidification.

(5) Fuel handling equipment

Refueling is carried out once per 12 to 24 months in principle for an equilibrium cycle, and the required refueling time period is about 20 days. The number of removed fuel assemblies at one refueling is 20 to 30% of the total fuel assemblies in a core.

(6) Fuel pool cooling and cleanup system

The fuel pool cooling and cleanup system is provided to remove the decay heat of the spent fuel with the heat exchangers of the reactor building closed cooling water system to cool the fuel pool water, and to maintain the water purity and visibility of the fuel pool, reactor well and pit for the steam dryer and steam-water separator by filter-demineralization of the fuel pool water with a filter demineralizer,

The fuel pool cooling and cleanup system consists of pumps, filter demineralizers, heat exchangers, auxiliary equipment etc.

(7) Turbine-generator equipment

(a) Steam turbine

Generally speaking, the steam turbine for nuclear power consumes more steam per unit output and is a larger size compared with the turbine for thermal power plants, as the turbine inlet steam condition is not good compared with that for thermal power plants.

Therefore, the rotation frequency of both the high-pressure and low pressure turbines is 1,500 to 1,800 rpm.

(b) Generator

The turbine generator for nuclear power plants has no essential difference from that for thermal power plants.

2.5. Power Control of BWR

(1) Power control method and self-regulating characteristics

The BWR generates steam with pressure about 70 kg/cm^2 by boiling light water in the reactor core. Moreover, the amount of steam bubbles (void) generated by the boiling is controlled with recirculation pumps (variable velocity pump) to control the nuclear reaction (power), which is called the recirculation flow control system. As control rods are withdrawn out of the core, the reactivity increases and then, the power (heat generation) increases, which results in increase of steam void leading to reduction of moderator density, and the rate of uranium fission becomes small and the reactivity decreases, which balances and stabilizes the reactor power (reactivity). As control rods are inserted into the core, the reactivity decreases and the power decreases, which results in decrease of steam void leading to increase of moderator density, and the rate of uranium fission becomes large and the reactivity increases, which balances and stabilizes the reactor power. In this way, BWRs have a self-regulating characteristic of the reactor power.

(2) Heat transfer and power control

The heat generated in fuel rods is transferred to the reactor coolant. The magnitude of heat transferred according to the temperature difference between the heat transfer surface and the coolant has been obtained in many experiments. Since the heat transfer decreases in the transition film-boiling region in which the boiling becomes violent that could cause a burnout of fuel cladding tube, the heat transfer in the nucleate-boiling region is utilized in BWR. Therefore, the reactor operation limits are imposed on BWRs not to approach to the transition film-boiling region during normal operation and abnormal operational transients.

(3) Load fluctuation and reactor pressure reduction

When BWRs experience a load fluctuation in automatic power control mode, first of all, the reactor power is adjusted by increase or decrease of the recirculation flow. Automatic power control is adjusted during about 70%--100% of the rated power. If electrical grid demands increase turbine generator output power, at first the power control system increases the recirculation flow that results in increase of the reactor power. The reactor pressure is controlled to be constant by opening of a turbine control valve by reactor pressure system. Opening of a turbine control valve increases the steam flow and the turbine generator output power. This method is called "the reactor master / turbine slave (nuclear reactor priority method)." In addition, when an abnormal turbine trip occurs, the steam flow is interrupted and the reactor scram occurs to protect abnormal pressure rise. Also, bypass valves are opened to bypass the steam to main condenser.

Chapter 3. Features of BWR

The BWR is characterized by two-phase fluid flow (water and steam) in the upper part of the reactor core. Light water (i.e., common distilled water) is the working fluid used to conduct heat away from the nuclear fuel. The water around the fuel elements also "thermalizes" neutrons, i.e., reduces their kinetic energy, which is necessary to improve the probability of fission of fissile fuel. Fissile fuel material, such as the U-235 and Pu-239 isotopes, have large capture cross sections for thermal neutrons.

3.1. BWR Design

(1) Generation of steam in a reactor core

In contrast to the pressurized water reactors that utilize a primary and secondary loop, in civilian BWRs the steam going to the turbine that powers the electrical generator is produced in the reactor core rather than in steam generators or heat exchangers. There is just a single circuit in a civilian BWR in which the water is at lower pressure (about 75 times atmospheric pressure) compared to a PWR so that it boils in the core at about 285°C. The reactor is designed to operate with steam comprising 12 to 15% of the volume of the two-phase coolant flow (the "void fraction") in the top part of the core, resulting in less moderation, lower neutron efficiency and lower power density than in the bottom part of the core. In comparison, there is no significant boiling allowed in a PWR because of the high pressure maintained in its primary loop (about 158 times atmospheric pressure).

(2) Feed water system

Inside of a BWR reactor pressure vessel (RPV), feedwater enters through nozzles high on the vessel, well above the top of the nuclear fuel assemblies (these nuclear fuel assemblies constitute the "core") but below the water level. The feedwater is pumped into the RPV from the condensers located underneath the low pressure turbines and after going through feedwater heaters that raise its temperature using extraction steam from various turbine stages.

(3) Fluid recirculation in the reactor vessel

The heating from the core creates a thermal head that assists the recirculation pumps in recirculating the water inside of the RPV. A BWR can be designed with no recirculation pumps and rely entirely on the thermal head to recirculate the water inside of the RPV. The forced recirculation head from the recirculation pumps is very useful in controlling power, however. The thermal power level is easily varied by simply increasing or decreasing the speed of the recirculation pumps.

The two phase fluid (water and steam) above the core enters the riser area, which is the upper region contained inside of the shroud. The height of this region may be increased to increase the thermal natural recirculation pumping head. At the top of the riser area is the water separator. By swirling the two phase flow in cyclone separators, the steam is separated and rises upwards towards the steam dryer while the water remains behind and flows horizontally out into the downcomer region. In the downcomer region, it combines with the feedwater flow and the cycle repeats.

The saturated steam that rises above the separator is dried by a chevron dryer structure. The steam then exits the RPV through four main steam lines and goes to the turbine.

(4) Reactor power control system

Reactor power is controlled via two methods: by inserting or withdrawing control rods and by changing the water flow through the reactor core.

Positioning (withdrawing or inserting) control rods is the normal method for controlling power when starting up a BWR. As control rods are withdrawn, neutron absorption decreases in the control material and increases in the fuel, so reactor power increases. As control rods are inserted, neutron absorption increases in the control material and decreases in the fuel, so reactor power decreases. Some early BWRs and the proposed ESBWR designs use only natural circulation with control rod positioning to control power from zero to 100% because they do not have reactor recirculation systems.

Changing (increasing or decreasing) the flow of water through the core is the normal and convenient method for controlling power. When operating on the so-called "100% rod line," power may be varied from approximately 70% to 100% of rated power by changing the reactor recirculation flow by varying the speed of the recirculation pumps. As flow of water through the core is increased, steam bubbles ("voids") are more quickly removed from the core, the amount of liquid water in the core increases, neutron moderation increases, more neutrons are slowed down to be absorbed by the fuel, and reactor power increases. As flow of water through the core is decreased, steam voids remain longer in the core, the amount of liquid water in the core decreases, neutron moderation decreases, fewer neutrons are slowed down to be absorbed by the fuel, and reactor power decreases.

(5) Steam turbines

Steam produced in the reactor core passes through steam separators and dryer plates above the core and then directly to the turbine, which is part of the reactor circuit. Because the water around the core of a reactor is always contaminated with traces of radionuclides, the turbine must be shielded during normal operation, and radiological protection must be provided during maintenance. Most of the radioactivity in the water is very short-lived (mostly N-16, with a 7 second half life), so the turbine hall can be entered soon after the reactor is shut down.

(6) Size of reactor core

A modern BWR fuel assembly comprises 74 to 100 fuel rods, and there are up to approximately 800 assemblies in a reactor core, holding up to approximately 140 tonnes of uranium. The number of fuel assemblies in a specific reactor is based on considerations of desired reactor power output, reactor core size and reactor power density.

Part 2. Advanced BWRs

Chapter 4. ABWR Development

ABWRs are Generation III reactors based on the boiling water reactor. The ABWR was designed by General Electric and Japanese BWR suppliers. The standard ABWR plant design has a net output of about 1350 megawatts electrical.

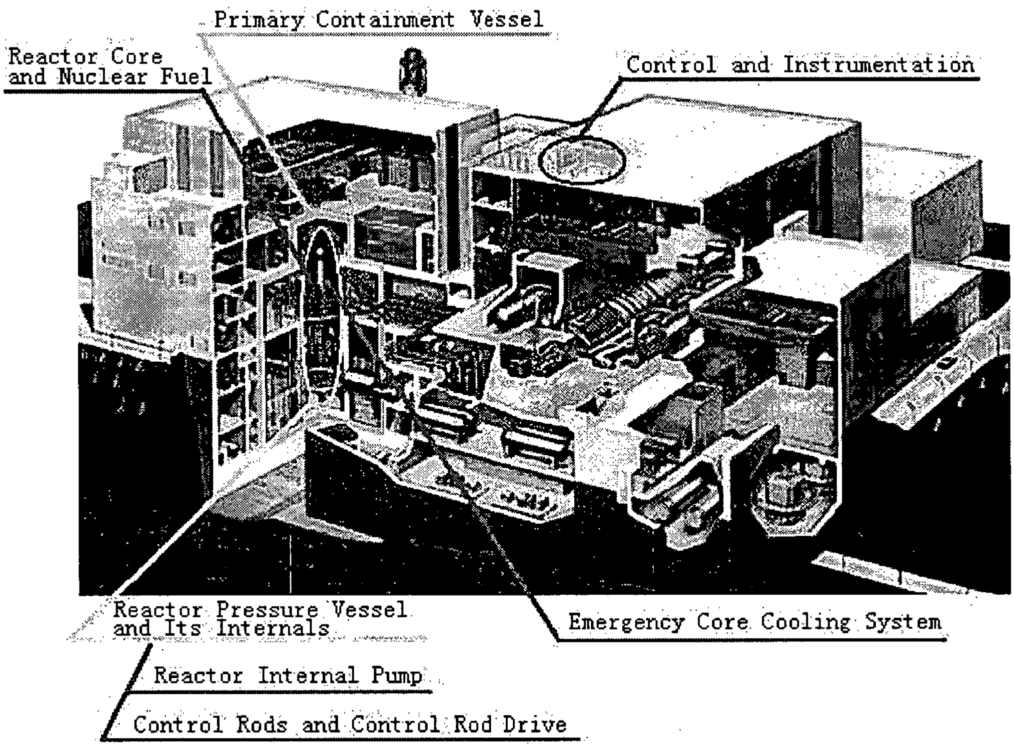


Figure 8. ABWR Power Plant Structure

Major differences between the BWR and ABWR designs are as shown in Table 3: the reactor coolant pump is changed from the combination of recirculation pumps and jet pumps to internal pumps (in-reactor-vessel type pump), the control rod drive system is changed to a combination of a motor-driven drive and a hydraulic pressure drive from the hydraulic pressure drive, and the containment is a reinforced-concrete type containment vessel. In addition, the kashiwazaki kariwa Unit-6 and Unit-7 (electrical output is 1,356,000kW gross, respectively) in Japan have started commercial operation as the first operating ABWRs in the world.

Table 3. Major Specifications for BWR and ABWR

Items		ABWR	Conventional BWR
Electricity output	MWe	1350 class	1100 class
Thermal output	MWt	3926	3293
Reactor pressure	kgf/cm^2g	72.1	70.7
Feed water temperature	Degree-C	215	215
Core flow	Kg/h	About $52x10^6$	About $48x10^6$
Fuel type		New-type 8x8	New-type 8x8
Number of fuel assemblies		872	764
Number of control rods		205	185
Reactor pressure vessel	ID: m H: m	About 7.1 About 21	About 6.4 About 22
Reactor water recirculation system		Reactor internal pumps (10)	Outer recirculation pumps (2) + jet pumps (20)
Control rod drive mechanism			
Power control		Fine motion CR drive (FMCRD) system	Hydraulic pressure CR drive (CRD) system
Scram		Fast scram with hydraulic pressure drive	Fast scram with hydraulic pressure drive
Steam flow restrictor		Reactor pressure vessel nozzle	Main steam pipe Venturi nozzle
Emergency core cooling system		Low pressure reflooder system (3 systems)	Low pressure reflooder system (3 systems)
		High pressure core reflooder system (2 systems)	Low pressure core spray system
		Reactor core isolation cooling system	High pressure core spray system
		Automatic depressurization system	Automatic depressurization system
Residual heat removal system		3 systems (common use)	2 systems (common use)
Containment		Building integral-type made of reinforced concrete	Advanced Mark-I or advanced Mark-II made of steel
Main turbine			
Type		TC8F52"	TC8F41"/43"
Thermal cycle		2 stage reheating	Non-reheating
Number of steam extraction stages		6	6

More details in Standard ABWR Technical Data

Following the Kashiwazaki-Kariwas Unit-6 and Unit-7, the Hamaoka Unit-5 of the Chubu Electric Power Co., Inc., which is the second generation ABWR adopting new technologies, started its commercial operation in January 2005 as the world's largest class output power station.

Chapter 5. ABWR Technologies

5.1 Features of ABWR

BWR characterized by the simplified direct cycle type is completed as a high reliability and safety nuclear reactor with many improvements, such as optimization of the core power density and fuel burnup, adoption of a built-in steam-water separator, multiple emergency core cooling system, etc. In addition to those improvements, ABWRs adopt the following superior technologies.

(1) Reactor pressure vessel and internals

The nuclear reactor of advanced building water reactor (ABWR) adopts the internal-pump system as a reactor-coolant recirculation system, which installs pumps in a reactor pressure vessel. The reactor internals consist of internal structures, such as steam-water separator and steam dryer, and a core support for fuel assemblies as shown in Figure 9.

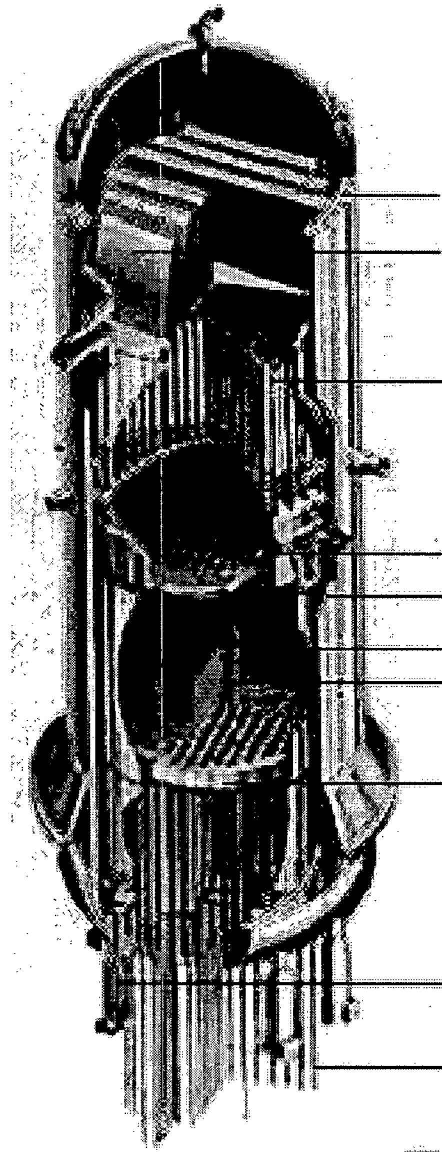


Figure 9. Reactor Pressure Vessel and Internals

Utilizing their 30 years of experience in operating BWR reactors, a special care is made in selecting the right material. Cobalt has been eliminated from the design. The steel used in the primary system is made of nuclear grade material (low carbon alloys) which are resistant to integranular stress corrosion cracking.

The ABWR reactor pressure vessel is 21 meters high and 7.1 meters in diameter.

The base metal of the reactor pressure vessel, which contains fuel assemblies, control rods and reactor internals, is made of low alloy steel and the inside surface of the vessel is lined with stainless steel to have a corrosion resistance.

Much of the vessel, including the 4 vessel rings from the core beltline to the bottom head, is made from single forging. The vessel has no nozzles greater than 2 inches in diameter anywhere below the top of the core because the external recirculation loops have been eliminated. Because of these two features, over 50% of the welds and all of the piping and pipe supports in the primary system have been eliminated and, along with it, the biggest source of occupational exposure in the BWR.

The reactor core comprises fuel assemblies as shown in Figure 10 and control rods. Each fuel rod in fuel assemblies contains sintered pellets of low-enriched uranium within a zirconium-lined cladding. They are brought together in fuel assemblies, 8x8 arrays of fuel rods held in place by upper and lower tie plates and spacers.

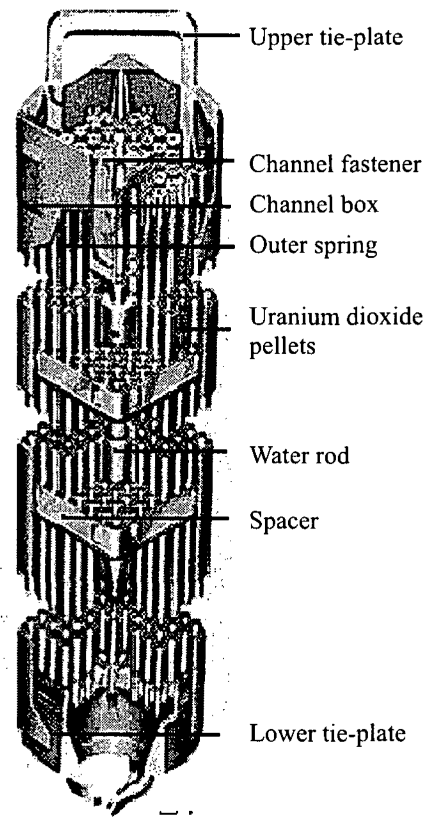


Figure 10 ABWR Fuel

(2) External recirculation system eliminated

One of the unique features of the ABWR is its external recirculation system elimination. The external recirculation pumps and piping have been replaced by ten reactor internal pumps mounted to the bottom head. (Refer to Figure 11)

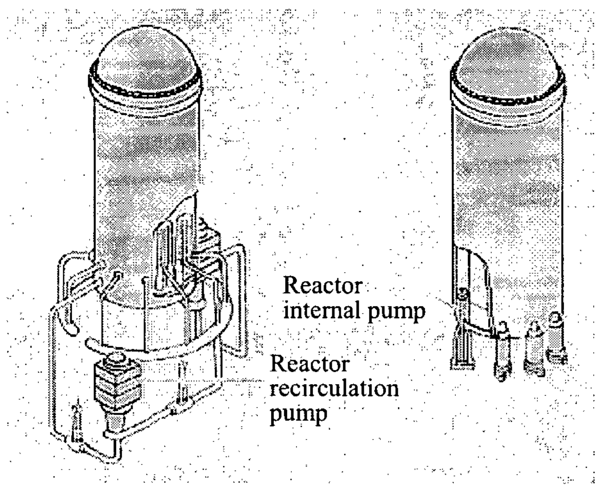


Figure 11. Reactor Cooling Pump for BWR and ABWR

Prior to the ABWR, all large commercial nuclear steam supply systems provided by GE from the BWR/3 through the BWR/6 designs used jet pump recirculation systems. These systems have two large recirculation pumps (each up to 9000 Hp) located outside of the reactor pressure vessel (RPV). Each pump takes a suction from the bottom of the downcomer region through a large diameter nozzle and discharges through multiple jet pumps inside of the RPV in the downcomer region. There is one nozzle per jet pump for the discharge back into the RPV and the external headers supplying these nozzles. Valves are required to isolate this piping in the event of a failure.

Consequently, reactor internal pumps eliminate all of the jet pumps (typically 10), all of the external piping, the isolation valves and the large diameter nozzles that penetrated the RPV.

(3) Internal pump

Reactor internal pumps inside of the reactor pressure vessel (RPV) are a major improvement over previous BWR reactor plant designs (BWR/6 and prior). These pumps are powered by wet-rotor motors with the housings connected to the bottom of the RPV and eliminating large diameter external recirculation pipes that are possible leakage paths. The 10 internal pumps are located at the bottom of the downcomer region.

The first reactors to use reactor internal pumps were designed by ASEA-Atom (now Westinghouse Electric Company by way of mergers and buyouts, which is owned by Toshiba) and built in Sweden. These plants have operated very successfully for many years.

The internal pumps reduce the required pumping power for the same flow to about half that required with the jet pump system with external recirculation loops. Thus, in addition to the safety and cost improvements due to eliminating the piping, the overall plant thermal efficiency is increased. Eliminating the external recirculation piping also reduces occupational radiation exposure to personnel during maintenance.

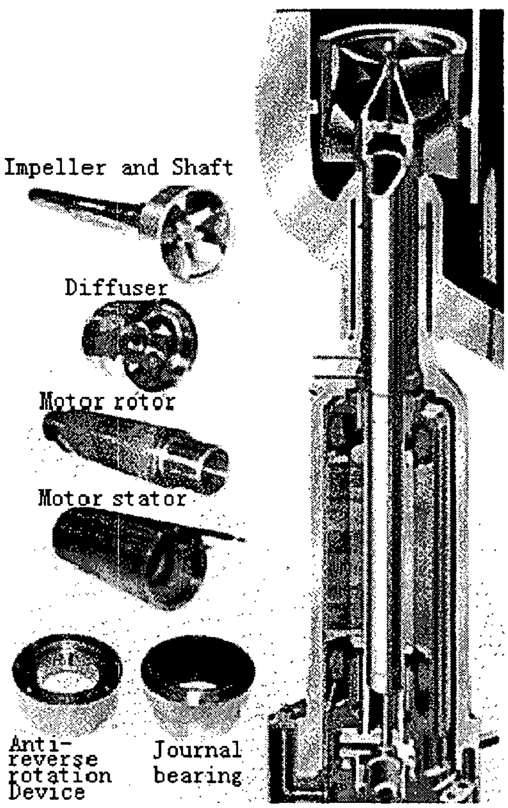


Figure 12. Reactor Internal Pump

(4) Control rod and drive mechanism

A operational feature in the ABWR design is electric fine motion control rod drives. BWRs use a hydraulic system to move the control rods which is driven by locking piston drive mechanism.

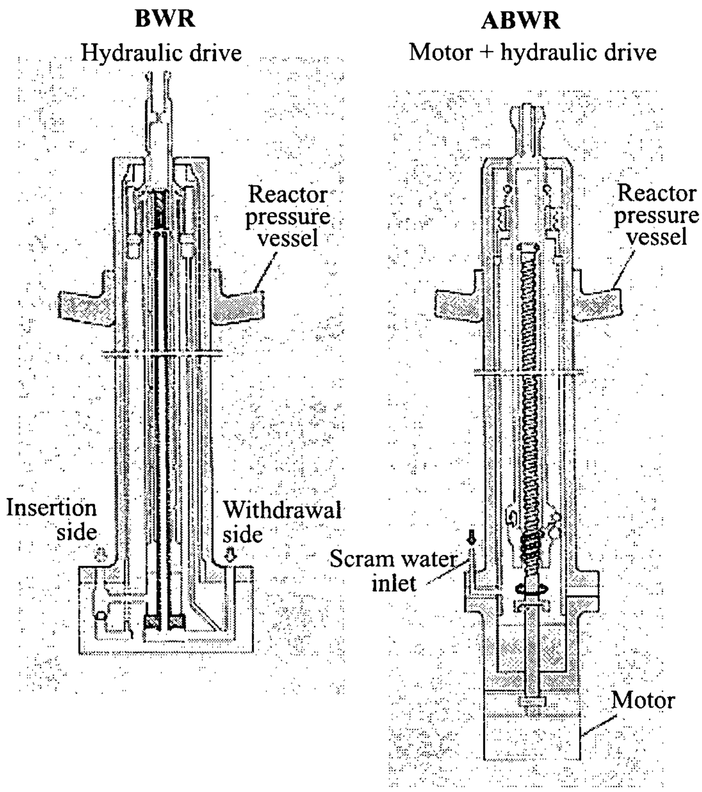


Figure 13. Control Drive Mechanism for BWR and ABWR

The materials in the control rods absorb neutrons and so restrain and control the reactor's nuclear fission chain reaction. The rods themselves have a cruciform cross section. They are inserted upwards, from the base of the RPV, into the rod spaces in fuel assemblies.

Fine motion control rod drives (FMCRD) are introduced in the ABWR. The control rods are scrammed hydraulically but can also scrammed by the electric motor as a backup. The FMCRDs have continuous clean water purge to keep radiation to very low levels.

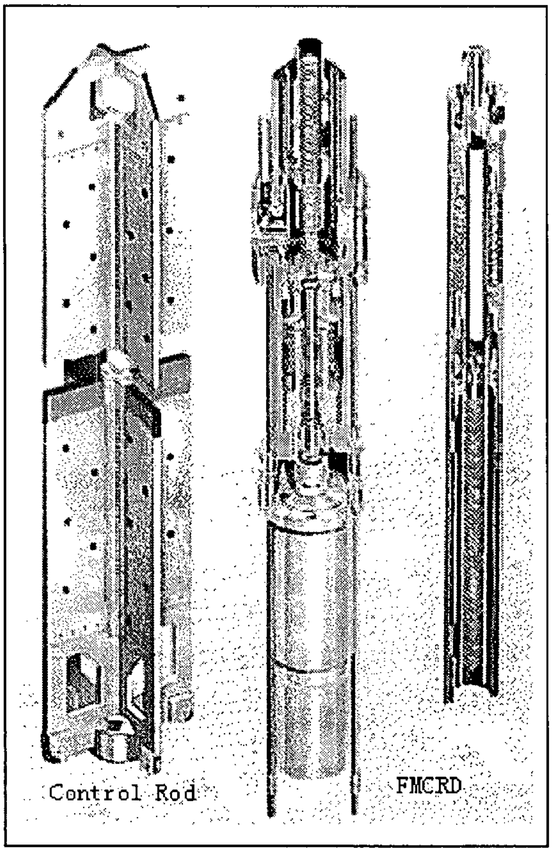


Figure 14. Control Rod and Drive Mechanism

(5) Safety - Simplified active safety systems

ABWR has three completely independent and redundant divisions of safety systems. The systems are mechanically separated and have no cross connections as in earlier BWRs. They are electronically separated so that each division has access to redundant sources of ac power and, for added safety, its own dedicated emergency diesel generator. Divisions are physically separated. Each division is located in a different quadrant of the reactor building, separated by fire walls. A fire, flood or loss of power which disables one division has no effect on the capability of the other safety systems. Finally, each division contains both a high and low pressure system and each system has its own dedicated heat exchanger to control core cooling and remove decay heat. One of the high pressure systems, the reactor core isolation cooling (RCIC) system, is powered by reactor steam and provides the diverse protection needed should there be a station blackout.

The safety systems have the capability to keep the core covered at all times. Because of this capability and the generous thermal margins built into the fuel designs, the frequency of transients which will lead to a scram and therefore to plant shutdown have been greatly reduced (to less than one per year). In the event of a loss of coolant accident, plant response has been fully automated.

Any accident resulting in a loss of reactor coolant automatically sets off the emergency core cooling system (ECCS). Made up of multiple safety systems, each one functioning independently, ECCS also has its own diesel-driven standby generators that take over if external power is lost.

High pressure core flooder (HPCF) and reactor core isolation cooling (RCIC) systems: These systems inject water into the core to cool it and reduce reactor pressure.

Low pressure flooder (LPFL) system: Once pressure in the reactor vessel is reduced, this system injects water into the reactor vessel. The reactor core is then cooled safely.

Automatic-depressurization system: Should the high-pressure injection system fails, this system lowers the reactor vessel pressure to a level where the LPFL system can function.

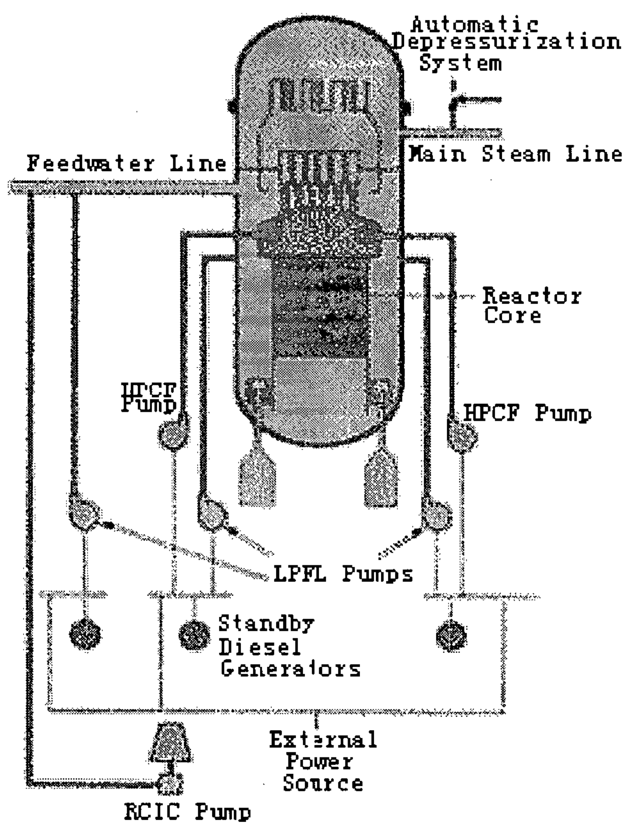


Figure 15. Emergency Core Cooling System (ECCS)

(注)
ECCS: Emergency Core Cooling System
HPCF: High Pressure Core Flooder (System), RCIC: Reactor Core Isolation Cooling (System), LPFL: Low Pressure Flooder (System), ADS: Auto-Depressurization System

The primary containment vessel encloses the reactor pressure vessel, other primary components and piping. In the highly unlikely event of an accident, this shielding prevents the release of radioactive substances. The ABWR uses a reinforced concrete containment vessel (RCCV). Its reinforced concrete outer shell is designed to resist pressure, while the internal steel liner ensures the RCCV is leak-proof. The compact cylindrical RCCV integrated into the reactor building enjoys the advantages of earthquake-resistant design and economic construction cost.

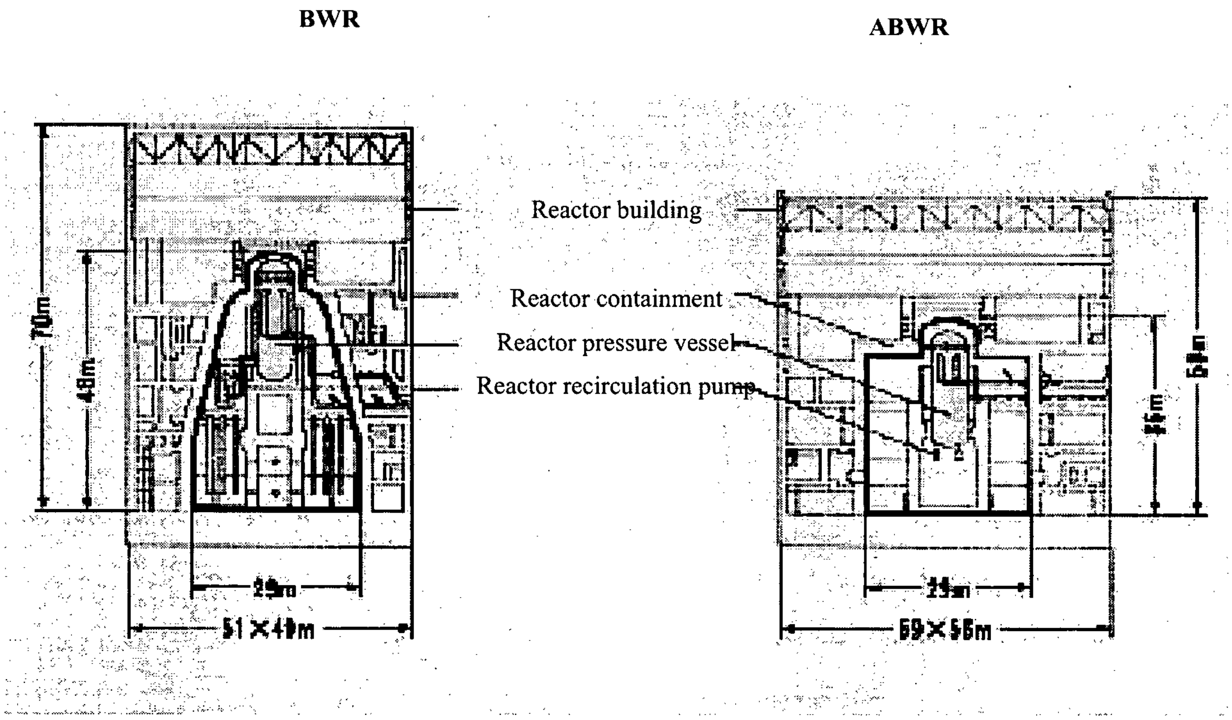


Figure 16. Reactor Containment for BWR and ABWR

(6) Digital control and instrumentation systems

The control and instrumentation (C&I) systems use state of the art digital and fiber optic technologies. The ABWR has four separate divisions of safety system logic and control, including four separate, redundant multiplexing networks to provide absolute assurance of plant safety. Each system includes microprocessors to process incoming sensor information and to generate outgoing control signals, local and remote multiplexing units for data transmission, and a network of fiber optic cables. Multiplexing and fiber optics have reduced the amount of cabling in the plant.

(7) Control room design

The entire plant can be controlled and supervised from the centered console and the large display panel in the main control room. The left side of console and large display panel is for the safety systems and the right side is for the balance of plant (turbine-generator, feedwater system etc.). The CRTs and flat panel displays on the centered console and the large display panel allow the operator to call up any system, its subsystems and components just by touching the screen. It is possible to operate an entire system in manual operation mode.

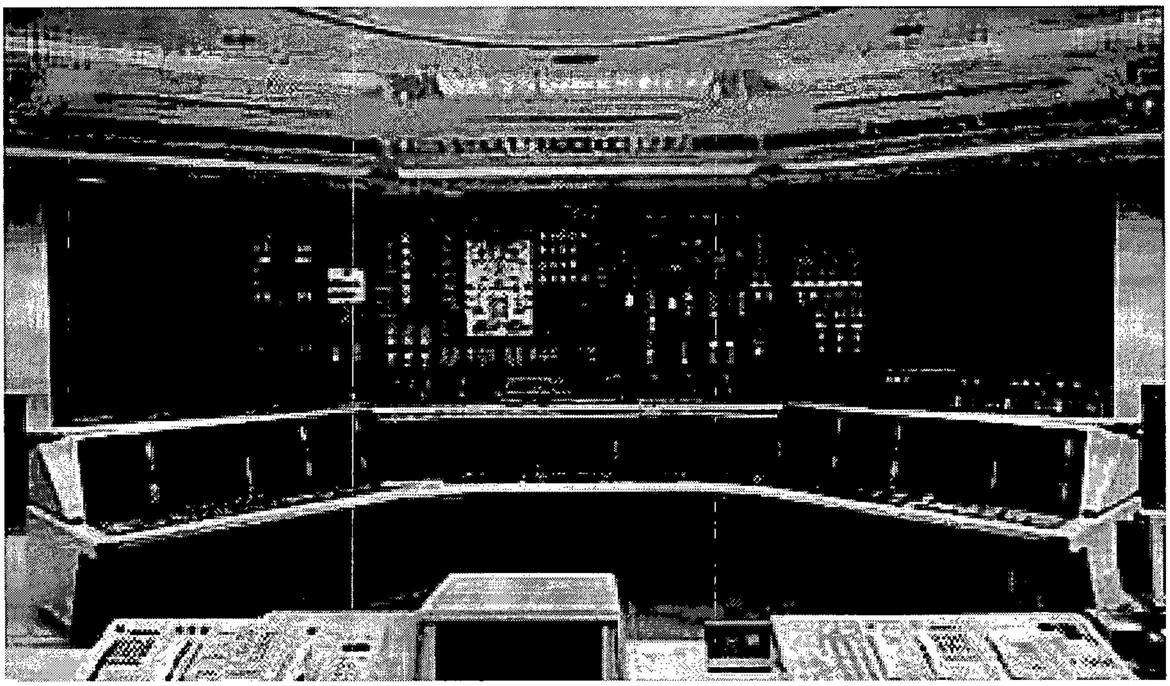
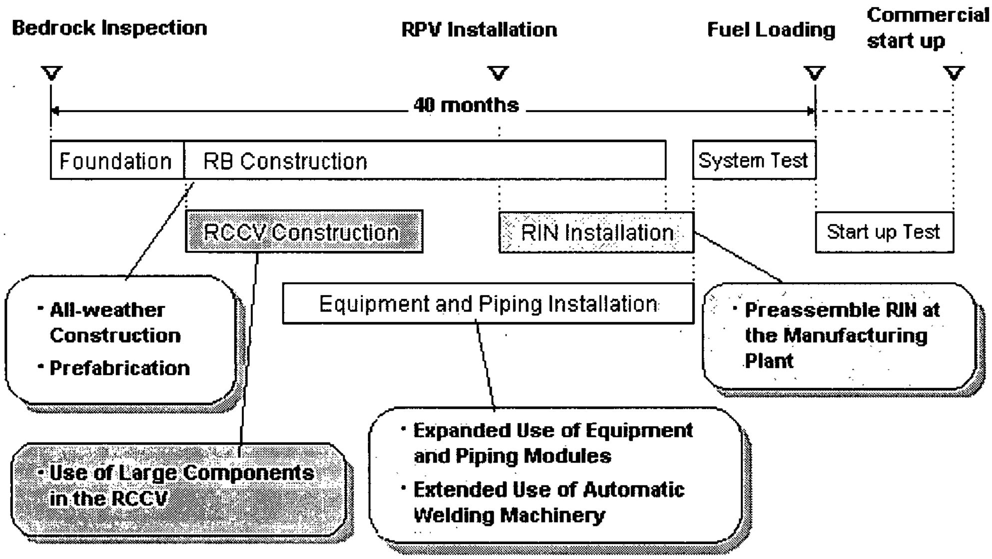


Figure 17. Control Room Design

(8) Plant construction

The reactor and turbine building are arranged "in-line" and none of the major facilities are shared with the other units. The containment is a reinforced concrete containment vessel (RCCV) with a leak tight steel lining. The containment is surrounded by the reactor building, which doubles as a secondary containment. A negative pressure is maintained in the reactor building to direct any radioactive release from the containment to a gas treatment system. The reactor building and the containment are integrated to improve the seismic response of the building and the containment are integrated to improve the seismic response of the building without additional increase in the size and load bearing capability of the walls.

At construction of the plant large modules which are prefabricated in the factory are used and assembled to large structure on site. A 1000 ton-crawler crane will lift these modules and place them vertically into the plant. Use of RCCV, modular construction and other construction techniques reduce construction times.



RCCV: Reinforced Concrete Containment Vessel
RPV: Reactor Pressure Vessel
RIN: Reactor Internals
RB: Reactor Building

Figure 18. ABWR construction schedule (typical)

Particular attention was paid to designing the plant for ease of maintenance. Monorails are available to remove equipment to a conveniently located service room via an equipment hatch.

Removal of the reactor internal pumps and FMCRDs for servicing has been automated. Handling devices, which in the case of the FMCRD is operated remotely from outside the containment, engage and remove the equipment. The pump or driver is laid on a transport device and removed through the equipment hatch. Just outside the hatch are dedicated service rooms, one for the RIPs and another for the FMCRDs, where the equipment can be decontaminated and serviced in a shielded environment. The entire operation is done efficiently and with virtually no radiation exposure to the personnel.

Chapter 6. Economic Simplified Boiling Water Reactor (ESBWR)

6.1 ESBWR and Natural Recirculation

The Economic Simplified Boiling Water Reactor (ESBWR) is a passively safe generation III+ reactor which builds on the success of the ABWR. Both are designs by General Electric, and are based on their BWR design. The plant data are shown in Table 4.

Table 4. ESBWR Technology Fact Sheet

Plant Life (years)	60
Thermal Power	4,500 MW
Electrical Power	1,560 MW
Plant Efficiency	34.7 %
Reactor Type	Boiling Water Reactor
Core	
Fuel Type	Enriched UO2
Fuel Enrichment	4.2%
No. of Fuel Bundles	1,132
Coolant	Light water
Moderator	Light water
Operating Cycle Length	12-24 months
Outage Duration	~14 days
Percent fuel replaced at refueling	See footnote 4
Average fuel burnup at discharge	~50,000 MWd/MT
Number of Steam Lines	4
Number of Feedwater Trains	2
Containment Parameters	
Design Temperature	340°F
Design Pressure	45 psig
Reactor Parameters	
Design Temperature	575°F
Operating Temperature	550°F
Design Pressure	1,250 psig
Nominal Operating Pressure	1,040 psia
Feedwater & Turbine Parameters	
Turbine Inlet/Outlet Temperature	543/93°F
Turbine Inlet/Outlet Pressure	985/0.8 psia
Feedwater Temperature	420°F
Feedwater Pressure	1,050 psia
Feedwater Flow	4.55 x 104 gpm
Steam mass flow rate	19.31 x 106 lbs/hr
Yearly Waste Generated	
High Level (spent fuel)	50 metric tons

Intermediate Level (spent resins, filters, etc.) and Low Level (compactable/non-compactable) Waste	1,765 cubic

The ESBWR uses natural circulation with no recirculation pumps or their associated piping.

Through design simplification, natural circulation in GE's ESBWR will decrease Operations and Maintenance (O&M) costs, reducing the overall cost of plant ownership. Natural circulation provides simplification over previous Boiling Water Reactor (BWR) and all Pressurized Water Reactor (PWR) designs that rely on forced circulation. This improvement is accomplished by the removal of recirculation pumps and associated motors, piping, valves, heat exchangers, controls, and electrical support systems that exist with forced circulation. Natural circulation in the ESBWR also eliminates the risk of flow disturbances resulting from recirculation pump anomalies.

The ESBWR and internals is shown in Figure 19. and the natural recirculation of ESBWR is shown in Figure 20.

