From: RST01 Hoc
Sent: Tuesday, March 29, 2011 1:27 PM
To: RST01B Hoc; Rob Versluis - DOE; RST08 Hoc; RST09 Hoc; Hoc, RST16
Subject: FW: FYI - REPORT FROM THE DOE EMBEDDED INDIVIDUAL (Bisconti TDY-Tokyo)

FYI

-----Original Message-----
From: Weber, Michael
Sent: Tuesday, March 29, 2011 1:19 PM
To: RST01 Hoc; LIA06 Hoc; LIA08 Hoc
Cc: ET07 Hoc; ET05 Hoc; OST02 HOC; FOIA Response.hoc Resource; Casto, Chuck; Dorman, Dan
Subject: FYI - REPORT FROM THE DOE EMBEDDED INDIVIDUAL (Bisconti TDY-Tokyo)

Here is a report from one of the DOE staff members who is embedded with the DART Team in Tokyo, along with our team.

-----Original Message-----
From: Bisconti, Giulia [mailto:Giulia.Bisconti@nuclear.energy.gov]
Sent: Tuesday, March 29, 2011 12:26 PM
To: PWG; DL-NITsolutions
Cc: Bisconti, Giulia
Subject: Bisconti TDY-Tokyo

Dear all:

As requested, this is an update of how I am helping in Tokyo for the week. My main duty is to be embedded with the NRC team at the Embassy. I am also performing other duties where I can be helpful to Ron and Aleshia. They have both been very welcoming.

Giulia

Here are some items of interest:

--Two PNNL experts to visit Japan (at the request of Japan)to help on water decontamination and storage issues.
--Japanese government is seeking private sector experts on fuel rod/pool issues with hands-on TMI experience (per NRC meetings).
--Japanese government is thrilled with NNSA's airborne monitoring cooperation (I joined MOFA/MEXT meeting with Alan).
--Met with Toshiba and B&W. Toshiba has hundreds of employees at the accident site and the TEPCO emergency control room. Toshiba is deploying equipment and resources. Toshiba and Hitachi are both in the emergency control room, and TEPCO is heavily relying on them. Toshiba offered to be an information resource to our specialists.
--6.3 quake in Northeastern Japan today--no damage reported to facilities.
--Aleshia and I met today with METI Vice Minister Okada (at his invitation). Okada mentioned that Japan is thinking about a "cover" for the Fukushima plants in the coming months. He and his colleagues expressed very deep appreciation for assistance from DOE and its National labs and everyone's hard work and long hours. They appreciated DOE recommendations on the salt/fresh water issue. Okada offered to personally work with DOE on any matter related to the Fukushima response and to help overcome any barrier. Although, he mentioned that information flow is much

better now (the government is better organized to receive and respond to inquiries) and the mechanisms seem to be working. He noted that Japan will be looking for assistance-including on the issue of water decontamination (10,000 tons ? of contaminated water). He said that the Japanese government would seek input from DOE and its labs, including PNNL, Idaho, Livermore, others...

--Participated in NRC meeting. Issues: remove heat from the reactor. Structural concerns for the pools. Controlling releases. Water management is a big issue. Are the Japanese workers wearing adequate protective clothing? Flooding--continued leakages? Need to establish the water level of the pools--want to get water above the rods, maybe 3-4 feet above.

Bano, Mahmooda

From: Scott, Michael
Sent: Wednesday, March 30, 2011 5:15 AM
To: Giessner, John
Subject: FW: Reducing oxygen in external water supply-- nitrogen sparging.

From: RST01 Hoc
Sent: Tuesday, March 29, 2011 9:10 AM
To: Cook, William; Scott, Michael; Blamey, Alan; Giessner, John; Taylor, Robert
Cc: Jackson, Todd; Monninger, John; Dorman, Dan; Miller, Marie; Ali, Syed; Sheikh, Abdul; Way, Ralph
Subject: FW: Reducing oxygen in external water supply-- nitrogen sparging.

FYI, here is another e-mail with recommendations for the Japanese regarding deoxygenating that haven't been vetted. This will be vetted at the 1100 EDT call

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From: Sheron, Brian
Sent: Tuesday, March 29, 2011 7:12 AM
To: RST01 Hoc
Cc: ET01 Hoc; HOO Hoc; Weber, Michael; Virgilio, Martin
Subject: FW: Reducing oxygen in external water supply-- nitrogen sparging.

See below. Note that the recommendation is to "...give this information to the Japanese." Also note that the author is the Secretary of Energy, Steve Chu.

As Mike notes below, it was our understanding that all recommendations to the Japanese were first to be vetted through the industry/government group (i.e., NRC, DOE, INPO, NR, EPRI, GEH, Bettis, KAPL).

My suggestion is that you discuss this with the DOE rep on the RST and have the rep interact with DOE and make sure that this is vetted through the industry/government group above (like the way the severe accident management recommendations were vetted a few days ago).

Can you also alert the site team to this, in case DOE decides to send it over without the vetting process.

Thanks.

From: Weber, Michael
Sent: Monday, March 28, 2011 7:41 PM
To: Sheron, Brian
Cc: Zimmerman, Roy; McDermott, Brian; Brown, Frederick; LIA06 Hoc; LIA08 Hoc; Casto, Chuck; Dorman, Dan; Borchardt, Bill; Virgilio, Martin; ET01 Hoc; ET05 Hoc; OST02 HOC; FOIA Response.hoc Resource
Subject: Response - Reducing oxygen in external water supply-- nitrogen sparging.

Thanks, Brian. Please vet this through the RST and share with our Site Team. My understanding from the Chairman is that any such recommendations need to be coordinated among the agencies and industry partners (INPO, GEH, etc.) And channeled through the Site Team to our Japanese counterparts.

From: Sheron, Brian
To: Weber, Michael
Sent: Mon Mar 28 19:13:27 2011
Subject: Fw: Reducing oxygen in external water supply-- nitrogen sparging.

Mike, see below. I think DOE is starting to go directly to the Japanese with recommendations. I thought recommendations were supposed to be vetted among NRC, EPRI, NR, GEH, etc. ?

However, I'm not going to tell the Secretary of Energy what he can and can't do.

From: SCHU <SCHU@hq.doe.gov>
To: Garwin, Dick (IBM) <rlg2@us.ibm.com>; Binkley, Steve <Steve.Binkley@science.doe.gov>
Cc: Brinkman, Bill <Bill.Brinkman@science.doe.gov>; Binder, Jeff <binderjl@ornl.gov>; Hurlbut, Brandon <Brandon.Hurlbut@hq.doe.gov>; Sheron, Brian; Poneman, Daniel <Daniel.Poneman@hq.doe.gov>; Connell, Elizabeth <elizabeth.connell@inl.gov>; McFarlane, Harold <harold.mcfarlane@inl.gov>; 'Harold Denton' <hdenton01@charter.net>; Adams, Ian <Ian.Adams@Hq.Doe.Gov>; John Holdren <(b)(6)>; 'JOE H. PAYER' <jhp@po.cwru.edu>; Kelly, John E (NE) <JohnE.Kelly@Nuclear.Energy.Gov>; Grossenbacher, John (INL) <john.grossenbacher@inl.gov>; Owens, Missy <Missy.Owens@hq.doe.gov>; Peterson, Per <peterson@nuc.berkeley.edu>; Lyons, Peter <Peter.Lyons@Nuclear.Energy.gov>; Finck, Phillip <phillip.finck@inl.gov>; Garwin, Dick (EOP) <(b)(6)>; Lee, Richard; Budnitz, Bob <RJBudnitz@lbl.gov>; Szilard, Ronaldo <ronaldo.szilard@inl.gov>; Aoki, Steven <Steven.Aoki@nnsa.doe.gov>; Koonin, Steven <Steven.Koonin@science.doe.gov>; Steve Fetter <(b)(6)>; Binkley, Steve <Steve.Binkley@science.doe.gov>; DAgostino, Thomas <Thomas.DAgostino@nnsa.doe.gov>
Sent: Mon Mar 28 17:47:48 2011
Subject: RE: Reducing oxygen in external water supply-- nitrogen sparging.

Attached are some commercial methods to deoxygenate water for boiler feeds and other applications. I suggest that we give this information to the Japanese. Before fresh water is introduced into the RPV, deoxengenation could lower the risk of another hydrogen explosion.

Don't know what the risk will be if the venting is into the now missing secondary containment. In speaking with the Millstone reactor folks today (in Waterford Conn.), they expressed some doubt that a hydrogen explosion could occur if the top of the secondary containment is not there. Just to make sure, there are large door at the bottom of the buildings that can be opened to "chimney": away the hydrogen.

Membrane technology
http://www.liqui-cel.com/applications/O2.cfm
The web site claims the largest unit can deoxengenate at a rate of 70 – 400 gpm. They have a branch in Toyko.

Liqui-Cel® Membrane Contactors are used around the world for deoxygenation of water and other liquids. Oxygen (O2) negatively impacts many processes; it is corrosive and can oxidize materials. In the power and industrial areas, piping, boilers and equipment are susceptible to corrosion if deaeration is not present. Liqui-Cel® Contactors offer easy-to-operate, modular solutions for degassing and oxygen (O2) removal from water without chemicals and without large vacuum towers or deaerators. Liqui-Cel® Contactors also offer the benefit of simultaneous oxygen and carbon dioxide removal from water as well as N2 control with one step.

Boiler Feed Water Deaerators and Corrosion Control
Many plants are now using Liqui-Cel® Contactors for the deoxygenation of their boiler feedwater. Boiler deaeration extends boiler and piping life by preventing corrosion of critical parts. Liqui-Cel® Contactors facilitate boiler deaeration and corrosion control.

ion exchange resins
http://msdssearch.dow.com/PublishedLiteratureDOWCOM/dh_0035/0901b803800353b0.pdf?filepath=liquidseps/pdfs/noreg/177-01840.pdf&fromPage=GetDoc

Steven Chu
Department of Energy

From: Garwin, Dick (IBM)
Sent: Sunday, March 27, 2011 5:42 PM
To: Binkley, Steve
Cc: Brinkman, Bill; Binder, Jeff; Hurlbut, Brandon; Sheron, Brian; Poneman, Daniel; Connell, Elizabeth; McFarlane, Harold; 'Harold Denton'; Adams, Ian; John Holdren; 'JOE H. PAYER'; Kelly, John E (NE); Grossenbacher, John (INL); Owens, Missy; Peterson, Per; Lyons, Peter; Finck, Phillip; Garwin, Dick (EOP); Lee, Richard (NRC); Budnitz, Bob; Szilard,

Ronaldo; SCHU; Aoki, Steven; Koonin, Steven; Steve Fetter; Binkley, Steve; DAgostino, Thomas
Subject: Reducing oxygen in external water supply-- nitrogen sparging.

A moment on the web gives me this:
Nitrogen Sparging and Blanketing of Water Storage Tanks

at http://www.steamcycle.com/nitrogen.htm

Please read and evaluate.

Dick Garwin

From: RST01B Hoc
Sent: Wednesday, March 30, 2011 8:04 AM
To: Kelly, John E (NE)
Cc: Versluis, Rob
Subject: RE: URGENT RE: Quick science group call today - 7:00pm EDT

I staff this desk on the Reactor Safety Team within the NRC Incident Response Center. Are you available to talk to now?

****
Rob Versluis, DOE NE-71, 301-903-1890 (o) (b)(6) (m)
****

-----Original Message-----
From: Kelly, John E (NE) [mailto:JohnE.Kelly@Nuclear.Energy.Gov]
Sent: Tuesday, March 29, 2011 9:07 PM
To: RST01B Hoc
Subject: RE: URGENT RE: Quick science group call today - 7:00pm EDT

Who is this emailing me? If it is Rob Versluis you need to call me ASAP John
(b)(6)

-----Original Message-----
From: RST01B Hoc [mailto:RST01B.Hoc@nrc.gov]
Sent: Tuesday, March 29, 2011 7:17 PM
To: Kelly, John E (NE); Golub, Sal; Larzelere, Alex
Cc: Versluis, Rob
Subject: URGENT RE: Quick science group call today - 7:00pm EDT
Importance: High

I was on a call with the NRC in-Japan team just now and the issue of vetting DOE recommendations with NRC and Industry is still a hot issue here. This concerns the statement in the email below that "Hence, the recommendation not to flood the drywell will be advanced by U.S. to the Japanese." I have an action to find out
- where and to whom that Science Council recommendation (see below) has gone and
- whether DOE intends to follow the process agreed by the NRC Chairman and the DOE Secretary to vet through the Industry Consortium, or if DOE is setting up a second channel to Japan.

We (DOE) need to get this issue back into the box.

NRC RST is willing to discuss flooding issues and believes they have taken some of Holdren's consideration into account but they don't agree with "not flooding". This will come up again at the 11 am telecom tomorrow.

Rob Versluis, DOE NE-71, 301-903-1890 (o) (b)(6) (m)
****

-----Original Message-----
From: Versluis, Rob
Sent: Tuesday, March 29, 2011 1:22 PM

To: Golub, Sal; Larzelere, Alex; Versluis, Rob; McCaughey, Bill; McFarlane, Harold
Subject: FW: Quick science group call today - 7:00pm EDT

I just got this (I was not logged into NRC system until an hour ago)

-----Original Message-----
From: RST01 Hoc [mailto:RST01.Hoc@nrc.gov]
Sent: Tuesday, March 29, 2011 9:56 AM
To: Versluis, Rob
Subject: FW: Quick science group call today - 7:00pm EDT

-----Original Message-----
From: Sheron, Brian
Sent: Tuesday, March 29, 2011 7:21 AM
To: Kelly, John E (NE)
Cc: Weber, Michael; Virgilio, Martin; RST01 Hoc; ET01 Hoc
Subject: FW: Quick science group call today - 7:00pm EDT

John, see below.

It was our understanding that all recommendations to the Japanese government were going to be first vetted internally within the U.S.

Last weekend our RST vetted the severe accident management recommendations with NRC, DOE, INPO, EPRI, NR, Bettis, KAPL, GEH and got alignment before the recommendations were sent to the site team..

It was also my understanding that Secretary Chu agreed to this process with Chairman Jaczko. Is DOE going to coordinate the vetting process, or do you want to send it over to the NRC's RST and let them vet it?

-----Original Message-----
From: Lee, Richard
Sent: Monday, March 28, 2011 7:44 PM
To: Sheron, Brian
Subject: RE: Quick science group call today - 7:00pm EDT

Brian:

Done already. Dana and I were on the phone. Dr. Holdrens is checking on the consensus view reached yesterday on the recommendation of not flooding the drywell. Without having any water level measurement in the drywell, concerns are: (i) condensing the steam which may cause a hydrogen burn; (ii) too much water in the drywell resulting in blocking the vent path. The blocking of the vent path will be very serious, because at this time, it is now the only path for relieving pressure in the RCS.