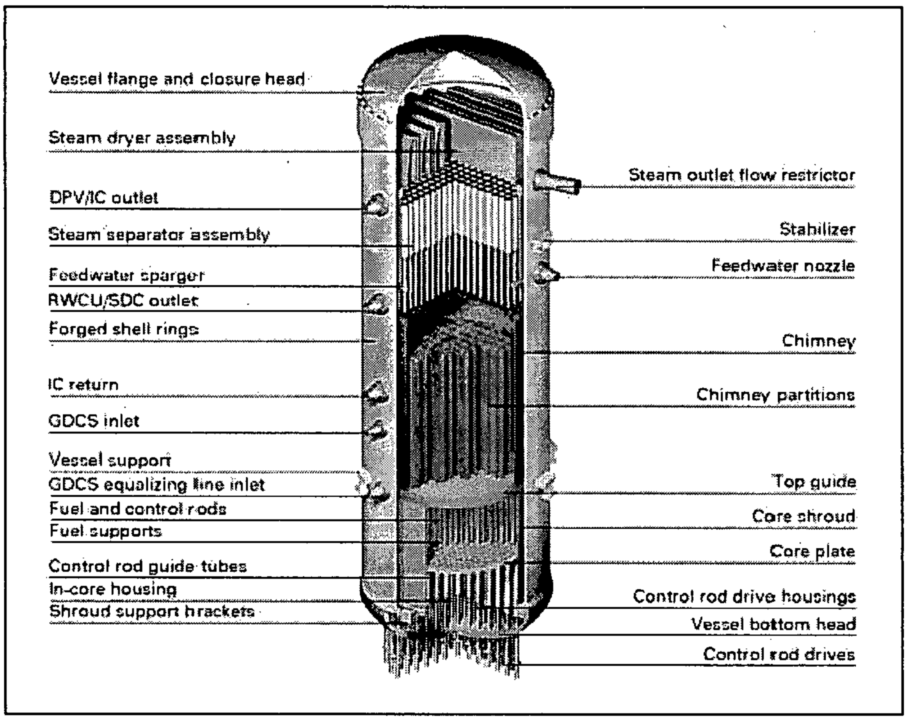


Figure 19. ESBWR and Internals

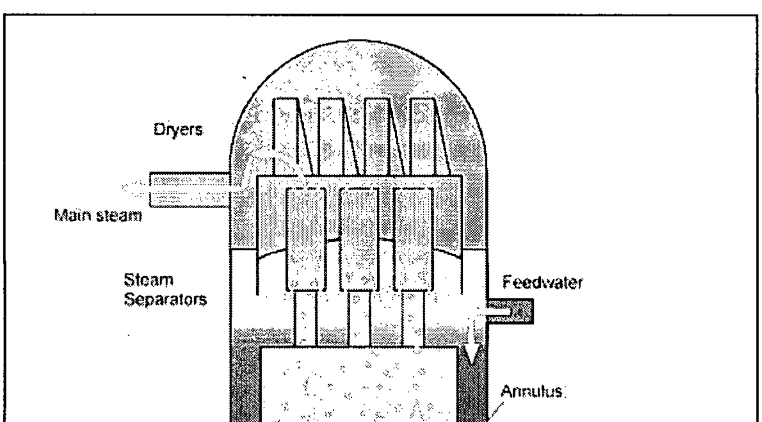


Figure 20. ESBWR Natural Recirculation

Natural circulation is consistent with the key objectives of the ESBWR program: a passive safety design with simplification achieved by evolutionary enhancements. Most of the components in the ESBWR design are standard to BWRs and have been operating in the commercial nuclear energy fleet for years. The main differences between natural and forced circulation are the additions of:

• A partitioned chimney above the reactor core to stabilize and direct the steam and water flow above the core.

• A correspondingly taller, open down-comer annulus that reduces flow resistance and provides additional driving head, pushing the water to the bottom of the core.

Natural circulation is a proven technology. Valuable operating experience was gained from previously employed natural circulation BWR designs. Examples of plants using only natural circulation include the Humboldt Bay plant in California and the Dodewaard plant in the Netherlands, which operated for 13 and 30 years respectively.

Today, large (>1000MW) BWRs can generate about fifty percent of rated power in natural circulation mode. The operating conditions in this mode—power, flow, stability, steam quality, void fraction, void coefficient, power density, and power distribution— are predicted by GE calculation models that were calibrated against operating plant data from LaSalle, Leibstadt, Forsmark, Confrentes, Nine Mile Point 2, and Peach Bottom 2. The ESBWR utilizes proven natural circulation technology to operate a reactor with the size and performance characteristics customers need today at one hundred percent of rated power.

6.2 ESBWR Passive Safety Design

The passively safe characteristics are mainly based on isolation condensers, which are heat exchangers that take steam from the vessel (Isolation Condensers, IC) or the containment (Passive Containment Cooling System, PCCS), condense the steam, transfer the heat to a water pool, and introduce the water into the vessel again.

Those systems are illustrated in Figure 21 and 22.

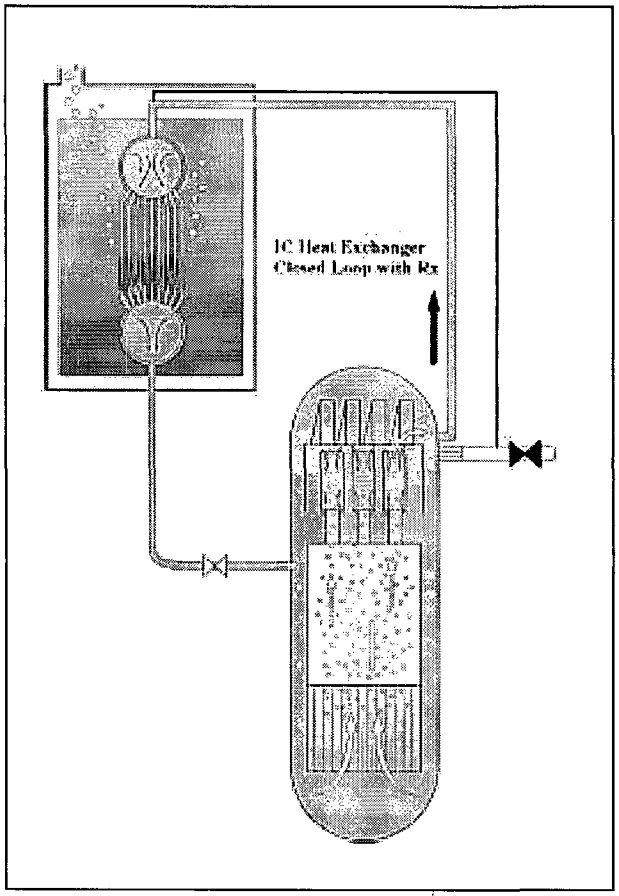


Figure 21. Isolation Condenser System

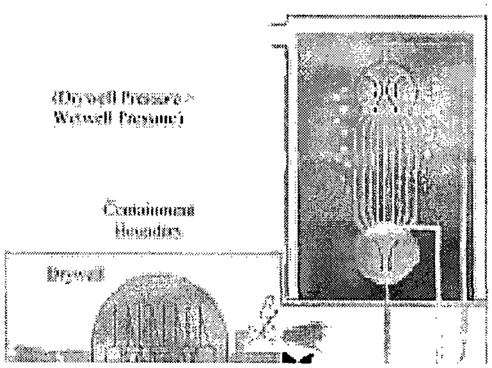


Figure 22. Passive Containment Cooling System

This is also based on the gravity driven cooling system (GDCS) shown in Figure 23, which are pools above the vessel that when very low water level is detected in the reactor, the depressurization system opens several very large valves to reduce vessel pressure and finally to allow these GDCS pools to reflood the vessel.

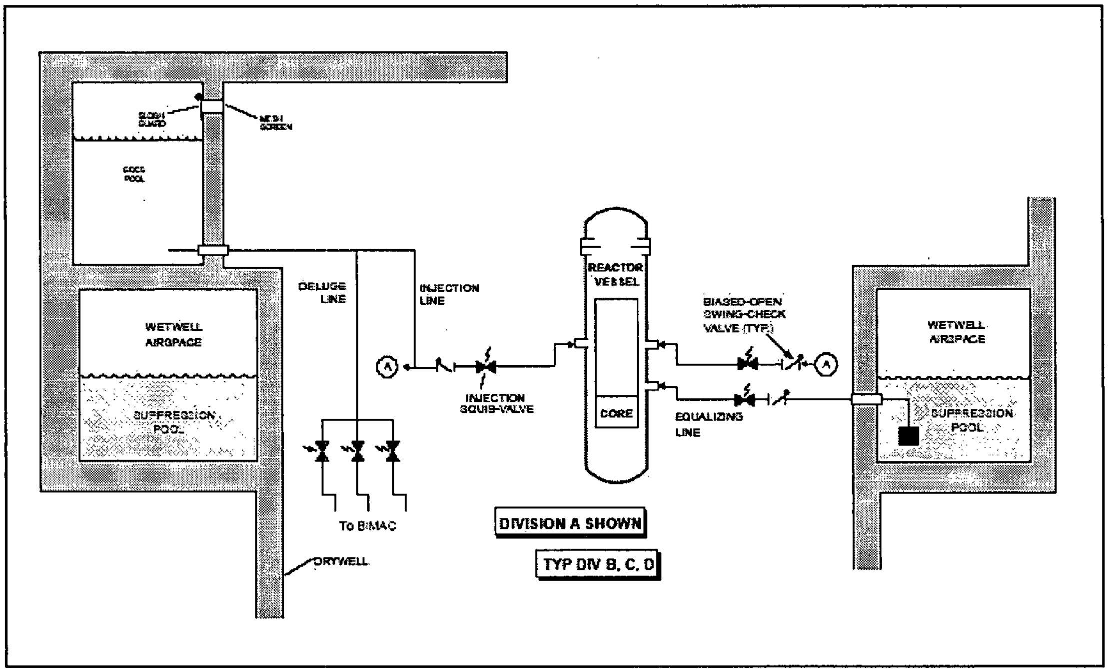


Figure 23. Gravity-Driven Cooling System

The core is shorter than conventional BWR plants because of the smaller core flow (caused by the natural circulation). There are 1132 bundles and the thermal power is 4500 MWth (1550 MWe).

Below the vessel, there is a piping structure which allows for cooling of the core during a very severe accident. These pipes divide the molten core and cool it with water flowing through the piping.

The probability of radioactivity release to the atmosphere is several orders of magnitude lower than conventional nuclear power plants, and the building cost is 60-70% of other light water reactors.

The energy production cost is lower than other plants due to:

1. Lower initial capital cost
2. Lower operational and maintenance cost

General Electric has recalculated maximum core damage frequencies per year per plant for its nuclear power plant designs:

BWR/4 -- 1×10^{-5} (a typical plant)
BWR/6 -- 1×10^{-6} (a typical plant)
ABWR -- 2×10^{-7} (now operating in Japan)
ESBWR -- 3×10^{-8} (submitted for Final Design Approval by NRC)

The ESBWR's maximum core damage frequency is significantly lower than that of the AP1000 or the European Pressurized Reactor.

Chapter 7. Current status

As of December 2006, four ABWRs were in operation in Japan: Kashiwazaki-Kariwa units 6 and 7, which opened in 1996 and 1997, Hamaoka unit 5, opened 2004 having started construction in 2000, and Shika 2 commenced commercial operations on March 15, 2006. Another two, identical to the Kashiwazaki-Kariwa reactors, were nearing completion at Lungmen in Taiwan, and one more (Shimane 3) had just commenced construction in Japan, with major siteworks to start in 2008 and completion in 2011. Plans for at least six other ABWRs in Japan have been postponed, cancelled, or converted to other reactor types, but three of these (Higashidori 1 and 2 and Ohma) were still listed as *on order* by the utilities, with completion dates of 2012 or later.

Several ABWRs are proposed for construction in the United States under the Nuclear Power 2010 Program. However these proposals face fierce competition from more recent designs such as the ESBWR (Economic Simplified BWR, a generation III+ reactor also from GE) and the AP1000 (Advanced, Passive, 1000MWe, from Westinghouse). These designs take passive safety features even further than the ABWR does, as do more revolutionary designs such as the pebble bed modular reactor.

On June 19, 2006 NRG Energy filed a Letter Of Intent with the Nuclear Regulatory Commission to build two 1358-MWe ABWRs at the South Texas Project site.

New Reactor Licensing Applications in US including ABWR and ESBWR from 2005 to 2010 and beyond are shown in the Figure 24.

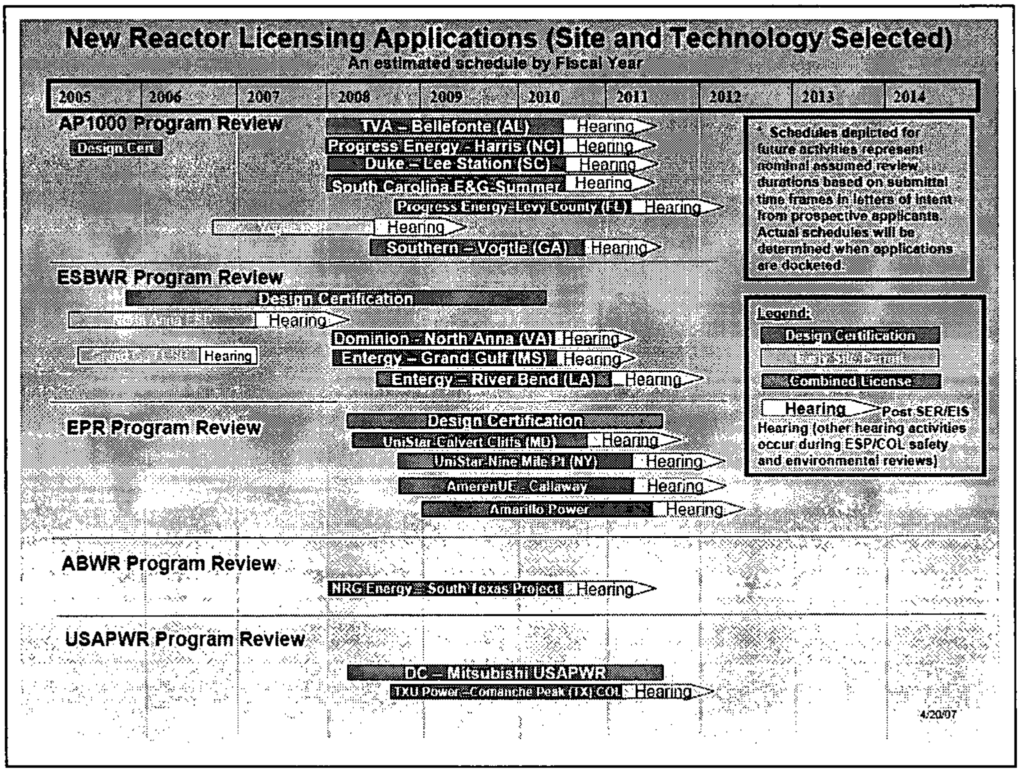


Figure 24. New Reactor Licensing Applications in US

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Nuclear Renaissance, a Former Regulator's Perspective Regarding the NRC Rrole and Activities, Ashok Thadani

Forsyth, Daniel

To: Keefe, Molly
Subject: RE: Japan

The Post, CNN, BBC and others are reporting that the Fukushima diesels failed on one unit and they lost cooling for a while.

From: Keefe, Molly
Sent: Friday, March 11, 2011 10:42 AM
To: Forsyth, Daniel
Subject: Japan

No Damage Reported At Japan Nuclear Plants Following Quake. Kyodo News (3/11) reports, "Nuclear plants on the Pacific coast in Miyagi and Fukushima prefectures have been automatically shut down Friday following a powerful earthquake that hit a wide area in northeastern Japan, the operators said." The "suspended power plants were the Onagawa plant in Miyagi Prefecture, operated by Tohoku Electric Power Co., and the Fukushima No. 1 and No. 2 plants in the adjacent Fukushima Prefecture, run by Tokyo Electric Power Co., according to the companies." TEPCO "said it kept operating the Kashiwazaki-Kariwa nuclear plant on the Sea of Japan coast in Niigata Prefecture, while Hokkaido Electric Power Co. reported no problems at its Tomari No. 1, No. 2 and No. 3 plants in the northernmost main island."

Reuters (3/11, Maeda, Tsukimori) notes that Hokuriku Electric's Higashidori plant north of Onagawa plant was not affected by the temblor, according to a company spokesman, who added that the company was surveying facilities for information about fires or other problems.

Tsunami Alert Issued After "Massive" 8.9 Magnitude Temblor. AFP (3/11) reports, "A massive 8.8-magnitude earthquake shook Japan on Friday unleashing a powerful tsunami that sent ships crashing into the shore...of coastal towns." Thus far, there are no reports of "immediate deaths," but the early afternoon quake did shake "buildings in greater Tokyo" where "at least six fires were reported."

Initially, the quake registered at a 7.9 magnitude, but it has since been upgraded, making it the fifth largest earthquake to rock the world since 1900, the Wall Street Journal (3/11, Mochizuki, Fujikawa, 2.09M) reports. Japanese Prime Minister Naoto Kan called an emergency meeting, during which he and his cabinet aimed to reassure the shaken nation.

Kan said the "government will do 'everything possible to minimize the damage,'" the Washington Post (3/11, Harlan, 605K) reported. "'We ask the people of Japan to exercise the spirit of fraternity and ask fast, and to assist one's family and neighbors,' Kan said." He also "urged people to watch television reports and stay calm, evacuating areas if necessary."

While much of Tokyo remained trapped underground after subway trains were halted and airports were shuttered, those at the epicenter of the quake were facing "an ominous 13-foot muddy wave," which began "washing across" the land, the Los Angeles Times (3/11, Demick, Pierson, Hall, 681K) reported. The "epicenter of the quake was 81 miles off the coast of Sendai, and it struck at a depth of 15 miles, which may have decreased the potential damage." The New York Times (3/11, Fackler, Drew, 1.01M) noted Kan said "nuclear power plants in the stricken area had not been affected."

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Human Factors Specialist

V/12

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Gambone, Kimberly

From: Gambone, Kimberly
Sent: Friday, March 11, 2011 11:40 AM
To: Fowler, William H LTC USAR 335TH SIG CMD
Subject: FW: Japan Update: Evcuations ordered around Fukishima

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From: Breskovic, Clarence
Sent: Friday, March 11, 2011 11:38 AM
To: Breskovic, Clarence
Subject: Japan Update: Evcuations ordered around Fukishima

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3,000 Ordered To Evacuate Near Quake-hit Fukushima Nuclear Plant

Fukushima Pref. Warns of Radiation Leak at N-plant

Japan Orders Evacuation of Residents Near N-plant

Tokyo, March 11 (Jiji Press) -- The government on Friday ordered evacuation of residents in a 3-kilometer radius from a quake-hit Tokyo Electric Power Co. nuclear power plant in Fukushima Prefecture, northern Japan, citing a possible radiation leak.

The government, however, has confirmed no radiation leak so far. The evacuation order was issued after the 8.8-magnitude quake hit northern Japan to have all the three reactors at the power plant shut down automatically.

Chief Cabinet Secretary Yukio Edano said at a news conference that the government called for preemptive evacuation, urging the 5,862 residents to stay calm in following the order.

The government also instructed 45,345 residents living outside the area but in a 10-kilometer radius to stay at home.

According to the Nuclear and Industrial Safety Agency of the Ministry of Economy, Trade and Industry, cooling functions of the No. 2 reactor at the plant have stopped working, affected by a power outage caused by the quake.

The agency is unable to confirm cooling water levels at the reactor and the No.1 reactor. The plant's emergency diesel power generation equipment has stopped working, leading the company to dispatch power supply cars, according to the agency.

As the power supply cars have reached the plant, the company is proceeding with work to resupply electricity to restore cooling functions.

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The Fukushima prefectural government has reported that cooling water levels at the No.2 reactor are dropping and warned that continued decline would expose nuclear fuel rods to air to generate radiation.

Reactors were also automatically shut down at the company's Fukushima No. 2 nuclear power station, with emergency supply of cooling water starting at one of them.

The nuclear safety agency said sufficient cooling water is supplied at the reactor, but tsunami prevented the agency from confirming whether pumps taking in sea water for two other reactors are working properly.

Kyodo: Gsdf Sent To Area Near Fukushima Nuke Plant To Assist Evacuation

Tokyo, March 12 Kyodo -- A total of around 160 Ground Self-Defense Force personnel and a number of large vehicles have been dispatched to an area near the Fukushima No. 1 nuclear plant in Fukushima Prefecture to help evacuate local residents, a senior SDF officer said late Friday.

More than 100 members of a GSDF special unit trained to deal with chemical disasters have been advancing toward the area, SDF chief Ryoichi Oriki said at a news conference at the Defense Ministry.

Some 3,000 residents near the nuclear plant have been ordered to evacuate due to a problem with a cooling system detected at one of the six reactors at the Tokyo Electric Power Co. plant.

Meanwhile, liaison officers from U.S. Forces Japan were being sent to the ministry to coordinate the disaster response of the SDF and U.S. forces, he added.

Around 300 aircraft and about 40 vessels of the SDF have been dispatched or are being prepared for dispatch to deal with the disaster, according to the ministry.

3,000 Ordered To Evacuate Near Quake-hit Fukushima Nuclear Plant

Tokyo, March 11 Kyodo -- (EDS: ADDING GOV'T SPOKESMAN'S COMMENTS) Japan declared a state of atomic power emergency Friday after the country, which has about 50 nuclear power reactors, was hit by a powerful earthquake, instructing around 3,000 residents near the Fukushima No. 1 plant to evacuate.

Japan's top government spokesman Yukio Edano told an evening press conference, "We have a situation where one of the reactors (of the plant) cannot be cooled down." But the chief Cabinet secretary said the evacuation instruction was only precautionary.

"No radiation has leaked outside the reactor. The incident poses no danger to the environment at the moment," Edano said.

The post-quake situation prompted the Vienna-based International Atomic Energy Agency to scramble for details from contacts with Japan's industry ministry, while saying in a statement that at least four nuclear power plants "closest to the quake have been safely shut down" after the 2:46 p.m. quake.

Tokyo Electric Power Co., the operator of the Fukushima plant, reported that the level of the water surrounding the fuel rods was going down in the reactor.

Radioactive materials could be emitted if part of a rod is exposed to the air.

But officials of the prefectural government dismissed a view that the plant is in any critical situation, saying the top of the water is 3.4 meters above the fuel rods at the troubled No. 2 reactor.

The evacuation advisory was issued for people living within a 3-kilometer radius of the plant, while those living within a 10-kilometer radius were asked to stay home, Edano said.

Prime Minister Naoto Kan declared the emergency even though no radiation leak has been detected after the magnitude 8.8 quake so that authorities can easily implement emergency relief measures, Edano said.

Japanese Defense Minister Toshimi Kitazawa ordered the Self-Defense Forces to act in response to the state of atomic power emergency. Also, the Defense Ministry dispatched a chemical corps of the Ground Self-Defense Force to the plant.

Motohisa Ikeda, senior vice industry minister, also left Tokyo for Fukushima on Friday evening by an SDF helicopter.

According to the industry ministry, a total of 11 nuclear reactors were automatically shut down at the Onagawa plant, Fukushima No. 1 and No. 2 plants and Tokai No. 2 plant after the biggest-magnitude quake in the country's modern history.

At the Onagawa plant in Miyagi Prefecture, a fire started at a building housing the turbine, the operator, Tohoku Electric Power Co., said, denying it detected any signs of radiation leaks.

Water spilled from pools containing fuel rods at the Kashiwazaki-Kariwa plant on the Sea of Japan coast in Niigata Prefecture and the Onagawa plant, the operators said, saying they saw no signs suggesting radiation leaks.

Hokkaido Electric Power Co. reported no problems at its Tomari No. 1, No. 2 and No. 3 plants on the northernmost main island.

There were no immediate signs of any problems at the Hamaoka nuclear plant on the Pacific coast in Shizuoka Prefecture, southwest of Tokyo, the prefectural government said.

Fukushima Pref. Warns of Radiation Leak at N-plant

Fukushima, March 11 (Jiji Press) -- The Fukushima prefectural government on Friday warned that water levels dropped at a reactor of a quake-hit Tokyo Electric Power Co. <9501> nuclear power plant, posing a threat of a radiation leak.

If the water levels at the No.2 reactor at the Fukushima No. 1 nuclear power station of the company keep falling, nuclear fuel rods would be exposed to air to generate radiation, according to the prefecture.

The prefecture urged residents in a 2-kilometer radius from the reactor to immediately evacuate.

Gambone, Kimberly

From: Gambone, Kimberly
Sent: Friday, March 11, 2011 12:07 PM
To: David Hamby (David.Hamby@oregonstate.edu)
Subject: FW: U.S. delivers coolant to Japan nuclear plant: Clinton/ Plant Being Cooled

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From: Breskovic, Clarence
Sent: Friday, March 11, 2011 12:02 PM
To: Breskovic, Clarence
Subject: U.S. delivers coolant to Japan nuclear plant: Clinton/ Plant Being Cooled

WASHINGTON | Fri Mar 11, 2011 11:05am EST
WASHINGTON (Reuters) - The United States has transported coolant to a Japanese nuclear plant affected by a massive earthquake and will continue to assist Japan, Secretary of State Hillary Clinton said on Friday.
"We just had our Air Force assets in Japan transport some really important coolant to one of the nuclear plants," Clinton said at a meeting of the President's Export Council.
"You know Japan is very reliant on nuclear power and they have very high engineering standards but one of their plants came under a lot of stress with the earthquake and didn't have enough coolant," Clinton said.

Japan Reactor Being Cooled

LONDON, March 11 (Reuters) - The World Nuclear Association, the main nuclear industry body, said on Friday that it understood the situation at Japan's Fukushima plant after a massive earthquake was under control, and water was being pumped into its cooling system.
"We understand this situation is under control," an analyst at the association told Reuters.
The Japanese government had declared an emergency situation around the plant as a precaution and evacuated residents, saying a cooling system was not working.
The analyst said he understood that a back-up battery power system had been brought online after about an hour, and begun pumping water back into the cooling system, where the water level had been falling.

V/14

Cruz, Luis

From: Sastre, Eduardo
Sent: Friday, March 11, 2011 2:14 PM
To: Diaz, Marilyn; Diaz-Sanabria, Yoira; Cruz, Luis
Subject: FW: Japan: Radioactive Steam Could Be Released From Troubled Plant

Feo!!! (ugly!!!)

From: Breskovic, Clarence
Sent: Friday, March 11, 2011 1:56 PM
To: Breskovic, Clarence
Subject: Japan: Radioactive Steam Could Be Released From Troubled Plant

Radioactive Steam Could Be Released From Troubled Plant

Tokyo Kyodo World Service<https://www.opensource.gov/wiki/display/nmp/Kyodo+World+News+Service>
1819 GMT 11 Mar 11

Tokyo, March 12 Kyodo -- Japanese authorities are nearing a decision to release radioactive steam from a troubled nuclear reactor, industry minister Benri Kaieda said Saturday.

Kaieda was referring to the rising pressure inside the No. 1 reactor of the Fukushima No. 1 plant, which was hit by a powerful earthquake Friday.

V/15

Gambone, Kimberly

From: Gambone, Kimberly
Sent: Friday, March 11, 2011 1:20 PM
To: Fowler, William H LTC USAR 335TH SIG CMD
Subject: FW: Radiation Level Rising in Fukushima Nuclear Plant Turbine Building - emergency generators dispatched

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From: Breskovic, Clarence
Sent: Friday, March 11, 2011 1:14 PM
To: Breskovic, Clarence
Subject: Radiation Level Rising in Fukushima Nuclear Plant Turbine Building - emergency generators dispatched

Radiation Level Rising in Fukushima Nuclear Plant Turbine Building

Fukushima, Japan, March 12 Kyodo -- The radiation level is rising in the building housing a turbine of the No. 1 reactor of the Fukushima No. 1 nuclear power plant following Friday's powerful earthquake, the operator Tokyo Electric Power Co. said Saturday.

The company also said monitoring data suggested the air pressure level has also soared inside the container of the reactor.

State of Emergency Declared at Fukushima Plant

Tokyo *Asahi Shimbun Online* 1733 GMT 11 Mar 11
Friday's devastating earthquake in the Tohoku region may have created a dangerous situation at two nuclear reactors in Fukushima Prefecture.

Officials of the Nuclear and Industrial Safety Agency were informed by Tokyo Electric Power Co. that the emergency core cooling system was not working at two reactors.

In addition, another mechanism that had been used to send water to the core also stopped at 8:30 p.m.

If the cores are not sufficiently cooled, there is a danger of a possible core meltdown.

At a news conference Friday night, Chief Cabinet Secretary Yukio Edano said a state of emergency at a nuclear facility was declared at 4:36 p.m.

It is the first time such a state of emergency has been declared.

According to NISA officials, although the reactor core stopped operations after the earthquake hit, water had to be inserted to the core to cool it because heat continued to be emitted from the nuclear fuel.

Although workers had to initiate emergency core cooling system procedures, the lack of an external power source and the failure of an emergency generator crippled the system that circulates water to the core to cool it.

TEPCO officials dispatched 51 generator vehicles to the reactors in an attempt to restore power. One vehicle

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reached one of the nuclear reactors late Friday and some of that reactor's power was restored.

At 9:23 p.m., the central government issued an evacuation instruction for residents living within a 3-kilometer radius of the No. 1 Fukushima nuclear power plant as well as an instruction to residents living within a radius of between 3 and 10 kilometers to remain indoors.

Edano said no radiation leakage had been detected.

The company issued an emergency evacuation order for the two reactors at the No. 1 Fukushima nuclear power plant. Officials from local communities gathered at a special monitoring facility in Okuma to oversee the cooling of the cores.

There was also the possibility that seawater pumps for cooling purposes may have stopped at two reactors at the No. 2 Fukushima nuclear power plant.

If those pumps remain inoperational, it could affect the emergency core cooling systems at those reactors as well.

Gambone, Kimberly

From: Gambone, Kimberly
Sent: Friday, March 11, 2011 3:27 PM
To: 'Fowler, William H LTC USAR 335TH SIG CMD'
Subject: FW: Japan: Radioactive Steam Could Be Released From Troubled Plant

LTC Fowler,

As you are probably aware, the NRC emergency operations center is staffed and operating, providing technical assistance to our Japanese counterparts.

LT

From: Breskovic, Clarence
Sent: Friday, March 11, 2011 1:57 PM
To: Breskovic, Clarence
Subject: Japan: Radioactive Steam Could Be Released From Troubled Plant

Radioactive Steam Could Be Released From Troubled Plant

Tokyo *Kyodo World Service* 1819 GMT 11 Mar 11
Tokyo, March 12 Kyodo -- Japanese authorities are nearing a decision to release radioactive steam from a troubled nuclear reactor, industry minister Benri Kaieda said Saturday.

Kaieda was referring to the rising pressure inside the No. 1 reactor of the Fukushima No. 1 plant, which was hit by a powerful earthquake Friday.

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PMT02 Hoc

From: PMT02 Hoc
Sent: Saturday, March 12, 2011 10:46 AM
To: Jaczko, Gregory; Virgilio, Martin; McDermott, Brian; Rosenberg, Stacey; Watson, Bruce

Sir,

Speculative cases ran using the RASCAL software include using the Oyster Creek site as a surrogate site for the following hypothetical scenarios:

- Reactor coolant release without filtering and ground release through the building, no PAGs are reached,
- Reactor fuel 10% cladding failure without filtering and ground release through the building,
- Reactor fuel 10% cladding failure with filtering and elevated stack release, a fraction of the PAGs are achieved close in distance,
- Reactor fuel 10% fuel failure without filtering and ground release through the building, a fraction of the PAGs are achieved close in distance,
- Reactor fuel 10% fuel failure with filtering and elevated stack release,
- Reactor fuel 40% fuel failure without filtering and ground release through the building, mimics TMI 2

The data has only been released to DOE Nuclear Incident Team at NNSA and NARAC.

PMT Dose Analyst (PMT02)
NRC Operation Center

U/18

From: OST02 HOC NSIR
To: Dorman, Dan; Virgilio, Martin; Borchardt, Bill; Weber, Michael; Ross-Lee, MaryJane; Hurd, Sapna; Pope, Tia; Perin, Vanice; Anderson, James; Chen, Yen-Ju; Kotzalas, Margie; Frazier, Alan; Figueroa, Roberto; Larson, Emily; Crutchley, Mary Glenn; Blount, Tom; Tschiltz, Michael; McGinty, Tim; Franovich, Rani; Turtil, Richard; Smith, Theodore; Chazell, Russell; Reed, Elizabeth; Salter, Susan; Lising, Jason; Shane, Raeann; Dacus, Eugene; Schmidt, Rebecca; Droggitis, Spiros; Powell, Amy; Riley (OCA), Timothy; Foggie, Kirk; Ramsey, Jack; Emche, Danielle; Abrams, Charlotte; Schwartzman, Jennifer; Mamish, Nader; Smith, Brooke; Fragoyannis, Nancy; Chowdhury, Prosanta; Ashkeboussi, Nima; Foster, Jack; Lubinski, John; Brock, Kathryn; Tappert, John; Casto, Greg; Rosenberg, Stacey; Watson, Bruce; Hart, Michelle; Schmidt, Duane; Clement, Richard; Huffert, Anthony; Sun, Casper; Case, Michael; Skeen, David; Ruland, William; Hiland, Patrick; Brown, Frederick; Dudes, Laura; Rini, Brett; Morlang, Gary; Cheok, Michael; Circle, Jeff; Dube, Donald; Brown, Eva; Esmaili, Hossein; Kolb, Timothy; Norton, Charles; Isom, James; Bloom, Steven; Padovan, Mark; Williams, Joseph; Hart, Ken; Williams, Donna
Subject: TAC # for Japan Earthquake and Tsunami Drill
Date: Sunday, March 13, 2011 5:08:57 AM

If you have participated in the "Japan Earthquake and Tsunami Drill" that began today (Friday March 11, 2011), please be sure to apply your time spent on this activity to the TAC Number listed below:

D92374 – Incident Response: Japan Earthquake and Tsunami Drill

V/19

From:	Operations Center Bulletin
To:	OST02 HOC
Subject:	FW: NRC IS RESPONDING TO AN EMERGENCY OUTSIDE of the United States
Date:	Sunday, March 13, 2011 11:15:09 AM

IN SIR

THIS IS NOT A DRILL

The NRC is coordinating its actions with other Federal agencies as part of the U.S. government response to the events in Japan. The NRC is examining all available information as part of the effort to analyze the event and understand its implications both for Japan and the United States. The NRC's Headquarters Operations Center in Rockville, MD has been stood up since the beginning of the emergency in Japan and is operating on a 24-hour basis.

NRC Incident Responders at Headquarters have spoken with the agency's counterpart in Japan and offered the assistance of U.S. technical experts. Two officials from the NRC with expertise on boiling water nuclear reactors have deployed to Japan as part of a U.S. International Agency for International Development (USAID) team. USAID is the Federal government agency primarily responsible for providing assistance to countries recovering from disasters.

U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety significant structures, systems, and components be designed to take in account the most severe natural phenomena historically estimated for the site and surrounding area.

The NRC will **not** provide information on the status of Japan's nuclear power plants. For the latest information on NRC actions see the NRC's web site at www.nrc.gov or blog at http://public-blog.nrc-gateway.gov.

Two important reminders:

It is possible that some of us will be requested by colleagues in another country to provide technical advice and assistance during this emergency. It is essential that all such communications be handled through the NRC Operations Center. Any assistance to a foreign government or entity must be coordinated through the NRC Operations Center and the U.S. Department of State (DOS). If you receive such a request, contact the NRC Operations Officer (301-816-5100 or via the NRC Operator) immediately.

If you receive information regarding this or any emergency (foreign or domestic) and you are not certain that the NRC's Incident Response Operations Officer is already aware of that information, you should contact the NRC Operations Officer (301-816-5100 or via the NRC Operator) and provide that information.

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Other Sources of Information:

USAID – www.usaid.gov

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U.S. Department of State – www.state.gov
FEMA – www.fema.gov
White House – www.whitehouse.gov
Nuclear Energy Institute – www.nei.org
International Atomic Energy Agency – www.iaea.org/press

No response to this message is required.

THIS IS NOT A DRILL

From: OST02 HOC MSIR
To: Dorman, Dan; Virgilio, Martin; Borchardt, Bill; Weber, Michael; Ross-Lee, MaryJane; Hurd, Sapna; Pope, Tia; Perin, Vanice; Anderson, James; Chen, Yen-Ju; Kotzalas, Margie; Frazier, Alan; Figueroa, Roberto; Larson, Emily; Crutchley, Mary Glenn; Blount, Tom; Tschiltz, Michael; McGinty, Tim; Franovich, Rani; Turtil, Richard; Smith, Theodore; Chazell, Russell; Reed, Elizabeth; Salter, Susan; Lising, Jason; Shane, Raeann; Dacus, Eugene; Schmidt, Rebecca; Droggitis, Spiros; Powell, Amy; Riley (OCA), Timothy; Foggie, Kirk; Ramsey, Jack; Emche, Danielle; Abrams, Charlotte; Schwartzman, Jennifer; Mamish, Nader; Smith, Brooke; Fragoyannis, Nancy; Chowdhury, Prosanta; Ashkeboussi, Nima; Foster, Jack; Lubinski, John; Brock, Kathryn; Tappert, John; Casto, Greg; Rosenberg, Stacey; Watson, Bruce; Hart, Michelle; Schmidt, Duane; Clement, Richard; Huffert, Anthony; Sun, Casper; Case, Michael; Skeen, David; Ruland, William; Hiland, Patrick; Brown, Frederick; Dudes, Laura; Rini, Brett; Morlang, Gary; Cheok, Michael; Circle, Jeff; Dube, Donald; Brown, Eva; Esmaili, Hossein; Kolb, Timothy; Norton, Charles; Isom, James; Bloom, Steven; Padovan, Mark; Williams, Joseph; Hart, Ken; Williams, Donna
Subject: TAC # for Japan Earthquake and Tsunami Drill
Date: Sunday, March 13, 2011 5:08:57 AM

If you have participated in the "Japan Earthquake and Tsunami Drill" that began today (Friday March 11, 2011), please be sure to apply your time spent on this activity to the TAC Number listed below:

D92374 – Incident Response: Japan Earthquake and Tsunami Drill

V/21

From:	Williams, Joseph
To:	Taylor, Robert; McIntyre, David
Cc:	Williams, Joseph; Hiland, Patrick
Subject:	Revised Question 15
Date:	Sunday, March 13, 2011 11:41:49 AM
Attachments:	Revised Question 15.doc

The attached file provides a proposed revision to Question 15 of the Chairman's Q&A.

Joe Williams
RST Communicator

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Revised Question 15. How many U.S. plants have designs similar to the affected Japanese reactors (and which ones)?

Public answer: Thirty-five of the 104 operating nuclear power plants in the U.S. are boiling water reactors (BWRs), as are the reactors at Fukushima.

Four of the U.S. BWRs are early designs which are similar to Fukushima Unit 1.

Nineteen U.S. BWRs are similar to Fukushima Unit 3.

Additional Information

Fukushima Unit 1 is a BWR-3 with a Mark 1 containment and an isolation condenser. Oyster Creek, Nine Mile Point Unit 1, and Dresden Units 2 and 3 are BWRs with Mark 1 containments and isolation condensers. Oyster Creek is a BWR-2 design, while the other three plants are BWR-3 designs.

Fukushima Unit 3 is a BWR-4 with a Mark 1 containment and a Reactor Core Isolation Cooling (RCIC) system. The remaining 31 U.S. BWRs use a Reactor Core Isolation Cooling (RCIC) system instead of an isolation condenser. Nineteen of those 31 reactors have a Mark 1 containment, while the remainder are more recent designs.

From: Hiland, Patrick
To: Case, Michael; Skeen, David; McDermott, Brian
Cc: Murphy, Andrew; Pires, Jose; Kammerer, Annie; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: RE: Japanese Earthquake Questions
Date: Monday, March 14, 2011 8:13:00 AM

Annie worked on refining her Qs and As during the day yesterday. We were asked by the ET to develop sets of "topical" question banks. When I left we had four topics: 1) Chairman's 15-questions, 2) RST Technical Questions, 3) PMT Technical Questions; and, 4) Research lead on Seismic/Tsunami questions. Not sure where we stand on coordinating these sections, but perhaps the IRC should take lead?

From: Case, Michael
Sent: Monday, March 14, 2011 7:51 AM
To: Skeen, David; Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Kammerer, Annie; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: Japanese Earthquake Questions

Hi guys. I don't know where we stand on the seismic related questions after Sunday's day shift activities (I assume Annie was able to continue). Nevertheless, I have access to some more experts here this morning. If there are residual activities, just let me know and we'll get them working.

From: Evans, Michele
To: Ruland, William; Leeds, Eric; Boger, Bruce
Cc: Schwarz, Sherry
Subject: RE: Confirmation of names for Japan
Date: Monday, March 14, 2011 2:18:09 PM

Bruce,

If there is an additional person going, please provide that name to the IRC Liaison team at these email addresses.

LIA02 HOC and

LIA03 HOC

Thanks

Michele

From: Ruland, William
Sent: Monday, March 14, 2011 2:11 PM
To: Evans, Michele; Christensen, Harold
Subject: FW: Confirmation of names for Japan

From: Leeds, Eric
Sent: Monday, March 14, 2011 1:11 PM
To: Collins, Elmo; Satorius, Mark; McCree, Victor; Dean, Bill; Sheron, Brian; Tracy, Glenn; Hudson, Jody; Johnson, Michael; Miller, Charles; Haney, Catherine; Zimmerman, Roy; Stewart, Sharon; Virgilio, Martin; Weber, Michael; Borchardt, Bill; Mamish, Nader; Doane, Margaret; Muessle, Mary
Cc: Boger, Bruce; Grobe, Jack; Ruland, William; Meighan, Sean
Subject: Confirmation of names for Japan

Folks –

Thanks so much for your help – we have a strong database of names/expertise to support the Japanese. For this first wave, we are sending Chuck Casto, John Monninger, Tony Nakanishi, Tim Kolb, Jack Foster and Richard Devercelly. I believe that Bruce Boger has contacted all those going to join Tony Ulsis and Jim Trapp in Japan.

I imagine that at some point we may need to send a second wave of responders to relieve our first wave. We will let you know as soon as we know if this needs to be done. We are also sensitive not to over-burden any one office.

Thanks again for your support!

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-1270

From: Gavrilas, Mirela
To: Gibson, Kathy; Case, Michael
Subject: Fw: Fukushima
Date: Monday, March 14, 2011 10:00:15 AM

Some information worth considering.

From: Farmer, Mitchell T. <farmer@anl.gov>
To: Tinkler, Charles
Cc: Basu, Sudhamay; Gavrilas, Mirela; Lee, Richard
Sent: Mon Mar 14 09:52:24 2011
Subject: RE: Fukushima

Hi Charlie,

I just wanted to send you a note and let you know that I'm a little concerned about the spent fuel storage pools for Units 1 and 3 for the reasons we've talked about over the years. I know you've probably thought of this but it's a stressful time and I just want to make sure the people you've deployed are thinking about this.

I doubt they have access inside the building due to radiation levels so I'm going to make a suggestion which may or may not be nieve, but given the circumstances I'll make it anyway. I know you can get the aerial lifts that can go up at least 10 stories. I was thinking you could send a brave individual up on that with a fire hose on the exterior of the building with an alarming TLD so that he would know if the radiation level was getting to high. You would use the exterior of the secondary containment as shielding. He could place the hose over the exposed wall and then wire tire that to one of the ibeams so that it doesn't blow off when you start deluge over the edge and onto the deck. The wire tie is imparitive as it'll blow back when you start the pump. If they have an extra fire pump that could push water head to 10 stories, you could get some water over the top and into the pool. This might take 1/2 hour or so to execute and so if the dose rate stays below 20 R/hour this could be pulled off.

I hope you don't mind me making suggestions and if it is problematic, please don't hesitate to let me know. Mirela has my cell phone; call me 24/7 if I can be of any assistance. As you know, you have resources here at the lab and I'm sure management would approve of us supporting you know.

Best Regards,
Mitch

ps. I wish we were further along on that remote sensing project for the RCIC that we just started for you; that could be quite helpful now.

From: Tinkler, Charles [mailto:Charles.Tinkler@nrc.gov]
Sent: Saturday, March 12, 2011 1:18 PM
To: Farmer, Mitchell T.
Subject: RE: Fukushima

Thanks Mitch, right now I don't know exactly why they are unable to use their isolation condenser or inject water. Thanks for the reminder on flooding. I appreciate your offer.

From: Farmer, Mitchell T. [mailto:farmer@anl.gov]
Sent: Friday, March 11, 2011 7:43 PM

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To: Gavrilas, Mirela; Tinkler, Charles; Basu, Sudhamay; Lee, Richard
Cc: Grandy, Christopher; 'corradin@cae.wisc.edu'
Subject: Fukushima

Hi Mirela, Charlie, Sud, Richard,

Don't know if you are out there. I've been watching the situation at Fukushima and don't like what I'm seeing, at least based on the news reports I have access to. I don't know how long a BWR can go w/o emergency core cooling and not sustain significant core damage but it seems like we're well into that time domain. Is there anything that can be done to help? I don't know, I'm searching. The one thing we learned from MCCI though: if you fear vessel failure and you have any means to flood the cavity then you should do that. They have siliecous concrete in Japan; too much interaction ex-vessel w/o water and coolability is lost. Let me know if there is anything I can do.

Mitch

From: Sheron, Brian
To: Case, Michael; Richards, Stuart
Cc: Uhle, Jennifer
Subject: FW: Japanese Earthquake Questions
Date: Monday, March 14, 2011 3:14:34 PM

Andy is an SLS seismic expert. We should be using him.

From: Murphy, Andrew
Sent: Monday, March 14, 2011 3:09 PM
To: Kammerer, Annie; Case, Michael; Skeen, David; Hiland, Patrick
Cc: Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: RE: Japanese Earthquake Questions

Is there anything that I can do to help the effort?

Andy

From: Kammerer, Annie
Sent: Monday, March 14, 2011 10:49 AM
To: Case, Michael; Skeen, David; Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: RE: Japanese Earthquake Questions

I have compiled a set of questions from all available sources, which I think are pretty complete. I am organizing them now and I have cliff and jon helping me with some of the answers. I've pulled form the questions we got a kashiwazaki, the questions we have that have come in, the GI-199 com plan, the DCNPP com plan, and other places.

I do have a request from RIV to pull a Q&A list for SONGS. If I brainstorm a list can I get help with answers?

What kind of experts do you have?

From: Case, Michael
Sent: Monday, March 14, 2011 7:51 AM
To: Skeen, David; Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Kammerer, Annie; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: Japanese Earthquake Questions

Hi guys. I don't know where we stand on the seismic related questions after Sunday's day shift activities (I assume Annie was able to continue). Nevertheless, I have access to some more experts here this morning. If there are residual activities, just let me know and we'll get them working.

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From: Gavrilas, Mirela
To: Case, Michael; Gibson, Kathy
Subject: Fw: Assessement of cooling requirements for Fukushima units 1-3
Date: Monday, March 14, 2011 2:36:54 PM

From: Farmer, Mitchell T. <farmer@anl.gov>
To: Tinkler, Charles; Basu, Sudhamay; Lee, Richard; Gavrilas, Mirela
Sent: Mon Mar 14 14:31:28 2011
Subject: FW: Assessement of cooling requirements for Fukushima units 1-3

FYI.
Mitch

From: Farmer, Mitchell T.
Sent: Monday, March 14, 2011 1:22 PM
To: Grandy, Christopher; Khalil, Hussein S.; Peters, Mark T.; Sattelberger, Alfred P.
Cc: 'corradin@cae.wisc.edu'; Seidensticker, Ralph W.
Subject: Assessement of cooling requirements for Fukushima units 1-3

All,

I did a few back of the envelope calculations to scope out what the cooling requirements will be at Fukushima units 1-3 in the event that they are not able to reestablish power to the site and, thereby, normal cooling functions at these plants.

The limited information I have suggests that they are supplying 30 MT/hour of seawater to unit 1, and so I'll assume that the same is currently going to units 2 and 3. To put this in perspective, that amount of cooling flow can remove 2.8 MW while remaining subcooled at atmospheric conditions, and up to 21.7 MW if this amount of water is completely boiled off. Ideally, you would like to get to subcooled outlet core conditions so you'll stop forming steam and then you can stop the venting that is causing concern right now.

That amount of heat removal needs to be compared to the decay heat levels in these reactors to determine when subcooled conditions can be reached. Unit 1 was 460 Mwe and Units 2- 3 were 784 Mwe per Chris's previous email. Thus, I estimate the thermal power levels of these reactors to be 1200 MWt and 2000 MWt, respectively. After three days (or currently), the power level for a U core would fall to about 0.4 % assuming that the reactors had operated for 200 full-power days before the earthquake (a little higher for the MOX core but I don't have data to assess that). Thus, decay heat in Unit 1 is now about 4.8 MW and for Units 2/3 it's about 8 MWt. Thus, I suspect they're still venting steam at all three units. I then looked at the times when the decay heat will fall below the level at which subcooling can be achieved (ie 2.8 MWt core decay heat level) and for unit 1 that is 6 days total (ie 3 days from now) and for units 2 and 3 it will be about 16 days (ie 13 more days).

This is a worst case scenario that assumes they can't get electricit back to the site and establish normal cooling function; ie they have to rely on sea water injection. Also, I assumed 200 full power days; the power level could be less or a little more if I overestimated/understimated operation times.

As far as coolability of the degraded cores, my opinion is that units 1 and 3 are in coolable configurations; it's been 3 days now and if the configuraiton was not coolable the material most likely would have failed the reactor pressure vessel. I guess the jury is still out on Unit 2; I think the entire core has gone dry at least once. The good news is that the decay heat is way down from what it was a few hours after the accident was initiated.

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Mitch

From: HSToday
To: Case, Michael
Subject: HSToday Daily Briefing - Focus on DHS
Date: Monday, March 14, 2011 1:27:42 PM

Monday, March 14, 2011 **E-Newsletter Sign-Up | E-mail To A Friend**

DAILY NEWS BRIEFING

US Weathers Tsunami, Sends Expert Help to Japan
Specialized personnel from the US Department of Homeland Security (DHS) continued to supply tsunami and earthquake assistance to domestic and international disaster efforts throughout the weekend in the wake of a crippling... »

TODAY'S NEWS ANALYSIS

Admiral Papp Outlines Coast Guard Rebuilding Priorities
Even in the current fiscal environment where resources are scarce rebuilding the Coast Guard to rebuild the Coast Guard, support front-line operations, invest in our people and families, and enhance maritime incident prevention... »

TSA Orders 'Re-tests' of Radiation Levels on Airport Body Scanners
The Transportation Security Administration on Friday ordered re-testing of all radiation-emitting full-body scanners after an internal review showed calculation errors, missing data and other discrepancies on paperwork by... »

Sen. Landrieu Says Japan Earthquake Shows Need for Disaster Funding
Senator Mary Landrieu (D-La.) says the devastating impact of the earthquake off the coast of Japan and subsequent flooding triggered by a tsunami in the Pacific Ocean highlight the need to maintain adequate funding for disaster... »

Calif. Fishing Town Battered by Tsunami Yet Again
Coastal residents forced to evacuate to higher ground were able to spend Friday night in their own homes, while work crews were assessing damage along the California Coast after a tsunami triggered by the massive earthquake in... »

Opinion: Did TSA Really Screen All Air Cargo?
The Transportation Security Administration says it screened all air cargo--but a government auditor said there's no way the TSA can know that. It's the second time this month the GAO has dinged the TSA for over-hyping itself and... »

TODAY'S HEADLINES

Japan Earthquake and Tsunami Death Toll Expected to Exceed 10,000
The death toll from Japan's earthquake and tsunami is almost certain to exceed 20,000, which is the number of people unaccounted for in two coastal cities alone, a Japanese newspaper reported Sunday. Elsewhere, hundreds of bodies... »

FEMA Pushes to Rid Louisiana of Their Trailers
The Federal Emergency Management Agency is pushing to get rid of the last 424 of its trailers still in Louisiana more than five years after Hurricane Katrina struck the state, leveling towns and flooding New Orleans. Click here... »

Reaction Time Critical in Calif. County Big Wave Scenario
A Monterey County tsunami emergency response plan says there would not be enough time to evacuate coastal residents if a local earthquake created a huge wave similar to the one that

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devastated Japan on Thursday.... »

US Lawmakers Say Go Slow on Nuclear Energy
The unfolding nuclear disaster in Japan at reactors damaged by a massive earthquake and tsunami has led some lawmakers to call for putting the "brakes" on US nuclear development. Click here for the full story »

Alaska Democrat Heads to Washington to Fight TSA Pat-Downs
Homeland Security officials and a congressional committee will get an earful from an Alaska politician this week. Rep. Sharon Cissna (D-Anchorage) is heading to Washington to argue that enhanced pat-downs at airports go too far... »

CORRESPONDENTS WATCH

Britain Convicts Awlaki Acolyte Targeting US Bound Planes
Last week a court in London convicted Rajib Karim, a 31-year-old Bangladeshi national in the UK working for British Airways of plotting with the Yemeni-American Al Qaeda in the Arabian Peninsula (AQAP) leader, Anwar Al... »

NEWS SHORTS

Committee Reveals Witness List for Hearing on Muslim Radicalization
The House Homeland Security Committee Monday unveiled the complete list of witnesses testifying at its first planned hearing on Muslim radicalization to be held this Thursday. Rep. Peter King (R-NY), committee chairman, plans to... »

GRANTS & FUNDING

Funding & Resources: Emergency Healthcare's Unique Funding Track
One of the four funding priorities supported by the Homeland Security Grant Program (HSGP) — the largest and most well-known homeland security funder—is, according to its mission statement, "Improving preparedness for, response... »

INDUSTRY ANNOUNCEMENTS

OSI Systems Awarded Contract Worth Approximately $31 Million
OSI Systems Inc., Hawthorne, Calif., a vertically-integrated provider of specialized electronic products for critical applications in the security and healthcare industries, has announced that its security division, Rapiscan... »

Centice Corporation Announces Beta Program for Portable Raman Spectroscopy Platform
Centice Corporation, Morrisville, NC, a pioneer in chemical verification and identification using Raman spectroscopy and computational sensor technology, has announced the start of a Beta Program with Cherokee Multi-Agency... »

NetStar-1 Chooses Monacelli to Lead Management Consulting Division
NetStar-1 Government Consulting Inc. (NetStar-1), Rockville, Md., a provider of consulting services in the areas of program management, financial management, and program governance, has named Pierre Monacelli Vice President of... »

From: Hiland, Patrick
To: Nguyen, Quynh
Subject: FW: Protracted RST Watch Bill - Extended to Friday March 18th
Date: Monday, March 14, 2011 11:00:00 AM
Importance: High

This is only the RST; need to get PMT and Liason and PA etc. Contact Peter Alter for info as he is the IRC coordinator today.

From: RST01 Hoc NSIR
Sent: Sunday, March 13, 2011 9:47 PM
To: Case, Michael; Skeen, David; Ruland, William; Hiland, Patrick; Brown, Frederick; Dudes, Laura; Rini, Brett; Alter, Peter; Hasselberg, Rick; Morlang, Gary; Collins, Frank; Thomas, Eric; Cheok, Michael; Circle, Jeff; Dube, Donald; Brown, Eva; Circle, Jeff; Esmaili, Hossein; Dube, Donald; Laur, Steven; Schaperow, Jason; Fuller, Edward; Salay, Michael; Kolb, Timothy; Shea, James; Isom, James; Bloom, Steven; Padovan, Mark; Williams, Joseph; Williams, Donna; Hart, Ken; Dozier, Jerry
Subject: Protracted RST Watch Bill - Extended to Friday March 18th

RST Members…

We have been instructed to expand the list of RST responders that we are pulling into shift work. The shifts have been extended until Friday night. Here is the proposed watch bill. PLEASE DROP BY THE RST ROOM OR CALL THE RST ON-DUTY COORDINATOR AT 301-816-5100 WITH ISSUES AND CONCERNS. Don't call Rick – He'll be sleeping!!!!

Reactor Safety Team Protracted Event Staffing for Japanese Earthquake Response

Team Position	RST Director	RST Coordinator	Accident Analyst	BWR Expert	RST Communicator
03/13/11 **Day** 0700 - 1500	Pat Hiland	Peter Alter	Jeff Circle	Tim Kolb	Joe Williams
03/13/11 **Swing** 1500 - 2300	Fred Brown	R. Hasselberg	Hossein Esmaili	C. Norton	Ken Hart
03/13/11 **Mid** 2300 - 0700	Dave Skeen	Mike Morlang	Mike Cheok	Eva Brown	none
03/14/11 **Day** 0700 - 1500	Laura Dudes	Peter Alter	Jeff Circle	Tim Kolb	Steve Bloom
03/14/11 **Swing** 1500 - 2300	Bill Ruland	R. Hasselberg	Don Dube	C. Norton	Mark Padovan
03/14/11 **Mid** 2300 - 0700	Mike Case	Brett Rini	Steve Laur	Eva Brown	Jerry Dozier
03/15/11 **Day** 0700 - 1500	Dave Skeen	Peter Alter	Jeff Circle	Jim Shea	Donna Williams
03/15/11 **Swing** 1500 - 2300	Fred Brown	Frank Collins	Hossein Esmaili	C. Norton	Jim Isom
03/15/11 **Mid** 2300 - 0700	Pat Hiland	Mike Morlang	J. Schaperow	Eva Brown	Ken Hart
03/16/11 **Day** 0700 - 1500	Laura Dudes	R. Hasselberg	Ed Fuller	Tim Kolb	Joe Williams
03/16/11 **Swing** 1500 - 2300	Bill Ruland	Eric Thomas	Mike Salay	C. Norton	Steve Bloom
03/16/11 **Mid** 2300 - 0700	Mike Case	Brett Rini	Mike Cheok	Eva Brown	Mark Padovan
03/17/11 **Day** 0700 - 1500	Dave Skeen	Frank Collins	Don Dube	Jim Shea	Donna Williams
03/17/11 **Swing** 1500 - 2300	Fred Brown	Mike Morlang	Steve Laur	C. Norton	Jerry Dozier

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03/17/11 **Mid** 2300 - 0700	Pat Hiland	Eric Thomas	Jeff Circle	Eva Brown	Ken Hart
03/18/11 **Day** 0700 - 1500	Laura Dudes	Peter Alter	Hossein Esmaili	Tim Kolb	Jim Isom
03/18/11 **Swing** 1500 - 2300	Bill Ruland	Brett Rini	J. Schaperow	C. Norton	Steve Bloom

From: Hiland, Patrick IMRR
To: Thomas, Eric
Cc: Brown, Frederick
Subject: FW: Japanese Earthquake Questions
Date: Monday, March 14, 2011 11:06:00 AM

You might want to reach out to Annie and get on distribution for her set of "seismic" questions. Also, the IRC WEB site is a location where some of the questions may reside.

From: Kammerer, Annie IRES
Sent: Monday, March 14, 2011 10:49 AM
To: Case, Michael; Skeen, David; Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: RE: Japanese Earthquake Questions

I have compiled a set of questions from all available sources, which I think are pretty complete. I am organizing them now and I have cliff and jon helping me with some of the answers. I've pulled form the questions we got a kashiwazaki, the questions we have that have come in, the GI-199 com plan, the DCNPP com plan, and other places.

I do have a request from RIV to pull a Q&A list for SONGS. If I brainstorm a list can I get help with answers?

What kind of experts do you have?

From: Case, Michael IRES
Sent: Monday, March 14, 2011 7:51 AM
To: Skeen, David; Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Kammerer, Annie; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: Japanese Earthquake Questions

Hi guys. I don't know where we stand on the seismic related questions after Sunday's day shift activities (I assume Annie was able to continue). Nevertheless, I have access to some more experts here this morning. If there are residual activities, just let me know and we'll get them working.

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From: Nguyen, Quynh NRR
To: Hiland, Patrick
Subject: FW: Japan Earthquake - ERO Staffing Schedule - March 11 to 15 (2).xlsx
Date: Monday, March 14, 2011 11:13:24 AM
Attachments: Japan Earthquake - ERO Staffing Schedule - March 11 to 15 (2).xlsx

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Pat,

Yeah, I just got the Master List... I need to cull it down for Eric.

From: Stone, Rebecca NSIR
Sent: Monday, March 14, 2011 11:00 AM
To: Nguyen, Quynh
Subject: FW: Japan Earthquake - ERO Staffing Schedule - March 11 to 15 (2).xlsx

Let me know if you need anything else. I'll be periodically checking my email.

-Rebecca

Rebecca Stone
Response Program
Office of Nuclear Security and Incident Response
U.S. Nuclear Regulatory Commission
301-415-5634 (Office)
e-mail: Rebecca.Stone@nrc.gov

From: OST02 HOC
Sent: Monday, March 14, 2011 10:58 AM
To: Stone, Rebecca
Subject: Japan Earthquake - ERO Staffing Schedule - March 11 to 15 (2).xlsx

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

Master Staffing Through March 18

Position	Date	Time	Staff
Executive Team			
ET Director	3/11-3/12	11pm - 7am	Dan Dorman
	12-Mar	7am - 3pm	Marty Virgilio
	12-Mar	3pm - 11pm	Bill Borchardt
	3/12-3/13	11pm - 7am	Mike Weber
	13-Mar	7am - 3pm	Marty Virgilio
	13-Mar	3pm - 11pm	Bill Borchardt
	3/13-3/14	11pm - 7am	Mike Weber
	14-Mar	7am - 3pm	Marty Virgilio
	14-Mar	3pm - 11pm	Jack Grobe
	3/14-3/15	11pm - 7am	Dan Dorman
	15-Mar	7am - 3pm	Mike Weber
	15-Mar	3pm - 11pm	Jack Grobe
	3/15-3/16	11pm - 7am	Dan Dorman
	16-Mar	7am - 3pm	Mike Weber
	16-Mar	3pm - 11pm	Jack Grobe
	3/16-3/17	11pm - 7am	Dan Dorman
	17-Mar	7am - 3pm	Mike Weber
	17-Mar	3pm - 11pm	Jack Grobe
	3/17-3/18	11pm - 7am	Dan Dorman
	18-Mar	7am - 3pm	Mike Weber
	18-Mar	3pm - 11pm	Jack Grobe
ET Response Advisor	3/11-3/12	7pm - 7am	Scott Morris
	12-Mar	7am - 3pm	Brian McDermott
	12-Mar	3pm - 11pm	Chris Miller
	3/12-3/13	11pm - 7am	Scott Morris
	13-Mar	7am - 3pm	Brian McDermott
	13-Mar	3pm - 11pm	Mary Jane Ross-Lee
	3/13-3/14	11pm - 7am	Chris Miller
	14-Mar	7am - 3pm	Brian McDermott
	14-Mar	3pm - 11pm	Mary Jane Ross-Lee
	3/14-3/15	11pm - 7am	Chris Miller
	15-Mar	7am - 3pm	Brian McDermott
	15-Mar	3pm - 11pm	
	3/15-3/16	11pm - 7am	Chris Miller
	16-Mar	7am - 3pm	Brian McDermott
	16-Mar	3pm - 11pm	
	3/16-3/17	11pm - 7am	
	17-Mar	7am - 3pm	Brian McDermott
	17-Mar	3pm - 11pm	
	3/17-3/18	11pm - 7am	
	18-Mar	7am - 3pm	Brian McDermott
	18-Mar	3pm - 11pm	
Executive Briefing Team			
EBT Admin. Assistant	3/11-3/12	11pm - 11am	Sapna Hurd
	12-Mar	11am - 11pm	Annette Stang
	3/12-3/13	11pm - 11am	Sapna Hurd
	13-Mar	11am - 11pm	Annette Stang
	3/13-3/14	11pm - 11am	Christina Merritt

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	14-Mar	11am - 11pm	Kelly Riner
	3/14-3/15	11pm - 7am	Tia Pope
	15-Mar	7am - 3pm	Sapna Hurd
	15-Mar	3pm - 11pm	Annette Stang
	3/15-3/16	11pm - 7am	Christina Merritt
	16-Mar	7am - 3pm	
	16-Mar	3pm - 11pm	Annette Stang
	3/16-3/17	11pm - 7am	
	17-Mar	7am - 3pm	Sapna Hurd
	17-Mar	3pm - 11pm	
	3/17-3/18	11pm - 7am	
	18-Mar	7am - 3pm	
	18-Mar	3pm - 11pm	
EBT Coordinator	3/11-3/12	11pm - 11am	Vanice Perin
	12-Mar	11am - 7pm	Sara Mroz
	3/12-3/13	7pm - 7am	Eric Schrader
	13-Mar	7am - 7pm	Sara Mroz
	3/13-3/14	7pm - 7am	Jim Anderson
	14-Mar	7am - 7pm	Yen-Ju Chen
	3/14-3/15	7pm - 7am	Eric Schrader
	15-Mar	7am - 3pm	Jim Anderson
	15-Mar	3pm - 11pm	Sara Mroz
	3/15-3/16	11pm - 7am	
	16-Mar	7am - 3pm	Jim Anderson
	16-Mar	3pm - 11pm	Sara Mroz
	3/16-3/17	11pm - 7am	
	17-Mar	7am - 3pm	Jim Anderson
	17-Mar	3pm - 11pm	Sara Mroz
	3/17-3/18	11pm - 7am	
	18-Mar	7am - 3pm	Jim Anderson
	18-Mar	3pm - 11pm	Sara Mroz
		Executive Support Team	
EST Status Officer	3/11-3/12	11pm - 7am	Jeff Grant
	12-Mar	7am - 3pm	Jane Marshall
	12-Mar	3pm - 11pm	Bill Gott
	3/12-3/13	11pm - 7am	Jeff Grant
	13-Mar	7am - 3pm	Jane Marshall
	13-Mar	3pm - 11pm	Bill Gott
	3/13-3/14	11pm - 7am	Jeff Grant
	14-Mar	7am - 3pm	Jane Marshall
	14-Mar	3pm - 11pm	Bill Gott
	3/14-3/15	11pm - 7am	Jeff Grant
	15-Mar	7am - 3pm	Jane Marshall
	15-Mar	3pm - 11pm	Bill Gott
	3/15-3/16	11pm - 7am	Jeff Grant
	16-Mar	7am - 3pm	Jane Marshall
	16-Mar	3pm - 11pm	Bill Gott
	3/16-3/17	11pm - 7am	Jeff Grant
	17-Mar	7am - 3pm	Jane Marshall
	17-Mar	3pm - 11pm	Bill Gott
	3/17-3/18	11pm - 7am	Jeff Grant

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	18-Mar	7am - 3pm	Jane Marshall
	18-Mar	3pm - 11pm	Bill Gott
EST Coordinator	3/11-3/12	11pm - 11am	Jeff Grant
	12-Mar	11am - 11pm	Tony Bowers
	3/12-3/13	11pm - 11am	Jeff Grant
	13-Mar	11am - 11pm	Tony Bowers
	3/13-3/14	11pm - 11am	Jeff Grant
	14-Mar	7am - 3pm	Tony Bowers
		3pm - 11pm	
	3/14-3/15	11pm - 7am	Jeff Grant
	15-Mar	7am - 3pm	Tony Bowers
		3pm - 11pm	
	3/15-3/16	11pm - 7am	Jeff Grant
	16-Mar	7am - 3pm	Tony Bowers
		3pm - 11pm	
	3/16-3/17	11pm - 7am	Jeff Grant
	17-Mar	7am - 3pm	Tony Bowers
		3pm - 11pm	
	3/17-3/18	11pm - 7am	Jeff Grant
EST Chronology Officer	3/11-3/12	11pm - 11am	Margie Kotzalas
	12-Mar	11am - 11pm	Alan Frasier
	3/12-3/13	11pm - 11am	Greg Bowman
	13-Mar	11am - 11pm	Alan Frasier
	3/13-3/14	11pm - 7am	Greg Bowman
	14-Mar	7am - 3pm	Jessica Kratchman
	14-Mar	3pm - 11pm	Rebecca Karas
	3/14-3/15	11pm - 7am	Scarbrough, Thomas
	15-Mar	7am - 3pm	Jessica Kratchman
	15-Mar	3pm - 11pm	Rebecca Karas
	3/15-3/16	11pm - 7am	Scarbrough, Thomas
	16-Mar	7am - 3pm	Jessica Kratchman
	16-Mar	3pm - 11pm	Rebecca Karas
	3/16-3/17	11pm - 7am	Scarbrough, Thomas
	17-Mar	7am - 3pm	Jessica Kratchman
	17-Mar	3pm - 11pm	Rebecca Karas
	3/17-3/18	11pm - 7am	
	18-Mar	7am - 3pm	Jessica Kratchman
	18-Mar	3pm - 11pm	Rebecca Karas
EST Response Ops Mgr	3/11-3/12	7pm-7am	Karen Jackson
	12-Mar	7am-10pm	Omar Khan
	3/12-3/13	10pm - 7am	Karen Jackson
	13-Mar	7am - 7pm	Roberto Figueroa
	3/13-3/14	7pm - 7am	Omar Khan
	14-Mar	7am - 3pm	Karen Jackson
	14-Mar	3pm - 11pm	Roberto Figueroa
	3/14-3/15	11pm - 7am	Omar Khan
	15-Mar	7am - 3pm	Karen Jackson
	15-Mar	3pm - 11pm	Roberto Figueroa
	3/15-3/16	11pm - 7am	Omar Khan

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	16-Mar	7am - 3pm	Karen Jackson
	16-Mar	3pm - 11pm	Roberto Figueroa
	3/16-3/17	11pm - 7am	Omar Khan
	17-Mar	7am - 3pm	Karen Jackson
	17-Mar	3pm - 11pm	Roberto Figueroa
	3/17-3/18	11pm - 7am	Omar Khan
EST Admin. Assistant	3/11-3/12	3pm - 11am	Linda Williamson /Andrea Wimbush
	12-Mar	11am - 11pm	Emily Larson
	3/12-3/13	11pm - 7am	Amy Salus
	13-Mar	7am - 3pm	Mary Glenn Crutchley
	13-Mar	3pm - 11pm	Emily Larson
	3/13-3/14	11pm - 7am	Linda Williamson
	14-Mar	7am - 3pm	Tabitha Howard
	14-Mar	3pm - 11pm	Mary Glenn Crutchley
	3/14-3/15	11pm - 7am	Amy Salus
	15-Mar	7am - 3pm	Linda Williamson
	15-Mar	3pm - 11pm	Michelle Manahan
	3/15-3/16	11pm - 7am	Andrea Wimbush
	16-Mar	7am - 3pm	Emily Larson
	16-Mar	3pm - 11pm	Mary Glenn Crutchley
	3/16-3/17	11pm - 7am	Andrea Wimbush
	17-Mar	7am - 3pm	Amy Salus
	17-Mar	3pm - 11pm	Mary Glenn Crutchley
	3/17-3/18	11pm - 7am	Linda Williamson
	18-Mar	7am - 3pm	Tabitha Howard
	18-Mar	3pm - 11pm	Mary Glenn Crutchley
Liason Team			
LT Director	3/11-3/12	7pm - 2am	Tom Blount
	12-Mar	2am - 7am	Mike Tschiltz
	12-Mar	7am - 11am	Tim McGinty
	12-Mar	11am - 11pm	Mark Thaggard
	3/12-3/13	11pm - 7am	Tom Blount
	13-Mar	7am - 3pm	Mike Tschiltz
	13-Mar	3pm-11pm	Tim McGinty
	3/13-3/14	11pm - 7am	Tom Blount
	14-Mar	7am - 3pm	Mark Thaggard
	14-Mar	3pm-11pm	Tim McGinty
	3/14-3/15	11pm - 7am	Tom Blount
	15-Mar	7am - 3pm	Mark Thaggard
	15-Mar	3pm - 11pm	Tim McGinty
	3/15-3/16	11pm - 7am	Tom Blount
	16-Mar	7am - 3pm	Mark Thaggard
	16-Mar	3pm - 11pm	Tim McGinty
	3/16-3/17	11pm - 7am	Tom Blount
	17-Mar	7am - 3pm	Mark Thaggard
	17-Mar	3pm - 11pm	Tim McGinty
	3/17-3/18	11pm - 7am	Tom Blount
	18-Mar	7am - 3pm	Mark Thaggard
	18-Mar	3pm - 11pm	Tim McGinty
LT Coordinator	3/11-3/12	7pm - 7am	Nathan Sanfilippo

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	12-Mar	2am - 7am	Rani Franovich
	12-Mar	7am - 7pm	Jeff Temple/Milt Murray
	3/12-3/13	7pm - 7am	Janelle Jesse
	13-Mar	7am - 7pm	Jeff Temple/Milt Murray
	3/13-3/14	7pm - 7am	Nathan Sanfilippo
	14-Mar	7am - 3pm	Rani Franovich
	14-Mar	3pm - 11pm	Milt Murray
	3/14-3/15	11pm - 7am	
	15-Mar	7am - 3pm	Milt Murray
	15-Mar	3pm - 11pm	Nathan Sanfilippo
	3/15-3/16	11pm - 7am	
	16-Mar	7am-3pm	Milt Murray
	16-Mar	3pm - 11pm	Nathan Sanfilippo
	3/16-3/17	11pm - 7am	
	17-Mar	7am - 3pm	Milt Murray
	17-Mar	3pm - 11pm	Rani Franovich
	3/17-3/18	11pm - 7am	
	18-Mar	7am - 3pm	Milt Murray
	18-Mar	3pm - 11pm	Rani Franovich
LT State Liason	13-Mar	7am-3pm	Rich Turtil
LT Federal Liason (2)	3/11-3/12	1am - 7am	Ted Smith
	12-Mar	7am - 7pm	Russ Chazell / Beth Reed
	3/12-3/13	7pm - 7am	Susan Salter / Jason Lising
	13-Mar	7am - 3pm	Russ Chazell
	13-Mar	3pm - 11 pm	Beth Reed
	3/13-3/14	11pm - 7am	Ted Smith/ Bethany Cecare
	14-Mar	7am - 3pm	Beth Reed
	14-Mar	3pm - 11pm	Jeffrey Lynch
	3/14-3/15	11pm - 7am	Jeff Temple
	15-Mar	7am - 3pm	Ted Smith
	15-Mar	3pm - 11pm	Jeffrey Lynch
	3/15-3/16	11pm - 7am	
	16-Mar	7am - 3pm	Beth Reed
	16-Mar	3pm - 11pm	
	3/16-3/17	11pm - 7am	
	17-Mar	7am - 3pm	Beth Reed
	17-Mar	3pm - 11pm	
	3/17-3/18	11pm - 7am	
	18-Mar	7am - 3pm	Beth Reed
	18-Mar	3pm - 11pm	
LT Congressional Liason (2)	3/11-3/12	10pm - 7am	Raeann Shane/Gene Dacus
	12-Mar	7am - 2pm	Becky Schmidt
	12-Mar	2pm - 9pm	Spiros Drogettis
	3/12-3/13	9pm -7am	David Decker
	13-Mar	7am - 2pm	Amy Powell
	13-Mar	2pm - 9pm	Tim Riley
	3/13-3/14	9pm -7am	Gene Dacus
	14-Mar	7am - 2pm	Raeann Shane
	14-Mar	2pm - 9pm	Amy Powell
	3/14-3/15	9pm -7am	Tim Riley

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	15-Mar	7am - 2pm	Spiros Drogettis
	15-Mar	2pm - 9pm	
	3/15-3/16	9pm -7am	
	16-Mar	7am-2pm	
	16-Mar	2pm - 9pm	
	3/16-3/17	9pm -7am	
	17-Mar	7am-2pm	
	17-Mar	2pm - 9pm	
	3/17-3/18	9pm -7am	
	18-Mar	7am-2pm	
	18-Mar	2pm - 9pm	
LT International Liason (2)	3/11-3/12	11pm - 7am	Eric Stahl
	12-Mar	7am - 3pm	Kirk Foggie
	12-Mar	3pm - 11pm	Jack Ramsey/Danielle Emche
	3/12-3/13	11pm - 7am	Charlotte Abrams/Jen Schwartzman
	13-Mar	7am - 3pm	Nader Mamish/Brooke Smith/Janice Owens
	13-Mar	3pm - 11pm	Kirk Foggie/Karen Henderson
	3/13-3/14	11pm - 7am	Nancy Fragoyanis/Eric Stahl
	14-Mar	7am - 3pm	Nader Mamish/Brooke Smith
	14-Mar	3pm - 11pm	Kirk Foggie
	3/14-3/15	11pm - 7am	Margaret Doane
	15-Mar	7am - 3pm	
	15-Mar	3pm - 11pm	
	3/15-3/16	11pm - 7am	
	16-Mar	7am - 3pm	
	16-Mar	3pm - 11pm	
	3/16-3/17	11pm - 7am	
	17-Mar	7am - 3pm	
	17-Mar	3pm - 11pm	
	3/17-3/18	11pm - 7am	
	18-Mar	7am - 3pm	
	18-Mar	3pm - 11pm	
Protective Measures Team			
PMTR Director	14-Mar	8:30am -5:30pm	Christiana Lui
	14-Mar		
	3/14-3/15		
PMTR Coordinator	3/11-3/12	11pm - 7am	Lou Brandon
	12-Mar	7am - 11am	Prosanta Chowdhury
	12-Mar	7am-7pm	Nima Ashkeboussi
	3/12-3/13	7pm - 7am	Lou Brandon
	13-Mar	7am-3pm	Jack Foster
	13-Mar	3pm-11pm	Nima Ashkeboussi
	3/13-3/14	11pm - 7am	John Lubinski
	14-Mar	7am-3pm	Prosanta Chowdhury
	14-Mar	3pm-11pm	Nima Ashkeboussi
	3/14-3/15	11pm - 7am	Lou Brandon
	15-Mar	7am-3pm	Prosanta Chowdhury
	15-Mar	3pm - 11pm	
	3/15-3/16	11pm - 8am	Lou Brandon
	16-Mar	8am - 3pm	Prosanta Chowdhury
	16-Mar	3pm - 11pm	Nima Ashkeboussi

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	3/16-3/17	11pm - 8am	Lou Brandon
	17-Mar	8am - 3pm	Prosanta Chowdhury
	17-Mar	3pm - 11pm	
	3/17-3/18	11pm - 7am	Lou Brandon
	18-Mar	7am - 3pm	
	18-Mar	3pm - 11pm	
PMTR Prot Actions Asst Dir	3/11-3/12	11pm - 7am	Kathryn Brock
	12-Mar	7am - 7pm	Stacey Rosenberg
	3/12-3/13	7pm - 7am	Greg Casto
	13-Mar	7am-3pm	Kathryn Brock
	13-Mar	3pm-11pm	John Tappert
	3/13-3/14	11pm - 7am	Greg Casto
	14-Mar	7am-3pm	Kathryn Brock
	14-Mar	3pm-11pm	Vince Holahan
	3/14-3/15	11pm-7am	Greg Casto
	15-Mar	7am-3pm	Stacey Rosenberg
	15-Mar	3pm - 11pm	Kathryn Brock
	3/15-3/16	11pm - 7am	Greg Casto
	16-Mar	7am - 3pm	Kathryn Brock
	16-Mar	3pm - 11pm	
	3/16-3/17	11pm - 7am	Greg Casto
	17-Mar	7am - 3pm	Kathryn Brock
	17-Mar	3pm - 11pm	John Tappert
	3/17-3/18	11pm - 7am	Greg Casto
	18-Mar	7am - 3pm	Kathryn Brock
	18-Mar	3pm - 11pm	
PMTR RAAD	3/11-3/12	11pm-7am	Steve LaVie
	12-Mar	7am-7pm	Bruce Watson
	3/12-3/13	7pm-7am	Michelle Hart
	13-Mar	7am-3pm	Bruce Watson
	13-Mar	3pm-11pm	Steve LaVie
	3/13-3/14	11pm-7am	Randy Sullivan
	14-Mar	7am-3pm	Bruce Watson
	14-Mar	3pm-11pm	Michelle Hart
	3/14-3/15	11pm-7am	Randy Sullivan / Patricia Milligan
	15-Mar	7am-3pm	Bruce Watson
	15-Mar	3pm-11pm	Steve LaVie
	3/15-3/16	11pm - 7am	Patricia Milligan
	16-Mar	7am - 2pm	Bruce Watson
	16-Mar	2pm - 11pm	Steve LaVie
	3/16-3/17	11pm - 7am	Randy Sullivan
	17-Mar	7am - 3pm	Bruce Watson
	17-Mar	3pm - 11pm	
	3/17-3/18	11pm - 7am	Randy Sullivan
	18-Mar	7am - 3pm	Bruce Watson
	18-Mar	3pm - 11pm	
PMTR Dose Assessment	3/11-3/12	7pm-7am	Kimberly (Ropon) Gambone
(RASCAL)	12-Mar	7am-11am	Prosanta Chowdhury
	12-Mar	11am-11pm	Gary Purdy
	13-Mar	7am-3pm	Duane Schmidt

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	13-Mar	7am-3pm	Kimberly Ropon (arrive 11am)
	13-Mar	3pm-11pm	Richard Clement (2pm-7pm)/Casper Sun
	3/13-3/14	11pm-7am	Patricia Milligan
	14-Mar	7am-3pm	Tony Huffert/Fritz Sturz
	14-Mar	3pm-11pm	Kimberly Gambone / Rich Clement (3pm - 8pm)
	3/14-3/15	11pm-7am	
	15-Mar	7am-3pm	Casper Sun / John Parillo
	15-Mar	3pm - 11pm	Fritz Sturz
	3/15-3/16	11pm - 7am	
	16-Mar	7am - 3pm	Kimberly Gambone
	16-Mar	3pm - 11pm	
	3/16-3/17	11pm - 7am	Fritz Sturz
	17-Mar	7am - 3pm	
	17-Mar	3pm - 11pm	Casper Sun
	3/17-3/18	11pm - 7am	Kimberly Gambone
	18-Mar	7am - 3pm	
	18-Mar	3pm - 11pm	
RASCAL Developer	15-Mar	1pm-7pm	George Athey (contractor)
PMTR GIS Analyst	13-Mar	10:30 am-5pm	Yong Li
	14-Mar	3pm - 11pm	Yong Li (leaving
	3/14-3/15	11pm - 7am	
	15-Mar	7am - 3pm	
	15-Mar	3pm - 11pm	
	3/15-3/16	11pm - 7am	
	16-Mar	7am - 3pm	
	16-Mar	3pm - 11pm	
	3/16-3/17	11pm - 7am	
	17-Mar	7am - 3pm	
	17-Mar	3pm - 11pm	
	3/17-3/18	11pm - 7am	
	18-Mar	7am - 3pm	
	18-Mar	3pm - 11pm	
	3/18-3/19	11pm - 7am	
Reactor Safety Team			
RST Director	3/11-3/12	11pm - 7am	Mike Case
	12-Mar	7am - 3pm	Dave Skeen
	12-Mar	3pm - 11pm	Bill Ruland
	3/12-3/13	11pm - 7am	Mike Case
	13-Mar	7am - 3pm	Pat Hiland
	13-Mar	3pm - 11pm	Fred Brown
	3/13-3/14	11pm - 7am	Dave Skeen
	14-Mar	7am - 3pm	Laura Dudes
	14-Mar	3pm - 11pm	Bill Ruland
	3/14-3/15	11pm - 7am	Mike Case
	15-Mar	7am - 3pm	Dave Skeen
	15-Mar	3pm - 11pm	Fred Brown
	3/15-3/16	11pm - 7am	Pat Hiland
	16-Mar	7am - 3pm	N/A
	16-Mar	3pm - 11pm	Bill Ruland
	3/16-3/17	11pm - 7am	Mike Case
	17-Mar	7am - 3pm	Dave Skeen

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	17-Mar	3pm - 11pm	Fred Brown
	3/17-3/18	11pm - 7am	Pat Hiland
	18-Mar	7am - 3pm	Laura Dudes
	18-Mar	3pm - 11pm	Bill Ruland
RST Coordinator	3/11-3/12	11pm - 7am	Brett Rini
	12-Mar	7am - 3pm	Peter Alter
	12-Mar	3pm - 11pm	Rick Hasselberg
	3/12-3/13	11pm - 7am	Mike Morlang
	13-Mar	7am - 3pm	Peter Alter
	13-Mar	3pm - 11pm	Rick Hasselberg
	3/13-3/14	11pm - 7am	Brett Rini
	14-Mar	7am - 3pm	Peter Alter
	14-Mar	3pm - 11pm	Rick Hasselberg
	3/14-3/15	11pm - 7am	Brett Rini
	15-Mar	7am - 3pm	Peter Alter
	15-Mar	3pm - 11pm	Frank Collins
	3/15-3/16	11pm - 7am	Mike Morlang
	16-Mar	7am - 3pm	Rick Hasselberg
	16-Mar	3pm - 11pm	Eric Thomas
	3/16-3/17	11pm - 7am	Greg Schoenbeck (?)
	17-Mar	7am - 3pm	Frank Collins
	17-Mar	3pm - 11pm	Mike Morlang
	3/17-3/18	11pm - 7am	Eric Thomas
	18-Mar	7am - 3pm	Peter Alter
	18-Mar	3pm - 11pm	Greg Schoenbeck (?)
Severe Accident/PRA	3/11-3/12	11pm - 7am	Mike Cheok
	12-Mar	7am - 3pm	Jeff Circle
	12-Mar	3pm - 11pm	Don Dube
	3/12-3/13	11pm - 7am	Eva Brown
	13-Mar	7am - 3pm	Jeff Circle
	13-Mar	3pm - 11pm	Hossein Esmaili
	3/13-3/14	11pm - 7am	Mike Cheok
	14-Mar	7am - 3pm	Jeff Circle
	14-Mar	3pm - 11pm	Don Dube
	3/14-3/15	11pm - 7am	Mike Cheok
	15-Mar	7am - 3pm	Jeff Circle
	15-Mar	3pm - 11pm	Hossein Esmaili
	3/15-3/16	11pm - 7am	J. Schaperow
	16-Mar	7am - 3pm	Ed Fuller
	16-Mar	3pm - 11pm	Mike Cheok
	3/16-3/17	11pm - 7am	Mike Salay (?)
	17-Mar	7am - 3pm	Jeff Circle
	17-Mar	3pm - 11pm	Steve Laur
	3/17-3/18	11pm - 7am	N/A
	18-Mar	7am - 3pm	Hossein Esmaili
	18-Mar	3pm - 11pm	J. Schaperow
BWR Expertise	3/11-3/12	11pm - 7am	Eva Brown
	12-Mar	7am - 3pm	Tim Kolb
	12-Mar	3pm - 11pm	Chuck Norton
	3/12-3/13	11pm - 7am	Eva Brown

JAPAN EARTHQUAKE - ERO STAFFING SCHEDULE
MARCH 11-18

	13-Mar	7am - 3pm	Tim Kolb
	13-Mar	3pm - 11pm	Chuck Norton
	3/13-3/14	11pm - 7am	Eva Brown
	14-Mar	7am - 3pm	Tim Kolb
	14-Mar	3pm - 11pm	Chuck Norton
	3/14-3/15	11pm - 7am	Eva Brown
	15-Mar	7am - 3pm	Tim Kolb
	15-Mar	3pm - 11pm	C. Norton
	3/15-3/16	11pm - 7am	Eva Brown
	16-Mar	7am - 3pm	Tim Kolb
	16-Mar	3pm - 11pm	C. Norton
	3/16-3/17	11pm - 7am	Eva Brown
	17-Mar	7am - 3pm	Jim Shea
	17-Mar	3pm - 11pm	C. Norton
	3/17-3/18	11pm - 7am	Eva Brown
	18-Mar	7am - 3pm	Jim Shea (?)
	18-Mar	3pm - 11pm	C. Norton
RST Comm/ERDS Operator	3/11-3/12	11pm - 7am	Jim Isom
	12-Mar	7am - 7pm	Steve Bloom
	12-Mar	3pm - 11pm	Mark Padovan (arrive at 5:00pm)
	13-Mar	7am-3pm	Joseph Williams
	13-Mar	3pm-11pm	Ken Hart
	14-Mar	7am-3pm	Steve Bloom
	14-Mar	3pm-11pm	Mark Padovan
	3/14-3/15	11pm - 7am	Jerry Dozier
	15-Mar	7am-3pm	Donna Williams
	15-Mar	3pm - 11pm	Jim Isom
	3/15-3/16	11pm - 7am	Ken Hart
	16-Mar	7am - 3pm	Joseph Williams
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	3/16-3/17	11pm - 7am	Mark Padovan
	17-Mar	7am - 3pm	Donna Williams
	17-Mar	3pm - 11pm	Jerry Dozier
	3/17-3/18	11pm - 7am	Ken Hart
	18-Mar	7am - 3pm	Jim Isom
	18-Mar	3pm - 11pm	Steve Bloom

From: Kammerer, Annie
To: Hiland, Patrick
Subject: RE: Japanese Earthquake Questions
Date: Monday, March 14, 2011 12:27:56 PM

Everything is helpful...Thanks!