Apparently, Dr. Holdrens spoke to our Chairman and was told by our Chairman that he understood the NRC still favors flooding the drywell. Dana and I both said the concern of blocking the vent path is a major concern especially we do not know or able to measure the water level in the drywell. I also mention that in case of molter core material breached the RPV, ANL (under DOE) is calculating the MCCI; and NRC had also provided a few days ago our estimate of FCI loads do not pose a treat to the containment. He was happy that we look into FCI already and gave him assurance the recommendation is the correct one to put forth.

The rest of the people call in (Bob Budniz?, Dick Garwin, ...) agreed. Hence, the recommendation not to flood the drywell will be advanced by U.S. to the Japanese.

Richard

From: Sheron, Brian
Sent: Monday, March 28, 2011 7:07 PM
To: Lee, Richard
Subject: Re: Quick science group call today - 7:00pm EDT

Great, thx.

From: Lee, Richard
To: Sheron, Brian
Sent: Mon Mar 28 17:11:42 2011
Subject: RE: Quick science group call today - 7:00pm EDT

Brian:

I will call in to see what it is all about,

Richard

From: Sheron, Brian
Sent: Monday, March 28, 2011 4:35 PM
To: Lee, Richard
Subject: Fw: Quick science group call today - 7:00pm EDT

From: Adams, Ian <Ian.Adams@Hq.Doe.Gov>
To: DL-NITsolutions <DL-NITsolutions@nnsa.doe.gov>; Owens, Missy <Missy.Owens@hq.doe.gov>
Cc: Smith, Haley <Haley.Smith@Hq.Doe.Gov>; Chambers, Megan (S4) <Megan.Chambers@science.doe.gov>; Narendra, Blake <Blake.Narendra@NNSA.Doe.Gov>; Fitzgerald, Paige <Paige.Fitzgerald@Hq.Doe.Gov>
Sent: Mon Mar 28 16:31:59 2011
Subject: Quick science group call today - 7:00pm EDT Good afternoon,

Dr. Holdren would like to pull everyone who is available together today at 7:00pm EDT for a few minutes. This is to discuss a technical question before a recommendation is made.

Apologies for the short notice - don't worry if you aren't able to make it, but for those of you who are able, we will have a brief call today from 7:00-7:15pm EDT.

Tomorrow's call will still take place as scheduled, at 4:45pm EDT. Wednesday's call will take place at 5:00pm EDT

Thanks
Ian

Nuclear science group conference call schedule:
Monday 3/28: 7:00pm-7:15pm EDT

Tuesday 3/29: 4:45pm-5:45pm EDT
Wednesday 3/30: 5:00pm-6:00pm EDT

Conference call information:
Please dial into (202) 586-2535
No PIN is needed.

Ian Adams
Office of the Secretary
Department of Energy
(202) 586-9585
ian.adams@hq.doe.gov

Bano, Mahmooda

From: Scott, Michael
Sent: Thursday, March 31, 2011 7:24 PM
To: Taylor, Robert
Subject: FW: Support for Japan - SFP Criticality Potential Update
Attachments: ORNL_Fukushima-Criticality_Notes_31Mar2011.pptx; Shika U1 ICE June 18 1999 070417E_Rinkai_Kaiseki.pdf

Your views?

From: Wood, Kent
Sent: Thursday, March 31, 2011 4:51 PM
To: Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

All,

I've recently heard that the Fukushima Daiichi Unit 3 SFP is or may be dry. And has been for some time.

If that is the case the borated aluminum that is reported to be in those racks is probably damaged by the heat. It may be completely melted away. As shown in that attached slides that would increase keff by about 30% in a flooded SFP. (This figure is consistent with other analyses I've seen.)

A typical BWR "***SFP criticality safety analyses were properly performed consistent with the SFP criticality safety requirements of the U.S. Nuclear Regulatory Commission***" would use a limiting lattice to demonstrate that peak reactivity, i.e. after depletion of most of the Gadolina, the SFP keff would be essentially 0.945 at a 95% probability with a 95% confidence level. If present any installed neutron absorber would be included in the analysis. We should all know that there are some conservatism/margin in those analyses (1) there is probably some margin between the peak reactivity of the 'limiting lattice' and the peak reactivity of the 'actual lattice', (2) the 'limiting lattice' would be something the license would allow the licensee to have in its SFP and so the delta between 'limiting lattice' and a maximum 'actual lattice' may not be all that large, (3) not all fuel assemblies in the SFP will be at the point of peak reactivity, only those whose have only had one cycle of use in the reactor would reasonably be at their peak reactivity, (4) the 'limiting lattice' fresh fuel with its gadolina will have a reactivity 12-14% Δkeff below the peak, 'actual lattice' (5) I usually estimate that 2nd cycle fuel assemblies will have reactivity probably a little less than the poisoned fresh probably 15-18% Δkeff below the peak.

However, I would not estimate that those analyses have 30% margin. Adding 30% Δkeff to the SFP rack and you are looking at a potential criticality event even in the 2nd burned fuel assemblies. It would probably only take four, certainly no more than six to start. A big question would be whether or not the moderator temperature coefficient is positive or negative, I've seen unpoisoned PWR racks have a positive MTC (I've not seen any MTC analysis for unpoisoned BWR racks).

I'm attaching a report on an inadvertent criticality event that Japan had at Shika U1. They had a criticality BWR because three control rods came partially out of the core during a refueling outage. That was a small volume under a full refueling pool. A criticality event in the Fukushima Daiichi U3 SFP would likely be larger and at least initially without any appreciable water as a shield. The criticality would continue until either boron was injected or the water boiled off. Once the fuel assemblies are uncovered, again, they will have a new higher decay heat load and source term, open to the atmosphere.

If the U3 SFP is currently dry and has been for some time one must consider how much worse the fuel can get if it is left dry.

Bottom line, if the U3 SFP is dry, they should not reflood the U3 SFP with unborated water unless they are certain the poison is intact.

Kent A. L. Wood
Team Leader
Spent Fuel Team (SFT)
Reactor Systems Branch (SRXB)
Division of Safety Systems (DSS)
Office of Nuclear Reactor Regulation (NRR)
301-415-4120

From: Wagner, John C. [mailto:wagnerjc@ornl.gov]
Sent: Thursday, March 31, 2011 10:27 AM
To: Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

Rob,
Thanks for sharing this! Please see revised slide packet that includes analyses (by Don Mueller) that

(b)(5)

Main issue, in my mind, for the U4 SFP is preservation of the assembly separation, which is the key to sub-criticality in the UF SFP rack designs (as we understand them to be).

Call if you have questions.

John C. Wagner, PhD
Oak Ridge National Laboratory
Phone: (865) 241-3570
Mobile: (b)(6)

From: Taylor, Robert [mailto:Robert.Taylor@nrc.gov]
Sent: Thursday, March 31, 2011 1:44 AM
To: Taylor, Robert; Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

We just realized that the pitch is different between the E-W direction and N-S directions. The numbers below are correct for the E-W direction. In the N-S direction, the pitch is slightly larger, 194mm.

From: Taylor, Robert
Sent: Thursday, March 31, 2011 1:28 AM
To: 'Wagner, John C.'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

John, Don, and others,

We have received hardcopy drawings of the spent fuel racks in Unit 4. As we read them, it looks like each cell is 152mm across and the center-to-center pitch is 168.5mm. They are high-density.

Rob

From: Wagner, John C. [mailto:wagnerjc@ornl.gov]
Sent: Tuesday, March 29, 2011 7:30 AM
To: Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

With attachment...