From: Hiland, Patrick ,nrc
Sent: Monday, March 14, 2011 12:27 PM
To: Kammerer, Annie
Subject: RE: Japanese Earthquake Questions

release

My quick assessment is we can take a shot at about 75%. Let me distribute and get back with you. There is a Crystal River restart conference meeting 1:30-2:30, so likely the best I can due by 3-4 is to state we accept the question and will provide answer.

From: Kammerer, Annie ,RES
Sent: Monday, March 14, 2011 12:26 PM
To: Hiland, Patrick
Subject: RE: Japanese Earthquake Questions

Thanks! Do you think you have the right people to help?

From: Hiland, Patrick ,nrc
Sent: Monday, March 14, 2011 12:25 PM
To: Kammerer, Annie
Subject: RE: Japanese Earthquake Questions

release

Below is the 4th question of 1st page: is there a typo; should it be **EDG**?

"How do we know that the EDFs in Diablo Canyon and SONGS will not fail to operate like in Japan?"

From: Kammerer, Annie ,RES
Sent: Monday, March 14, 2011 12:20 PM
To: Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer; Case, Michael; Skeen, David; Munson, Clifford; Ake, Jon
Subject: RE: Japanese Earthquake Questions

Pat,

I currently have about 17 pages of questions that we should have pulled together in a pretty useful form later today.

Attached, please see a list of unanswered engineering type questions that I pulled from the larger Q&A document. If you can get your guys working on these it would be very helpful. I am hoping to publish a version at about 4 or 5 today. So, if I can get something on these by perhaps 3 or 4, that would be great. Otherwise, we will note that we are

V/32

working on it.

FYI, Jon Ake and Cliff Munson are working on a separate set of the seismic questions.

Also, I don't have any questions on Seismic PRA, which is a hot topic with industry lately (as evidenced by the recent letter from NEI asserting that SPRA is too undeveloped). I have asked Nilesh to develop some Q&As that we may see coming from industry to us as a result of all of this. Those are not likely to make it into the version I want to get out today, but we can add later.

Annie

From: Hiland, Patrick NRR
Sent: Monday, March 14, 2011 11:05 AM
To: Kammerer, Annie
Cc: Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer; Case, Michael; Skeen, David
Subject: RE: Japanese Earthquake Questions

release

NRR/DE has Kamal (seismic structures) to review specific questions. I also have several very experienced structural design engineers on staff (George Thomas & Farhead Farzam) If electrical, I have qualified staff and George Wilson that can help.

From: Kammerer, Annie RES
Sent: Monday, March 14, 2011 10:49 AM
To: Case, Michael; Skeen, David; Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: RE: Japanese Earthquake Questions

I have compiled a set of questions from all available sources, which I think are pretty complete. I am organizing them now and I have cliff and jon helping me with some of the answers. I've pulled form the questions we got a kashiwazaki, the questions we have that have come in, the GI-199 com plan, the DCNPP com plan, and other places.

I do have a request from RIV to pull a Q&A list for SONGS. If I brainstorm a list can I get help with answers?

What kind of experts do you have?

From: Case, Michael RES
Sent: Monday, March 14, 2011 7:51 AM
To: Skeen, David; Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Kammerer, Annie; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: Japanese Earthquake Questions

Hi guys. I don't know where we stand on the seismic related questions after Sunday's day shift activities (I assume Annie was able to continue). Nevertheless, I have access to some more experts here this morning. If there are residual activities, just let me know and we'll get them working.

From: Hiland, Patrick NRR
To: Thomas, Eric
Subject: FW: Japanese Earthquake Questions
Date: Monday, March 14, 2011 1:07:00 PM
Attachments: seismic questions for structural and electrical engineers.docx

---

Fya; I'm asking DE staff who can answer these questions. I promised to respond to Annie by cob if I have staff to answer.

release

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Cc: Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer; Case, Michael; Skeen, David; Munson, Clifford; Ake, Jon
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Cc: Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer; Case, Michael; Skeen, David
Subject: RE: Japanese Earthquake Questions

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To: Case, Michael; Skeen, David; Hiland, Patrick

V/33

Cc: Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: RE: Japanese Earthquake Questions

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To: Skeen, David; Hiland, Patrick
Cc: Murphy, Andrew; Pires, Jose; Kammerer, Annie; Hogan, Rosemary; Sheron, Brian; Uhle, Jennifer
Subject: Japanese Earthquake Questions

Hi guys. I don't know where we stand on the seismic related questions after Sunday's day shift activities (I assume Annie was able to continue). Nevertheless, I have access to some more experts here this morning. If there are residual activities, just let me know and we'll get them working.

Guidance: please answer the question in two parts (1) a "public response" that is high level and in layman's terms and (2) additional technical or sensitive information that in-house staff should know.

Questions:

How do we know that the equipment in plants is safe in earthquakes?

Public response: ADD
Additional, technical, non-public information: ADD

How do we know equipment will work if the magnitude is bigger than expected, like in Japan?

Public response: ADD
Additional, technical, non-public information: ADD

Are US plants susceptible to the same kind of loss of power as happened in Japan?

Public response: ADD
Additional, technical, non-public information: ADD

How do we know that the EDFs in Diablo Canyon and SONGS will not fail to operate like in Japan?
Public response: ADD
Additional, technical, non-public information: ADD

Is the earthquake safety of US plants periodically reviewed?

Public response: ADD
Additional, technical, non-public information: ADD

Is all equipment at the plant vulnerable to tsunami?

Public response: ADD
Additional, technical, non-public information: ADD

What protection measures do plants have against tsunami?

Public response: ADD
Additional, technical, non-public information: ADD

Is there a risk of loss of water during tsunami drawdown? Is it considered in design?

Public response: ADD
Additional, technical, non-public information: ADD

What is the design level flooding for DNCPP and SONGS? Can a tsunami be larger?

Public response: ADD
Additional, technical, non-public information: ADD

Are nuclear building built to withstand earthquakes? What about tsunami?

Public response: ADD
Additional, technical, non-public information: ADD

Are aftershocks considered in the design of equipment at the plants? Are aftershocks considered in design of the structure?

Public response: ADD
Additional, technical, non-public information: ADD

Why do we have confidence that US nuclear power plants are adequately designed for earthquakes and tsunamis?

Public response: ADD
Additional, technical, non-public information: ADD

If the earthquake in Japan was a larger magnitude than considered by plant design, why can't the same thing happen in the US?

Public response: ADD
Additional, technical, non-public information: ADD

What would be the results of a tsunami generated off the coast of a US plant? (Or why are we confident that large tsunamis will not occur relatively close to US shores?)

Public response: ADD

Additional, technical, non-public information. ADD

Are there any special issues associated with seismic design at the plants? For example, Diablo Canyon has special requirements. Anyone else?

Public response: ADD
Additional, technical, non-public information: ADD

Does GI-199 consider tsunami?

Public response: ADD
Additional, technical, non-public information: ADD

From:	Scales, Kerby
To:	Hiland, Patrick; Giitter, Joseph; Thomas, Eric
Cc:	Wilson, George
Subject:	RE: Need a table
Date:	Monday, March 14, 2011 4:51:58 PM

/NRR

Pat,
I will work on this with DORL.

kerby

re(c)(8)

From: Hiland, Patrick /NRR
Sent: Monday, March 14, 2011 4:51 PM
To: Giitter, Joseph; Thomas, Eric
Cc: Scales, Kerby; Wilson, George
Subject: FW: Need a table
Importance: High

Kerby, important that you followup with Roger Rihm and eric Thomas on Tuesday a.m. to assure Chaiman gets what he needs for Wednesday's hill meeting.

Joe, believe DORL can provide as noted.

re(c)(8)

From: Rihm, Roger /EDO
Sent: Monday, March 14, 2011 4:47 PM
To: Hiland, Patrick
Cc: Thomas, Eric
Subject: FW: Need a table
Importance: High

Tried calling, but no answer @ x3298.

So the 2 things I need from you/NRR are:

1. Whether you have that Mark 1 graphic we can simplify
2. A table as discussed below

(I'm dealing with RES on some earthquake graphics, etc)

From: Rihm, Roger /EDO
Sent: Monday, March 14, 2011 4:42 PM
To: Hiland, Patrick
Subject: Need a table
Importance: High

Is it you or maybe Joe Gitter?

For all Rx sites:

Name

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Safe shutdown earthquake
Reference level earthquake
(for coastal sites) probably max tsunami OR max tsunami water level

Tang, David

From: Garcia-Santos, Norma
Sent: Monday, March 14, 2011 8:12 AM
To: NMSS_DSFST Distribution
Subject: FYI ONLY

Good morning,

FYI ONLY - Some news articles about Japan's situation:

http://www.financialexpress.com/news/japan-warns-of-2nd-blast-at-nplant/761976/

http://ansnuclearcafe.org/

Norma Garcia Santos, Acting Chief
Thermal and Containement Branch
Division of Spent Fuel
Storage and Transportation
Office of Nuclear Material
Safety and Safeguards
Mail Stop EBB-3D-02M
Washington, DC 0020555

E-mail: Norma.Garcia-Santos@nrc.gov
Phone No.: (301)-492-3290
Fax Nos.: (301)-492-3342 or (301)-492-3348

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Kauffman, John

From: Fuhrmann, Mark
Sent: Monday, March 14, 2011 9:33 AM
To: Kauffman, John
Subject: FW: Fukushima Event Status as of this morning
Attachments: Fukushima_event-status. (12.30) Mar 14.pdf

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

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

From: 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.

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	460	784	784	784	784	1100
	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
uake occur	Service	Service	Service	Outage	Outage	Outage
	Damaged	Not Damaged	Damaged	Not Damaged	Not Damaged	Not Damaged
	Not Damaged	Not Damaged	Not Damaged	Not Damaged	Not Damaged	Not Damaged
	Not Functional	Not Functional	Not Functional	Not necessary	Not necessary	Not necessary
	Not Functional	RCIC Working	Not Functional	Not necessary	Not necessary	Not necessary
	Damaged	Not Damaged	Damaged	Not Damaged	Not Damaged	Not Damaged
	Radiation monitor detect radiation increase in the environment (NPS boarder: 20 μ Sv/h at 11:44AM)					
l	Unknown	Above the top	Unknown	Safe	Safe	Safe
	Stable	Stable	Stable	Safe	Safe	Safe
	Stable	Stable	Stable	Safe	Safe	Safe
	Suspended	To be decided	Done	Not necessary	Not necessary	Not necessary
	Done	Preparing	Done	Not necessary	Not necessary	Not necessary
	20km from NPS					
	Level 4 (estimated by NISA)					

	Fukushima #2 Nuclear Power Station			
	1	2	3	4
	1100	1100	1100	1100
	BWR-5	BWR-5	BWR-5	BWR-5
d	Service	Service	Service	Service
	Not Damaged	Not Damaged	Not Damaged	Not Damaged
	Not Damaged	Not Damaged	Not Damaged	Not Damaged
	Functioning	Not Functional	Funcitioning	Not Functional
	Not necessary	Functioning	Not necessary	Functioning
	Not Damaged	Not Damaged	Not Damaged	Not Damaged
	Stable (NPS boarder: 0.038 μ Sv/h at 8AM)			
l	(No info)	(No info)	(No info)	(No info)
	(No info)	(No info)	(No info)	(No info)
	(No info)	Increase	(No info)	Increase
	Not necessary	to be decided	Not necessary	to be decided
	Not necessary	to be decided	Not necessary	to be decided
	10km from NPS			
	(No Info)			

quaters: News Release (10:30), Press conference (11:45)
fety Agency): News Release (7:30)
Release (6:01, 8:00), Press Conference (12:10)

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oolina System

From: Hiland, Patrick NRR
To: Thomas, Eric
Subject: FW: (Action) Tsunami Fact Sheet - NUREG issued in March 2009 Link
Date: Monday, March 14, 2011 1:21:00 PM
Attachments: NRC TsunamiPaper Bagchi.pdf
Paper 15-0007 Kammerer 14WCEE.pdf
Paper 15-0009 Kammerer 14WCEE.pdf
Appendix for DS 417 US NRC AKammerer GBagchi HJones.doc

Didn't see you on distribution

From: Kammerer, Annie RES
Sent: Monday, March 14, 2011 12:45 PM
To: Brown, Frederick; Giitter, Joseph; Howe, Allen; Hiland, Patrick; Skeen, David; Case, Michael; Ruland, William; Dudes, Laura
Cc: McDermott, Brian; Ross-Lee, MaryJane; Hasselberg, Rick
Subject: RE: (Action) Tsunami Fact Sheet - NUREG issued in March 2009 Link

I have a fair amount of info on tsunami. I don't recall ever seeing a tsunami fact sheet, but could be wrong.

My suggestion, if we don't have one, is to get Henry Jones and Goutam Bagchi working on one. I lead the RES work, but can't really dig into this until tomorrow. Goutam and Henry are the two people in NRO who I work most closely with on this topic. They could give us an excellent start. Should I ask them?

BTW, there is a good (and only slightly out of date) summarization of our regulatory approach and regulatory research in an appendix on US practice that I wrote for an IAEA guide on flooding (DS417). Also, Goutam, Henry and I wrote a paper for an IAEA workshop last year.

Annie

From: Brown, Frederick NRR
Sent: Monday, March 14, 2011 7:13 AM
To: Giitter, Joseph; Howe, Allen; Hiland, Patrick; Skeen, David; Case, Michael; Ruland, William; Dudes, Laura
Cc: McDermott, Brian; Ross-Lee, MaryJane; Kammerer, Annie; Hasselberg, Rick
Subject: FW: (Action) Tsunami Fact Sheet - NUREG issued in March 2009 Link

FYI

From: King, Mark NRR
Sent: Monday, March 14, 2011 7:08 AM
To: Thorp, John; Boger, Bruce
Cc: Brown, Frederick; Thomas, Eric
Subject: RE: (Action) Tsunami Fact Sheet - NUREG issued in March 2009 Link

We had a NUREG issued on this subject back in March 2009.

TSUNAMI HAZARD ASSESSMENT AT NUCLEAR POWER PLANT SITES IN THE UNITED STATES OF AMERICA
Click link to view: [NUREG/CR-6966]

http://pbadupws.nrc.gov/docs/ML0915/ML091590193.pdf

From: Thorp, John
Sent: Monday, March 14, 2011 6:57 AM
To: Boger, Bruce
Cc: Brown, Frederick; King, Mark; Thomas, Eric
Subject: RE: (Action) Tsunami Fact Sheet

We'll look for it; If we don't find it quickly, we'll start producing one. (Mark King, please start looking)

I take it we would define & describe the tsunami phenomena, then address which nuclear stations in the U.S. are located in areas subject to tsunami waves, and describe what we can regarding the design of plants to withstand tsunami impacts?

Thanks,

John

From: Boger, Bruce
Sent: Monday, March 14, 2011 6:48 AM
To: Thorp, John
Cc: Brown, Frederick
Subject: Tsunami Fact Sheet

I seem to recall that OpE developed a tsunami fact sheet? Should we dust it off?

Tsunami Safety Criteria and Current Site Reviews in the United States

By

Goutam Bagchi, Hosung Ahn, Henry Jones, Annie Kammerer, Richard Raione and Nilesh Chokshi

United States Nuclear Regulatory Commission

Abstract

The U.S. Nuclear Regulatory Commission (NRC) has promulgated an alternate licensing framework for early site permits (ESPs), certified reactor designs, and combined construction permits and operating licenses (COLs) as described in 10 Code of Federal Regulations (CFR) Part 52. New applicants have been using the Part 52 framework in submittals since 2003. The reactor site criteria are addressed in 10 CFR Part 100. Guidance for the public on approaches that meet NRC requirements is outlined in NRC regulatory guides. Factors to be considered when selecting the site include physical characteristics of the site including seismology, meteorology, geology, and hydrology. The NRC staff review guidance and acceptance criteria are provided in a document, "Review of Safety Analysis Reports for Nuclear Power Plants, NUREG 0800, Revised March 2007." Section 2.4 of the staff guidance in NUREG 0800 relates to hydrology and flooding design basis for a nuclear power plant.

The objective of this paper is to describe several initiatives undertaken in the U.S. to capture the lessons learned from the 2004 Indian Ocean tsunami; to describe revision of the staff guidance documented in NUREG 0800 Section 2.4.6, "Probable Maximum Tsunami Hazards" and some essential elements from Section 2.4.5, "Probable Maximum Surge and Seiche Flooding;" and to describe efforts related to the revision of the regulatory guide 1.59, "Design Basis Floods for Nuclear Power Plants." This document also describes the efforts to use the lessons and insights learned from the current site reviews.

Several coastal sites are currently under review for assessment of flood parameters associated with tsunami and hurricane (e.g. maximum and minimum surge levels, residence time, recession rate, erosion and sedimentation effects, etc.). Modeling of wave propagation and overland runup is important for these efforts. Also, tsunami and hurricane surge estimates, including consideration of site-specific long term climate change and sea level rise effects are important aspects of the assessment. At coastal sites, the effects of tsunami and hurricane should be carefully examined to determine which effect governs the site flooding hazard.

Introduction

The Code of Federal Regulation Title 10, Part 100 (10 CFR Part 100) relates to Reactor Site Criteria, and Subpart A applies to applications prior to 1997 and Subpart applies to applications after 1997. The site factors that are required to be considered include geological, seismological, hydrological, meteorological and other factors. In order to expedite site selection and certification of standard reactor designs a decoupled process was incorporated in 10 CFR Part 52 of the NRC regulation. This decoupled process allows for early site permit (ESP) applications to be separate from the standard reactor certification. The ESP needs to establish site characteristics that can accommodate an envelope of plant parameters. An applicant seeking to license a nuclear power plant can then use an ESP and a certified reactor design to submit an application for a combined operating license. Although the option exists for an applicant to use a new reactor design at a brand new site or use an ESP with a new reactor design.

NRC regulation 10 CFR Part 100.20 requires adherence to a set of siting factors. Assessment activities related to these factors include the following:

- The nature and proximity of man-related hazards (e.g., airports, dams, transportation routes, military and chemical facilities) must be evaluated to establish site parameters for use in determining whether a plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low.
- Physical characteristics of the site, including seismology, meteorology, geology, and hydrology must be identified, characterized and assessed.
- Meteorological characteristics of the site that are necessary for safety analysis or that may have an impact upon plant design (such as maximum probable wind speed and precipitation) must be identified and characterized.
- Factors important to hydrological radionuclide transport (such as soil, sediment, and rock characteristics, adsorption and retention coefficients, ground water velocity, and distances to the nearest surface body of water) must be obtained from on-site measurements. The maximum probable flood along with the potential for seismically induced floods must be estimated using historical data.

In addition to the consideration of the siting factors above, a proposed facility must include the principal design criteria. The principal design criteria establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components important to safety; that is, structures, systems, and components that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Appendix A to 10 CFR Part 50 specifies these general design criteria (GDC) to establish minimum requirements for the principal design criteria for water-cooled nuclear power plants similar in design and location to plants for which construction permits have been issued by the Commission. The General Design Criteria are also considered to be generally applicable to other types of nuclear power units and are intended to provide guidance in establishing the principal design criteria for such other units. GDC 2 requires appropriate consideration of 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. Appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena are also required.

Regulatory Guidance on Flood Hazard Determination

Regulatory Guide (RG) 1.59, "Design Basis Floods for Nuclear Power Plants" provides guidance for one acceptable method of establishing the design basis floods at a specific site and NUREG 0800, "Standard Review Plan (SRP)" provides guidance to the NRC staff on details of conducting the review and the determination of safety findings. RG 1.59 is currently being revised, and the SRP was revised on March 31, 2007.

NRC has adopted the concept of a "probable maximum event," for estimating design bases. The probable maximum event, which is determined by accounting for the physical limits of the natural phenomenon, is the event that is considered to be the most severe reasonably possible at the location of interest and is thought to exceed the severity of all historically observed events. For example, dam failures, a probable maximum flood (PMF) is the hypothetical flood generated in the drainage area by a probable maximum precipitation (PMP) event. The probable maximum storm surge is generated by the probable maximum hurricane (PMH) or the probable maximum windstorm (PMWS). These events are defined by the American National Standards Institute (ANSI) and ANS in ANSI/ANS-2.8-1992 (ANS, 1992). Similar concepts exist for a probable maximum tsunami, which is not covered in the ANSI standard. Because the PMP is a deterministic concept with no associated probability distribution, estimating the PMF also is a deterministic process.

In order to assess the design basis flood, first, for the selected site of a nuclear power plant, the causal phenomena or mechanisms that could lead to flooding should be identified. Flooding causal mechanisms refer to the set of those hydro-meteorological, geo-seismic, or structural failure phenomena (embankment, near by water control structures) that may produce a flood at or near the site. The geographical area that is relevant when determining floods at or near the site for each flooding causal mechanism should be identified. This geographical area, generally termed the vicinity of the site or site region (or just "the vicinity"), depends on the nature of the flood causal mechanism being considered. Floods generated in the vicinity because of the hydro-meteorological, geo-seismic, or structural failure may propagate to the site. For example, a PMF in a river that flows by a site may consist of the entire watershed of the river upstream of the site. For a site located near coastal regions, an ocean, or a large lake may also be subjected to tsunamis or storm surges that might propagate to the site.

An inspection of historical data may reveal the flooding causal mechanisms that should be considered for a site. For example, an inspection of air temperature data may suggest potential for formation of ice jams or dams, the subsequent collapse of which may generate a flood. More important is the need to inspect the hydrology, topography, morphology, and geology and the presence of any water control structures in the vicinity of the site (e.g., a site located on the banks of a river should be investigated for the PMF in the river; a site that has several upstream dams should be analyzed for floods from single and cascading dam failures). Typically, flooding causal mechanisms that should be considered include local intense precipitation, flooding in rivers and streams, flooding from upstream dam breaches or failures, flooding from storm surges or seiches, flooding from tsunamis, flooding from ice-induced events, and flooding from channel diversions towards the site. A hierarchical hazard assessment starts with the most conservative simplifying assumptions that maximize the hazards from the probable maximum event for each natural flooding causal phenomenon expected to occur in the vicinity of a proposed site. If the site is not inundated by floods from any of the phenomena, a conclusion that the site is not susceptible to flooding would be valid (ANS, 1992), and no further flood hazard assessment is needed. For these reasons, the SRP emphasizes the need to apply a hierarchical approach for establishing the design basis flood.

U. S. Tsunami Initiatives Post-2004 Indian Ocean Tsunami

In response to the 2004 Indian Ocean tsunami, in 2005 the NRC coordinated a tsunami safety study with the National Tsunami Safety initiative conducted by the National Oceanic and Atmospheric Administration (NOAA). The NRC tsunami hazard study was conducted by the Pacific Northwest National Laboratory and the Pacific Marine and Environmental Laboratory which is a part of NOAA. This early effort resulted in the publication of two documents. They were NUREG-CR 6966, "Tsunami Hazard Assessment at Nuclear Power Plant Sites in the Untied States of America", which was published in final form in March 2009, and NOAA Technical Memorandum OAR PMEL-136, "Scientific and Technical Issues in Tsunami Hazard Assessment of Nuclear Power Plant Sites,", which was published in 2007. These documents form the basis of the 2007 tsunami-related updates to NUREG 0800.

In 2006, the NRC also initiated a long-term research tsunami research program. This program, which includes cooperative work with the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA), was designed both to support activities associated with the licensing of new nuclear power plants in the U.S and to support development of new regulatory guidance. This research program has resulted in several publication and made important contributions to tsunami modeling approach and standards, as summarized in conference papers by Kammerer (2008)

Necessarily, the US NRC research program includes assessment of both seismic- and landslide-based tsunamigenic sources in both the near and the far fields. The inclusion of tsunamigenic landslides, an important category of sources that impact tsunami hazard levels for the Atlantic and Gulf Coasts, is a key difference between this program and most other tsunami hazard assessment programs that existed at the time. The initial phase of work undertaken by the USGS as part of the research program consisted of collection, interpretation, and analysis of available offshore data, with significant effort focused on characterizing offshore near-field landslides and analyzing their tsunamigenic potential and properties. This work is summarized in ten Brink et al (2008). In addition, eight papers have been published in a special edition of Marine Geology Marine Geology Special Issue: Tsunami Hazard Along the U.S. Atlantic Coast, Volume 264, Issues 1-2, (2009) dedicated in whole to the results of the NRC research program. These papers are listed in the reference section of this document.

In the current phase of research, additional field investigations are being conducted in key locations of interest and additional analysis of the data is being undertaken. Simultaneously, the MOST tsunami generation and propagation model used by NOAA has been enhanced to include landslide-based initiation mechanisms and is being used to investigate the impact of the tsunamigenic sources identified and characterized by the USGS. The potential for probabilistic tsunami hazard assessment will also be explored in the final phases of the program.

Regulatory Guide 1.59 (1977) briefly discussed tsunami as a source of flooding. This regulatory guide is currently being updated. However, the update of this guide will not include tsunami-induced flooding. NRC staff is currently preparing a new regulatory guide focused on tsunami hazard assessment and risk.

U. S. Storm Surge Initiatives Post-2005 Hurricane Katrina

At the end of August 2005, Hurricane Katrina made landfall near the Louisiana/ Mississippi border. Less than one month later, Hurricane Rita struck near the Louisiana/Texas border. Both of these storms produced catastrophic damage, and areas of the Louisiana and Mississippi coasts were devastated. NRC tasked the U.S. Army Corps of Engineers (USACE) to review the NOAA Technical Report NWS 23, "Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Wind Fields, Gulf and East Coasts of the United States" and the NRC Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants". Regulatory Guide 1.59 and its supporting documents provide a methodology for estimating the probable maximum surge (PMS) for open coast locations of the Atlantic and Gulf of Mexico. The PMS estimates are determined by use of the probable maximum hurricane (PMH) parameters applied as input to a quasi-two-dimensional numerical storm surge model developed in the early 1970s. The PMH is a hypothetical hurricane having a combination of characteristics that give the highest sustained wind speed that can probably occur at a specified location.

In 2009, the Engineer Research and Development Center, Corps of Engineers Coastal and Hydraulics Laboratory (ERDC CHL) recommended that both the NWS Report 23 and Regulatory Guide 1.59 be updated. The meteorological criteria for the PMH wind fields are developed in the NOAA Technical Report NWS 23 published in September 1979. However, additional information from the many sources which were unavailable at the time of that study, along with data from many well-documented storms since 1979, have shown some potentially important inconsistencies between the PMH derived in that study and current understanding of the characteristics of intense hurricanes. Similarly, the two-dimensional storm surge model developed in 1971 is extremely limited by restrictions and simplifications made in order to make the problem computationally tractable given the computer resources available in the early to mid 1970's. The model assumptions and simplifications reduce the applicability and accuracy of the model.

Based on new theoretical concepts and data, NRC has continued its strong collaboration with NOAA and USACE with the ultimate objective to transition storm surge regulatory guidance to a more risk-informed methodology (1) by accounting for annual probabilities of exceedance of joint wind speed/storm surge events, and (2) by considering the effects of topography and bathymetry at the sites of interest, as the storm surge at any specific location is highly dependent upon these factors. In general, the methodology involves the simulation and selection of a stochastic set of storm tracks (synthetic approach), integration of the selected storm tracks into a hydrodynamic simulation model to generate time histories of wind speeds and corresponding time histories of storm surge heights at a site, and the application of probabilistic methods to develop joint probabilities of exceedance and mean recurrence intervals for wind speed/storm surge height events.

Limited observed data and the scale and extent of coastal storm surges have defeated attempts to characterize them by a statistical analysis of direct measurements. Thus, it is necessary to perform simulation studies using knowledge of the local climatology combined with numerical models capable of accurately simulating storm surges throughout the coastal zone. The current state-of-the-art uses the Empirical Simulation Technique (EST) and Joint Probability Method (JPM). The EST method utilizes historic data to generate a large number of multi-year simulations of possible future storm events for a specific location. The approach is based on resampling and interpolation of data contained in a database of events derived from historic events. The ensemble of simulations is consistent with the statistics and correlations of past storm activity at the site, but allows for random deviations in behavior that are likely to occur in the future. The JPM method considers all possible combinations of storm characteristics at landfall, calculates the surge effects for each combination, and then combines these results considering the combinations' associated probabilities. The result is the annual probability of exceeding any desired storm stage. Both the EST and JPM methods have become the standard approach for the evaluation of surge inundation from tropical cyclones.

EST and JPM schemes have been developed and applied in recent probabilistic hurricane-studies performed by teams led by NOAA and by USACE for the central Gulf of Mexico coast. An empirical simulation technique for modeling the entire tracks of tropical cyclones was first published by Vickery, et al. (2000a) and used to determine hurricane wind speeds and storm surge for the Gulf of Mexico and Atlantic coasts for the NRC. The surge model used in the Vickery study was the NOAA standard storm surge model SLOSH (Sea, Lake and Overland Surges from Hurricanes). The USACE has an ongoing study for the Gulf of Mexico coast using the JPM method and ADCIRC (Advanced Circulation) storm surge model to refine the physics of the processes that contribute to storm surge (Resio and Westerink, 2008).

The Great Lakes and climate change remain challenges. Although the EST method is applicable to extratropical storms, more research will be required to update guidance for future NRC nuclear power plant sites located on the Great Lakes. Current guidance for extratropical storm surge is defined by the American National Standards Institute (ANSI) and ANS in ANSI/ANS-2.8-1992 (ANS, 1992). Similar to tropical cyclones, PMS estimates are determined by use of the probable maximum storm (PMS) parameters applied as input to a quasi-two-dimensional numerical storm surge model developed in the early 1970s. Site-specific flooding analyses from PMS is carried out by using qualified and benchmarked wave run models based on detailed flow channel cross sections and contours. In regard to climate change, since the statistics, and thus the risks of certain surge heights, depend on the storms, any change in storm intensities will lead to a change in storm surge heights. While mean sea level is expected to rise, storms may become in some regions more frequent and violent, while in others less so. This remains an area of intense scientific scrutiny. When any significant change becomes evident, the NRC has regulatory measures available to implement changes, if necessary for adequate protection of public health and safety.

Current Reviews for Coastal Sites

There are several coastal sites that are currently in review. Section 2.4.6 of the Final Safety Analysis Report (FSAR) for COL applications includes the description of PMT, historical tsunami record, source generator characteristics, tsunami analysis, tsunami water levels, hydrography and harbor or breakwater influences on tsunami, and effects on safety-related facilities. FSAR are produced by each licensee and submitted to the US NRC.

The NRC staff bases the PMT for the costal sites on the historical record of tsunamis and previously published tsunami assessments for the Gulf of Mexico or the Atlantic Ocean. Wave heights from offshore landslide sources were considered in the establishment of the PMT.

The NRC staff then establishes a maximum water level at the site of interest, by applying a runup amplification factor and taking into account 10% exceedance spring high tide and global sea-level rise within the next century. The staff determines whether the estimated PMT will not affect safety-related facilities at the proposed site or not based on the maximum on-site surge level. If affected, the staff proposes flood protection measures in FSAR Section 2.4.10. If the tsunami forces or erosion is of concern, the staff recommends sea walls or wave break structures. If the site flooding is of concern, then external flood protections\measures are necessary for plant safety.

Historical and/or Paleo Tsunami

The staff examines published information to determine the source characteristics for several different types of potential tsunamis sources: seismogenic, volcanogenic, and landslide generated. Both far-field seismogenic sources and near-field submarine and above ground landslide sources as potential generators for the PMT are considered. After reviewing published and internet-based tsunami catalogs, databases, and historical accounts, the staff identifies historical tsunami events for the site of interest.

The application should address any evidence of paleo-tsunami deposits in the FSAR. For example for South Texas site in the USA, a deposit located in Falls County, Texas near the Brazos River was originally interpreted as caused by a paleo-tsunami. The common interpretation of this deposit is that it was emplaced by a tsunami generated from Chicxulub asteroid impact, owing to its date and the existence of impact ejecta at the Brazos site. Researchers suggested that a tsunami wave 50-100 m high was necessary to explain this deposit. It appears that the wave that created these deposits was not likely to be generated by any landslide source that would be of relevance to the present-day PMT determination. Waves emanating from such a source would not have the needed extreme wave heights and long periods to be able to propagate significant wave energy far inland to a potential NPP site. The common interpretation of this deposit is that it was emplaced by a tsunami generated by the Chicxulub impact. It is unlikely, however, that the wave heights inferred from the deposit are relevant to determination of the present-day PMT at a proposed site.

Potential Tsunamigenic Sources

Potential tsunami sources that are likely to determine the PMT at the U.S. costal sites are submarine landslides, subaerial landslides, volcanogenic sources, near-field intra-plate earthquakes and inter-plate earthquakes. These sources are identified as following:. .

Subaerial Landslides: With regard to subaerial landslides, the staff looks for major coastal cliffs near the site that would produce tsunami-like waves that exceed the amplitude of those generated by other sources.

Volcanogenic Sources: The staff relies on the databases developed by either USGS, NOAA, or other government agencies (e.g. the Global Volcanism Program of the Smithsonian Institution, from*http://www.volcano.si.edu/*). Catastrophic failures associated with volcanoes along the U.S. Coasts are considered as potential tsunami sources that generate significant wave activity near the sites of interests.

Intra-Plate Earthquakes: The staff relies on the tectonic plate boundary maps in the Gulf of Mexico and Atlantic regions. Also looking are the maximum magnitude and slip of earthquakes. The staff reviews the maximum slip, and consequently the maximum sea floor displacement, associated with an earthquake scales with its magnitude to determine the initial tsunami wave amplitude associated with an intra-plate earthquake..

Inter-Plate Earthquakes: In the far-field, description of major plate boundary faults, specific source parameters, and offshore tsunami amplitudes from oceanic inter-plate earthquakes are estimated.

Local Submarine Landslides: Submarine landslides in the U.S. Coasts are considered a potential tsunami hazard for the reactor sites for two reasons: (1) some dated landslides in the region have post-glacial ages, suggesting that triggering conditions for these landslides are still present and (2) analysis of recent seismicity suggest the presence of small-scale energetic landslides in the region.

The primary landslide parameters that are used in the tsunami wave generation models include the excavation depth, volume and slide width, which can be directly measured from sea floor mapping of the largest observed slide in the four geologic provinces. The other necessary parameter is down slope landslide length, interpreted from the runout distance. The runout distance measured from sea floor mapping is a combination of fast plug flow (low viscosity, non-turbulent), creeping plug flow (high viscosity/viscoplastic, non-turbulent) and turbidity currents (turbulent boundary layer fluid). The latter two likely have little to no tsunami-generating potential. The amplitude of the initial negative wave above the excavation region is linked to the maximum excavation depth. The amplitude of the initial positive wave above the deposition region is determined from a conservation of landslide volume. The excavation volume can be well determined using GIS techniques (see below). Setting the deposition volume equal to the excavation volume, the positive amplitude is determined for a given landslide length. For a fixed volume, increasing the landslide length decreases the initial positive amplitude of the tsunami.

Landslide volume calculations are based on measuring the volume of material excavated from the landslide source area using a technique similar to that of ten Brink and others (2006) and Chaytor and others (2009). Briefly stated, the approach involves using multibeam bathymetry to outline the extent of the excavation area, interpolating a smooth surface through the polygons that define the edges of the slide to provide an estimate of the pre-slide slope surface, and subtracting this surface from the present seafloor surface.

The maximum observed landslide from multibeam surveys is taken as the maximum landslide for a given region. It may be possible that larger landslides could occur in a given region; however this determination of the maximum landslide is consistent with the overall definition of PMT as "the most severe of the natural phenomena that have been historically reported or determined from geological and physical data for the site and surrounding area". In this case, the maximum landslide is taken from geologic observations spanning tens of thousands of years.

Seismic Seiches

Rather than being impulsively generated by displacement of the sea floor, seismic seiches occur from resonance of seismic surface waves within enclosed or semi-enclosed bodies of water. The harmonic periods of the oscillation are dependent on the dimensions and geometry of the body of water. For instance in 1964, seiches were set up along the Gulf Coast from seismic surface waves emanating from the M=9.2 Gulf of Alaska earthquake, owing in part to amplification of seismic waves from the thick sedimentary section along the Gulf Coast. Because the propagation path from Alaska to the Gulf Coast is almost completely continental and because the magnitude of the 1964 earthquake is close to the maximum possible for that subduction zone, it is likely that the historical observations of 1964 seiche wave heights are the maximum possible and less than the PMT amplitudes from landslide sources.

Tsunami Propagation Modeling

Tsunami propagation, runup, and inundation have been computed using COULWAVE model which is a 2-dimentional non-linear wave model. At the beginning of the wave simulation, the staff used to make an initial simulation using a one-dimension wave model. The purpose of these initial simulations is to provide an upper limit of the tsunami wave height that could be generated by different landslide scenarios.

Source parameters for the simulation include landslide width, length, and excavation depth. Although landslide volume is not a direct parameter used in the model, the volumes of excavation and deposition are conserved and are used in determining the amplitude of the initial positive wave. Note that these limiting simulations use physical assumptions that are arguably unreasonable; the results of these simulations are useful to filter out tsunami sources under even the most conservative assumptions. Specifically, these assumptions are:

1. Time scale of submarine landslide motion is very small (i.e., instantaneous) compared the period of the generated tsunami
2. Bottom roughness, and the associated energy dissipation, is negligible in locations that are initially wet (i.e. locations with negative bottom elevation, offshore)

With Assumption 1, the free water surface response matches the change in the seafloor profile exactly. The landslide time evolution parameter, which is associated with a high degree of uncertainty, is thus removed. Assumption 2 prevents the use of an overly high bottom roughness coefficient, which could artificially reduce the tsunami energy reaching the shoreline. Such an assumption is too physically unrealistic to accept for the inland regions where the roughness height may be the same order as the flow depth. For tsunami inundation, particularly for inland regions such as those currently under review, the wave would need to inundate long reaches of densely vegetated land to reach the site; therefore inclusion of a conservative measure of bottom roughness is necessary in these cases.

Tsunami and Hurricane surge induced wave run-up modeling is important, since these can cause site flooding that can lead to erosion induced failure of levee/embankment etc that may be used as safety significant water control structures at the site.

References

10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

10 CFR Part 50, Appendix A, General Design Criterion 44, "Cooling Water."

10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

10 CFR Part 100, "Reactor Site Criteria."

ANSI/ANS-2.8-1992 (ANS, 1992), "Determining Design Basis Flooding at Power Reactor Sites."

Kammerer A., Ten Brink, U., Titov, V. (2008) "Overview of the U.S. Nuclear Regulatory Commission Collaborative Research Program to Assess Tsunami Hazard for Nuclear Power Plants on the Atlantic and Gulf Coasts." Proceedings of the 14th World Conference on Earthquake Engineering, Beijing China, October 2008

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OVERVIEW OF THE U.S. NUCLEAR REGULATORY COMMISSION COLLABORATIVE RESEARCH PROGRAM TO ASSESS TSUNAMI HAZARD FOR NUCLEAR POWER PLANTS ON THE ATLANTIC AND GULF COASTS

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ABSTRACT :

In response to the 2004 Indian Ocean Tsunami, the United States Nuclear Regulatory Commission (US NRC) initiated a long-term research program to improve understanding of tsunami hazard levels for nuclear facilities in the United States. For this effort, the US NRC organized a collaborative research program with the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA) with a goal of assessing tsunami hazard on the Atlantic and Gulf Coasts of the United States. Necessarily, the US NRC research program includes both seismic- and landslide-based tsunamigenic sources in both the near and the far fields. The inclusion of tsunamigenic landslides, an important category of sources that impact tsunami hazard levels for the Atlantic and Gulf Coasts is a key difference between this program and most other tsunami hazard assessment programs. The initial phase of this work consisted of collection, interpretation, and analysis of available offshore data, with significant effort focused on characterizing offshore near-field landslides and analyzing their tsunamigenic potential and properties. In the next phase of research, additional field investigations will be conducted in key locations of interest and additional analysis will be undertaken. Simultaneously, the MOST tsunami generation and propagation model used by NOAA will first be enhanced to include landslide-based initiation mechanisms and then will be used to investigate the impact of the tsunamigenic sources identified and characterized by the USGS. The potential for probabilistic tsunami hazard assessment will also be explore in the final phases of the program.

KEYWORDS:
Tsunami, Landslide, Seismic, Hazard, Nuclear

1. BACKGROUND

In response to the 2004 Indian Ocean Tsunami, as well as the anticipation of the submission of license applications for new nuclear facilities, the United States Nuclear Regulatory Commission (US NRC) initiated a long-term research program to improve understanding of tsunami hazard levels for nuclear power plants and other coastal facilities in the United States. To undertake this effort, the US NRC organized a collaborative research program with researchers at the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA) for the purpose of assessing tsunami hazard on the Atlantic and Gulf Coasts of the United States. The project work described in this paper represents the combined effort of a diverse group of marine geologists, geophysicists, geotechnical engineers, and hydrodynamic modelers to evaluate tsunami sources that have the potential to impact the U.S. Atlantic and Gulf coasts.

The Atlantic and Gulf Coasts are the focus of this program, both because of the number of existing and proposed nuclear facilities located on these coasts and because many promising research efforts for assessing tsunami hazard in the Pacific Coast of the United States are already underway as a result of programs outside the US NRC. Tsunami has been long known as a hazard in the Pacific Ocean. However, the 2004 tsunami highlighted the fact the tsunamis can occur in other oceans that are less prepared for this rare phenomenon. Although tsunami are far rarer along the Atlantic and Gulf of Mexico coastlines, some areas can be highly vulnerable to tsunamis when they do occur because major population centers and industrial faculties are located near the shoreline at low-lying elevations, and often in estuaries. This is in comparison to the Pacific coast where tsunamis are more frequent but the coastline is more sparsely populated and most sections have more topographic relief.

Because the US NRC is interested in understanding hazard associated with the rare large tsunami that may occur over long time periods (in excess of 10,000 years), the research program was developed to investigate both seismic and landslide tsunamigenic sources. It also includes the study and characterization of large sources in the far field, as well as sources in the near field such that all key sources were considered. The study of near-field and far-field tsunamigenic landslides is a key difference between this research program and other tsunami hazard assessment programs, which are typically focused on seismic sources. Although seismic sources are important on the Atlantic and Gulf Coasts, submarine landslides have also historically generated destructive tsunamis and so must be fully investigated in this program. In landslide initiated tsunami, the extent of damaging waves generated by landslides is generally smaller and more localized. However, along coastlines proximal to catastrophic submarine landslides, tsunami run-up can be significant as exemplified by the 1929 Grand Banks tsunami (Newfoundland and Nova Scotia), which likely had a significant landslide-generated component. Less is generally known about submarine landslides as tsunami triggers in comparison to their earthquake counterparts.

Although only a few years old, this research program has already produced significant results that are currently or will soon be available to the public through a variety of technical publications. These publications include a USGS report to the US NRC (Ten Brink et al, 2007) and multiple articles in a special issue of Marine Geology to be published late 2008 or early 2009 (Barkana et al; Chaytor et al; Geist et al; Lee; Locat et al; Ten Brink et al, 2008). The early research and results discussed in the USGS report were focused on providing sufficient information on the source parameters useful for qualitative assessment of tsunami hazard for the Atlantic and Gulf coasts. This information is currently being used to develop and review tsunami hazard assessments for new nuclear power facilities in the United States. A companion paper in this conference summarizes and discusses in more detail some of the early results of the US NRC program (Kammerer et al, 2008)

2. INITIAL INVESTIGATION OF NEAR-FIELD LANDSLIDE SOURCES IN THE ATLANTIC

In the initial phase of work a significant level of effort was focused on identifying and characterizing offshore near-field landslides and on understanding their regional distribution along the coasts. In this work, efforts were made to consider the impact of varying conditions, such as the effects of glacial periods and sea level changes. Once early results on the location and characterization of offshore landslides was obtained, an effort towards modeling one of the larger slides, the Currituck Slide, was initiated to better understand the tsunami hazard posed by the mapped slides. Before tsunami generation and propagation modeling of the Currituck slide could be undertaken, important properties of the slide, such as flow velocity, needed to be characterized. Work at Laval University included analysis of the dynamic elements of the Carrituck slide; and modeling of the slide was undertaken by both Texas A&M University and the USGS. A summary of each of these steps is provided below and a more complete discussion of the results of key research elements is provided in the companion paper in this conference. This early work has also been well documented in the public USGS report (Ten Brink et al, 2007).

2.1 DATA COLLECTION

The first step in the initial investigation of lanslides in the Atlantic was the collection and analysis of a large amount of available information useful for the identification and characterization of offshore landslides along the Atlantic coast of the U.S. Multibeam bathymetry, Geologic Long-Range Inclined Asdic (GLORIA) sidescan sonar imagery, a regional grid of high-resolution seismic profiles, and published accounts of sediment cores from the region was collected (Figure 1). In addition to these data sets, a review of past work studying the geology of the offshore environment, as well as studies of offshore landslides were also collected, reviewed, and summarized. A discussion of the body of previous work is provided in the USGS report (Ten Brink et al, 2007).

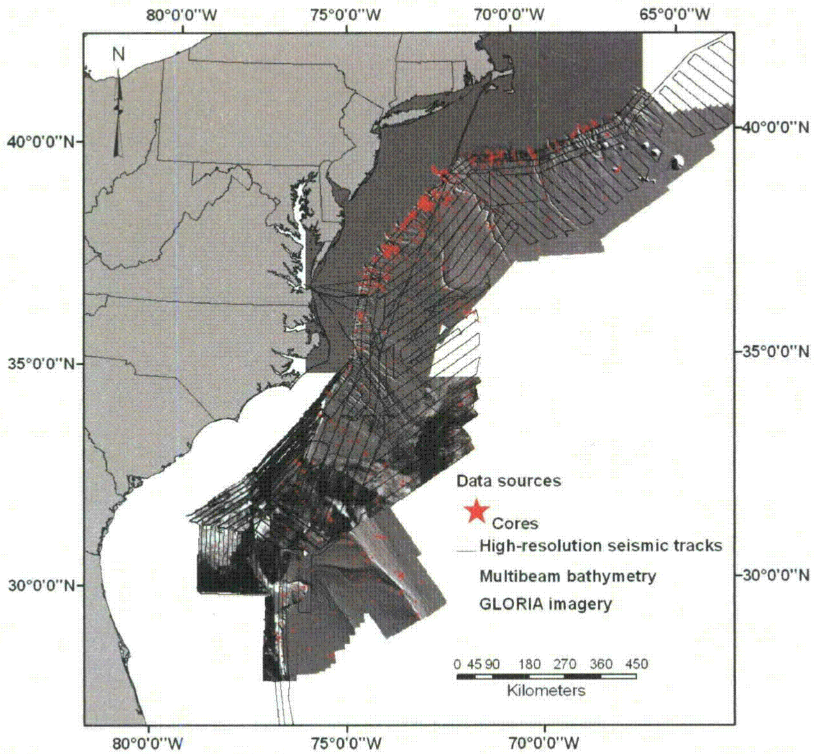

Figure 1 Data Collected for Study of Potential Tsunamigenic Landslides on U.S. Atlantic Coast

Data used in the compilation of the Atlantic coast bathymetry map used in the study were acquired from several sources and vary in age, sounding density, and positional accuracy. The primary data set was acquired by the University of New Hampshire (UNH) (Gardner et al., 2006; Cartwright and Gardner, 2005) and provides near continuous coverage of the U.S. Atlantic margin from the base of the continental slope down to the abyssal plain. These data include gridded bathymetric soundings and mosaiced acoustic backscatter. For sections of the continental slope and rise not covered by the UNH data set, several additional multibeam datasets were used. For areas in which no multibeam soundings were available, sounding data from the National Ocean Service hydrographic database and the NOAA coastal relief model provided bathymetric coverage of the continental slope. Efforts will be made to address some of these data gaps through field studies in future phases of the program. The final map developed for this project covers the ocean floor from the shoreline to depths greater than 5,000 m, between 43.5 and 24 degrees north latitude.

In addition to the acoustic backscatter data from the UNH multibeam surveys, GLORIA sidescan sonar data were used to identify and map landslide features along the U.S. Atlantic continental margin (EEZ-SCAN 87, 1991). Analogue records of 3.5-kHz seismic reflection profiles, co-acquired with the GLORIA sidescan imagery, were used to determine location, geometry, and thickness of landslide features. Although other data sets are available, the acquisition parameters and quality of these data are consistent over the entire area of study, and they provide a relatively clear picture of the upper sedimentary section.

Over 1400 cores have also been collected from the study area off the Atlantic coast, and descriptions of the cores are available. Approximately 1,000 have been visually described, and 145 of them have had general ages assigned based on faunal content. While the descriptions provided are often brief, they provide a valuable summary of the overall lithology of many of the cores.

2.2 IDENTIFICATION AND CHARACTERIZATION OF LANDSLIDES

The volume and quality of data collected greatly assisted in mapping the distribution and style of surficial submarine landslides along the eastern U.S. margin between the eastern end of Georges Bank and the northern end of the Blake Spur. The near-complete coverage of the Atlantic continental slope and rise by multibeam bathymetry provided a key high-quality and uniform data set that allowed for a more detailed and consistent view and assessment of the geomorphology of submarine landslides than had been possible in the past.

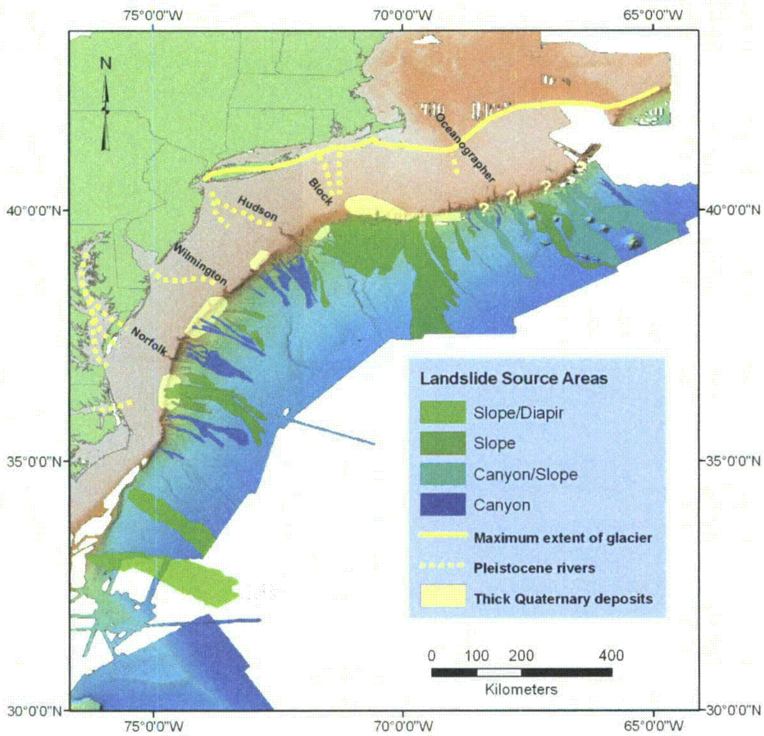

Figure 2 Initial Map of Landslide Source Areas Along the U.S. Atlantic Coast

The mapping of these landslide-affected areas was broken into several steps. The first step was to identify any scarps of significant size around and within landslide source areas. Scarps were easily identified in shaded-relief and slope maps derived from the bathymetric data. Next the areas affected by landslides were outlined. Depending on availability, a mix of shaded-relief imagery, backscatter imagery from the multibeam system, and GLORIA imagery were used. The final step was to merge the thickness information derived from subbottom profiles with the interpretation of the sea-floor imagery to distinguish the erosional and depositional sections of the landslide. The volumes of the source areas of mapped and potential slides of various sizes and differing geologic settings (e.g. submarine canyons or the open slope) were calculated.

This mapping indicates that landslides along the U.S. Atlantic margin initiate predominantly in two morphologic settings, canyon (heads and sidewalls) and on the open continental slope (Figure 2). The canyon-sourced failures often have several canyons feeding a single deposit, and the deposits are smaller than those derived from the open slope. As a result, they are unlikely to cause tsunami events. Open-slope failures commonly originate on the middle and lower slope in 800-2,200 m depths. These landslides extend farther offshore, are thicker, and have considerably larger volumes than their canyon derived counterparts. As a result of the large volumes of material that sometimes fail, open slope-sourced slides are considered to have the most potential to initiate tsunami (Murty, 2003). However, a significant volume of material may also be mobilized in landslides associated with areas of salt diapirism as well. From the modeling of source volumes of individual scarps along the margin, we see that three regions (off Georges Bank, Currituck area, and in the Carolina Trough) have had a history of, and potential for, large volume failures. With the current data, it is difficult to determine if landslides on the southern New England slope involve large volumes of material per event, or if the region is dominated by smaller, but more numerous landslides.

2.3 CARRITUCK LANDSLIDE ASSESSMENT AND MODELING

In order to gain an initial understanding of the implications of the mapped landslides on the tsunami hazard along the Atlantic coast, a study to characterize and perform hydrodynamic modeling of the Carrituck landslide was undertaken. This work also showed the potential for the methods employed. Tsunami magnitude depends strongly upon the size of the slide and how the landslide moves as it fails and flows. Therefore, the first step was to determine the parameters needed for the tsunami generation and propagation modeling. This work had significant challenges because the initial geometry of the material was not known, it was unclear if there had been a single event or multiple events, and the properties of the geologic material were not well characterized. During this work several issues were considered and the researchers endeavored to answer the following multiple lines of inquiry. Ultimately a possible initial velocity and acceleration of the failed mass was developed from the mobility analyses.

Once estimates of the important landslide parameters had been developed, preliminary hydrodynamic modeling of the slide was conducted for the purpose of determining the range of possible near-shore wave heights and understanding the possible impact of the continental shelf. Considerations of bottom friction and non-linearity were included in this work. This study was undertaken early in the program and played an important role for the US NRC because the modeling allowed staff to understand the general implications of the initial landslide mapping results. It also helped to scope and focus the organization of the broader research program.

3. INVESTIGATION OF FAR FIELD TSUNAMIGENIC LANDSLIDES IN THE ATLANTIC

The research related to far field tsunamigenic landslides, has focused on collecting information and assessing the potential impact to the U.S. Atlantic and Gulf coasts. Numerous debris deposits from landslides have been identified in the literature along the Canadian, European and African coasts of the Atlantic Ocean and a number of possible source areas were considered in detail for this program. These areas include the Canary Islands, the Mid-Atlantic Ridge, the glaciated margins of northern Europe and Canada, the Scotia margin immediately NE of the U.S. border, the northern European margin, and the Puerto Rico trench. In many cases, evidence of tsunamis from landslides were found, although the effects were often highly localized as is common for landslide-initiated tsunami. The USGS report provides information on both historical tsunamis and proposed modeling parameters for these areas.

Perhaps the most publicized hypothesized hazard is that of a possible collapse of Cumbre Vieja, a volcano on the Canary island of La Palma (Ward and Day, 2001). As envisioned by Ward and Day, a flank collapse of the volcano may drop a rock volume of up to 500 km^3 into the surrounding ocean. The ensuing submarine slide is further hypothesized to generate a strong tsunami with amplitudes of 25 m in Florida. In the time since the initial work was published, significant work by other researchers has been undertaken to look at their assumptions. A review of all associated work was undertaken for this program and it was concluded that the danger to the U.S. Atlantic coast from the possible collapse of Cumbre Vieja is exaggerated. Mader (2001) pointed out that Ward and Day's assumption of linear propagation of shallow water waves is incorrect, because it only describes the geometrical spreading of the wave and neglects dispersion effects. A more rigorous hydrodynamic modeling by Gisler et al. (2006), confirms Mader's criticism. Their predicted wave amplitude for Florida is between 1 and 77 cm. A fuller discussion is provided in the USGS report and the potential impact of a collapse of Cumbra Vieja will be further studies by NOAA as part of this project.

4. INITIAL INVESTIGATION OF TSUNAMIGENIC LANDSLIDES IN THE GULF OF MEXICO

This project has also started investigating the potential for tsunamigenic landslides in the Gulf of Mexico. The Gulf of Mexico is a small, geologically diverse ocean basin that includes three distinct geologic provinces: a carbonate province, a salt province, and canyon to deep-sea fan province. Currently the work in this area is not as advanced as the assessment in the Atlantic. However, early work investigating landslides undertaken by this project and others that indicates that submarine landslides have occurred in each of the three provinces, although they vary in style and size among these different provinces. Landslides also have been shown to be active throughout much of the history of this basin, including in the Quaternary Period, up to the present. Submarine landslides have been studied in the Gulf of Mexico in the past for two reasons: first they can pose a hazard to offshore platforms and pipelines and second, when more deeply buried they can serve either as hydrocarbon reservoirs or barriers in reservoirs depending on their composition. The threat of submarine landslides as a generator of tsunamis has not previously been addressed for the Gulf of Mexico region. However, the existing literature describing the distribution and style of submarine landslides that have occurred in the Gulf of Mexico during the Quaternary has been reviewed for this program and is summarized in the USGS report. The review focused on landslides that have occurred in on the continental slope and rise in the Gulf of Mexico; with much of the discussion focused on the part of the basin within the U.S. Exclusive Economic Zone (EEZ) due to the availability of a greater number of publications from this region. Research is on-going in this area.

5. IDENTIFICATION AND CHARACTERIZATION OF SEISMIC SOURCES THAT MAY IMPACT THE ATLANTIC OR GULF COASTS

5.1 Sources in the Atlantic Ocean

Earthquake-generated tsunamis generally originate by the sudden vertical movement of a large area of the seafloor during a large magnitude earthquake. Such movement is generated by reverse or thrust faulting, most often in subduction zones. The Atlantic Ocean basin is generally devoid of subduction zones or potential sources of large reverse faults. The two exceptions are the Hispaniola-Puerto Rico-Lesser Antilles subduction zone, where the Atlantic tectonic plate subducts under the Caribbean plate, and the enigmatic zone of large earthquakes west of Gibraltar. These two earthquake source areas were investigated, an evaluation of their tsunamigenic potential was undertaken, and the potential for impact to the U.S. coastline by resulting tsunami was considered.

Four large tsunamigenic earthquakes have occurred in the Atlantic Ocean west of Gibraltar in the last 300 years. However, there is no simple tectonic model for this area that explains the generation of these earthquakes. As a result, promising work undertaken to determine the source parameters of the 1755 Lisbon earthquake is of particular interest. A variety of past studies have hypothesized various sources for this earthquake, which is known to have caused a tsunami around much of the Atlantic Ocean. However, prior to this project there had not been an attempt to fit cross-ocean tsunami reports of the 1755 Lisbon earthquake to any of the proposed fault sources. As part of this program, modeling of various sources is being undertaken to try to determine a viable source location and geometry that predicts the many records of tsunami impacts from the earthquake.

5.2 Sources in the Caribbean

The 2004 magnitude 9.2 Sumatra-Andaman earthquake was a surprise from a geologic and tectonic perspective in that it occurred along a highly oblique subduction zone, where the convergence rate is low, and where very large earthquakes were thought unlikely to occur. Many of the tsunamigenic fault zones in the Caribbean and

Atlantic are characterized by similar tectonics and may have higher hazard than has been previously predicted. In particular, a major concern was raised about the Puerto Rico trench, because a tsunami initiating here has a potential impact on the U.S. East Coast. The USGS has recently carried out extensive fieldwork in the Puerto Rico trench to understand the tectonics of the area. As a result, researchers on the US NRC project were able to rapidly provide an evaluation for this source. As part of this analysis, tsunami propagation from several different large-magnitude earthquakes in the Caribbean was modeled to estimate deep ocean tsunami amplitudes offshore U.S. Atlantic and Gulf coasts. A range of tsunami amplitudes is determined based on natural variations in slip distribution patterns expected for large magnitude earthquakes along plate boundaries in the Caribbean. This work is ongoing and has been useful for providing general hazard information to the US NRC.

A series of large earthquakes with mostly thrust motion took place in the eastern half of northern Hispaniola between 1946 and 1953. One of the events in 1946 was accompanied by a destructive local tsunami. In contrast to the Puerto Rico trench, a larger vertical motion is expected for a given magnitude of slip on portions of the Hispaniola trench. It is unclear, whether the western part of the subduction zone would rupture in a single earthquake and how far west the rupture would extend. Modeling is needed to determine if the U.S. Atlantic coast would be protected from tsunamis generated in this subduction zone by the Bahamas banks which are near sea level and act as obstructions to tsunami wave propagation.

5.2 Sources in the Gulf of Mexico

The Gulf of Mexico basin is devoid of subduction zones or potential sources of large reverse faults. However, the Caribbean basin contains two convergence zones whose rupture may affect the Gulf of Mexico, the North Panama Deformation Belt and the Northern South America Convergent Zone. Hydrodynamic modeling is needed to evaluate the role of the Yucatan straits (between Cuba and the Yucatan Peninsula) in modifying the propagation of tsunamis into the Gulf of Mexico, though some initial modeling hs been initiated.

6. UPCOMING ACTIVITIES

As part of the second phase of the program, which is currently underway, the USGS will conduct field investigations in key locations for the purpose of obtaining new data useful for determining tsunami hazard assessment of nuclear facilities. The USGS is also continuing investigations into assessing landslide potential in the Gulf of Mexico, determining the source of the 1755 Lisbon earthquake, and a variety of other topic of interest.

Simultaneously, the MOST tsunami generation and propagation model used by NOAA is currently being enhanced to include landslide-based initiation mechanisms and is being validated with case studies, including the 1958 Lituya Bay megatsunami. The enhanced MOST model will be used to investigate the tsunamigenic sources identified and characterized by the USGS, with the goal of creating an estimation of deterministic tsunami hazard levels for the full length of Atlantic and Gulf Coasts. This information may ultimately be developed into a map of deterministic tsunami hazard for these coastlines and will be of direct benefit to the US NRC efforts to assess tsunami hazard at coastal facilities.

The potential for developing tools and data to undertake probabilistic tsunami hazard assessments (PTHA) will also be a key focus of later phases of the research program. PTHA will require an understanding of the frequency of different initiating events. Some areas in which the US NRC is likely to initiate additional work in the coming years relates to understanding the timing of the submarine landslides identified in the Atlantic. One example is careful age dating on cores recovered from within and adjacent to mapped landslides. In the companion paper in this conference, information on the result of ongoing work, some of which is leading to PTHA is provided.

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PRELIMINARY RESULTS OF THE U.S. NUCLEAR REGULATORY COMMISSION COLLABORATIVE RESEARCH PROGRAM TO ASSESS TSUNAMI HAZARD FOR NUCLEAR POWER PLANTS ON THE ATLANTIC AND GULF COASTS

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ABSTRACT :
In response to the 2004 Indian Ocean Tsunami, the United States Nuclear Regulatory Commission (US NRC) initiated a long-term research program to improve understanding of tsunami hazard levels for nuclear facilities in the United States. For this effort, the US NRC organized a collaborative research program with the United States Geological Survey (USGS) and other key researchers for the purpose of assessing tsunami hazard on the Atlantic and Gulf Coasts of the United States. The initial phase of this work consisted principally of collection, interpretation, and analysis of available offshore data and information. Necessarily, the US NRC research program includes both seismic- and landslide-based tsunamigenic sources in both the near and the far fields. The inclusion of tsunamigenic landslides, an important category of sources that impact tsunami hazard levels for the Atlantic and Gulf Coasts over the long time periods of interest to the US NRC is a key difference between this program and most other tsunami hazard assessment programs. Although only a few years old, this program is already producing results that both support current US NRC activities and look toward the long-term goal of probabilistic tsunami hazard assessment. This paper provides a summary of results from several areas of current research. An overview of the broader US NRC research program is provided in a companion paper in this conference.

KEYWORDS:
Tsunami, Landslide, Seismic, Hazard, Nuclear

1. BACKGROUND

In response to the 2004 Indian Ocean Tsunami, as well as the anticipation of the submission of license applications for new nuclear facilities, the United States Nuclear Regulatory Commission (US NRC) initiated a long-term research program to improve understanding of tsunami hazard levels for nuclear power plants and other coastal facilities in the United States. To undertake this effort, the US NRC organized a collaborative research program with researchers at the United States Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), and other key researchers for the purpose of assessing tsunami hazard on the Atlantic and Gulf Coasts of the United States. The research described in this paper represents the combined effort of a diverse group of marine geologists, geophysicists, geotechnical engineers, and hydrodynamic modelers to evaluate tsunami sources that have the potential to impact the U.S. Atlantic and Gulf coasts.

The Atlantic and Gulf Coasts are the focus of this program, both because of the number of existing and proposed nuclear facilities located on these coasts and because many promising research efforts for assessing tsunami hazard in the Pacific Coast of the United States are already underway as a result of programs outside the US NRC. Tsunami has been long known as a hazard in the Pacific Ocean. However, the 2004 tsunami highlighted the fact the tsunamis can occur in other oceans that are less prepared for this rare phenomenon. Although tsunami are far rarer along the Atlantic and Gulf of Mexico coastlines, some areas can be highly vulnerable to tsunamis when they do occur because major population centers and industrial faculties are located near the shoreline at low-lying elevations, and often in estuaries. This is in comparison to the Pacific coast where tsunamis are more frequent but the coastline is more sparsely populated and most sections have more topographic relief.

Because the US NRC is interested in understanding hazard associated with the rare large tsunami that may occur over long time periods (in excess of 10,000 years), the research program was developed to investigate both seismic and landslide tsunamigenic sources. It also includes the study and characterization of large sources in the far field, as well as sources in the near field such that all key sources were considered. The study of near-field and far-field tsunamigenic landslides is a key difference between this research program and other tsunami hazard assessment programs, which are typically focused on seismic sources. Submarine landslides have also historically generated destructive tsunamis and so must be fully investigated in this program. In landslide initiated tsunami, the extent of damaging waves generated by landslides is generally smaller and more localized. However, along coastlines proximal to catastrophic submarine landslides, tsunami run-up can be significant as exemplified by the 1929 Grand Banks tsunami (Newfoundland and Nova Scotia), which likely had a significant landslide-generated component. Less is generally known about submarine landslides as tsunami triggers in comparison to their earthquake counterparts.

The development of tools and data to undertake probabilistic tsunami hazard assessments (PTHA) is a key long-term goal and the focus of later phases of the US NRC research program. Effectively developing PTHA tools will require an understanding of the frequency of different initiating events. Some areas in which the US NRC is likely to initiate additional work in the coming years relates to understanding the timing of the submarine landslides identified in the Atlantic. Some of the research discussed here represents the start of this long term element of the program.

Although less than two years old, this research program has already produced significant results that are currently or will soon be available to the public through a variety of technical publications. These publications include a USGS report to the US NRC (Ten Brink et al, 2007) and multiple articles in a special issue of Marine Geology to be published late 2008 or early 2009 (Barkana et al; Chaytor et al; Geist et al; Lee; Locat et al; Ten Brink et al, 2008). The early research and results discussed in the USGS report were focused on providing sufficient information on the source parameters useful for qualitative assessment of tsunami hazard for the Atlantic and Gulf coasts. The USGS report will be revised in 2008 and will include details related to the work summarized here. This information is currently being used to develop and review tsunami hazard assessments for new nuclear power facilities in the United States. A companion paper in this conference summarizes and discusses the complete US NRC program in more detail and provides a discussion of the seismic and landslide-based tsunami source characterizations (Kammerer et al, 2008).

2. SIZE DISTRIBUTION OF SUBMARINE LANDSLIDES ALONG THE U.S. ATLANTIC MARGIN AND ITS IMPLICATION TO TSUNAMI HAZARDS

The ability to determine the number, size, and frequency of large submarine landslides is a critical component in determining the hazard posed to coastal regions by destructive landslide-generated tsunamis. The efforts to characterize submarine landslides off the Atlantic coast represents the earliest effort of the US NRC tsunami research program. This work is investigating the size distribution of submarine landslides along the U.S. Atlantic continental slope and rise using the size of the landslide excavation regions. The data collected for this effort, a description of methods used, and other information is discussed in more detail in the companion paper submitted to this conference (Kammerer et al, 2008).

The first step in the initial investigation of landslides in the Atlantic was the collection and analysis of a large amount of available information useful for the identification and characterization of offshore landslides along the Atlantic coast of the U.S. Multibeam bathymetry, Geologic Long-Range Inclined Asdic (GLORIA) sidescan sonar imagery, a regional grid of high-resolution seismic profiles, and published accounts of sediment cores from the region was collected. The near-complete coverage of the Atlantic continental slope and rise by multibeam bathymetry provided a key high-quality and uniform data set that allowed for a more detailed and consistent view and assessment of the geomorphology of submarine landslides than had been possible in the past.

This landslide mapping results indicated that landslides along the U.S. Atlantic margin initiate predominantly in two morphologic settings, canyon (heads and sidewalls) and on the open continental slope. The canyon-sourced failures often have several canyons feeding a single deposit, and the deposits are smaller than those derived from the open slope. As a result, they are unlikely to cause tsunami events. Open-slope failures commonly originate on the middle and lower slope in 800-2,200 m depths. These landslides extend farther offshore, are thicker, and have considerably larger volumes than their canyon derived counterparts. As a result of the large volumes of material that sometimes fail, open slope-sourced slides are considered to have the most potential to initiate tsunami. However, a significant volume of material may also be mobilized in landslides associated with areas of salt diapirism as well.

Landslide source excavation areas along the margin identified in a detailed bathymetric Digital Elevation Model (DEM) ranged between 0.89 km^2 and 2410 km^2. The volumes range between 0.002 km^3 and 179 km^3. The area to volume relationship of these source excavations is almost linear (power law exponent close to 1), suggesting a fairly uniform failure thickness of a few tens of meters in each event, with only rare, deep excavating landslides. The cumulative volume distribution of the excavations is well described by a log-normal distribution rather than by a power-law commonly used to describe both subaerial and submarine landslides. A log-normal distribution centered on a volume of 0.86 km3, may indicate that landslides preferentially mobilize a moderate amount of material (on the order of 1 km3), rather than large landslides or very small ones. Conversely, the log-normal distribution may reflect a power law distribution modified by a size-dependent probability of observing landslide excavations in the bathymetry data. If the latter is the case, for example, a power law distribution with an exponent of 1.3±0.3, modified by the conditional probability of success in identifying landslide excavations with increasing slide size, fits the observed size distribution equally well and predicts that geology of the source region has strong control on the size of the excavation. This exponent value corresponds favorably with the 1.2±0.3 predicted for subaerial landslides in unconsolidated material. The log-normal distribution of the observed excavation volumes suggests that large landslides, which have the greatest potential to generate damaging tsunamis, occur infrequently along the margin. The reader is directed to Chaytor et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

3. GEOLOGIC CONTROLS ON THE DISTRIBUTION OF SUBMARINE LANSLIDES ALONG THE U.S ATLANTIC CONTENTIAL MARGIN

Submarine landslides along the continental slope of the U.S. Atlantic margin are potential sources of tsunami hazard along the U.S. Atlantic coast. The magnitude of potential tsunamis depends on the volume and location of the landslides; and tsunami frequency depends on their recurrence interval. Unfortunately, both the size and recurrence interval of submarine landslides along the U.S. Atlantic margin is poorly understood.

Well-studied landslide-generated tsunamis in other parts of the world have been shown to generally be associated with earthquakes as a triggering mechanism. Because the size distribution and recurrence interval of earthquakes is generally better known than those for submarine landslides, if may be possible to estimate the size and recurrence interval of submarine landslides from the size and recurrence interval of earthquakes in the near vicinity of the potential landslides. To do this it is necessary to calculate the maximum expected landslide size for a given earthquake magnitude, use recurrence interval of each magnitude of earthquake to estimate the recurrence interval of landslides of a certain size, and assume a threshold landslide size that can generate a destructive tsunami.

The maximum expected landslide size for a given earthquake magnitude is calculated in 3 ways: by slope stability analysis for catastrophic slope failure on the Atlantic continental margin, by using land-based compilation of maximum observed distance from earthquake to liquefaction, and by using land-based compilation of maximum observed area of earthquake-induced landslides. We find that the calculated distances and failure areas from the slope stability analysis is similar or slightly smaller than the maximum triggering distances and failure areas in subaerial observations. The results from all three methods compare well with the slope failure observations of the Mw=7.2, 1929 Grand Banks earthquake, the only historical tsunamigenic earthquake along the North American Atlantic margin.

The results further suggest that a Mw=7.5 earthquake (the largest expected earthquake in the eastern U.S.) must be located offshore and within 100 km of the continental slope to induce a catastrophic slope failure. Thus,based on this method a repeat of the 1755 Cape Anne and 1881 Charleston earthquakes would not be expected to cause landslides on the continental slope. The observed rate of seismicity offshore the U.S. Atlantic coast is very low with the exception of New England, where some microseismicity is observed. An extrapolation of annual strain rates from the Canadian Atlantic continental margin suggests that the New England margin may experience the equivalent of a magnitude 7 earthquake on average every 600–3000 yr. A minimum triggering earthquake magnitude of 5.5 is suggested for a sufficiently large submarine failure to generate a devastating tsunami and only if the epicenter is located within the continental slope. The reader is directed to Twitchell et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

4. GEOMORPHOLOGY, STABILITY, AND MOBILITY FROM THE CURRITUCK LANDSLIDE

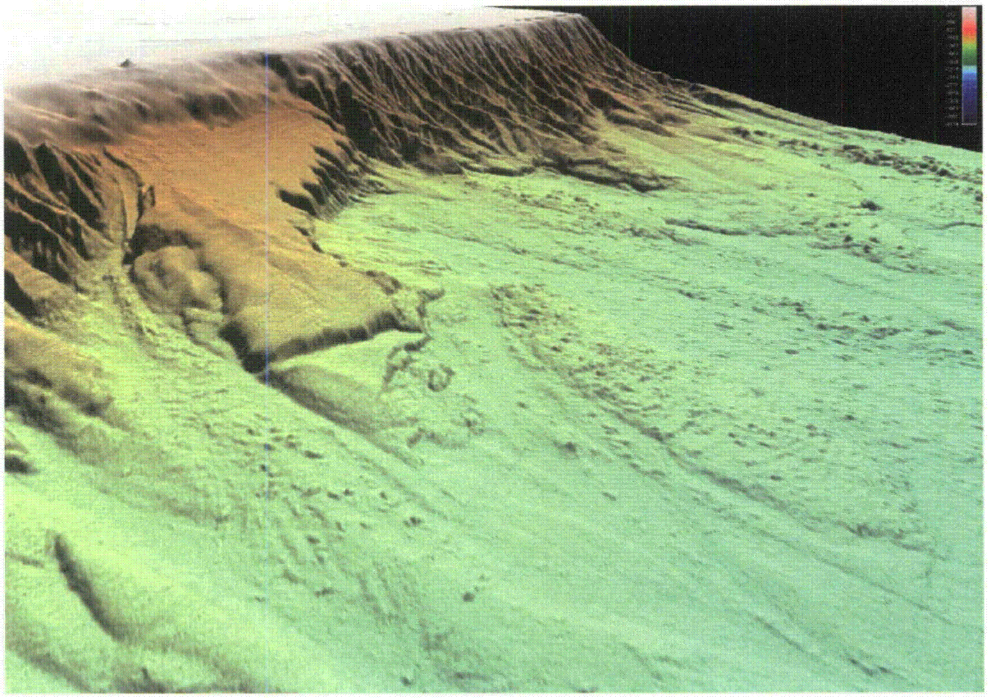

Figure 1 Image of the Carrituck Landslide Off the U.S. Atlantic Coast

In order to gain an initial understanding of the implications of the mapped landslides on the tsunami hazard along the Atlantic coast, a study to characterize and perform hydrodynamic modeling of the Carrituck landslide was undertaken. Tsunami magnitude depends strongly upon the size of the slide and how the landslide moves as it fails and flows. Therefore, the first step in the process was to determine the parameters needed for the tsunami generation and propagation modeling. This work had significant challenges because the initial geometry of the material was not known, it was unclear if there had been a single event or multiple events, and the properties of the geologic material were not well characterized. During this work several issues were considered and the researchers endeavored to answer the following multiple lines of inquiry. Ultimately a possible initial velocity and acceleration of the failed mass was developed from the mobility analyses.

The Currituck slide, located off the coast of Virginia, is a major submarine mass movement that was likely triggered during a time of low sea level. This slide removed a total volume of about 165 km^3 from this section of the continental slope. The departure zone still shows a very clean surface that dips at 4° and is only covered by a thin veneer of Holocene sediment. Multibeam bathymetric data suggest that this slide took place along three failures surfaces. The morphology of the source area suggests that the sediments were already at least normally consolidated at the time of failure. The slide debris covers an area as much as 55 km wide that extends 180 km from the estimated toe of the original slope.

The back analysis of slide initiation indicates that very high pore pressure, a strong earthquake, or both had to be generated to trigger slides on such a low failure plane angle. The shape of the failure plane, the fact that the surface is almost clear of any debris, and the mobility analysis, all support the argument that the slides took place nearly simultaneously. Potential causes for the generation of high pore pressures could be seepage forces from coastal aquifers, delta construction and related pore pressure generation due to the local sediment loading, gas hydrates, and earthquakes.

This slide, and its origin, is a spectacular example of the potential threat that submarine mass movements can pose to the US Atlantic coast and underline the need to further assess the potential for the generation of such large slides, like the Grand Banks 1927 landslide of similar volume. The reader is directed to Locat et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

5. HYDRODYNAMIC MODELING OF TSUNAMIS FROM THE CURRITUCK LANDSLIDE

Once estimates of the important landslide parameters of the Currituck landslide offshore North Carolina had been developed in the research discussed above, preliminary hydrodynamic modeling of the slide was conducted for the purpose of determining the range of possible near-shore wave heights and understanding the possible impact of the continental shelf. A long and intermediate wave modeling package (COULWAVE) based on the non-linear Boussinesq equations was used to simulate the tsunami. This model includes procedures to incorporate bottom friction, wave breaking, and overland flow during runup. Potential tsunamis generated from the Currituck landslide were analyzed using four approaches: (1) the tsunami wave history was calculated from several different scenarios indicated by geotechnical stability and mobility analyses; (2) a sensitivity analysis was conducted to determine the effects of both landslide failure duration during generation and bottom friction along the continental shelf during propagation; (3) the wave history was calculated over a regional area to determine the propagation of energy oblique to the slide axis; and (4) a high resolution 1D model was developed to accurately model wave breaking and the combined influence of nonlinearity and dispersion during nearshore propagation and runup.

From the sensitivity analyses, it was concluded that the primary source parameter that affected tsunami severity for this case study is landslide volume, with failure duration having a secondary influence. Bottom friction during propagation across the continental shelf has a strong influence on the attenuation of the tsunami during propagation. The high-resolution1D model also indicates that the tsunami undergoes non-linear fission prior to wave breaking, generating independent, short-period waves. Wave breaking occurs approximately 40-50 km offshore where a tsunami bore is formed that persists during runup. These analyses illustrate the complex nature of landslide tsunamis, necessitating the use of detailed landslide stability/mobility models and higher-order hydrodynamic models to determine their hazard.

This study was undertaken early in the program and played an important role for the US NRC because the modeling allowed staff to understand the general implications of the initial landslide mapping results. It also helped to scope and focus the organization of the broader research program. The reader is directed to Geist et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

6. ASSESSMENT OF SOURCE PROBABILITIES FOR POTENTIAL TSUNAMI AFFECTING THE U.S. COASTS

A key element of determining risk to a coastal facility from tsunami is understanding the likelihood that a tsunami will occur. Estimating the likelihood of tsunamis occurring along the U.S. Atlantic coast critically depends on knowledge of the annual probability of all potential tsunami sources that may impact a site of interest. To address this need a review of available information on both earthquake and landslide probabilities from potential sources that could generate local and transoceanic tsunamis has been performed. Estimating source probability includes defining both size and recurrence distributions for earthquakes and landslides. For the former distribution, source sizes are often distributed according to a truncated or tapered power-law relationship. For the latter distribution, sources are often assumed to occur in time according to a Poisson process, simplifying the way tsunami probabilities from individual sources can be aggregated. For the U.S. Atlantic coast, earthquake tsunami sources primarily occur at transoceanic distances along plate boundary faults. Probabilities for these sources are constrained from previous statistical studies of recorded seismicity.

In contrast, there is presently little information constraining landslide probabilities that may generate local tsunamis. Though there is significant uncertainty in tsunami source probabilities for the Atlantic, results from this study yield a comparative analysis of tsunami source recurrence rates that can form the basis for future probabilistic analyses. The reader is directed to Lee (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

7. TIMING OF LARGE SUBMARINE LANDSLIDES ON THE ATLANTIC OCEAN MARGIN

The frequency of occurrence of tsunami due to specific sources, such as tsunamigenic landslide is a necessary and important parameter required for any probabilistic tsunami hazard assessment (PTHA). Thus, developing and understanding of the frequency of tsunamigenic landslides that may impact the U.S. coastline is an important element in reaching the long term program goal of developing PSHA tools for the Atlantic and Gulf coasts.