John C. Wagner, PhD
Oak Ridge National Laboratory
Phone: (865) 241-3570
Mobile: (b)(6)

From: Wagner, John C.
Sent: Tuesday, March 29, 2011 7:28 AM
To: 'Taylor, Robert'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

Rob,
Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have Al-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

John C. Wagner, PhD
Oak Ridge National Laboratory
Phone: (865) 241-3570
Mobile: (b)(6)

From: Taylor, Robert [mailto:Robert.Taylor@nrc.gov]
Sent: Tuesday, March 29, 2011 6:01 AM
To: Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,
Rob

From: Wagner, John C. [mailto:wagnerjc@ornl.gov]
Sent: Monday, March 28, 2011 11:32 PM
To: Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.
Subject: RE: Support for Japan - SFP Criticality Potential Update

Don,
As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):
"-->*Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*
Unit 4 has only non-borated stainless racks."
This information is consistent with the information you have below.

The above information raises questions/concerns

- Available information suggestions the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:
"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such."
Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

Questions for you:

1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

John C. Wagner, PhD
Oak Ridge National Laboratory
Phone: (865) 241-3570
Mobile: (b)(6)

From: Carlson, Donald [mailto:Donald.Carlson@nrc.gov]
Sent: Monday, March 28, 2011 9:14 PM
To: Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert
Subject: RE: Support for Japan - SFP Criticality Potential Update
Importance: High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1st cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncovery

Our NRC+ORNL technical opinion as of March 19 was as follows:
Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool. (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

Question: Do we now see a need to modify or expand the above technical opinion? If so, how?

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,
Don

Donald E. Carlson
NRO/ARP/ARB1
Cell: (b)(6)

Office: 301-415-0109

From: Taylor, Robert
Sent: Monday, March 28, 2011 6:59 PM
To: Carlson, Donald; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated
Switching to fresh water injection on 3/29
Shutdown last November with 1/3 of the core offload being 1st cycle fuel
204 fresh fuel assemblies were present in the pool
Japanese concerns that the racks may have shifted.
Fuel damage due to uncovery

Regards,
Rob

From: Carlson, Donald
Sent: Monday, March 28, 2011 6:23 PM
To: Taylor, Robert; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,
Don

From: Taylor, Robert
Sent: Monday, March 28, 2011 5:59 PM
To: Carlson, Donald; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

From: Carlson, Donald
Sent: Monday, March 28, 2011 1:07 PM
To: Brown, Frederick
Cc: Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher
Subject: RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----
From: Carlson, Donald
Sent: Monday, March 28, 2011 9:30 AM
To: Brown, Frederick
Cc: Taylor, Robert; Scott, Michael
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----
From: Brown, Frederick
Sent: Sunday, March 27, 2011 9:11 PM
To: Carlson, Donald
Cc: Taylor, Robert; Scott, Michael
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,
Fred

April 17, 2007
Rev.0
Japan Nuclear Technology Institute

Analysis on Criticality 'Accident' Occurred at Shika 1 of Hokuriku Electric Power Company

1. Overview

In March 2007, it was revealed that Shika 1 core had become criticality during outage due to unexpected withdrawal of 3 control rods in June 1999. Therefore, Japan Nuclear Technology Institute (JANTI) made core performance analyses using information provided from Hokuriku Electric Power Company (Hokuriku EPCO).

Analysis result showed that in the conservative condition of control rods withdrawal speed with the associated reactivity inserted (standard case), it was possible that the core had been in prompt criticality. The power decreased instantly (in 0.3 second) following rapid increase to 14% (230MW) of rated thermal power after 6 seconds of (delayed) criticality. The maximum enthalpy increase during peak power period was calculated to be 13cal/gUO_2, which is well below fuel PCMI failure threshold of 85cal/gUO_2(*1). Also, the maximum fuel enthalpy was calculated to be 49cal/gUO_2, which is below limit value of 230cal/gUO_2(*2) in accident or 92cal/gUO_2(*3) in abnormal transient during operation. In some cases such as with low control rod withdrawal speed, the core status did not result in prompt criticality, and stayed in delayed criticality.

*1) Threshold value for PCMI (Pellet-Cladding Mechanical Interaction) failure

*2) Threshold to prevent occurrence of mechanical energy by pressure impact resulted from fuel failure due to pellet melting and vaporization.

*3) Threshold to prevent fuel failure due to high temperature rapture,

melting and nil-ductility of cladding

2. Analysis Condition

(1) Determination of Analysis Condition

Timeline of input parameter determination is shown in Table 1. In the determination process, sensitivity analysis was made on the associated parameter to focus on parameters with high priority, since exact value was not available at first. Then, after checking analyses condition of Hokuriku EPCO, analysis condition of standard case was determined. Also, variable range was determined for inserted reactivity and control rods withdrawal speed in analyses.

(2) Power Distribution in the Core

At Shika 1, criticality occurred as 3 out of 89 control rods were withdrawn. The situation can be understood that 'small partial core' was constituted inside the full core (Figure 1). The power distribution had shape of top peak as shown in Figure 2. In the partial core where control rods were withdrawn, 70% of power was generated in 4% of the full core volume. Kinetics importance of the partial core was estimated to be equivalent to the full core. Thus, JANTI analysis was made on the partial core shown in Figure 1.

(3) Inserted Reactivity and Control Rods Speed in Standard Case

In the analyses, inserted reactivity and control rods withdrawal speed were considered as parameter. For both parameters, basic values (standard case) were determined as follows.

- Keff in Standard Case: 1.0079
- Control Rods Speed in Standard Case: 47mm/s

Inserted reactivity (Keff) of the core in the standard case was determined based on the analysis by Hokuriku EPCO.

Control rods withdrawal speed in the standard case was determined as practically fastest speed based on mockup test by

Hokuriku EPFO.

(4) Affect due to Inserted Reactivity and Control Rods Speed

In standard case, inserted reactivity (0.0079 Δ K =1.3$) is above β (0.0060=1$). However, as extent of power increase depends on the reactivity insertion rate, it was not to be concluded that there was/was not prompt criticality occurred just based on value of inserted reactivity in excess of β. Therefore, sensitivity analyses were made to identify cases which result in prompt criticality.

For inserted reactivity, analyses were made on the core with higher/lower reactivity by 0.5$ each in addition to the standard case considering accuracy of analysis code.

- Standard Case: 1.3$
- High Reactivity: 1.8$ (0.5$ higher)
- Low Reactivity: 0.81$ (0.5$ lower)

For control rods movement, the following three withdrawal speeds were selected for analysis.

- Standard Case: 47mm/s
- High Speed: 76mm/s (normal operation speed of control rods)
- Low Speed: 16mm/s (assumed average speed of control rod (26-39) from 0pos. to 16pos. during 77 seconds between start of control rod(s) withdrawal signal and initiation of scram signal. (26-39) was at peaking power location as shown in Figure 2)

Reactivity insertion rate in each case is shown in Figure 3.

(5) Analysis Code

JANTI analyses were made using multi regional nuclear-thermal hydraulics combined kinetics code EUREKA-2. In EUREKA-2, both nuclear and thermal hydraulics feedback (Doppler feedback and coolant temperature feedback) can be treated simultaneously. In

the analyses by Hokuriku EPCO, kinetics calculation was made by reactivity insertion events analysis code APEX considering Doppler feedback, followed by analysis using thermal hydraulics code SCAT with APEX result as input. Comparison of calculation method is shown in Table 3-1.

In the analyses by JANTI, EUREKA-2 code is used primarily because of its high performance during peak power period that is characteristic of reactivity insertion accidents. Meanwhile, EUREKA-2 tends to calculate conservative results for fuel enthalpy after power peak due to its assumption of constant power distribution, and due to its incapability of calculation in boiling condition etc. Therefore, in JANTI analyses, result of fuel enthalpy after power peak was considered as reference. Also, as EUREKA-2 is not capable of calculation in boiling condition, higher core pressure value was used for calculation to avoid boiling.