However, landslides are complicated and non-stationary process. Submarine landslides are distributed unevenly both in space and time. Spatially, they occur most commonly in fjords, active river deltas, submarine canyon-fan systems, the open continental slope, and on the flanks of oceanic volcanic islands. Temporally, they are influenced by the size, location, and sedimentology of migrating depocenters, changes in seafloor pressures and temperatures, variations in seismicity and volcanic activity, and changes in groundwater flow conditions.

In the past, the dominant factor influencing the times of submarine landslide occurrence has been glaciation. A review of known ages of submarine landslides along the margins of the Atlantic Ocean, augmented by a few ages from other submarine locations shows a relatively even distribution of large landslides with time from the last glacial maximum until about five thousand years after the end of glaciation. During the past 5000 years the frequency of occurrence is less by a factor of 1.7 to 3.5 than during or shortly after the last glacial/deglaciation period. Such an association likely exists because of the formation of thick deposits of sediment on the upper continental slope during glacial periods and increased seismicity caused by isostatic readjustment during and following deglaciation. Hydrate dissociation may play a role, as suggested previously in the literature, but the connection is unclear.

Developing an full understanding of the rate of past event, as well as the underlying causes, will continue to be an important research topic within the US NRC program. By understanding the underlying causes of past behavior, a more informed assessment of future rates will be possible. The reader is directed to Lee (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

8. INVESTIGATION OF THE SOURCE OF THE 1755 LISBON EARTHQUAKE AND TSUNAMI USING TRANS-OCEANIC MODELING

Four large tsunamigenic earthquakes have occurred in the Atlantic Ocean west of Gibraltar in the last 300 years. The great Lisbon earthquake is one of these. However, there is no simple tectonic model for this area that explains the generation of these earthquakes. As a result, promising work undertaken to determine the source parameters of the 1755 Lisbon earthquake is of particular interest.

The Lisbon earthquake occurred in 1755 and had an estimated moment magnitude of 8.5 to 9.0 and was the most destructive earthquake in European history. In the near field associated tsunami run-up was reported to have reached 5-15 m along the Portuguese and Moroccan coasts and the run-up was significant at the Azores and Madeira Island. However, Lander et al. (2002) compiled a list of reports on the effect of the 1755 Lisbon tsunami in distant locations such as the Caribbean: Antigua, Saba, St. Martin at the northeast corner of the Caribbean had the highest flooding, but flooding was also reported from Santiago de Cuba and Samana Bay, Dominican Republic, in the north to Barbados in the south. There are also reports about flooding in Bonavista, north of St. Johns, Newfoundland. However, there are no reports of flooding anywhere else between Cuba and Newfoundland, despite the presence at that time of population centers in low-lying areas of the eastern U.S. and Canada.

A variety of past studies have hypothesized various sources for this earthquake based on geophysical surveys, modeling the near-field earthquake intensity, or tsunami effects. However, as part of this research, modeling of various sources is being undertaken to determine the source location and geometry that best fits the many far field records of tsunami impacts from the earthquake. Prior to this project there had not been an attempt to fit cross-ocean tsunami reports of the 1755 Lisbon earthquake to any of the proposed fault sources. Studying far field effects, as undertaken in this research, is advantageous because the tsunami is less influenced by near source bathymetry and is unaffected by triggered submarine landslides at the source. Source location, fault orientation and bathymetry are the main elements governing transatlantic tsunami propagation to sites along the U.S. East Coast, much more than distance from the source and continental shelf width.

Results of the far and near-field tsunami simulations undertaken and a relative amplitude comparison limit the earthquake source area to a region located south of the Gorringe Bank in the center of the Horseshoe Plain. This is in contrast with previously suggested sources such as Marqués de Pombal Fault, and Gulf of Cádiz Fault, which are farther east of the Horseshoe Plain. The earthquake was likely to be a thrust event on a fault striking ~345° and dipping to the ENE as opposed to the suggested earthquake source of the Gorringe Bank Fault, which trends NE-SW. Gorringe Bank, the Madeira-Tore Rise (MTR), and the Azores appear to have acted as topographic scatters for tsunami energy, shielding most of the U.S. Atlantic Coast from the 1755 Lisbon tsunami. Additional simulations to assess tsunami hazard to the U.S. Atlantic Coast from possible future earthquakes along the Azores-Iberia plate boundary indicate that sources west of the MTR and in the Gulf of Cadiz may affect the southeastern coast of the U.S. The Azores-Iberia plate boundary west of the MTR is characterized by strike-slip faults, not thrusts, but the Gulf of Cadiz may have thrust faults. Southern Florida seems to be at risk from sources located east of MTR and South of the Gorringe Bank, but it is mostly shielded by the Bahamas. The Gulf of Cádiz is another source area of potential tsunami hazard to the U.S. Atlantic Coast. Higher resolution near-shore bathymetry along the U.S. Atlantic Coast and the Caribbean as well as a detailed study of potential tsunami sources in the central west part of the Horseshoe Plain are necessary to verify the simulation results. The reader is directed to Barkana et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

9. SUMMARY

This paper highlights some recent results from research performed for the US NRC tsunami research program. This information is provided as an overview of the types of projects undertaken in the program. The goal of the program is to develop an understanding of the deterministic hazard from tsunami along the U.S. Atlantic and Gulf coasts in the short term, with a long-term goal of developing the tools and parameters necessary to perform probabilistic seismic hazard assessments. The research here represents a wide variety of topics that are essential to ultimately meet these goals. For additional information, please see the companion paper in this conference (Kammerer et al, 2008).

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Summary of Current Regulations, Guidance, and Activities related to NRC Review of Tsunami Hazard Analyses for New NPPs in the United States

The United States Nuclear Regulatory Commission (NRC) considers and assesses tsunami and tsunami-like phenomena under its tsunami hazard and risk assessment protocols. To perform a tsunami hazard and risk assessment, the NRC uses a hierarchical framework and a variety of technical approaches as appropriate for each of the various source types. Currently NRC guidance on tsunami uses a deterministic approach based on assessment of the Probable Maximum Tsunami (PMT). This annex describes the current approach NRC staff use in the review of license applications.

The NRC is moving towards risk-informed approaches and guidance across the agency. Probabilistic approaches can be proposed as a basis for review by the licensee. Current state-of-the-art practice in the U.S. uses probabilistic approaches to determine tsunami hazard on the Pacific coast. Probabilistic tsunami hazard assessment (PTHA) methods are an area of active research within the NRC and are currently viable on the Pacific coast. Currently a lack of information on the rate of activity of tsunamigenic sources that may affect the Atlantic and Gulf Coasts of the U.S. preclude the practical use of probabilistic methods.

Regulations and Regulatory Guidance

NRC regulations related to tsunami hazard assessments, as provided in the Code of Federal Regulations (CFR), include the following:

1. 10 CFR Part 100, as it relates to identifying and evaluating hydrological features of the site. The requirements to consider physical site characteristics in site evaluations are specified in 10 CFR 100.20(c) for new applications.

2. 10 CFR 100.23(d) sets criteria to determine the siting factors for plant design bases with respect to seismic induced floods and water waves at the site.

3. 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, for CP and OL applications, as it relates to consideration of 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.

4. 10 CFR 52.17(a)(1)(vi), for early site permit (ESP) applications, and 10 CFR 52.79, for combined operating licenses (COL) applications, as they relate to identifying hydrological site characteristics with appropriate consideration of 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.

Regulatory Guide 1.59 (1977) briefly discussed tsunami as a source of flooding. This regulatory guide is currently being updated. However, the update of this guide will not include tsunami-induced flooding. NRC staff is currently preparing a new regulatory guide focused on tsunami hazard assessment and risk.

Section 2.4.6 of the NRC Standard Review Plan (SRP) NUREG 0800 (NRC, 2007) describes review procedures and acceptance criteria for tsunami hazards currently used by NRC staff.

The National Oceanic and Atmospheric Administration (NOAA) is responsible for developing standards of accuracy for tsunami simulation models for the U.S. federal government and for conducting research to support the National Tsunami Hazard Mitigation Program. In 2007, NOAA provided the NRC with a state-of-the-art report on tsunami hazard assessment in the U.S. which, along with NUREG/CR-6966, forms the basis for the current NRC review approach.

In 2006, the NRC initiated a long-term research tsunami research program. This program, which includes cooperative work with the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA), was designed both to support activities associated with the licensing of new nuclear power plants in the U.S and to support development of new regulatory guidance.

Additional supporting documentation is available as described in the sections below.

The Application of the Hierarchical Approach

A hierarchical approach acceptable to NRC staff is described in NUREG/CR-6966. As noted in this document, a hierarchical-assessment approach consists of a series of stepwise, progressively more refined analyses that are used to evaluate the hazard resulting from a specific phenomenon. In the case of tsunami, this approach is defined by three steps that answer the following questions:

1. Is the site region subject to tsunamis?
2. Could the plant site be affected by tsunamis?
3. What is the risk to safety of the plant caused by tsunamis?

The first step, which is essentially a regional screening test, is performed to determine whether or not a site can be screened out based on its proximity to a water body capable of producing a tsunami or tsunami-like effect. If the region in which a site is located is not subject to tsunamis, no further analysis for tsunami hazards is required. This finding should be supported by region-specific evidence. If this cannot be conclusively shown, the second step, below, is required.

The second step can be regarded as a site-screening test. This step determines whether plant systems important to safety are exposed to hazards from tsunami. The methods used to perform site-specific hazard assessments, including the calculation of site-specific run-up elevations, are described later in this Annex. It may be possible to determine that, even though the general site region is subject to tsunami hazards, all safety-related systems are located at an elevation above the calculated maximum wave run-up.

The third step assesses the risk to a facility that may exist if the elevation of the safety-significant structures, systems and components (SSC) cannot be conclusively shown to exceed the calculated tsunami run-up. This step requires the most refined and complex analysis.

Areas of Review by NRC Staff

NRC Staff review the technical areas summarized below. These review areas are described in more detail in the current version of the NRC SRP (NUREG 0-800), which is available for download at the NRC's online reading room.

1. Historical Tsunami Data. The staff reviews historical tsunami data, including paleotsunami data. Historical data may help in establishing the frequency of occurrence and other useful indicators such as the maximum observed run-up height. The NOAA National Geophysical Data Center collects and archives information on tsunami sources and effects to support tsunami modeling and engineering for the U.S. government and should be used as a key source of data. International sources that are relevant to plants exposed to trans-oceanic tsunami should also be investigated.

2. Probable Maximum Tsunami. Currently, NRC staff reviews applications for adequacy based on deterministic assessment of a Probable Maximum Tsunami (PMT), as noted in Regulatory Guide 1.59 (1977). The staff reviews the PMT with respect to the identification of the source mechanisms, the characteristics of these source mechanisms, and the simulation of the wave propagating towards the proposed plant site. A discussion of tsunamigenic sources is provided later in this Annex.

3. Tsunami Propagation Models. The staff reviews the computation models used in the hazard analysis. Elements of tsunami modeling are discussed in more detail later in this Annex.

4. Wave Run-up, Inundation, and Drawdown. The staff reviews the run-up caused by the PMT. An appropriate initial water surface elevation for the body of water under consideration, before the arrival of the tsunami waves, should be assumed. similar to that recommend for storm surges and seiches by ANSI/ANS-2.8-1992. For example, to estimate the highest tsunami wave run-up at a coastal site, the 90th percentile of high tides must be used as the initial water surface elevation near the site. To estimate the lowest drawdown caused by receding tsunami waves, the 10th percentile of the low tides may be used

Any inundation indicated by the assessment should be considered in the flooding design bases of the plant and may necessitate flooding protection for some safety-related SSC. Staff also reviews drawdown caused by tsunami waves and how it may affect the safety-related intakes, if they are used in the plant design and are exposed to the effects of the tsunami. The staff also reviews the duration of the drawdown to estimate the time during which a safety-related intake may be affected. The suggested criteria of Regulatory Guide 1.27 apply when the water supply comprises part of the ultimate heat sink.

It should be demonstrated that the extent and the duration of the inundation and the drawdown caused by the tsunami waves are adequately established for the purposes of the plant design bases.

5. Hydrostatic and Hydrodynamic Forces. The staff reviews the hydrostatic and the hydrodynamic forces on the safety-related SSC caused by the tsunami waves. Because the tsunami occurs as a train of waves, several incoming and receding wave cycles should be considered. Local geometry and bathymetry can significantly affect the height, velocity, and momentum flux near the locations of the safety-related SSC. The suggested criteria of Regulatory Guide 1.26 apply when the water supply comprises part of any water-cooled ultimate heat sink.

   It should be demonstrated that hydrostatic and hydrodynamic forces caused by the tsunami waves are adequately established for the purposes of the plant design bases.

6. Debris and Water-Borne Projectiles. The staff reviews the likelihood of debris and water-borne projectiles carried along with the tsunami currents and their ability to cause damage to the safety-related SSC. The suggested criteria of Regulatory guide 1.27 apply when the water supply comprises part of the ultimate heat sink. It should be demonstrated that any possibility of damage to the safety-related SSC from debris and water-borne projectiles is adequately established for the purposes of the plant design bases.

7. Effects of Sediment Erosion and Deposition. The staff reviews the sediment deposition during the tsunami, as well as the erosion caused by the high velocity of flood waters or wave action during the tsunami and its effect on foundations of the safety-related SSC, to ensure that these are adequately established for the purposes of the plant design bases. Any potential erosion and sediment deposition should not affect safety-related functioning of the exposed SSC. The suggested criteria of Regulatory Guide 1.27 apply when the water supply comprises part of the ultimate heat sink.

8. Consideration of other Site-Related Evaluation Criteria. 10 CFR Part 100 describes site-related proximity, seismic and non-seismic evaluation criteria for power reactor applications. Subpart A to 10 CFR Part 100 addresses the requirements for applications before January 10, 1997, and Subpart B is for

applications on or after January 10, 1997. The staff's review will include evaluation of pertinent information to determine if these criteria are appropriately used in postulation of worst-case tsunami scenarios.

Tsunamigenic Source Characterization

Tsunami hazard along the United States coastlines comes from two predominant source categories; landslides and seismic sources. Sources in these categories exist in both the near- and far-field. A regional assessment of tsunamigenic sources should be carried out to determine all sources that may generate the PMT at the proposed plant site. The source mechanisms considered in the assessment should include earthquakes, submarine and sub-aerial landslides and volcanoes. The characteristic of the sources that are used for the specification of the PMT should be conservative.

The landslide sources should be characterized using the maximum volume parameter determined from seafloor mappings or geologic age dating of the historical landslides. A slope-stability analysis should be performed to assess the potential tsunami generation efficiency of the candidate landslides. The tsunamigenic source types caused by volcanic activity considered in the PMT assessment should include pyroclastic flows, submarine caldera collapse, explosions, and debris avalanches or flank failures.

To support license activities related to new reactors, the NRC has initiated a long-term tsunami research program. As part of this program, the United States Geological Survey (USGS) has provided a report summarizing the tsunamigenic source mechanisms in the Atlantic Ocean and the Gulf of Mexico (ten Brink et al 2008). The sources detailed in this report are used by the NRC staff as a starting point for tsunami assessment for proposed sites located near these water bodies. Research is on-going in this area and additional references and source characterizations may become available in the future.

Tsunami Modeling Methods

As part of the licensing process, the staff reviews the computational models used in the tsunami hazard analyses. Tsunami propagation models should be used, such as those used by NOAA that are published in peer-reviewed literature and are verified using extensive testing.

The staff reviews propagation of the PMT waves from the source towards the proposed site. If appropriate, the shallow water wave approximate should be used to simulate propagation of the PMT waves in deep waters. The simulation of the propagation of the PMT waves in shallow waters, where the shallow water wave approximation is not valid, should use non-linear wave dynamics approaches.

The staff reviews the model parameters and the input data used to simulate the propagation of the PMT waves towards the site. The model parameters should be described and their conservative values should be chosen. All other data used for model input should be described and their respective sources noted. Usually bathymetry and topography data archived and maintained by NOAA/NGDC, and the USGS, and the U.S. Army Corps of Engineers are sufficient for sites in the U.S. However, some sites may require additional data.

NOAA has the responsibility to develop standards of accuracy for tsunami simulation models for the U.S. federal government and to conduct research to support the National Tsunami Hazard Mitigation Program. NOAA, through USAID funding, has developed an interface tool, the Community Model Interface for Tsunami (ComMIT), that allows individuals and institutions to make use of NOAA seismic source models, tools, and results. This publically-available interface tool, when applied by an appropriately trained analyst and coupled with high-quality local bathymetric information, is a useful tool to undertake tsunami hazard analyses at many locations both within and outside the U.S. It is highly recommended than any analyst using the tool should first perform the benchmark test problems provided on the NOAA website.

The NRC intends to use the NOAA ComMIT tool, as appropriate, and will continue to work with NOAA to enhance NRC practices and guidance in the future. For landslide-related tsunamigenic sources alternate methods and tools are required. Development of guidance on landslide-based tsunami modeling is ongoing.

References for Annex:

The below references are available either through the NRC ADAMS system using the ML ascension number (if shown), or through the NRC reading room. Both can be accessed through the NRC website located at http://www.nrc.gov

10 CFR Part 50. Code of Federal Regulations. Title 10, Energy, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 52. Code of Federal Regulations. Title 10, Energy, Part 52 "Early Site Permits; Standard Design Certifications; and Combined License for Nuclear Power Plants."

10 CFR Part 100. Title 10, Energy, Part 100, "Reactor Site Criteria."

ANSI/ANS-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites" (not available at NRC site)

Gonzalez, F.I., Bernard, E., Dunbar, P., Geist, E., Jaffe, B., Kanoglu, U., Locat, J., Mofjeld, H., Moore, A., Synolakis, C., and Titov, V., (2007), "Scientific and Technical Issues in Tsunami Hazard Assessment of Nuclear Power Plant Sites," NOAA Technical Memorandum OAR PMEL-136, Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, Seattle, Washington.

NOAA National Geophysical Data Center (NGDC), (2007) NOAA/WDC Historical Tsunami Database at NGDC, URL: http://www.ngdc.noaa.gov/hazard/tsu_db.shtml

NOAA Community Model Interface for Tsunami (ComMIT) download and documentation are available at http://nctr.pmel.noaa.gov/ComMIT/

Pacific Northwest National Laboratory (2009), "Tsunami Hazard Assessment at Nuclear Power Plant Sites in the United States of America." NUREG/CR-6996, PNNL-17397. Available for download at the NRC reading room.

Ten Brink, U.S, Twitchell, D., Geist, E.L., Chaytor, J., Locat, H., Lee, B., Buczkowski, B., Barkan, R., Solow, A., Andrews, B., Parsons, T., Synett, P., Lin, J., and M. Sansoucy Atlantic and Gulf of Mexico Tsunami Hazard Assessment Group (2008), "Evaluation of Tusnami Sources with the Potential to Impact the U.S. Atlantic and Gulf Coasts: An Updated Report to the Nuclear Regulatory Commission," U.S. Geological Survey Administrative Report, Woods Hole, Massachusetts. (ML082960196)

U.S. Nuclear Regulatory Commission (1977), "Design Floods for Nuclear Power Plants." Regulatory Guide 1.59, Washington, D.C.

U.S. Nuclear Regulatory Commission (1976), "Ultimate Heat Sink for Nuclear Power Plants." Regulatory Guide 1.27, Revision 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (2007), "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," LWR Edition, Office of Nuclear Reactor Regulations, Washington, D.C.

NS/R

Japan

From: Correia, Richard
To: Coe, Doug; Coyne, Kevin
Subject: FW: ACTION: Assistance to Japanese
Date: Monday, March 14, 2011 7:27:52 AM

Doug, Kevin,

This is a heads up. I'm sure DRA has very capable folks that could assist here but let's see what Brian and Jennifer find out.

From: Leeds, Eric (NRR)
Sent: Monday, March 14, 2011 7:24 AM
To: Dean, Bill; McCree, Victor; Satorius, Mark; Collins, Elmo; Sheron, Brian; Evans, Michele; Zimmerman, Roy; Johnson, Michael
Cc: Holahan, Gary; Campbell, Andy; Correia, Richard; Uhle, Jennifer; Howell, Art; Pederson, Cynthia; Wert, Leonard; Lew, David; Weber, Michael; Virgilio, Martin; Grobe, Jack; Boger, Bruce; HOO Hoc
Subject: ACTION: Assistance to Japanese

Folks –

The Japanese requested the US supply six individuals with knowledge of the BWR 3 & 4 design to assist them in their hour of need. I'd like to discuss potential candidates with you on a conference call today at 9:30 am. I will work through the HOOs to set up a conference call and send you the number. We do not have a lot of details with regard to how long, although we do know these folks will assist in their EOCs at two different locations in Japan. I'll keep you informed as we learn more.

Thanks for your help!

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-1270

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NSIR
Japan

From: Uhle, Jennifer
To: Coyne, Kevin; Coe, Doug; Scott, Michael; Gibson, Kathy; Richards, Stuart; Case, Michael
Subject: FW: Confirmation of names for Japan
Date: Monday, March 14, 2011 4:51:47 PM

Everyone, here are the names, see below. Thanks for your help. I contacted BNL and DSA contact SNL so everyone from RES' list is standing down. Thanks,

J

From: Leeds, Eric (NRR)
Sent: Monday, March 14, 2011 1:11 PM
To: Collins, Elmo; Satorius, Mark; McCree, Victor; Dean, Bill; Sheron, Brian; Tracy, Glenn; Hudson, Jody; Johnson, Michael; Miller, Charles; Haney, Catherine; Zimmerman, Roy; Stewart, Sharon; Virgilio, Martin; Weber, Michael; Borchardt, Bill; Mamish, Nader; Doane, Margaret; Muessle, Mary
Cc: Boger, Bruce; Grobe, Jack; Ruland, William; Meighan, Sean
Subject: Confirmation of names for Japan

Folks –

Thanks so much for your help – we have a strong database of names/expertise to support the Japanese. For this first wave, we are sending Chuck Casto, John Monninger, Tony Nakanishi, Tim Kolb, Jack Foster and Richard Devercelly. I believe that Bruce Boger has contacted all those going to join Tony Ulsis and Jim Trapp in Japan.

I imagine that at some point we may need to send a second wave of responders to relieve our first wave. We will let you know as soon as we know if this needs to be done. We are also sensitive not to over-burden any one office.

Thanks again for your support!

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-1270

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Benner, Eric

From: Garcia-Santos, Norma
Sent: Monday, March 14, 2011 8:12 AM
To: NMSS_DSFST Distribution
Subject: FYI ONLY

Good morning,

FYI ONLY - Some news articles about Japan's situation:

http://www.financialexpress.com/news/japan-warns-of-2nd-blast-at-nplant/761976/

http://ansnuclearcafe.org/

Norma Garcia Santos, Acting Chief
Thermal and Containement Branch
Division of Spent Fuel
Storage and Transportation
Office of Nuclear Material
Safety and Safeguards
Mail Stop EBB-3D-02M
Washington, DC 0020555

E-mail: Norma.Garcia-Santos@nrc.gov
Phone No.: (301)-492-3290
Fax Nos.: (301)-492-3342 or (301)-492-3348

V/40

Vera, John

From: Einziger, Robert
Sent: Monday, March 14, 2011 7:44 AM
To: Day, Neil; DePaula, Sara; Einziger, Robert; Gordon, Matthew; Hornseth, Geoffrey; Piotter, Jason; Raynaud, Patrick; Tang, David; Tarantino, David; Tripathi, Bhasker; Vera, John
Subject: FW: Go to ANSNUCLEARCAFE.ORG for Japan's Nuclear Plant Status

-----Original Message-----
From: ANS Broadcasts [mailto:broadcasts@ans.org]
Sent: Friday, March 11, 2011 7:26 PM
To: Einziger, Robert
Subject: Go to ANSNUCLEARCAFE.ORG for Japan's Nuclear Plant Status

The ANS Nuclear Cafe blog is posting the latest links to information about the status of Japan's Nuclear Power Plants. Go to http://ansnuclearcafe.org/ for a collection of sources covering Japan's earthquake and Tsunami.

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Barto, Andrew

From: Call, Michel
Sent: Monday, March 14, 2011 2:10 PM
To: NMSS_DSFST_CSDAB; Witt, Kevin; Hornseth, Geoffrey; Parkhill, Ron; Borowsky, Joseph; Glenny, Jessica; Wharton, Raynard
Subject: Updates via WNN on Fukushima Daiichi and Daini facilities.

I don't know who all would be interested in this, but thought you all might be.
Mike

From: World Nuclear News [mailto:wnn=world-nuclear-news.org@mcsv64.net] **On Behalf Of** World Nuclear News
Sent: Monday, March 14, 2011 2:00 PM
To: Call, Michel
Subject: WNN Daily: Loss of coolant at Fukushima Daiichi 2

View the WNN Daily in your browser.

wnn DAILY
world nuclear news **Today's top stories**

To ease heavy website congestion, all these stories are available on WNN's Facebook page in the Notes section

14 March 2011

REGULATION & SAFETY: Loss of coolant at Fukushima Daiichi 2
Serious damage to the reactor core of Fukushima Daiichi 2 seems likely after all coolant was lost for a period.

REGULATION & SAFETY: Explosion rocks third Fukushima reactor
Another hydrogen explosion has rocked the Fukushima Daiichi nuclear power plant, this time at the third reactor unit. Analysis shows the containment structure remains intact.

REGULATION & SAFETY: Cold shutdowns at Fukushima Daini
Two more reactors at Fukushima Daini have now achieved cold shutdown with full operation of cooling systems. Engineers are working for the same at the last unit.

REGULATION & SAFETY: Rolling blackouts as Japanese efforts continue
Japanese utilities are introducing rolling blackouts in the face of energy shortages following the natural disasters of the last few days. Meanwhile, the country is relying more than ever on the continued operation of its other nuclear reactors.

13 March 2011

REGULATION & SAFETY: Efforts to manage Fukushima Daiichi 3
Operations to relieve pressure in the containment of Fukushima Daiichi 3 have taken place

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after the failure of a core coolant system. Seawater is being injected to make certain of core cooling. Malfunctions have hampered efforts but there are strong indications of stability.

REGULATION & SAFETY: Contamination check on evacuated residents
Potential contamination of the public is being studied by Japanese authorities as over 170,000 residents are evacuated from within 20 kilometres of Fukushima Daini and Daiichi nuclear power plants. Nine people's results have shown some degree of contamination.

12 March 2011

REGULATION & SAFETY: Battle to stabilise earthquake reactors
Attention remains focused on the Fukushima Daiichi and Daini nuclear power plants as Japan struggles to cope in the aftermath of its worst earthquake in recorded history. A dramatic explosion did not damage containment and sea water injection continues through the night.

From:	Sheron, Brian
To:	Bonaccorso, Amy; Calvo, Antony; Case, Michael; Coe, Doug; Correia, Richard; Dion, Jeanne; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Rini, Brett; Sangimino, Donna-Marie; Uhle, Jennifer; Valentin, Andrea
Subject:	FW: Press Release: NRC Sends Additional Experts to Assist Japan
Date:	Tuesday, March 15, 2011 7:34:57 AM
Attachments:	11-048.docx

From: Harrington, Holly
Sent: Monday, March 14, 2011 8:48 PM
To: OPA Resource; Ash, Darren; Barkley, Richard; Batkin, Joshua; Bell, Hubert; Belmore, Nancy; Bergman, Thomas; Bollwerk, Paul; Bonaccorso, Amy; Borchardt, Bill; Bozin, Sunny; Brenner, Eliot; Brock, Terry; Brown, Boris; Bubar, Patrice; Burnell, Scott; Burns, Stephen; Carpenter, Cynthia; Chandrathil, Prema; Clark, Theresa; Collins, Elmo; Couret, Ivonne; Crawford, Carrie; Cutler, Iris; Dacus, Eugene; Dapas, Marc; Davis, Roger; Dean, Bill; Decker, David; Dricks, Victor; Droggitis, Spiros; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Haney, Catherine; Hannah, Roger; Harbuck, Craig; Hasan, Nasreen; Hayden, Elizabeth; Holahan, Gary; Holahan, Patricia; Holian, Brian; Jacobssen, Patricia; Jaczko, Gregory; Jasinski, Robert; Jenkins, Verlyn; Johnson, Michael; Jones, Andrea; Kock, Andrea; Kotzalas, Margie; Ledford, Joey; Lee, Samson; Leeds, Eric; Lepre, Janet; Lew, David; Lewis, Antoinette; Loyd, Susan; Magwood, William; McCrary, Cheryl; McGrady-Finneran, Patricia; McIntyre, David; Mensah, Tanya; Mitlyng, Viktoria; Monninger, John; Montes, David; Nieh, Ho; Ordaz, Vonna; Ostendorff, William; Owen, Lucy; Powell, Amy; Quesenberry, Jeannette; Reddick, Darani; Regan, Christopher; Reyes, Luis; Riddick, Nicole; RidsSecyMailCenter Resource; Riley (OCA), Timothy; Rohrer, Shirley; Samuel, Olive; Satorius, Mark; Schaaf, Robert; Schmidt, Rebecca; Scott, Catherine; Screnci, Diane; Shaffer, Vered; Shane, Raeann; Sharkey, Jeffry; Sheehan, Neil; Sheron, Brian; Siurano-Perez, Osiris; Steger (Tucci), Christine; Svinicki, Kristine; Tabatabai, Omid; Tannenbaum, Anita; Taylor, Renee; Temp, WDM; Thomas, Ann; Uhle, Jennifer; Uselding, Lara; Vietti-Cook, Annette; Virgilio, Martin; Virgilio, Rosetta; Walker-Smith, Antoinette; Weaver, Doug; Weber, Michael; Weil, Jenny; Werner, Greg; Wiggins, Jim; Williams, Evelyn; Zimmerman, Roy; Zorn, Jason
Subject: RE: Press Release: NRC Sends Additional Experts to Assist Japan

This press release has gone out with slight change. See attached.

From: OPA Resource
Sent: Monday, March 14, 2011 6:59 PM
To: Ash, Darren; Barkley, Richard; Batkin, Joshua; Bell, Hubert; Belmore, Nancy; Bergman, Thomas; Bollwerk, Paul; Bonaccorso, Amy; Borchardt, Bill; Bozin, Sunny; Brenner, Eliot; Brock, Terry; Brown, Boris; Bubar, Patrice; Burnell, Scott; Burns, Stephen; Carpenter, Cynthia; Chandrathil, Prema; Clark, Theresa; Collins, Elmo; Couret, Ivonne; Crawford, Carrie; Cutler, Iris; Dacus, Eugene; Dapas, Marc; Davis, Roger; Dean, Bill; Decker, David; Dricks, Victor; Droggitis, Spiros; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Haney, Catherine; Hannah, Roger; Harbuck, Craig; Harrington, Holly; Hasan, Nasreen; Hayden, Elizabeth; Holahan, Gary; Holahan, Patricia; Holian, Brian; Jacobssen, Patricia; Jaczko, Gregory; Jasinski, Robert; Jenkins, Verlyn; Johnson, Michael; Jones, Andrea; Kock, Andrea; Kotzalas, Margie; Ledford, Joey; Lee, Samson; Leeds, Eric; Lepre, Janet; Lew, David; Lewis, Antoinette; Loyd, Susan; Magwood, William; McCrary, Cheryl; McGrady-Finneran, Patricia; McIntyre, David; Mensah, Tanya; Mitlyng, Viktoria; Monninger, John; Montes, David; Nieh, Ho; Ordaz, Vonna; Ostendorff, William; Owen, Lucy; Powell, Amy; Quesenberry, Jeannette; Reddick, Darani; Regan, Christopher; Reyes, Luis; Riddick, Nicole; RidsSecyMailCenter Resource; Riley (OCA), Timothy; Rohrer, Shirley; Samuel, Olive; Satorius, Mark; Schaaf, Robert; Schmidt, Rebecca; Scott, Catherine; Screnci, Diane; Shaffer, Vered; Shane, Raeann; Sharkey, Jeffry; Sheehan, Neil; Sheron, Brian; Siurano-Perez, Osiris; Steger (Tucci), Christine; Svinicki, Kristine; Tabatabai, Omid; Tannenbaum, Anita; Taylor, Renee; Temp, WDM; Thomas, Ann; Uhle, Jennifer; Uselding, Lara; Vietti-Cook, Annette; Virgilio, Martin; Virgilio, Rosetta; Walker-Smith, Antoinette; Weaver, Doug; Weber, Michael; Weil, Jenny; Werner, Greg; Wiggins, Jim; Williams, Evelyn; Zimmerman, Roy; Zorn, Jason
Subject: Press Release: NRC Sends Additional Experts to Assist Japan

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For immediate release.

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US Nuclear Regulatory Commission
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NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION

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Blog: http://public-blog.nrc-gateway.gov

No. 11-048 March 14, 2011

NRC SENDS ADDITIONAL EXPERTS TO ASSIST JAPAN

Acting as part of a U.S. Agency for International Development assistance team, the NRC has dispatched eight additional experts to Tokyo to provide assistance as requested by the Japanese government.

The first members of the team left the United States Monday evening and were due to arrive in Tokyo Wednesday afternoon. The team includes additional reactor experts, international affairs professional staffers, and a senior manager from one of the NRC's four operating regions.

The team members come from the NRC's headquarters in Rockville, Md., and from offices in King of Prussia, Pa., and Atlanta. The team has been instructed to: conduct all activities needed to understand the status of efforts to safely shut down the Japanese reactors; better understand the potential impact on people and the environment of any radioactivity releases; if asked, provide technical advice and support through the U.S. ambassador for the Japanese government's decision making process; and draw on NRC-headquarters expertise for any other additional technical requirements. The team will be in communication with the Japanese regulator, the U.S. Embassy, NRC headquarters, and other government stakeholders as appropriate.

The team is led by Charles A. Casto, deputy regional administrator of the NRC's Center of Construction Inspection, based in NRC's office in Atlanta. Casto has worked in the commercial nuclear power industry at three different nuclear power plants, including Browns Ferry, which has three boiling water reactors, operated by the Tennessee Valley Authority in Alabama. He has also worked as a licensed reactor operator and operator instructor. Casto will provide a single point of contact for the U.S. Ambassador in Japan on nuclear reactor issues.

The two reactor experts sent Saturday to Japan will participate as members of this assistance team.

###

From: Miranda, Samuel
To: Mendiola, Anthony; Ruland, William
Cc: Lyon, Warren
Subject: Crisis Revives Doubts on Regulation
Date: Tuesday, March 15, 2011 7:26:56 AM

- 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.

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.

From: EDO Update
To: Taylor, Renee
Subject: EDO Update
Date: Tuesday, March 15, 2011 10:15:27 AM

EDO Banner EDO Banner

EDO Update

Tuesday, March 15, 2011

We are all saddened about the tragic events in Japan. Our thoughts and prayers go out to all of those affected by the earthquake and tsunami. The serious nuclear power plant issues have obviously been a special focus of the NRC. Rest assured, we are closely monitoring the situation and providing requested assistance. Senior managers and staff have been manning the Operations Center in rotations 24 hours a day since the earthquake. Over the weekend, we sent two staff members to Japan who are boiling-water reactor experts (the technology used at the Fukushima site). At the Japanese government's request, we have also sent nine additional NRC staff to help the American embassy in Tokyo and to support the Japanese regulators. Not surprisingly, the Congressional hearing scheduled for this Wednesday, which was originally to focus on our Fiscal Year 2012 budget, will now be primarily focused on the events in Japan.

It is not for the NRC to speak for the Japanese or United States governments, so I won't comment on the situation in any greater detail. Additional information can be obtained from the International Atomic Energy Agency and the U.S. Agency for International Development, a part of the State Department that is coordinating the U.S. response and assistance efforts.

It is possible that some of you will be requested by colleagues in another country to provide technical advice and assistance during this emergency. It is essential that all such communications be handled through the NRC Operations Center. If you receive such a request, contact the NRC Operations Officer (301-816-5100 or via the NRC Operator) immediately. All media calls should be forwarded to the Office of Public Affairs (301-415-8200).
If you receive information regarding this or any emergency (foreign or domestic) and you are not certain that the NRC's Incident Response Operations Officer is already aware of that information, you should contact the NRC Operations Officer (301-816-5100 or via the NRC Operator) and provide that information.

Notwithstanding the significance of what is occurring in Japan, we still have our domestic mission to carry out, and with the exception of the small number of people who have been directly called upon to respond to this situation we should all proceed with previously planned activities. We will continue to process licensing actions, conduct inspections, and fulfill our regulatory responsibilities.

In accordance with NRC regulations, every American nuclear power plant is designed with multiple, redundant safety systems to be robust enough to withstand the seismic and natural event risks associated with its specific location. In other words, the NRC analyzes every reactor site for own specific features and potential hazards, and requires the plant to be designed and operated accordingly. But in calculating risks, a certain level of uncertainty is always present. To compensate for these uncertainties, the NRC utilizes the concept of "defense in depth"—an approach to safety where multiple, diverse, and redundant layers of protection are used to prevent accidents and mitigate consequences. While it is inappropriate to speculate on what would happen to an American nuclear power plant under similar circumstances to the Japan event, we do know that U.S. nuclear facilities are among the most robust and well-protected civilian structures in the country.

Let me express my thanks to the NRC staff that have served in or supported the Operations Center since the earthquake hit. I'd also like to thank those who have had to compensate for their colleagues who have been called away from their regular duties.

I will keep you informed of ongoing developments.

Bill Borchardt, EDO

From: OST02 HOC
To: Uhle, Jennifer; Skeen, David; Dudes, Laura; Hiland, Patrick; Monninger, John; Case, Michael; Holahan, Gary; Ruland, William; Brown, Frederick
Cc: Evans, Michele
Subject: Staffing the Ops Center 24/7
Date: Tuesday, March 15, 2011 6:20:21 PM
Importance: High

NSIR

RST Directors:

Per EDO direction we plan to staff the Ops Center 24/7 while we have staff dispatched in Japan. And we are currently planning to identify a second team to send to Japan in about 2 weeks, with the idea that they may stay there for an additional two weeks. That would take us out to April 10 or so.

Staffing in the IRC will remain at the current levels for potentially another week. Possibly we will be able to scale back somewhat at that point. The intent is to develop a schedule through April 10 at this point. The immediate focus is to staff for the first week, starting Saturday March 19.

We'd like to have a little more consistency in the staffing of most positions. So we'd like to staff the RST director in 4 day blocks, three shifts each day, starting March 19.

Fred Brown/Tim McGinty/John Lubinski has offered to take the lead to coordinate among the potential RST Directors to fill the schedule. Please work with him and provide at least the schedule for the first four day block by COB Wednesday March 16.

Michele

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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 8:30:09 AM

NRR

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
Loud noises were heard at Fukushima Daiichi 2 at 6.10am this morning. A major component beneath the reactor is confirmed to be damaged. Evacuation to 20 kilometres is being completed, while a fire on site was put out. Tepco have said containment shows 'no change'.

Loss of coolant at Fukushima Daiichi 2
14 March 2011
Serious damage to the reactor core of Fukushima Daiichi 2 seems likely after all coolant was lost for a period.

Explosion rocks third Fukushima reactor
14 March 2011
Another hydrogen explosion has rocked the Fukushima Daiichi nuclear power plant, this time at the third reactor unit. Analysis shows the containment structure remains intact.

Cold shutdowns at Fukushima Daini
14 March 2011
Two more reactors at Fukushima Daini have now achieved cold shutdown with full operation of cooling systems. Engineers are working for the same at the last unit.

Rolling blackouts as Japanese efforts continue
14 March 2011
Japanese utilities are introducing rolling blackouts in the face of energy shortages following the natural disasters of the last few days. Meanwhile, the country is relying more than ever on the continued operation of its other nuclear reactors.

Efforts to manage Fukushima Daiichi 3
13 March 2011
Operations to relieve pressure in the containment of Fukushima Daiichi 3 have taken place after the failure of a core coolant system. Seawater is being injected to make certain of core cooling. Malfunctions have hampered efforts but there are strong indications of stability.

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Contamination check on evacuated residents
13 March 2011
Potential contamination of the public is being studied by Japanese authorities as over 170,000 residents are evacuated from within 20 kilometres of Fukushima Daini and Daiichi nuclear power plants. Nine people's results have shown some degree of contamination.

Battle to stabilise earthquake reactors
1 March 2011
Attention remains focused on the Fukushima Daiichi and Daini nuclear power plants as Japan struggles to cope in the aftermath of its worst earthquake in recorded history. A dramatic explosion did not damage containment and sea water injection continues through the night.

Massive earthquake hits Japan
1 March 2011
Nuclear reactors shut down during today's massive earthquake in Japan. Official sources have reported no detected radioactive release but are still monitoring the situation, meanwhile work to establish adequate cooling at Fukushima Daiichi continues.

US nuclear regulator OKs Vermont Yankee extension
1 March 2011
The US Nuclear Regulatory Commission has said that it will renew the operating licence for the Vermont Yankee nuclear power plant for a further 20 years, although the regulator does not have the final say in the plant's future operation.

Two US nuclear projects put back 18 months
8 March 2011
The US Nuclear Regulatory Commission has told Dominion and Luminant that their licence applications to build at North Anna and Comanche Peak will be delayed by some 18 months due after changes in the design of Mitsubishi Heavy Industries' Advanced Pressurized Water Reactor.

WASTE & RECYCLING:

Double attack on US nuclear waste fees
10 March 2011
American utilities and regulators have both filed lawsuits against the Department of Energy for continuing to charge for the halted Yucca Mountain project.

CORPORATE:

Areva, Rolls-Royce team up for UK EPRs
11 March 2011
Areva has signed an industrial cooperation agreement with the UK's Rolls-Royce for the manufacture of components for nuclear energy related projects both in the UK and overseas.

Endesa to access AP1000 technology
9 March 2011
Westinghouse has signed an agreement with Spanish utility Endesa to share information on its AP1000 reactor technology. The move makes Endesa a likely partner for nuclear new build projects in Spain and South America.

Import agreement: Baltic to Lithuania
8 March 2011
A deal has been struck that will see major power exports from the Baltic nuclear power plant to Lithuania. Russian-controlled utilities will transmit 1000 MWe across the border shortly after the start of operation.

EXPLORATION & NUCLEAR FUEL:

China Guangdong makes Kalahari offer

8 March 2011
A deal in the offing could give China Guangdong Nuclear Power Corporation's uranium subsidiary a major stake in the Husab uranium project in Namibia.