3. Analysis Result

(1) Analysis Result of Standard Case

Trend of power are shown in Figure 4-1 and Figure 4-2. In standard case, 1.1$ of net reactivity was inserted, and rapid power increase due to prompt criticality occurred 6 seconds after (delayed) criticality. But because of inherent reactivity feedback mechanism as shown in Figure 4-3, the power decreased instantly (in 0.3 second) following rapid increase to 14% of rated power (230 MW). Then, the power became stable about 0.3% of rated power (4MW).

The maximum enthalpy increase during peak power was calculated to be 13cal/gUO_2, which is well below fuel PCMI failure threshold of 85cal/gUO_2. The analysis results were similar to the ones by Hokuriku EPCO as shown in Table 2. The fuel enthalpy increased gradually to become maximum value of 49cal/gUO_2 after 10 seconds of rapid power increase, which is well below limit value of 230cal/gUO_2 during accident or 92cal/gUO_2 during abnormal

transients during operation.

Maximum pellet temperature was about 700℃ as shown in Figure 4-4, and the maximum coolant temperature in the partial core was the boiling temperature at core outlet as shown in Figure 4-5.

(2) Affect of Inserted Reactivity

Calculation results are shown in Table 4, Figures 5-1 and 5-2. In each case, control rods withdrawal speed was considered to be 47mm/s. In the cases where reactivity of more than 1$ was inserted, the results were well below fuel PCMI failure threshold while prompt criticality was observed. In the case of large reactivity insertion, less than 0.1$ of difference was observed in the net inserted reactivity as compared with the standard case.

(3) Affect of Control Rods Movement Speed

Calculation results are shown in Table 5, Figures 6-1 and 6-2. While reactivity of 1.3$ were inserted, the net inserted reactivity was below 1$ in the case of low control rods withdrawal speed, and rapid power increase was not observed. In all cases, the results were well below fuel PCMI failure threshold.

(4) Affect of Analysis Model

Sensitivity analysis was made using "zero" coolant temperature coefficient. The result is shown in Table 3-2. No large affect due to difference in treatment of coolant temperature reactivity coefficient was observed.

4. Conclusion

Analyses were made on various conditions for criticality 'accident' occurred at Shika 1 using inserted reactivity and control rods withdrawal speed as variable parameters. Analyses result showed possibility of being prompt criticality in cases with conservative

condition. On the other hand, in cases such as with low control rod withdrawal speed, the core did not result in prompt criticality, and stayed in delayed criticality. For all analyzed cases, the maximum enthalpy increase during peak power period was well below fuel PCMI failure threshold. Results of JANTI analyses were equivalent to the ones by Hokuriku EPCO. Also, the reference analyses result of maximum fuel enthalpy was below threshold value in accident or in abnormal transient during operation for all analyzed cases.

5. Attachment

(1) Summary of "Treatment of High Burn-up Fuels in Reactivity Insertion Accident of Light Water Reactor Generation Facilities"

(2) Summary of "Safety Analyses Review Guide for Light Water Reactor Generation Facilities"

(3) Summary of "Reactivity Insertion Accident Review Guide for Light Water Reactor Generation Facilities"

(4) Definition of Terms

6. Reference

"Report Regarding Criticality Accident at Shika 1 NPS"
(April 6, 2007, Hokuriku Electric Power Company)

"LWR Reactivity Insertion Accident Code EUREKA-2"
(JAERI-M 84-074, May 1984, Japan Atomic Energy Research Institute)

"BWR Analyses Method of Reactivity Insertion Accident"
(HLR-012R3, February 1999, Hitachi Co.)

Table 1 Timeline of Input Parameter Determination by JANTI

From March 20, 2007: Start consideration of core analysis

【Phase I (Preliminary analysis using 3 region core model)】

- Sensitivity Analysis using assumed Inserted Reactivity, Control Rod Withdrawal Speed, Reactivity Coefficient etc.

Parameter	Considered Value
Inserted Reactivity ($)	1.2, 1.4, 1.6
Control Rod Speed (mm/s)	10, 30, 60, 100
Doppler Coefficient (Δ k/k/℃)	-2×10^{-5}
Coolant Temperature Coefficient (Δ k/k/℃)	-1.0×10^{-4}
Coolant Speed (cm/s)	10

- Consideration of analysis condition of Hokuriku EPCO, analysis condition of standard case was determined as follows except for control rods withdrawal speed.

Parameter	Considered Value
Inserted Reactivity ($)	1.3
Control Rod Speed (mm/s)	Per mockup test
Doppler Coefficient (Δ k/k/℃)	-2×10^{-5}
Coolant Temperature Coefficient (Δ k/k/℃)	-4.0×10^{-5}
Coolant Speed (cm/s)	10*

*Determined by sensitivity analysis (4cm/s and 10cm/s).

From March 24, 2007

【Phase II (Analysis of Partial Core based on 3-D Core Analysis)】

- Setup of partial core with 5 horizontal & 10 axial regions.
- Sensitivity analysis of inserted reactivity and control rod speed.
  - ① Inserted Reactivity ($): 0.81, 1.3, 1.8 etc.
  - ② Control Rods Withdrawal Speed (mm/s): 16, 47, 76 etc.
- Additional analysis with zero coolant temperature coefficient.

Table 2 Comparison of Analyses Input and Result

①Analyses Condition (Initial Condition)

	JANTI	Hokuriku EPCO
Analyzed Core	Partial Core (34 fuels)	Full Core (368 fuels)
Initial Power	0.7E-6%	1E-6%
Reactivity Excess	0.0079 Δ k (Standard Condition)	0.0079 Δ k (1)
Reactivity Feedback	Doppler Coefficient Coolant Temperature Coefficient	Doppler Coefficient

②Analyses Result

	JANTI (Standard Condition)	Hokuriku EPCO (1)	Threshold
Peak Power (Fraction to Rated Power)	14%	15%	—
Max. Enthalpy Increase during Peak Power [cal/gUO_2]	13	13	85 (2)
Max. Fuel Enthalpy [cal/gUO_2]	49	41	230 (3) 92 (3)

(1) Among conditions considered by Hokuriku EPCO, reactivity excess estimated by cold criticality test results was selected.

(2) Threshold value for fuel PCMI failure per "Treatment of High Burn-up Fuels in Reactivity Insertion Accident of Light Water Reactor Generation Facilities"

(3) Limit value in accidents/abnormal transients during operation per "Reactivity Insertion Accident Review Guide for Light Water Reactor Generation Facilities"

Table 3-1 Comparison of Analysis Method

Analysis by JANTI	Analysis by Hokuriku EPCO
• Calculation of both nuclear and thermal hydraulics feedback (Doppler coefficient and coolant temperature coefficient) by EUREKA-2. • Input value of pressure was increased as calculation needed to be done with no void condition. • Accuracy of heat removal calculation is not comparable to SCAT. • Power distribution is constant.	• Calculation of Nuclear feedback (Kinetics Calculation considering Doppler Coefficient) was calculated by APEX. • Input APEX result into thermal hydraulics code SCAT to calculate fuel thermal power. • Power distribution change is considered.