INDUSTRY TALK:

Shin Kori 1 enters commercial operation
10 March 2011
Shin Kori unit 1 entered commercial operation on 28 February, according to the Korea Institute of Nuclear Safety (KINS). The indigenously designed OPR-1000 is South Korea's seventh such unit and 21st nuclear power reactor overall.

ESBWR approaches design certification
10 March 2011
The US Nuclear Regulatory Commission has found GE-Hitachi's Economic Simplified Boiling Water Reactor (ESBWR) to be safe and technically acceptable. After five years of consideration the NRC has issued a final safety evaluation report and final design approval for the reactor. Full design certification should follow later this year.

Reactors continue through earthquake
9 March 2011
Nuclear power plants were barely affected by the Sanriku offshore earthquake that rocked Japan at 11.45am this morning. The earthquake measured 7.3 on the Richter scale and originated 160 kilometres offshore some 8 kilometres underground. Nuclear power plants on the Pacific coast that felt the quake include Onagawa, Higashidori and Fukushima Daini and Fukushima Daiichi.

From: Ramsey, Jack
To: Ruland, William; Collins, Timothy; Dudes, Laura
Subject: FW: Update to Information Sheet Regarding the Tohoku Earthquake as of 11:00AM (EST), March 15, 2011
Date: Tuesday, March 15, 2011 1:06:03 PM
Attachments: Update to Information Sheet 11.03.15.doc
Fukushima daiichi unit1-3 parameter.xls
Importance: High

FYI, just in case you haven't seen. The Excel spreadsheet contains reported core parameters for Fukushima Daiichi Units 1 to 3 over the past few days. This has been shared with the RST.

From: SHIMASAKI SEIICHI [mailto:seiichi.shimasaki@mofa.go.jp]
Sent: Tuesday, March 15, 2011 11:25 AM
Subject: FW: Update to Information Sheet Regarding the Tohoku Earthquake as of 11:00AM (EST), March 15, 2011

Dear Friends,

Forward the updated information made by FEPC.

Best,
Shima

From: Tai Inada [mailto:Inada@denjiren.com]
Sent: Tuesday, March 15, 2011 11:20 AM
To: Tai Inada
Subject: Update to Information Sheet Regarding the Tohoku Earthquake as of 11:00AM (EST), March 15, 2011

Dear Friends,
Below and attached is the updated information regarding nuclear facilities for your information.

Best Regards,

Tai

Update to Information Sheet Regarding the Tohoku Earthquake

The Federation of Electric Power Companies of Japan (FEPC) Washington DC Office

As of 11:00AM (EST), March 15, 2011

- Radiation Levels
  - At 10:22AM (JST) on March 15, a radiation level of 400 milli sievert per hour was recorded outside secondary containment building of the Unit 3 reactor at Fukushima Daiichi Nuclear Power Station.
  - At 3:30PM on March 15, a radiation level of 596 micro sievert per hour was recorded at the main gate of Fukushima Daiichi Nuclear Power Station.
  - At 4:30PM on March 15, a radiation level of 489 micro sievert per hour was recorded on the site of the Fukushima Daiichi Nuclear Power Station.
  - For comparison, a human receives 2400 micro sievert per year from natural radiation in the form of sunlight, radon, and other sources. One chest CT scan

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generates 6900 micro sievert per scan.

- Fukushima Daiichi Unit 1 reactor
    - As of 10:00PM on March 14, the pressure inside the reactor core was measured at 0.05 MPa. The water level inside the reactor was measured at 1.7 meters below the top of the fuel rods.
- Fukushima Daiichi Unit 2 reactor
    - At 6:14AM on March 15, an explosion was heard in the secondary containment building. TEPCO assumes that the suppression chamber, which holds water and stream released from the reactor core, was damaged.
    - At 1:00PM on March 15, the pressure inside the reactor core was measured at 0.608 MPa. The water level inside the reactor was measured at 1.7 meters below the top of the fuel rods.
- Fukushima Daiichi Unit 3 reactor
    - At 6:14AM on March 15, smoke was discovered emanating from the damaged secondary containment building.
- Fukushima Daiichi Unit 4 reactor
    - At 9:38AM on March 15, a fire was discovered on the third floor of the secondary containment building.
    - At 12:29PM on March 15, TEPCO confirmed extinguishing of the fire.
- Fukushima Daini Unit 1 reactor
    - At 7:00PM on March 14, TEPCO confirmed cold shutdown.
    - As of 12:00AM on March 16, TEPCO continues to cool the reactor core.
- Fukushima Daini Unit 2 reactor
    - At 7:00PM on March 14, TEPCO confirmed cold shutdown.
    - As of 12:00AM on March 16, TEPCO continues to cool the reactor core.
- Fukushima Daini Unit 3 reactor
    - At 12:15PM on March 14, cold shutdown.
    - As of 12:00AM on March 16, TEPCO continues to cool the reactor core.
- Fukushima Daini Unit 4 reactor
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  - As of 12:00AM on March 16, TEPCO continues to cool the reactor core.

		Water Level [mm]			Ractor Pressure [Mpa]			Drywell Pre
		1F1	1F2	1F3	1F1	1F2	1F3	1F1
3/12	1004	-500						
	1113				0.74			
	1120	-900						
	1205	-1500						
	1528	-1700						
	1830	ds						
	1430				0.67			
	1528				0.54			
3/13	800	-1700	3650	-3000	0.353	6.1	7.27	-
	820	-1700	3650	-325	0.356	6.1	7.24	-
	910	-1700	3700	1800	0.358	6.08	7.24	-
	925	-1700	3700	1000	0.353	6.08	0.35	-
	955	-1700	3700	600	0.353	1.283	0.24	-
	1035	-1750	3700	-700	0.362	1.283	-	-
	1055	-1700	3700	-1200	0.358	ds	0.1	-
	1125	-1700	3700	0	0.364	ds	0.11	-
	1155	-1700	3750	1000	0.3645	ds	0.12	-
	1240	-1700	3750	-1400	0.3645	ds	0.45	-
	1300	-1700	3760	-2000	0.3668	ds	0.19	-
	1410	-1700	3750	-2200	0.3713	ds	0.08	-
	1500	-1700	3750	-2000	0.3735	ds	0.09	600
	1600	-1700	3750	-2000	0.378	5.85	0.18	605
	1615	-1700	-	-2000	0.378	5.85	0.19	606
	1645	-1700	3780	-1900	0.3713	5.85	0.24	605
	1700	-1700	3750	-2100	0.3623	5.85	0.24	605
	1730	-1700	3750	-2200	0.3578	5.78	0.24	600
	1845	-1700	3800	-2200	0.3533	-	0.25	590
	1930	-1700	3800	-2200	0.3422	-	0.25	580
	1955	-1700	3800	-2200	-	-	0.25	575
	2045	-1750	3800	-2200	-	-	-	560
	2050	-1750	3800	-2200	-	-	-	-
	2100	-1750	-	-2200	-	-	-	-
	2105	-1750	-	-2200	-	-	-	-
	2110	-1750	-	-2200	-	-	-	-
	2115	-1750	-	-2200	-	-	-	-
	2140	-1750	-	-2200	0.342	-	-	550
	2205	-1750	3800	-2250	0.342	-	-	540
	2220	-1750	3900	-2250	0.333	-	-	540
	2300	-1750	3900	-2250	0.333	-	0.089	540
	2330	-1750	3900	-2250	0.324	-	0.068	530
3/14	030	-1750	3900	-2250	0.324	-	0.051	530
	200	-1700	3900	-2300	0.315	-	0.077	510
	300	-1700	3900	-2800	0.306	5.45	0.134	505
	400	-1700	3900	ds	0.304	5.42	0.169	495
	500	-1700	3900	ds	0.299	5.4	0.181	490
	600	-1700	3900	-3000	0.293	5.4	0.181	485
	700	-1750	3900	-1000	0.288	5.355	0.338	475
	800	-1750	3950	-1500	0.284	5.31	0.32	460
	900	-1750	3900	-1600	0.275	5.31	0.38	450
	1115	-1800	3800	-1800	0.275	5.648	0.215	440

	1125	-1800	3800	-1800	0.275	5.648	0.191	440
	1130	-1800	3800	-2200	0.275	5.648	0.19	440
	1200	-1800	3400	-2200	0.275	6.008	0.191	460
	1300	-1800	2950	-2200	0.275	6.188	0.251	ds
	1400	-1800	2000	-2200	0.275	7.583	0.281	ds
	1500	-1800	1200	-2200	0.268	7.268	0.298	-
	1600	-1750	300	-2200	0.27	7.448	0.306	-
	1700	-1750	-800	-2200	0.27	7.403	0.261	-
	1900	-1750	ds	-2300	0.27	6.63	0.183	-
	2003	-1750	-	-2300	0.245	0.54	0.183	-
	2104	-1750	-	-2300	0.243	1.418	0.183	-
	2240	-1700	-160	-2300	0.24	0.405	0.189	-
	2300	-1700	-700	-2300	0.24	0.428	0.196	-
3/15	000	-1700	ds	-2300	0.24	0.653	0.21	-
	100	-1700	ds	-2300	0.24	1.823	0.223	-
	200	-1700	ds	-2300	0.24	0.63	0.234	-
	300	-1700	ds	-2300	0.223	0.653	0.242	-
	400	-1750	ds	-2300	0.216	0.653	0.249	-
	500	-1750	ds	-2300	0.216	0.626	0.244	-
	628	-1750	-270	-2300	0.216	0.612	0.244	-
	1142	-1700	-1400	-2300	0.185	0.315	0.249	-
	1300	-1700	-1700	-2300	0.185	0.608	0.251	-
	1530	-1800	-1950	-2300	0.166	0.113	0.251	-
	1610	-	-1800	-2300	-	0.113	0.24	-

ssure [kPa]		S/C Pressure [kPa]		
1F2	1F3	1F1	1F2	1F3
360	466			
350	465			
360	637			
360	530			
260	400			
10	280			
-	270			
-	280			
-	-			
-	480			
595	300			
600	235			
395	260			
400	350			
400	360			
400	410			
400	410			
410	415			
410	420			
420	425			
420	425			
420	410			
-	405			
-	400			
-	395			
-	380			
-	380			
425	375	550	-	320
425	320	540	-	300
430	300	540	-	295
430	295	530	-	275
435	275	530	-	260
436	260	530	-	255
440	265	505	-	275
-	275	500	-	305
-	315	490	-	325
467	340	485	467	345
467	365	480	467	400
455	425	470	455	500
474	520	455	474	480
460	500	445	478	475
460	490	435	481	390

460	380	435	481	380
460	360	435	481	360
460	360	485	485	380
465	360	-	486	430
460	430	-	-	450
440	460	-	-	470
420	480	-	-	475
-	480	-	-	440
400	440	-	-	ds
400	380	-	-	ds
419	380	-	-	ds
480	360	-	-	ds
482	380	-	-	ds
745	370	-	350	ds
720	380	-	300	ds
725	400	-	330	ds
750	400	-	330	ds
750	410	-	330	ds
750	415	-	330	ds
730	415	-	300	ds
155	420	-	0	ds
415	420	-	-	ds
275	420	-	-	-
270	415	-	-	ds

From:	Aggarwal, Satish
To:	Case, Michael
Cc:	Koshy, Thomas
Subject:	Japan Nuclear Emergency
Date:	Tuesday, March 15, 2011 10:26:27 AM
Attachments:	Fukishima Event - FPLSummary.ppt ANS Japan Backgrounder[1].pdf America Needs More Nuclear Power The Philly Post.mht

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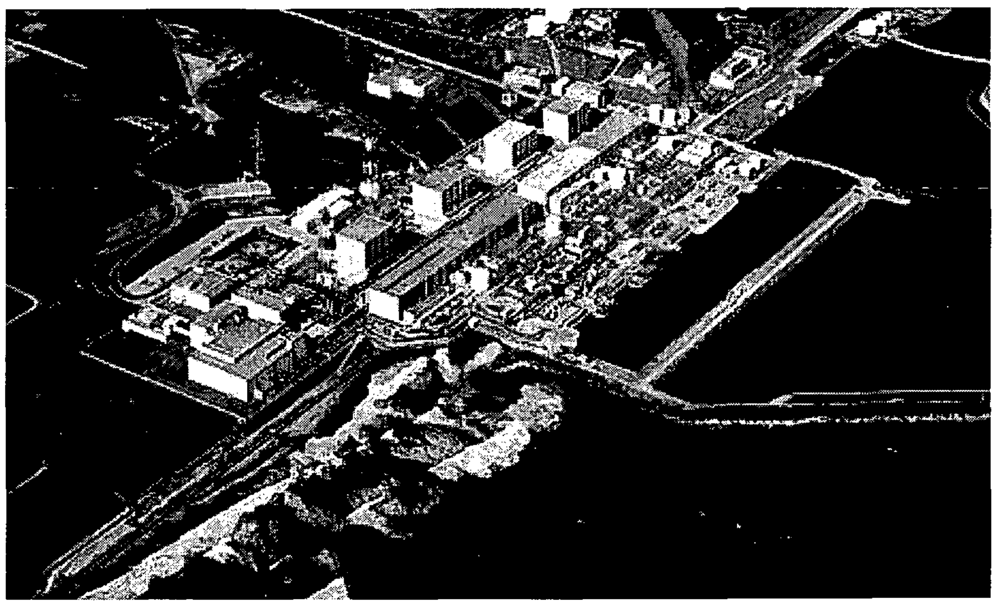
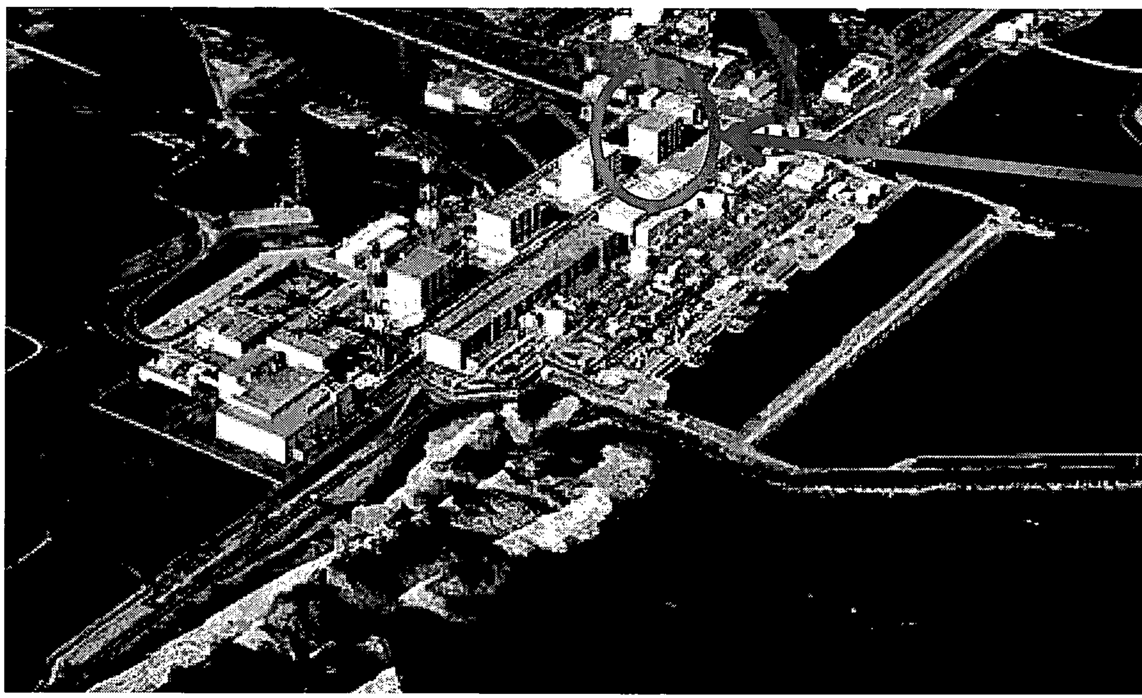
DUANE ARNOLD

Fukushima Daiichi Nuclear Plant Event Summary and FPL/DAEC Actions



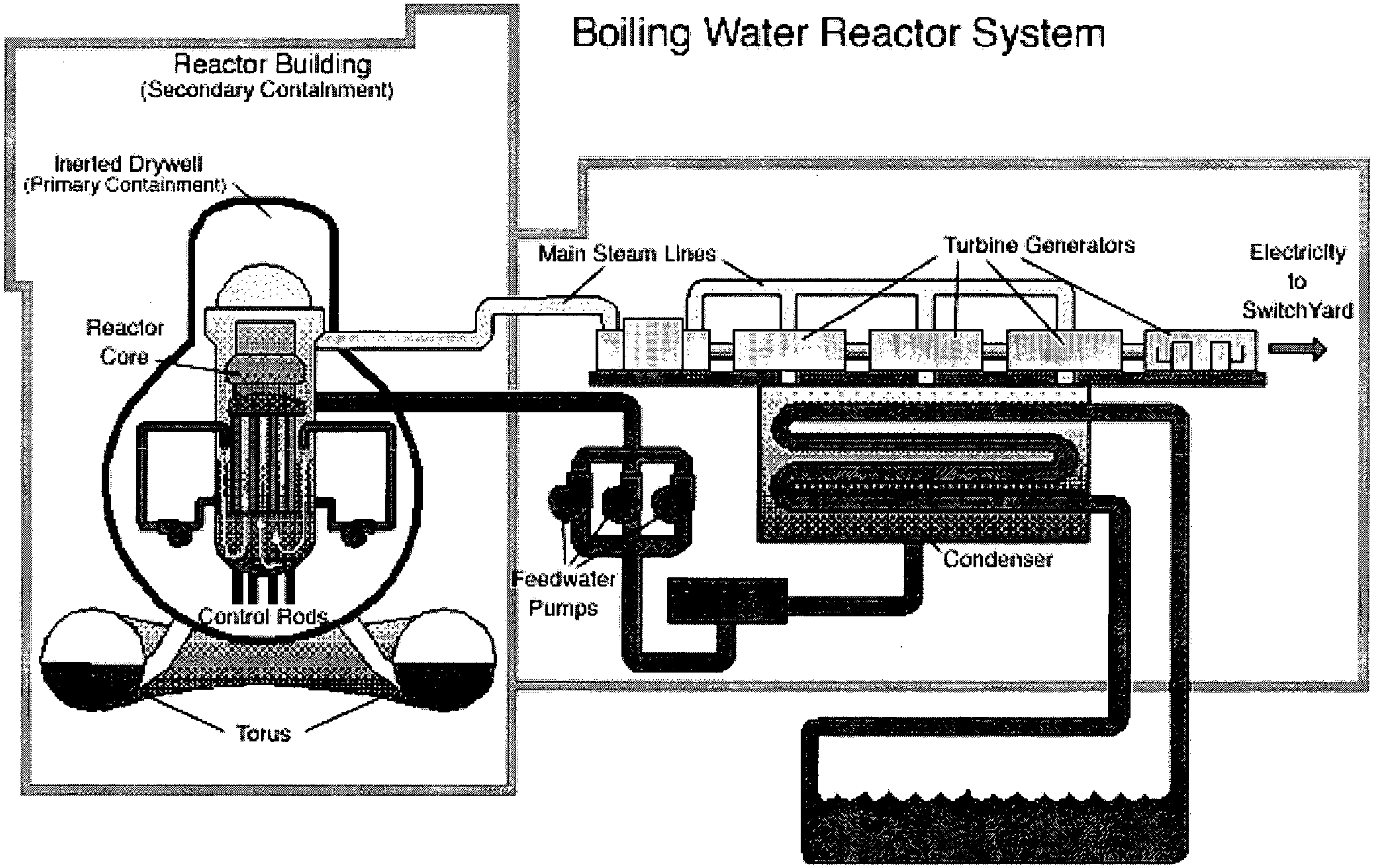
Fukushima Daiichi Nuclear Station

- Six BWR units at the Fukushima Nuclear Station:
  - Unit 1: 439 MWe BWR, 1971 (unit was in operation prior to event)
  - Unit 2: 760 MWe BWR, 1974 (unit was in operation prior to event)
  - Unit 3: 760 MWe BWR, 1976 (unit was in operation prior to event)
  - Unit 4: 760 MWe BWR, 1978 (unit was in outage prior to event)
  - Unit 5: 760 MWe BWR, 1978 (unit was in outage prior to event)
  - Unit 6: 1067 MWe BWR, 1979 (unit was in outage prior to event)



Fukushima Daiichi Unit 1

- Typical BWR 3 and 4 Reactor Design
- Some similarities to Duane Arnold Energy Center



Fukushima Daiichi Unit 1

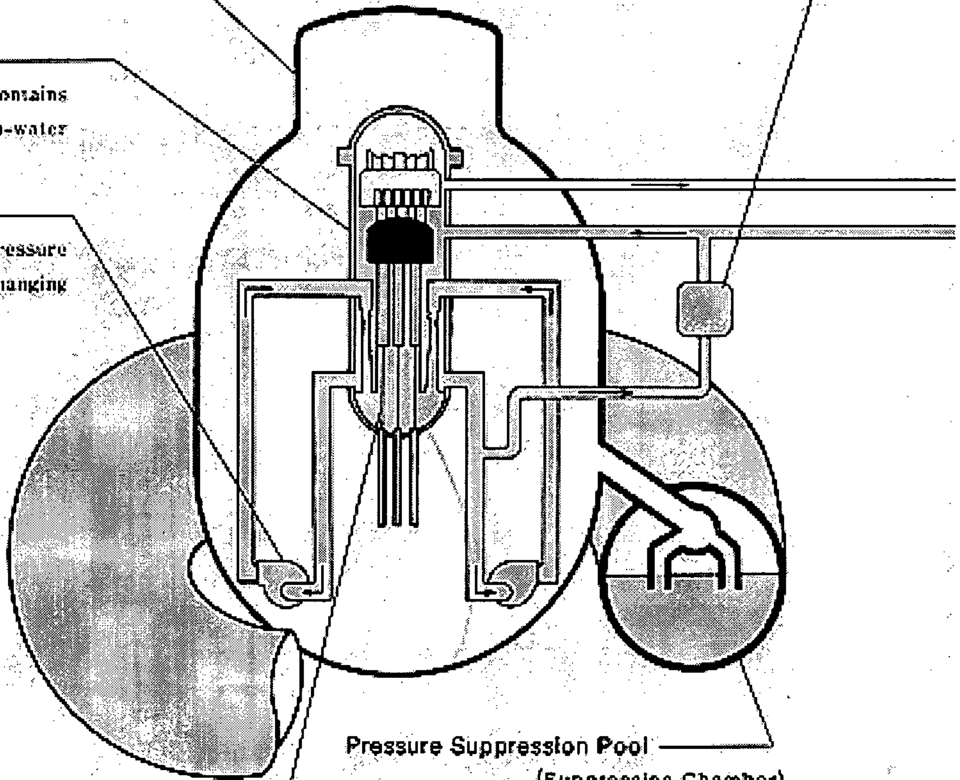
■Mechanism of Boiling Water Reactor Power Station

Primary Containment Vessel (Dry Well)
It would confine radioactive substances discharged from the reactor facilities if some pipes were broken by accident.

Reactor Pressure Vessel
It is made of 12cm thick steel and contains fuel, control rods, jet pumps, steam-water separator and steam dryer.

Primary Recirculation pump
It circulates water in the reactor pressure vessel and changes reactor power by changing water quantity.

Cleanup Water System
It maintains the purity of the water circulating through the reactor.



Pressure Suppression Pool (Suppression Chamber)
It always contains water. Should pipes in the primary containment vessel ever break, leaked steam would be conducted into the pool, where it would be cooled down and condensed with a large amount of water to suppress any rise in pressure in the primary containment vessel.

Control Rods
They are used to start and stop the reactor and to change reactor power (amount of nuclear fission) by individually inserting and extracting from the bottom of the reactor.

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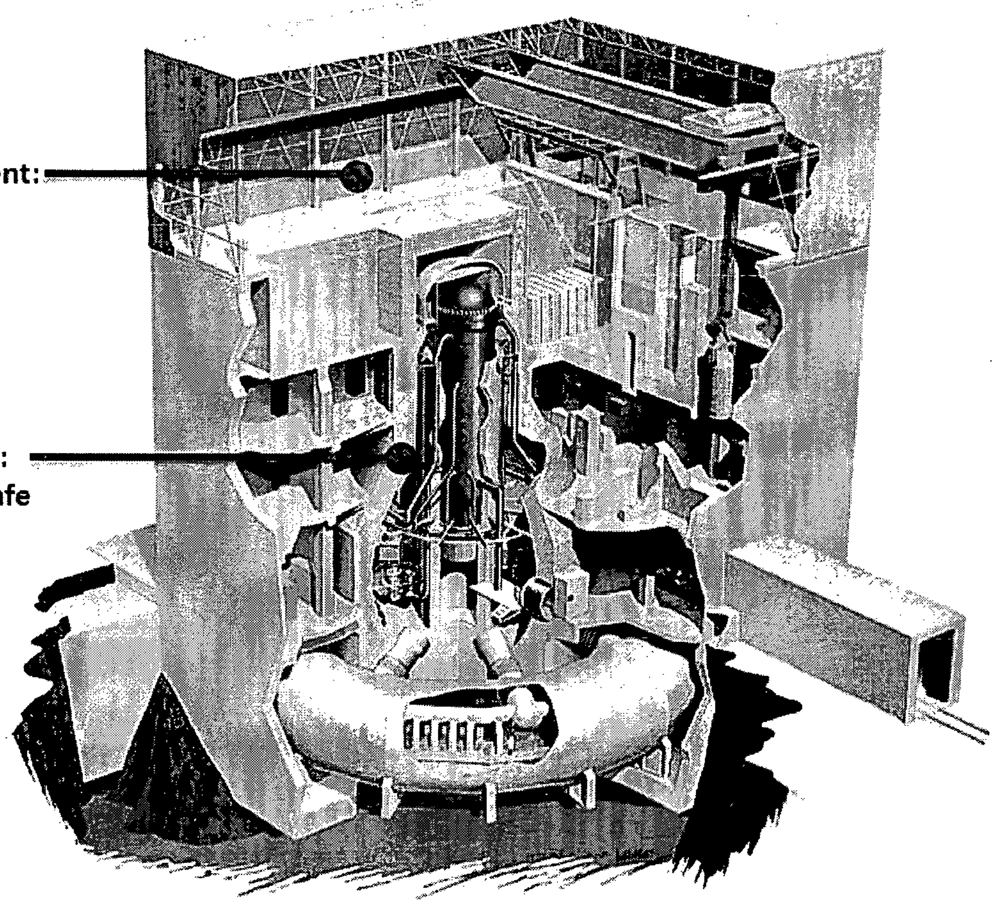
Fukushima Daiichi Unit 1

Secondary containment: Area of explosion at Fukushima Daiichi 1

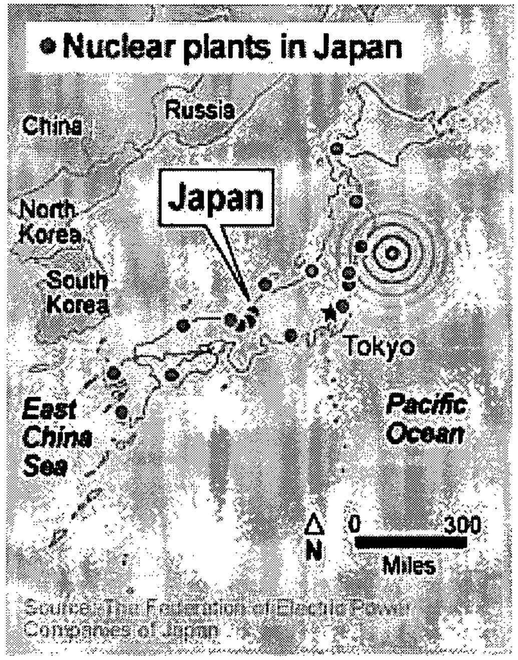
Primary containment: Remains intact and safe



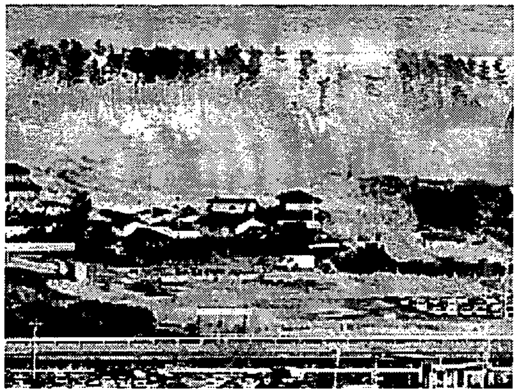
Boiling Water Reactor Design

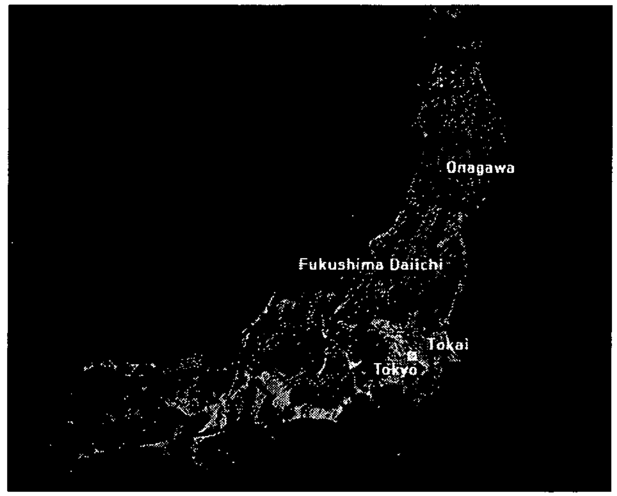
Event Initiation

- The Fukushima nuclear facilities were damaged in a magnitude 8.9 earthquake on March 11 (Japan time), centered offshore of the Sendai region, which contains the capital Tokyo.
  - Plant designed for magnitude 8.2 earthquake. An 8.9 magnitude quake is 7 times in greater in magnitude.
- Serious secondary effects followed including a significant tsunami, significant aftershocks and a major fire at a fossil fuel installation.



By Janet Loehrke, USA TODAY





NEXTera ENERGY DUANE ARNOLD

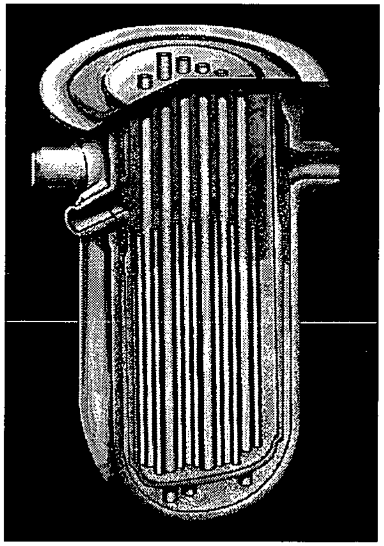
Initial Response

- Nuclear reactors were shutdown automatically. Within seconds the control rods were inserted into core and nuclear chain reaction stopped.
- Cooling systems were placed in operation to remove the residual heat. The residual heat load is about 3% of the heat load under normal operating conditions.
- Earthquake resulted in the loss of offsite power which is the normal supply to plant.
- Emergency Diesel Generators started and powered station emergency cooling systems.
- One hour later, the station was struck by the tsunami. The tsunami was larger than what the plant was designed for. The tsunami took out all multiple sets of the backup Emergency Diesel generators.
- Reactor operators were able to utilize emergency battery power to provide power for cooling the core for 8 hours.
- Operators followed abnormal operating procedures and emergency operating procedures.

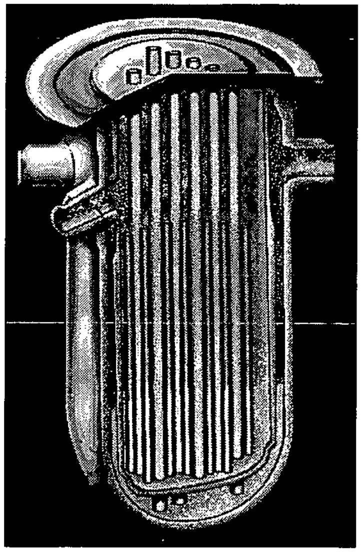
Loss of Makeup

- Offsite power could not be restored and delays occurred obtaining and connecting portable generators.
- After the batteries ran out, residual heat could not be carried away any more.
- Reactor temperatures increased and water levels in the reactor decreased, eventually uncovering and overheating the core.
- Hydrogen was produced from metal-water reactions in the reactor.
- Operators vented the reactor to relieve steam pressure - energy (and hydrogen) was released into the primary containment (drywell) causing primary containment temperatures and pressures to increase.
- Operators took actions to vent the primary containment to control containment pressure and hydrogen levels. Required to protect the primary containment from failure.
- Primary Containment Venting is through a filtered path that travels through duct work in the secondary containment to an elevated release point on the refuel floor (on top of the reactor building).
- A hydrogen detonation subsequently occurred while venting the secondary containment. Occurred shortly after and aftershock at the station. Spark likely ignited hydrogen.

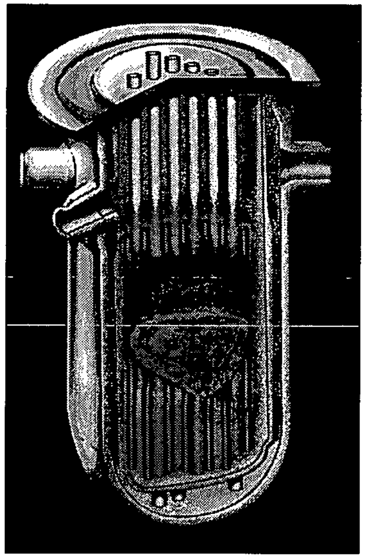
Core Damage Sequence



Core Uncovered

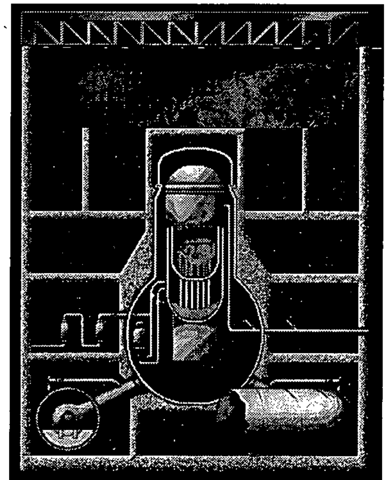


Fuel Overheating



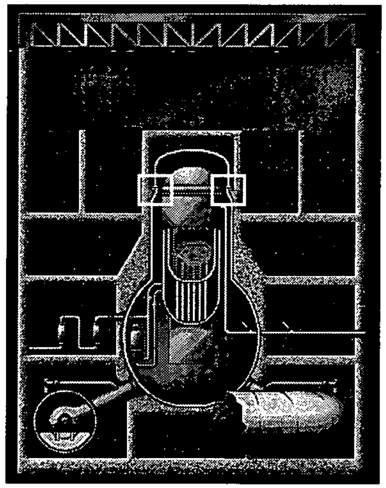
Fuel melting - Core Damaged

Core Damaged but retained in vessel

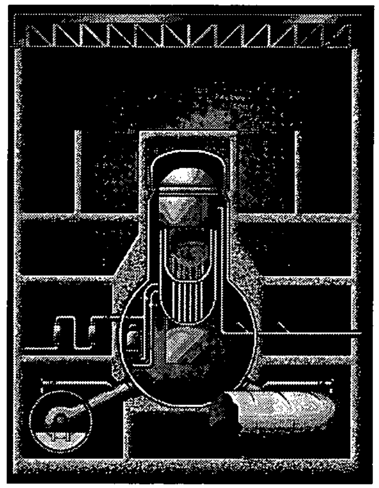


Core Melt-through

Some portions of core melt into lower RPV head

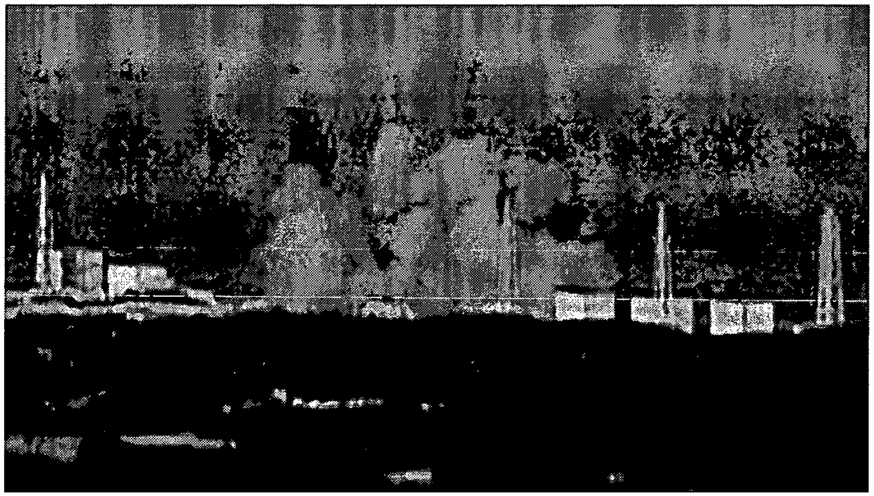


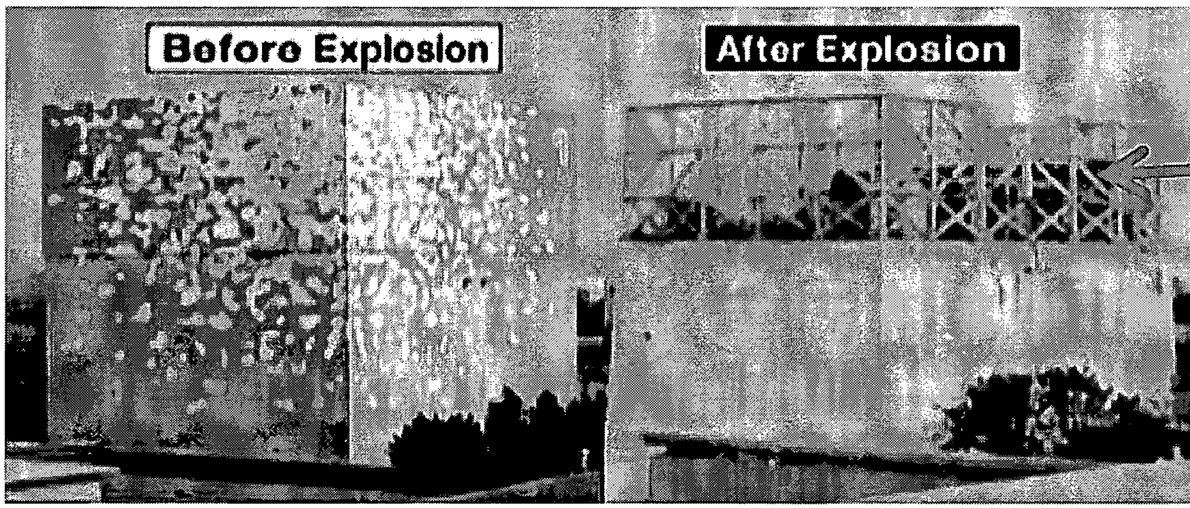
Containment pressurizes. Leakage possible at drywell head



Releases of hydrogen into secondary containment

Hydrogen Detonation at Unit 1





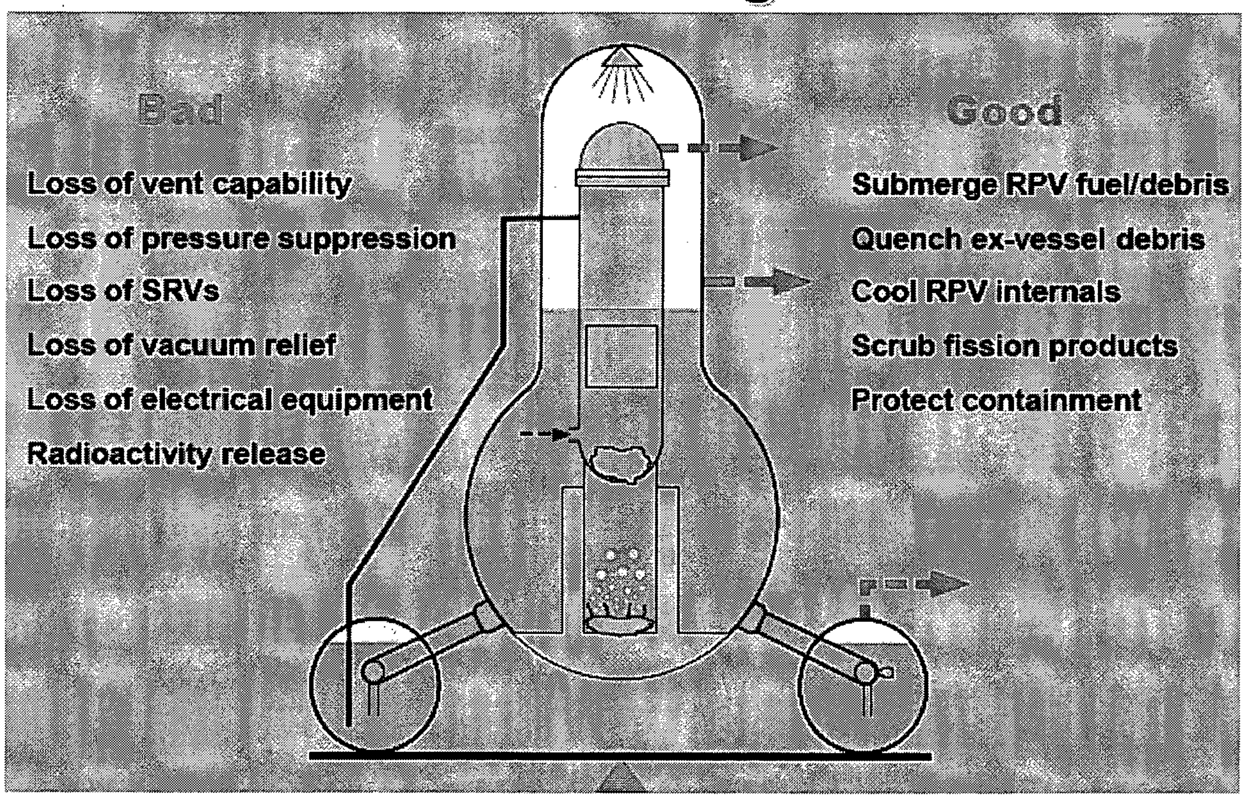
Refuel Floor

Reactor Building

Mitigating Actions

- The station was able to deploy portable generators and utilize a portable pump to inject sea water into the reactor and primary containment.
- Station was successful in flooding the primary containment to cool the reactor vessel and debris that may have been released into the primary containment.
- Boric acid was added to the seawater used for injection. Boric acid is "liquid control rod". The boron captures neutrons and speeds up the cooling down of the core. Boron also reduces the release of iodine by buffering the containment water pH.