Table 3-2 Sensitivity Analysis of Affect of Coolant Temperature Coefficient

	Standard Condition	With "Zero" Coolant Temperature Coefficient
Net Inserted Reactivity [$]	1.11	1.11
Peak Power (Fraction to Rated Power)	14%	15%
Max. Enthalpy Increase during Peak Power [cal/gUO_2]	13	13
(Reference) Max. Fuel Enthalpy [cal/gUO_2]	49	53

Table 4 Analyses Result (Affect of Reactivity Inserted to the Core)

Analyzed Case	Large	Standard	Small
Inserted Reactivity	1.8$	1.3$	0.81$
Net Inserted Reactivity [$]	1.15	1.11	0.81
Peak Power (Fraction to Rated Power)	23%	14%	1%
Max. Enthalpy Increase during Peak Power [cal/gUO$_2$]	15	13	–
(Reference) Max. Fuel Enthalpy [cal/gUO$_2$]	66	49	–

- In all cases, control rods withdrawal speed is 47mm/s$_e$

- In all cases, maximum enthalpy increase is well below 85cal/gUO$_2$, threshold value of fuel PCMI failure during reactivity insertion accident.

- Larger reactivity being inserted, increase of net inserted reactivity is small due to reactor core inherent feedback effect.

(Analysis Result by Hokuriku EPCO)

- Control Rod Withdrawal Speed: 47mm/s
- Peak Power: 15%
- Max. Enthalpy Increase during Peak Power: 13cal/gUO$_2$
- Max. Fuel Enthalpy : 41cal/gUO$_2$

Table 5 Analyses Result (Affect of Control Rod Withdrawal Speed)

Analyzed Case	High Speed	Standard	Low Speed
Control Rod Withdrawal Speed	76mm/s	47mm/s	16mm/s
Net Inserted Reactivity [$]	1.17	1.11	0.98
Peak Power (Fraction to Rated Power)	28%	14%	3%
Max. Enthalpy Increase during Peak Power [cal/gUO$_2$]	17	13	–
(Reference) Max. Fuel Enthalpy [cal/gUO$_2$]	50	49	–

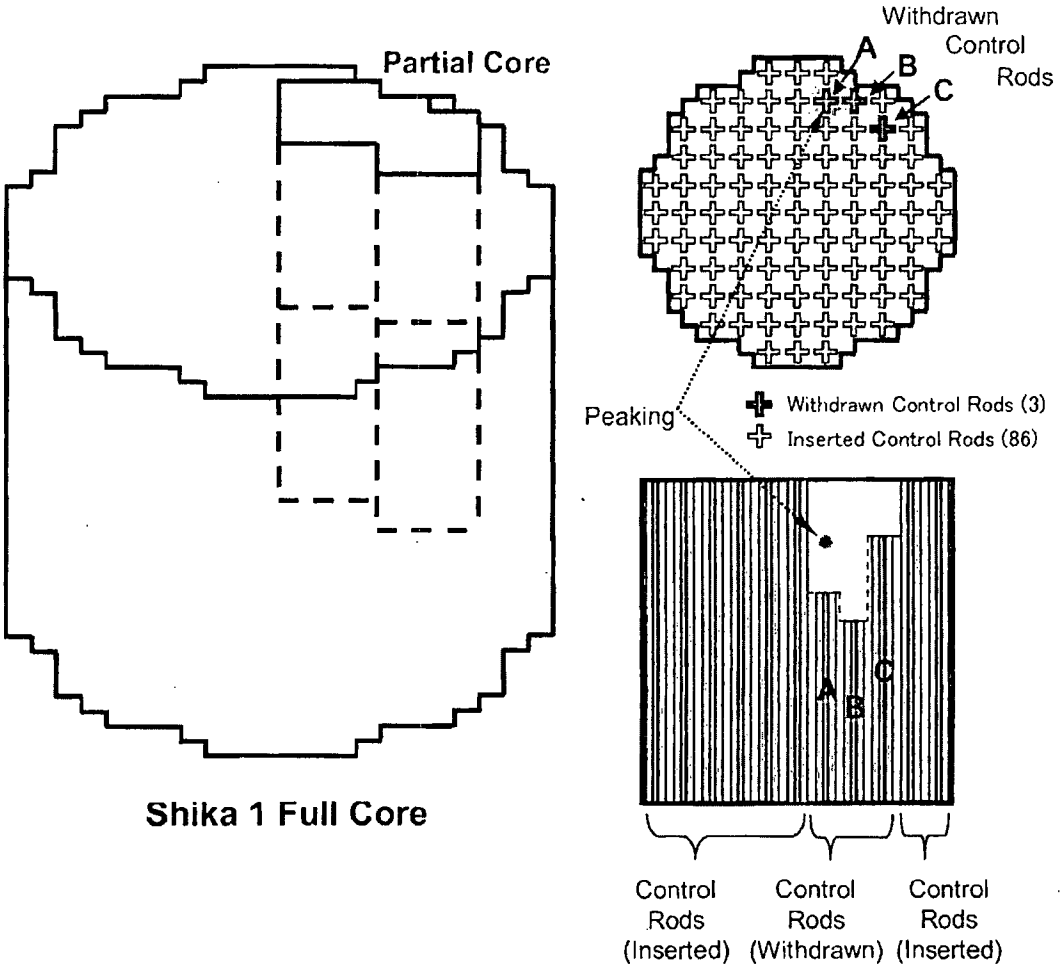
- In all cases, inserted reactivity is 1.3$.

- In all cases, maximum enthalpy increase is well below 85cal/gUO$_2$, threshold value of fuel PCMI failure during reactivity insertion accident.

- Even if reactivity of more than 1 $ is inserted by control rods withdrawal, net inserted reactivity can be below 1 $ based on withdrawal speed of control rods. (reactivity insertion speed)

(Analysis Result by Hokuriku EPCO)

- Control Rod Withdrawal Speed: 47mm/s
- Peak Power: 15%
- Max. Enthalpy Increase during Peak Power: 13cal/gUO$_2$
- Max. Fuel Enthalpy : 41cal/gUO$_2$



Analyzed Core (Partial Core)

- Number of Fuels : 34 of 368 (9%)
- Height : 10/24 from Top (40%)
- Volume : 4% of Full Core
- Heat Generatiion : 70% of Full Core
- Peaking of Partial Core : 3.5

Figure 1 Analyzed Partial Core

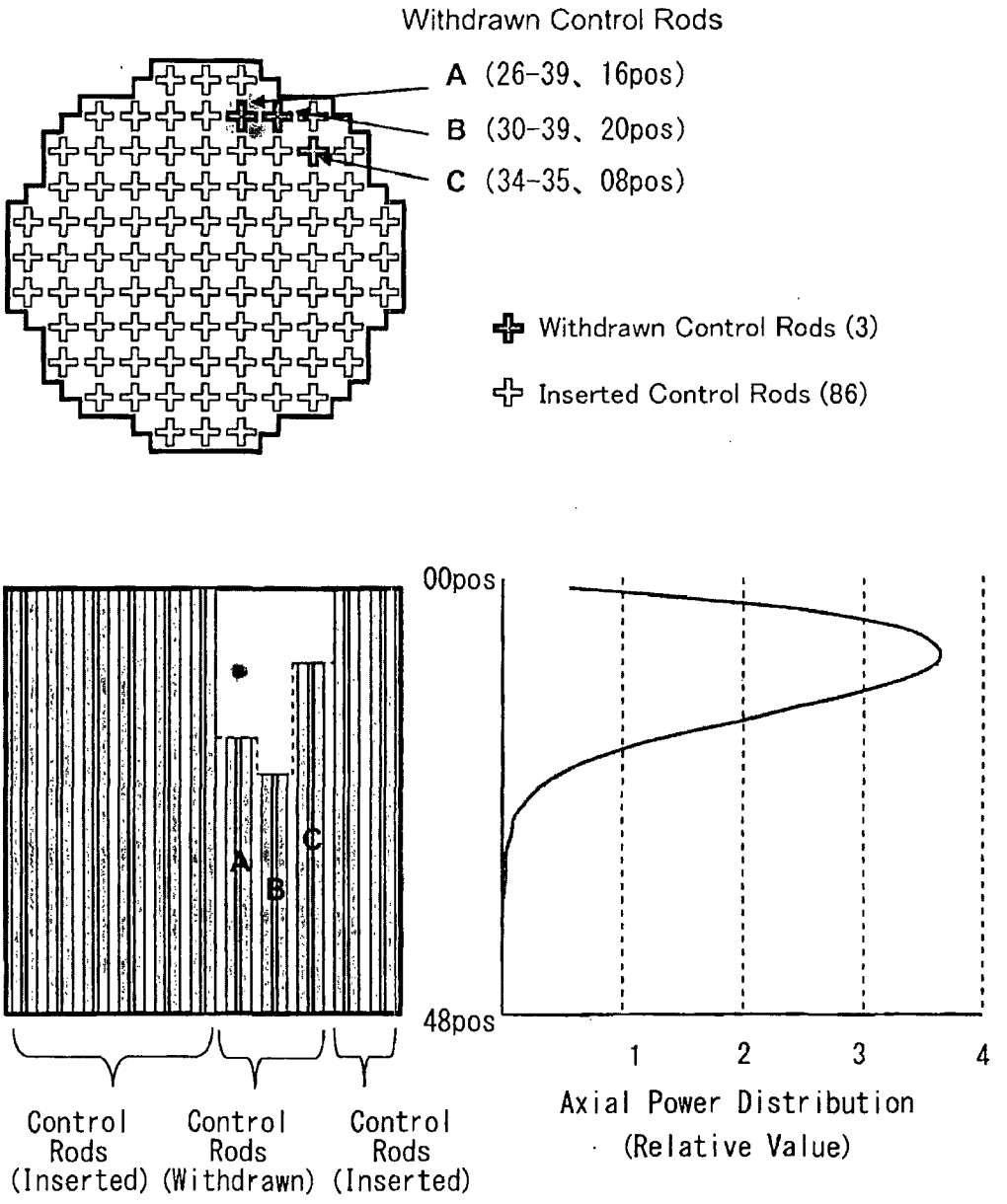
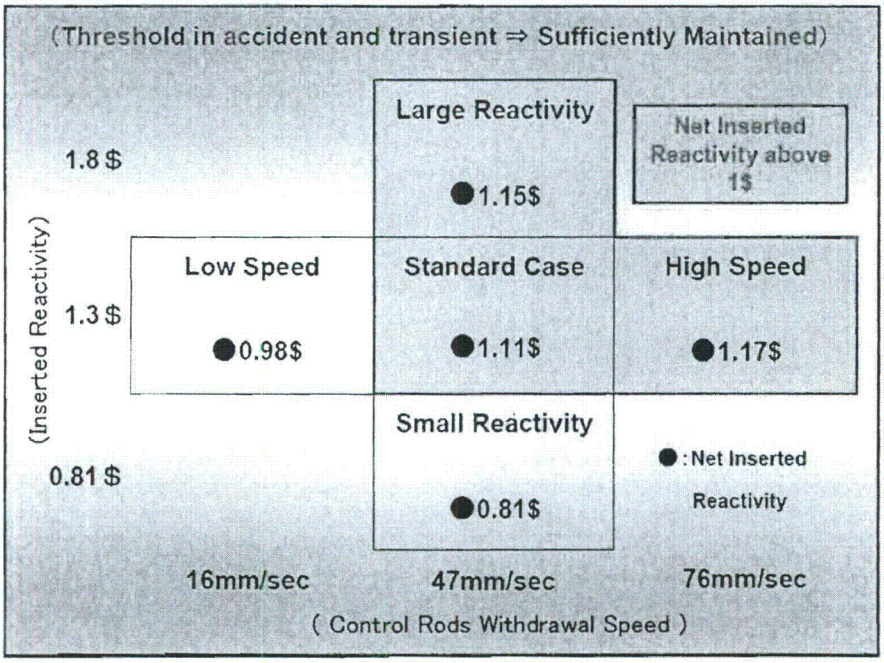