Containment Flooding Effects



Emergency Response

- Equivalent of General Emergency declared to the event at Unit 1.
- Evacuation of public performed within 20 km (13 miles) of plant; approximately 200,000 people evacuated.
- Similar hydrogen detonation subsequently occurred at Unit 3 on Sunday, March 14th (Japan time). Primary containment remained intact at Unit's 1 and 3 throughout the accident. There was considerable damage to the secondary containment (reactor building).
- Highest recorded radiation level at the Fukushima Daiichi site was 155.7 millirem. Radiation levels were subsequently reduced to 4.4 millirem after the after the containment was flooded. The NRC's radiation dose limit for the public is 100 millirem per year.
- Several fatalities occurred at the station along with numerous injured workers.
- Authorities distributed Potassium-iodide tablets to protect the public from potential health effects of radioactive isotopes of iodine that could potentially be released. This is quickly taken up by the body and its presence prevents the take-up of iodine-131 should people be exposed to it.
- Over 300 after shocks have occurred and continue to challenge station response.

FPL/DAEC Response

- The Juno Beach Command Center has been staffed.
- The CNO is in direct contact with INPO, NEI, and the NRC.
- Extensive evaluations are underway to validate design capabilities and vulnerabilities of all FPL units for events such as earthquakes, flooding, and extended Station Blackouts.
- Operators and Emergency Response personnel maintain a high level of readiness to respond to events including severe accidents.
- Procedures are in place to respond to events including abnormal operating procedures, emergency operating procedures, and severe accident management guidelines.
- After 9/11, stations implemented Emergency Management Guidelines designed to optimize response to large scale events such as those experienced at Fukushima.

FPL/DAEC Response

- As part of the 9/11 response, stations took the following additional actions:
  - Procured portable diesel-driven pumps and developed procedures to use the portable pumps to inject water from external sources into the reactor, primary containment, spent fuel pool, hotwell, and condensate storage tanks.
  - Made modifications to the plant to provide connections for using the portable diesel-driven pump.
  - Developed procedures and staged equipment needed to manually open reactor relief valves and containment vent valves under loss of power conditions
- FPL will continue to work with INPO, NEI and the NRC to access lessons learned and additional actions that can be taken to further enhance our readiness for severe accidents.

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.

Attachment America Needs More Nuclear Power The Philly P.mht (891814 Bytes) cannot be converted to PDF format.

From:	Sheron, Brian
To:	Bonaccorso, Amy; Calvo, Antony; Case, Michael; Coe, Doug; Correia, Richard; Dion, Jeanne; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Rini, Brett; Sangimino, Donna-Marie; Uhle, Jennifer; Valentin, Andrea
Subject:	FW: Press Release: NRC Sends Additional Experts to Assist Japan
Date:	Tuesday, March 15, 2011 7:29:16 AM
Attachments:	11-048.docx

From: OPA Resource
Sent: Monday, March 14, 2011 6:59 PM
To: Ash, Darren; Barkley, Richard; Batkin, Joshua; Bell, Hubert; Belmore, Nancy; Bergman, Thomas; Bollwerk, Paul; Bonaccorso, Amy; Borchardt, Bill; Bozin, Sunny; Brenner, Eliot; Brock, Terry; Brown, Boris; Bubar, Patrice; Burnell, Scott; Burns, Stephen; Carpenter, Cynthia; Chandrathil, Prema; Clark, Theresa; Collins, Elmo; Couret, Ivonne; Crawford, Carrie; Cutler, Iris; Dacus, Eugene; Dapas, Marc; Davis, Roger; Dean, Bill; Decker, David; Dricks, Victor; Droggitis, Spiros; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Haney, Catherine; Hannah, Roger; Harbuck, Craig; Harrington, Holly; Hasan, Nasreen; Hayden, Elizabeth; Holahan, Gary; Holahan, Patricia; Holian, Brian; Jacobssen, Patricia; Jaczko, Gregory; Jasinski, Robert; Jenkins, Verlyn; Johnson, Michael; Jones, Andrea; Kock, Andrea; Kotzalas, Margie; Ledford, Joey; Lee, Samson; Leeds, Eric; Lepre, Janet; Lew, David; Lewis, Antoinette; Loyd, Susan; Magwood, William; McCrary, Cheryl; McGrady-Finneran, Patricia; McIntyre, David; Mensah, Tanya; Mitlyng, Viktoria; Monninger, John; Montes, David; Nieh, Ho; Ordaz, Vonna; Ostendorff, William; Owen, Lucy; Powell, Amy; Quesenberry, Jeannette; Reddick, Darani; Regan, Christopher; Reyes, Luis; Riddick, Nicole; RidsSecyMailCenter Resource; Riley (OCA), Timothy; Rohrer, Shirley; Samuel, Olive; Satorius, Mark; Schaaf, Robert; Schmidt, Rebecca; Scott, Catherine; Screnci, Diane; Shaffer, Vered; Shane, Raeann; Sharkey, Jeffry; Sheehan, Neil; Sheron, Brian; Siurano-Perez, Osiris; Steger (Tucci), Christine; Svinicki, Kristine; Tabatabai, Omid; Tannenbaum, Anita; Taylor, Renee; Temp, WDM; Thomas, Ann; Uhle, Jennifer; Uselding, Lara; Vietti-Cook, Annette; Virgilio, Martin; Virgilio, Rosetta; Walker-Smith, Antoinette; Weaver, Doug; Weber, Michael; Weil, Jenny; Werner, Greg; Wiggins, Jim; Williams, Evelyn; Zimmerman, Roy; Zorn, Jason
Subject: Press Release: NRC Sends Additional Experts to Assist Japan

For immediate release.

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NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION
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E-mail: opa.resource@nrc.gov Site: www.nrc.gov
Blog: http://public-blog.nrc-gateway.gov

No. 11-048 March 14, 2011

NRC SENDS ADDITIONAL EXPERTS TO ASSIST JAPAN

Acting as part of a U.S. Agency for International Development assistance team, the NRC has dispatched nine additional experts to Tokyo to provide assistance as requested by the Japanese government.

The first members of the team left the United States Monday evening and were due to arrive in Tokyo Wednesday afternoon. The team includes additional reactor experts, international affairs professional staffers, and a senior manager from one of the NRC's four operating regions.

The team members come from the NRC's headquarters in Rockville, Md., and from offices in King of Prussia, Pa., and Atlanta. The team has been instructed to: conduct all activities needed to understand the status of efforts to safely shut down the Japanese reactors; better understand the potential impact on people and the environment of any radioactivity releases; if asked, provide technical advice and support through the U.S. ambassador for the Japanese government's decision making process; and draw on NRC-headquarters expertise for any other additional technical requirements. The team will be in communication with the Japanese regulator, the U.S. Embassy, NRC headquarters, and other government stakeholders as appropriate.

The team is led by Charles A. Casto, deputy regional administrator of the NRC's Center of Construction Inspection, based in NRC's office in Atlanta. Casto has worked in the commercial nuclear power industry at three different nuclear power plants, including Browns Ferry, which has three boiling water reactors, operated by the Tennessee Valley Authority in Alabama. He has also worked as a licensed reactor operator and operator instructor. Casto will provide a single point of contact for the U.S. Ambassador in Japan on nuclear reactor issues.

The two reactor experts sent Saturday to Japan will participate as members of this assistance team.

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To: Bonaccorso, Amy; Calvo, Antony; Case, Michael; Coe, Doug; Correia, Richard; Dion, Jeanne; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Rini, Brett; Sangimino, Donna-Marie; Uhle, Jennifer; Valentin, Andrea
Subject: FW: Press Release: NRC Analysis Continues to Support Japan"s Protective Actions
Date: Tuesday, March 15, 2011 2:14:09 PM
Attachments: 11-049.docx

From: OPA Resource
Sent: Tuesday, March 15, 2011 1:30 PM
To: Ash, Darren; Barkley, Richard; Batkin, Joshua; Bell, Hubert; Belmore, Nancy; Bergman, Thomas; Bollwerk, Paul; Bonaccorso, Amy; Borchardt, Bill; Bozin, Sunny; Brenner, Eliot; Brock, Terry; Brown, Boris; Bubar, Patrice; Burnell, Scott; Burns, Stephen; Carpenter, Cynthia; Chandrathil, Prema; Clark, Theresa; Collins, Elmo; Couret, Ivonne; Crawford, Carrie; Cutler, Iris; Dacus, Eugene; Dapas, Marc; Davis, Roger; Dean, Bill; Decker, David; Dricks, Victor; Droggitis, Spiros; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Haney, Catherine; Hannah, Roger; Harbuck, Craig; Harrington, Holly; Hasan, Nasreen; Hayden, Elizabeth; Holahan, Gary; Holahan, Patricia; Holian, Brian; Jacobssen, Patricia; Jaczko, Gregory; Jasinski, Robert; Jenkins, Verlyn; Johnson, Michael; Jones, Andrea; Kock, Andrea; Kotzalas, Margie; Ledford, Joey; Lee, Samson; Leeds, Eric; Lepre, Janet; Lew, David; Lewis, Antoinette; Loyd, Susan; Magwood, William; McCrary, Cheryl; McGrady-Finneran, Patricia; McIntyre, David; Mensah, Tanya; Mitlyng, Viktoria; Monninger, John; Montes, David; Nieh, Ho; Ordaz, Vonna; Ostendorff, William; Owen, Lucy; Powell, Amy; Quesenberry, Jeannette; Reddick, Darani; Regan, Christopher; Reyes, Luis; Riddick, Nicole; RidsSecyMailCenter Resource; Riley (OCA), Timothy; Rohrer, Shirley; Samuel, Olive; Satorius, Mark; Schaaf, Robert; Schmidt, Rebecca; Scott, Catherine; Screnci, Diane; Shaffer, Vered; Shane, Raeann; Sharkey, Jeffry; Sheehan, Neil; Sheron, Brian; Siurano-Perez, Osiris; Steger (Tucci), Christine; Svinicki, Kristine; Tabatabai, Omid; Tannenbaum, Anita; Taylor, Renee; Temp, WDM; Thomas, Ann; Uhle, Jennifer; Uselding, Lara; Vietti-Cook, Annette; Virgilio, Martin; Virgilio, Rosetta; Walker-Smith, Antoinette; Weaver, Doug; Weber, Michael; Weil, Jenny; Werner, Greg; Wiggins, Jim; Williams, Evelyn; Zimmerman, Roy; Zorn, Jason
Subject: Press Release: NRC Analysis Continues to Support Japan's Protective Actions

Attaching the press release would be helpful!

To be issued and posted to the live web in **15 minutes.**

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Blog: http://public-blog.nrc-gateway.gov

No. 11-049 March 15, 2011

NRC ANALYSIS CONTINUES TO SUPPORT JAPAN'S PROTECTIVE ACTIONS

NRC analysts overnight continued their review of radiation data related to the damaged Japanese nuclear reactors. The analysts continue to conclude the steps recommend by Japanese authorities parallel those the United States would suggest in a similar situation.

The Japanese authorities Monday recommended evacuation to 20 kilometers around the affected reactors and said that persons out to 30 kilometers should shelter in place.

Those recommendations parallel the protective actions the United States would suggest should dose limits reach 1 rem to the entire body and 5 rem for the thyroid, an organ particularly susceptible to radiation uptake.

A rem is a measure of radiation dose. The average American is exposed to approximately 620 millirems, or 0.62 rem, of radiation each year from natural and manmade sources.

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From:	Sheron, Brian
To:	Bonaccorso, Amy; Calvo, Antony; Case, Michael; Coe, Doug; Correia, Richard; Dion, Jeanne; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Rini, Brett; Sangimino, Donna-Marie; Uhle, Jennifer; Valentin, Andrea
Subject:	FW: Press Release: (Revised) NRC Sends Additional Experts to Assist Japan
Date:	Tuesday, March 15, 2011 2:03:39 PM
Attachments:	11-048R.docx

From: OPA Resource
Sent: Tuesday, March 15, 2011 11:41 AM
To: Ash, Darren; Barkley, Richard; Batkin, Joshua; Bell, Hubert; Belmore, Nancy; Bergman, Thomas; Bollwerk, Paul; Bonaccorso, Amy; Borchardt, Bill; Bozin, Sunny; Brenner, Eliot; Brock, Terry; Brown, Boris; Bubar, Patrice; Burnell, Scott; Burns, Stephen; Carpenter, Cynthia; Chandrathil, Prema; Clark, Theresa; Collins, Elmo; Couret, Ivonne; Crawford, Carrie; Cutler, Iris; Dacus, Eugene; Dapas, Marc; Davis, Roger; Dean, Bill; Decker, David; Dricks, Victor; Droggitis, Spiros; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Haney, Catherine; Hannah, Roger; Harbuck, Craig; Harrington, Holly; Hasan, Nasreen; Hayden, Elizabeth; Holahan, Gary; Holahan, Patricia; Holian, Brian; Jacobssen, Patricia; Jaczko, Gregory; Jasinski, Robert; Jenkins, Verlyn; Johnson, Michael; Jones, Andrea; Kock, Andrea; Kotzalas, Margie; Ledford, Joey; Lee, Samson; Leeds, Eric; Lepre, Janet; Lew, David; Lewis, Antoinette; Loyd, Susan; Magwood, William; McCrary, Cheryl; McGrady-Finneran, Patricia; McIntyre, David; Mensah, Tanya; Mitlyng, Viktoria; Monninger, John; Montes, David; Nieh, Ho; Ordaz, Vonna; Ostendorff, William; Owen, Lucy; Powell, Amy; Quesenberry, Jeannette; Reddick, Darani; Regan, Christopher; Reyes, Luis; Riddick, Nicole; RidsSecyMailCenter Resource; Riley (OCA), Timothy; Rohrer, Shirley; Samuel, Olive; Satorius, Mark; Schaaf, Robert; Schmidt, Rebecca; Scott, Catherine; Screnci, Diane; Shaffer, Vered; Shane, Raeann; Sharkey, Jeffry; Sheehan, Neil; Sheron, Brian; Siurano-Perez, Osiris; Steger (Tucci), Christine; Svinicki, Kristine; Tabatabai, Omid; Tannenbaum, Anita; Taylor, Renee; Temp, WDM; Thomas, Ann; Uhle, Jennifer; Uselding, Lara; Vietti-Cook, Annette; Virgilio, Martin; Virgilio, Rosetta; Walker-Smith, Antoinette; Weaver, Doug; Weber, Michael; Weil, Jenny; Werner, Greg; Wiggins, Jim; Williams, Evelyn; Zimmerman, Roy; Zorn, Jason
Subject: Press Release: (Revised) NRC Sends Additional Experts to Assist Japan

Attached to be released in approximately 15 minutes.

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V/52

REVISED: NRC SENDS ADDITIONAL EXPERTS TO ASSIST JAPAN

The NRC has sent nine additional experts to Tokyo to provide assistance as requested by the Japanese government. Acting as part of a U.S. Agency for International Development assistance team, the NRC has dispatched the experts to Tokyo to provide assistance as requested by the Japanese government.

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The team members come from the NRC's headquarters in Rockville, Md., and from offices in King of Prussia, Pa., Chattanooga, Tenn., and Atlanta. The team has been instructed to: conduct all activities needed to understand the status of efforts to safely shut down the Japanese reactors; better understand the potential impact on people and the environment of any radioactivity releases; if asked, provide technical advice and support through the U.S. ambassador for the Japanese government's decision making process; and draw on NRC-headquarters expertise for any other additional technical requirements. The team will be in communication with the Japanese regulator, the U.S. Embassy, NRC headquarters, and other government stakeholders as appropriate.

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The two reactor experts sent Saturday to Japan will participate as members of this assistance team.

Note To Editors: Revision reflects an additional team member, there are now a total of 11 NRC staffers on the assistance team.

###

White, Bernard

From: Nuclear Plant Journal [anu@goinfo.com]
Sent: Tuesday, March 15, 2011 5:47 PM
To: Bajwa, Chris
Subject: E-News from Nuclear Plant Journal

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Nuclear Plant Journal
An International Publication
Published in the United States

Nuclear Plant Journal E-News

Japan Update
March 15, 2011

Dear CHRIS,

Nuclear Plant Journal brings you a special E-edition of the Journal with the latest information from events related to the Miyagiken-Oki Earthquake and ensuing tsunami on March 11, 2011, in northern Japan.

All Fukushima Daiichi Nuclear Power Plants have an INES Radiation Alert Level 4. Please see this IAEA link for an explanation of the levels.

The following two links provides updates as of March 15, 2011:

- On the JAIF website, there is a complete summary PDF that includes status updates of all units at the Fukushima plant.
- The Prime Minister's office update.

Organizations which are currently providing the current status of the Japanese affected nuclear power stations are listed below.

TEPCO News Releases

Tokyo Electric Power Company provides the latest updates from the utility that owns the Fukushima Daiichi Nuclear Power Station.

TOKYO ELECTRIC POWER COMPANY

Japan Atomic Industrial Forum

Please see this link for the most current from the Japan Atomic Industrial Forum.

V/53

JAIF 社団法人 日本原子力産業協会
JAPAN ATOMIC INDUSTRIAL FORUM,INC.

Nuclear and Industrial Safety Agency (NISA)

Please see this link for the most current from NISA.

N I S A Nuclear and Industrial Safety Agency

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Day, Neil

From: Saverot, Pierre
Sent: Tuesday, March 15, 2011 10:00 AM
To: Day, Neil
Subject: FW: 1F-4 Fire, 1F-2 explosion: BWR update
Attachments: List of Power Plants (BWR) Earthequake 3-15.xls; 1F picture.doc

from a friend in Japan...

Following is summary of today's events.

2. About 9:30 am 1F-4 fire at reactor building. It is extinguished now.

The cause of the fire is unknown. Two big holes (8m square ?) are on the wall of the building.

We are afraid of any effect on the fuel in the spent fuel pool.

3. About 7 am 1F-2 exploded after possibly dry out (short period) of fuel.

This explosion might cause crack in the pressure vessel

Sea water injection succeeded and getting stable. However water level under the top of the fuel

4. Radiation level 11 mSv/hr at the gate (9 am) due to the #3 and #4 accidents. 0.4mSv/hr

People in 20 km from site are evacuated and people in 20-30 km are requested stay inside the house.

C/54

5. 1F-5/6 temperature (of what?) is slightly increasing.

We do not know whay? I hope it is not serious

6. As a whole:

Unit 1-3 : Sea water injection. But not enough water to cover fuel

1F-2 is still in critical status.

Unit 4-6 : Cooling by regular water (including fuel pool)

I think if we can keep water injection tonight, it will become under control condition soon.

FYI

I attached pictures of 1F site and pictures taken just after 1F-3 explosion.

Nuclear Power Plants in Japan (BWR)   Status (March-15-2011)

Utility	Plant	Type	Mwe	Operation Starts	Manufacturere Reactor	Turbine	before EQ
TEPCO	Fukushima-1-1	BWR	460	1971	GE	GE	Operating
	1-2	BWR	784	1974	T/GE	Toshiba	Operating
	1-3	BWR	784	1976	T	T	Operating
	1-4	BWR	784	1978	Hitachi	H	Outage
	1-5	BWR	784	1978	T	T	Outage
	1-6	BWR	1100	1979	T/GE	T	Outage
	Fukushima-2-1	BWR	1100	1982	T	T	Operating
	-2-2	BWR	1100	1984	H	H	Operating
	2-3	BWR	1100	1985	T	T	Operating
	2-4	BWR	1100	1987	H	H	Operating
	Kashiwazaki -1	BWR	1100	1985	T	T	Operating
	-2	BWR	1100	1990	T	T	
	-3	BWR	1100	1993	T	T	
	-4	BWR	1100	1994	H	H	
	-5	BWR	1100	1990	H	H	Operating
	-6	BWR	1356	1996	T	H	Operating
	-7	BWR	1356	1997	H	T	Operating
	Higashidori-1	BWR	1385	2017	H	T	
Chubu	Hamaoka-1	BWR	540	1976	T	H	
	-2	BWR	840	1978	T	H	
	-3	BWR	1100	1987	T	H	Outage
	-4	BWR	1137	1993	T	H	Operating
	-5	BWR	1380	2005	T	H	Operating
Hokuriku	Shika-1	BWR	540	1993	H	H	Stop

	-2	BWR	1358	2006	H	H	Outage

Utility	Plant	Type	Mwe	Operation Starts	Manufacturere		
					Reactor	Turbine	
Tohoku	Onagawa-1	BWR	524	1984	T	T	Operating
	-2	BWR	825	1995	T	T	Outage
	-3	BWR	825	2002	T	H	Operating
	Higashidori-1	BWR	1100	2005	T	T	Outage
JAPCO	Tsuruga-1	BWR	357	1970	GE	GE	Outage
	Tsuruga-2	PWR	1160	1987	Mitsubishi	M	Operating
	Tokai-2	BWR	1100	1978	GE	GE	Operating
Chugoku	Shimane-1	BWR	460	1974	H	H	
	-2	BWR	820	1989	H	H	
	-3	BWR	1373	2011	H	H	
J-Power	Ohma	BWR	1383	2012	H	T	

Status		
Current Status	Effect	
Hydrogen Explosion (3-12)		
Cooling by Sea water injection, **Explosion**	3・15	new
Hydrogen Explosion (3-14)		
Outage Fire & Extinguished	3・15	new
Outage	3・15	new
Outage	3・15	new
Cooling down. And Stable condition		
Cooling down. And Stable condition		
Cooling down. And Stable condition		
Cooling down. And Stable condition		
Operating		
Outage (Reparing damage by previous earthquake)		
Operating		
Operating		
Operating		
Under Decomissioning		
Under Decomissioning		
Outage		
Operating		
Operating		
Stop (Pump seal replacement)		

Outage	

Cooling down. And Stable condition	
Outage	
Cooling down. And Stable condition	
Outage	
Outage	
Operating	
Cooling down. And Stable condition	

(Before) 1,2,3,4 units (from right to left) 1,2,3,4 units are left 4,6 units are right

Unit 3 before explosion

During the explosion of Unit 3

Left bottom is ruin of unit 1 (exploded 12th) Unit 2 (at the middle) is still OK at that time

Unit 3 (top right) just exploded.

From:	Weber, Michael
To:	Sheron, Brian; Uhle, Jennifer
Cc:	Bowman, Gregory; Evans, Michele; Wiggins, Jim; Case, Michael
Subject:	FYI - April meetings in DC on how high reliability organizations manage catastrophic risks
Date:	Wednesday, March 16, 2011 6:55:56 PM

These meetings could be interesting, especially in light of our ongoing response to the situation in Japan.

From: Sanfilippo, Nathan
Sent: Wednesday, March 16, 2011 11:45 AM
To: Weber, Michael
Cc: Bowman, Gregory; Franovich, Mike
Subject: FW: April meetings in DC on how high reliability organizations manage catastrophic risks

Mike,

During our meeting with the CSB last week, they mentioned these two meetings in April that we might be interested in. Perhaps you could pass to RES?

Thanks,
Nathan

From: Hoyle, Bill [mailto:Bill.Hoyle@csb.gov]
Sent: Tuesday, March 15, 2011 4:36 PM
To: Franovich, Mike
Cc: Sanfilippo, Nathan
Subject: April meetings in DC on how high reliability organizations manage catastrophic risks

Michael and Nathan,

Thanks so much for your time last week. It was extremely helpful. Below are links to two interesting meetings in DC next month.

Regards,
Bill Hoyle
CSB Senior Investigator

April 19th http://berkeleysph.qualtrics.com/SE/?SID=SV_e4zISCHqiZ0PIR6

April 20-21 http://www.high-reliability.org/Documents/Conferences/Washington_DC/Agenda/Agenda_Intl_HRO_Conference_April2011.pdf

V/55

From:	Murphy, Andrew
To:	Case, Michael
Subject:	GI-199 & Japanese Qs & As
Date:	Wednesday, March 16, 2011 2:54:13 PM
Attachments:	Outline.docx

Mike,

Attached is a draft of an outline for the discussion/briefing with Brian & Jennifer.

Your comments; please.

Andy

V/56

NBC Report vis-à-vis Japanese Event Qs & As

Seismic Background
- Tectonics of Japanese Island Area
  - Earthquakes
  - Tsunami
- Tectonics of North America
  - West Coast of North America (California)
    - Earthquakes
    - Tsunami
  - Central & Eastern North America (U.S.)
    - Earthquakes
    - Tsunami

GI-199 Background
- Origin
- Panel & its Memo
- Transfer to NRR for Generic Communication
- Qs & As

Implications for Japanese Earthquake & Aftermath – (earth science implications not BWR systems material)

Indian Point Fragility

There should be sufficient information in the 30+ pages of Japanese event Qs & As to prepare a briefing – some of the tectonic discussion will very probably require additional material slides.

G:\DE\SGSEB\AMurphy\Indian Point - NBC Report v-a-v Japanese Qs & As.docx\Outline.docx

From: Veltri, Debra
To: Uhle, Jennifer
Cc: Case, Michael
Subject: Japan Nuclear
Date: Wednesday, March 16, 2011 8:52:22 AM

Article has great graphics is why I'm sending to you.

http://www.washingtonpost.com/business/economy/nuclear-crisis-deepens-as-third-reactor-loses-cooling-capacity/2011/03/14/ABk6rQV_story.html?wpisrc=nl_buzz

Debbie Veltri
301-251-7530
Debra.Veltri@NRC.gov

V/57

Barto, Andrew

From: Longmire, Pamela
Sent: Wednesday, March 16, 2011 8:36 AM
To: Goshen, John; Li, Zhian; Einziger, Robert; Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Hardin, Kimberly; Huang, Daniel; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Bajwa, Chris; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Tripathi, Bhasker; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick; H.Ryu@iaea.org; herve.issard@areva.com; njwchoi@kaeri.re.kr; paul.n.standring@sellafieldsites.com; sasa@criepi.denken.or.jp; takats@tsenercon.hu
Subject: RE: info on Japanese reactors

http://ansnuclearcafe.org/ is a better one stop shop.

From: Goshen, John
Sent: Wednesday, March 16, 2011 7:50 AM
To: Li, Zhian; Einziger, Robert; Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Hardin, Kimberly; Huang, Daniel; Longmire, Pamela; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Bajwa, Chris; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Tripathi, Bhasker; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick; H.Ryu@iaea.org; herve.issard@areva.com; njwchoi@kaeri.re.kr; paul.n.standring@sellafieldsites.com; sasa@criepi.denken.or.jp; takats@tsenercon.hu
Subject: RE: info on Japanese reactors

People, The only thing close accurate reporting is on www.nei.org .

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Sent: Wednesday, March 16, 2011 7:40 AM
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Subject: RE: info on Japanese reactors

Bob,

Thank you. This information looks comprehensive and credible. Listening to CNN and other news media, I was never able to get a clear picture what was going on. There were "experts" from all of the world talking about the accidents, but more you listen the more you get confused. I was watching NHK last night, even the Japanese government spokesman did not seem to be able to give a clear description on what exactly was going on. Sigh!

V/58

Zhian

From: Einziger, Robert
Sent: Wednesday, March 16, 2011 7:09 AM
To: Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Goshen, John; Hardin, Kimberly; Huang, Daniel; Longmire, Pamela; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Bajwa, Chris; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Einziger, Robert; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Li, Zhian; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Tripathi, Bhasker; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick; H.Ryu@iaea.org; herve.issard@areva.com; njwchoi@kaeri.re.kr; paul.n.standring@sellafieldsites.com; sasa@criepi.denken.or.jp; takats@tsenercon.hu
Subject: info on Japanese reactors

Day, Neil

From: Einziger, Robert
Sent: Wednesday, March 16, 2011 7:09 AM
To: Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Goshen, John; Hardin, Kimberly; Huang, Daniel; Longmire, Pamela; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Bajwa, Chris; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Einziger, Robert; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Li, Zhian; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Tripathi, Bhasker; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick; H.Ryu@iaea.org; herve.issard@areva.com; njwchoi@kaeri.re.kr; paul.n.standring@sellafieldsites.com; sasa@criepi.denken.or.jp; takats@tsenercon.hu
Subject: info on Japanese reactors
Attachments: ENGNEWS01_1300168169P.pdf

U/59

Status of nuclear power plants in Fukushima as of 13:00 March 15 (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
Operation Status at the earthquake occurred	Service	Service	Service	Outage	Outage	Outage
Fuel Integrity	Damaged	Unknown	Damaged	Not Damaged	Not Damaged	Not Damaged
Containment Integrity	Not Damaged	Damage Suspected	Not Damaged	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	Partially Damaged	Not Damaged	Not Damaged
Environmental effect	Radiation monitor detect radiation increase in the environment (NPS border: 8,217 μSv/h at 8:31)					
water level of the pressure vessel	Unknown	Recovering after Dried-up	Unknown	Safe	Safe	Safe
pressure of the pressure vessel	Stable	(No info)	Stable	Safe	Safe	Safe
Containment pressure	Stable	D/W: Unknown, S/P: Atmosphere	Stable	Safe	Safe	Safe
Sea water injection to core	Done	Done	Done	Not necessary	Not necessary	Not necessary
Sea water injection to Containment Vessel	Done	to be decided	to be decided	Not necessary	Not necessary	Not necessary
Containment venting	Done	Preparing	Done	Not necessary	Not necessary	Not necessary
Evacuation Area	20km from NPS ＊ People who live between 20km to 30km from the Fukushima #1NPS are to stay indoors.					
INES	Level 4 (estimated by NISA)					
Remarks	Fire broke on the 4th floor of the Unit-4 Reactor Building around 6AM 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. It is estimated that the spent fuels stored in the spent fuel pit heated and hydrogen was generated from these fuels, resulting in the explosion. TEPCO later announced the fire had been extinguished. Other staff and workers than 50 TEPCO employees, who are engaged in water injection operation, have been evacuated.					

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
Operation 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 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
Environmental effect	Stable (NPS border: 38.5 μSv/h at 6:00)			
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)
Sea water injection to core	Not necessary	Not necessary	Not necessary	Not necessary
Sea water injection to Containment Vessel	Not necessary	Not necessary	Not necessary	Not necessary
Containment venting	Not necessary	Not necessary	Not necessary	Not necessary
Evacuation Area	10km from NPS			
INES	(No Info)			

[Source]
Governmental Emergency Headquarters: News Release (3/14 13:30), Press conference (3/14 11:45, 16:15, 3/15 8:00, 11:00)
NISA: News Release (3/14 7:30)
Tokyo Electric Power Co.: Press Release (3/14 16:00, 17:35, 3/15 6:00), Press Conference (3/14 12:10, 20:00, 3/15 8:00, 8:30)

[Abbreviations]
INES: International Nuclear Event Scale
NISA: Nuclear and Industrial Safety Agency

[Significance]
(green) : low
(yellow) : high
(red) : severe

Temps, Robert

From: Goshen, John
Sent: Wednesday, March 16, 2011 7:50 AM
To: Li, Zhian; Einziger, Robert; Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Hardin, Kimberly; Huang, Daniel; Longmire, Pamela; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Bajwa, Chris; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Tripathi, Bhasker; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick; H.Ryu@iaea.org; herve.issard@areva.com; njwchoi@kaeri.re.kr; paul.n.standring@sellafieldsites.com; sasa@criepi.denken.or.jp; takats@tsenercon.hu
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Subject: info on Japanese reactors

V/60

Benner, Eric

From: Benner, Eric
Sent: Wednesday, March 16, 2011 8:01 AM
To: Fopma, Melody

NEI is actually providing pretty good coverage of the event:

http://nei.cachefly.net/newsandevents/information-on-the-japanese-earthquake-and-reactors-in-that-region/

About haflway down the page is a nice fact sheet on spent fuel storage.

V/61

Vera, John

From: Bajwa, Chris
Sent: Wednesday, March 16, 2011 9:00 AM
To: Einziger, Robert; Tripathi, Bhasker; Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Goshen, John; Hardin, Kimberly; Huang, Daniel; Longmire, Pamela; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Li, Zhian; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick
Subject: RE: info on Japanese reactors

Reactor 3 is MOX.

From: Einziger, Robert
Sent: Wednesday, March 16, 2011 8:45 AM
To: Tripathi, Bhasker; Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Goshen, John; Hardin, Kimberly; Huang, Daniel; Longmire, Pamela; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Bajwa, Chris; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Li, Zhian; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick
Subject: RE: info on Japanese reactors

I don't know, but I wouldn't be surprised if they used some MOX

From: Tripathi, Bhasker
Sent: Wednesday, March 16, 2011 8:42 AM
To: Einziger, Robert; Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Goshen, John; Hardin, Kimberly; Huang, Daniel; Longmire, Pamela; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Bajwa, Chris; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Li, Zhian; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick
Subject: RE: info on Japanese reactors

Bob: I just read this few minutes ago. Is it true that damaged Reactor # 3 uses some mixture of Plutonium for fuel?

Bhasker (Bob) P. Tripathi, P.E., F. ASCE
Senior Structural Engineer
Division of Spent Fuel Storage and Transportation
Office of Nuclear Materials Safety and Safeguards
U. S. Nuclear Regulatory Commission
Mail Stop: EBB 3 D02M
Washington, DC 20555-0001 USA
E-mail: Bhasker.Tripathi@nrc.gov
Phone: +1 301-492-3281

V/62

Fax: +1 301-492-3350

From: Einziger, Robert
Sent: Wednesday, March 16, 2011 7:09 AM
To: Benner, Eric; Davis (NMSS), Jennifer; Easton, Earl; Garcia-Santos, Norma; Gee, Frank; Glenny, Jessica; Goshen, John; Hardin, Kimberly; Huang, Daniel; Longmire, Pamela; Love, Earl; Morell, Clyde; Pearson, Jim; Pstrak, David; Rahimi, Meraj; Sampson, Michele; Saverot, Pierre; Staab, Christopher; Temps, Robert; Vechioli, Lucieann; Wharton, Raynard; Bajwa, Chris; Barto, Andrew; Bjorkman, Gordon; Call, Michel; Chang, Jimmy; Day, Neil; DePaula, Sara; Einziger, Robert; Forsyth, Daniel; Gambone, Kimberly; Gordon, Matthew; Hornseth, Geoffrey; Ireland, JoAnn; Jordan, Natreon; Li, Zhian; Parkhill, Ron; Piotter, Jason; Smith, Jeremy; Solis, Jorge; Sotomayor-Rivera, Alexis; Tang, David; Tarantino, David; Tripathi, Bhasker; Vera, John; Waters, Michael; Wilson, Veronica; Raynaud, Patrick; H.Ryu@iaea.org; herve.issard@areva.com; njwchoi@kaeri.re.kr; paul.n.standring@sellafieldsites.com; sasa@criepi.denken.or.jp; takats@tsenercon.hu
Subject: info on Japanese reactors

From: Operations Center Bulletin
To: Operations Center Bulletin
Subject: UPDATE: NRC IS RESPONDING TO JAPANESE EVENTS
Date: Wednesday, March 16, 2011 10:40:17 AM

THIS IS NOT A DRILL

The Office of Public Affairs is expecting a large volume of calls from media and the general public regarding the latest statements from the State Department and the NRC regarding the situation in Japan. ALL CALLS from media or the general public on this topic must be referred to the 301-415-8200 number.

The NRC is coordinating its actions with other Federal agencies as part of the U.S. government response to the events in Japan. The NRC is examining all available information as part of the effort to analyze the event and understand its implications both for Japan and the United States. The NRC's Headquarters Operations Center in Rockville, MD has been stood up since the beginning of the emergency in Japan and is operating on a 24-hour basis.

NRC Incident Responders at Headquarters have spoken with the agency's counterpart in Japan and offered the assistance of U.S. technical experts. NRC representatives with expertise on boiling water nuclear reactors have deployed to Japan as part of a U.S. International Agency for International Development (USAID) team. USAID is the Federal government agency primarily responsible for providing assistance to countries recovering from disasters.

U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety significant structures, systems, and components be designed to take in account the most severe natural phenomena historically estimated for the site and surrounding area.

The NRC will **not** provide information on the status of Japan's nuclear power plants. For the latest information on NRC actions see the NRC's web site at www.nrc.gov or blog at http://public-blog.nrc-gateway.gov.

Two important reminders:

It is possible that some of us will be requested by colleagues in another country to provide technical advice and assistance during this emergency. It is essential that all such communications be handled through the NRC Operations Center. Any assistance to a foreign government or entity must be coordinated through the NRC Operations Center and the U.S. Department of State (DOS). If you receive such a request, contact the NRC Operations Officer (301-816-5100 or via the NRC Operator) immediately.

If you receive information regarding this or any emergency (foreign or domestic) and you are not certain that the NRC's Incident Response Operations Officer is already aware of that information,

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you should contact the NRC Operations Officer (301-816-5100 or via the NRC Operator) and provide that information.

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Other Sources of Information:

USAID – www.usaid.gov
U.S. Department of State – www.state.gov
FEMA – www.fema.gov
White House – www.whitehouse.gov
Nuclear Energy Institute – www.nei.org
International Atomic Energy Agency – www.iaea.org/press

No response to this message is required.

THIS IS NOT A DRILL

From: Givvines, Mary
To: Bahadur, Sher; Blount, Tom; Brown, Frederick; Cheok, Michael; Cunningham, Mark; Evans, Michele; Galloway, Melanie; Giitter, Joseph; Givvines, Mary; Hiland, Patrick; Holian, Brian; Howe, Allen; Lee, Samson; Lubinski, John; Lund, Louise; McGinty, Tim; Nelson, Robert; Quay, Theodore; Ruland, William; Skeen, David
Subject: FW: Scheduling Call Summary - March 14, 2011
Date: Wednesday, March 16, 2011 1:16:07 PM
Attachments: Scheduling Call Summary for 3-14-11.docx

NRR

From: Taylor, Renee
Sent: Tuesday, March 15, 2011 4:21 PM
To: Abraham, Susan; Akstulewicz, Brenda; Andersen, James; Ash, Darren; Baker, Pamela; Belmore, Nancy; Bettis, Ashley; Boger, Bruce; Borchardt, Bill; Boyce, Thomas (OIS); Boyd, Lena; Brenner, Eliot; Brown, Milton; Buckley, Patricia; Campbell, Andy; Casby, Marcia; Casto, Chuck; Cianci, Sandra; Cohen, Miriam; Collins, Elmo; Crawford, Carrie; Crouch, Nicole; Cullison, David; Dambly, Jan; Dapas, Marc; Darby, Krystal; Deegan, George; Delligatti, Mark; Dembek, Stephen; Doolittle, Elizabeth; Dorman, Dan; Dubose, Sheila; EDO Distribution; Ficks, Ben; Flory, Shirley; Garland, Stephanie; Givvines, Mary; Golder, Jennifer; Grobe, Jack; Gusack, Barbara; Harris, Natasha; Hasan, Nasreen; Hayden, Elizabeth; Higginbotham, Tina; Holahan, Gary; Holahan, Patricia; Hopkins, Rhonda; Howard, Patrick; Howell, Art; Jaegers, Cathy; Kaplan, Michele; Kelley, Corenthis; Krupnick, David; Landau, Mindy; Lee, Pamela; Lew, David; Mamish, Nader; Matakas, Gina; McCrary, Cheryl; Miles, Patricia; Mitchell, Reggie; Moore, Scott; Muessle, Mary; ODaniell, Cynthia; Owen, Lucy; Pederson, Cynthia; Poland, Catherine; Powell, Amy; Pulliam, Timothy; Quesenberry, Jeannette; Raynor, Kathleen; Reynolds, Steven; Rheaume, Cynthia; Riddick, Nicole; Ronewicz, Lynn; Ross, Brenda; Ross, Robin; Salus, Amy; Santiago, Patricia; Satorius, Mark; Schaeffer, James; Schmidt, Rebecca; Schum, Constance; Schumann, Stacy; Schwarz, Sherry; Shah, Maria; Shay, Jason; Smith, Beverly; Somerville, Glenda; Sprogeris, Patricia; Stewart, Sharon; Tannenbaum, Anita; Taylor, Renee; Tomczak, Tammy; Tracy, Glenn; Uhle, Jennifer; Veltri, Debra; Virgilio, Martin; Walker, Dwight; Weber, Michael; Wert, Leonard; West, Steven; Williams, Barbara; Wyatt, Melissa; Zimmerman, Roy; Seltzer, Rickie; Arildsen, Jesse
Subject: Scheduling Call Summary - March 14, 2011

EDO

Please find attached the notes from the March 14th scheduling call with the AO.

Thank you,

Renee Taylor
Administrative Assistant to the Executive Director for Operations
U.S. Nuclear Regulatory Commission
(301) 415-1701

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Scheduling Call Summary for March 14, 2011

Agenda/Action Items:

1) OEDO discussed issues associated with NRC's support of recovery efforts in Japan. It was noted that all requests for support from the NRC Operations Center have first priority. Two NRC personnel were deployed to the American Embassy in Tokyo and nine additional (six program office and three OIP) personnel are being deployed to help support the Japanese regulators. Staff not directly supporting the response efforts should continue to focus on work in progress. It was also noted that the upcoming Congressional briefings will shift focus from budget issues to issues associated with the Japanese nuclear incidents.

2) NSIR stated that the Headquarters Operations Center staffing is expected to continue at current levels through Friday, and at possible reduced levels through the weekend.

3) OEDO discussed the Strategic Acquisition Transformation Plan. The SRM was issued on February 28th, and both major recommendations were accepted by the Commission. It was noted that contractual authority will reside with the EDO, to be further delegated, and that the process for generating Chairman papers has been terminated. It was also noted that new procurement templates will be promulgated in the near future.

4) OEDO discussed profiling of OIG reports and emphasized that, after a final report is published it will be made public and posted in ADAMS. Following this, all subsequent correspondence should be made public (with the exception of items that are classified, OUO, etc).

5) OEDO discussed feedback from the recent Commission Agenda Planning Meeting. It was noted that the Commissioners were very pleased with recent meetings. Notable points included good eye contact from speakers (i.e., not reading from a script), good presentation of technical detail, and use of pictures to illustrate salient points. The need for revisions to guidance for Commission meeting preparation is being evaluated.

6) CFO requested survey feedback concerning implementation of FAIMIS by March 25.