Figure 2 Power Distribution of the Core



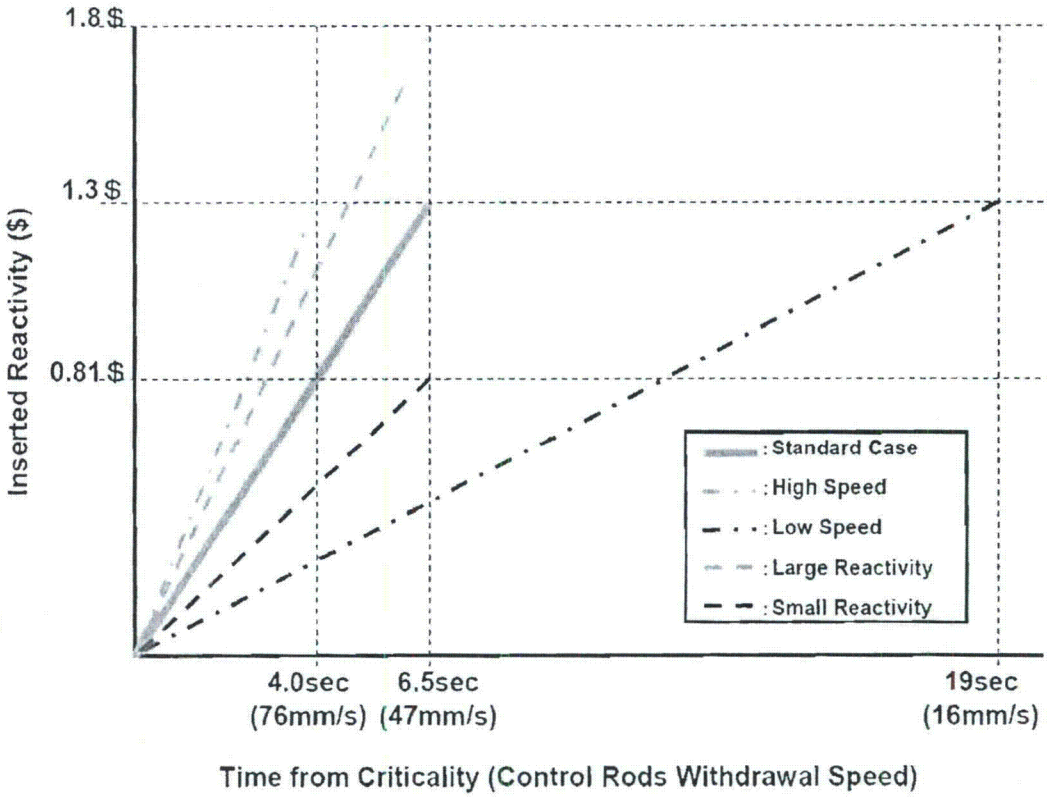


Figure 3 Reactivity Insertion Speed

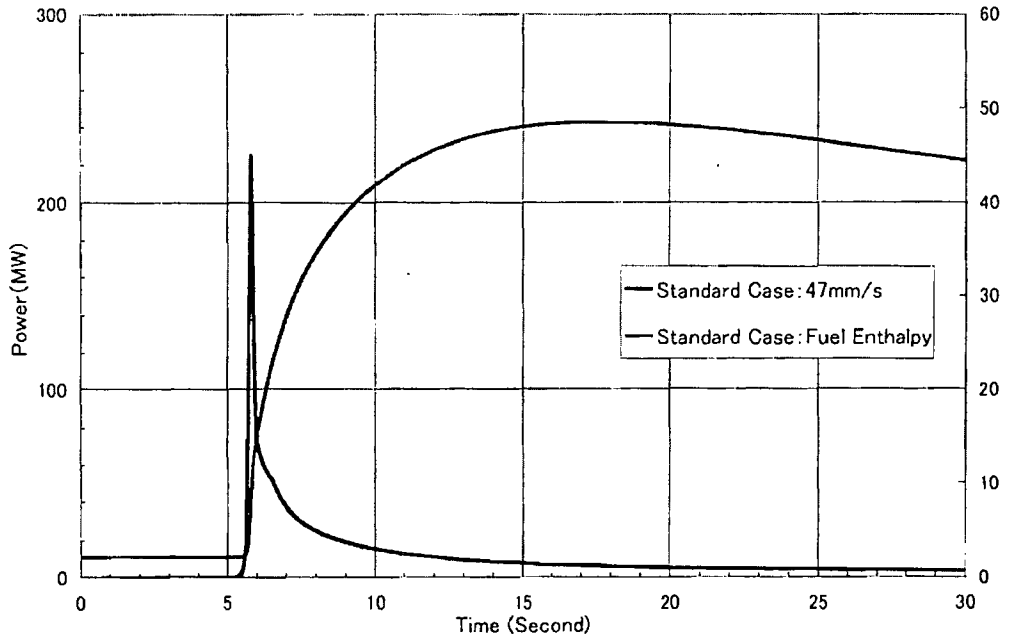


Figure 4-1 Trend of Power (Standard Case)

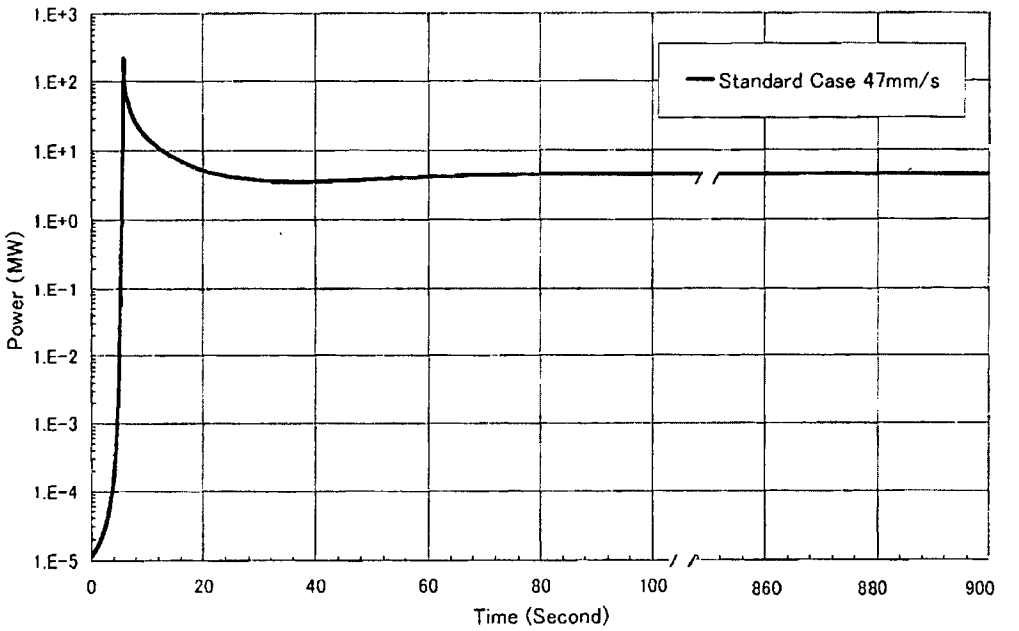


Figure 4-2 Trend of Power (Standard Case)

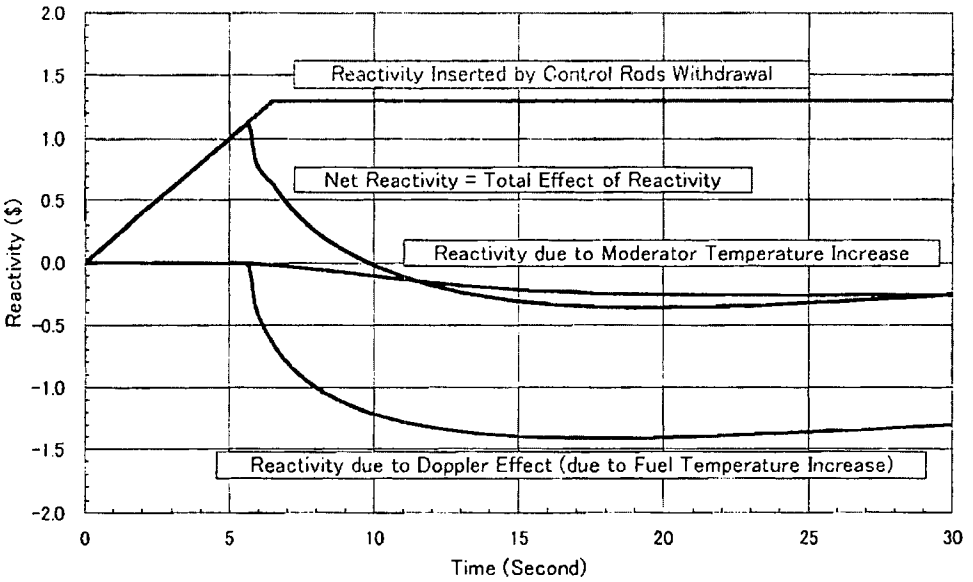


Figure 4-3 Effect of Reactivity Feedback (Standard Case)

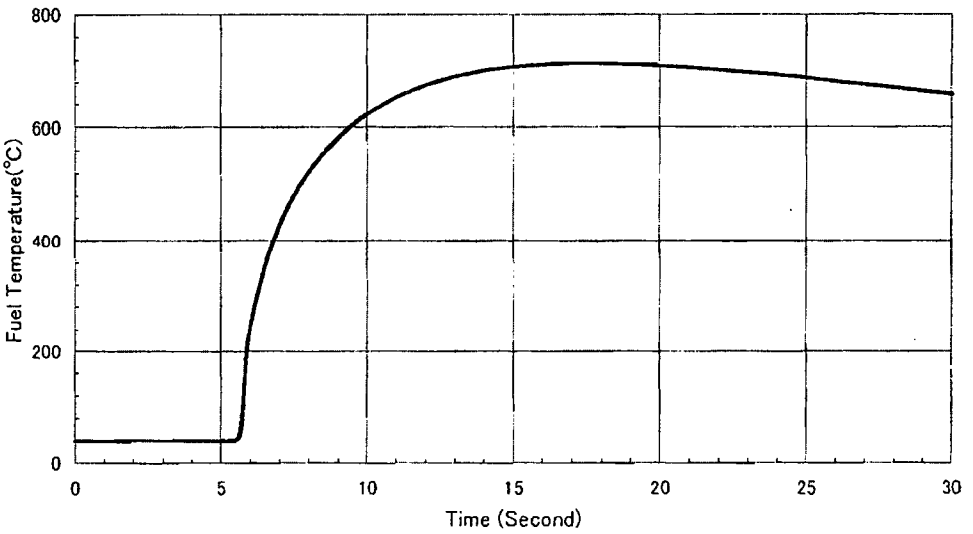
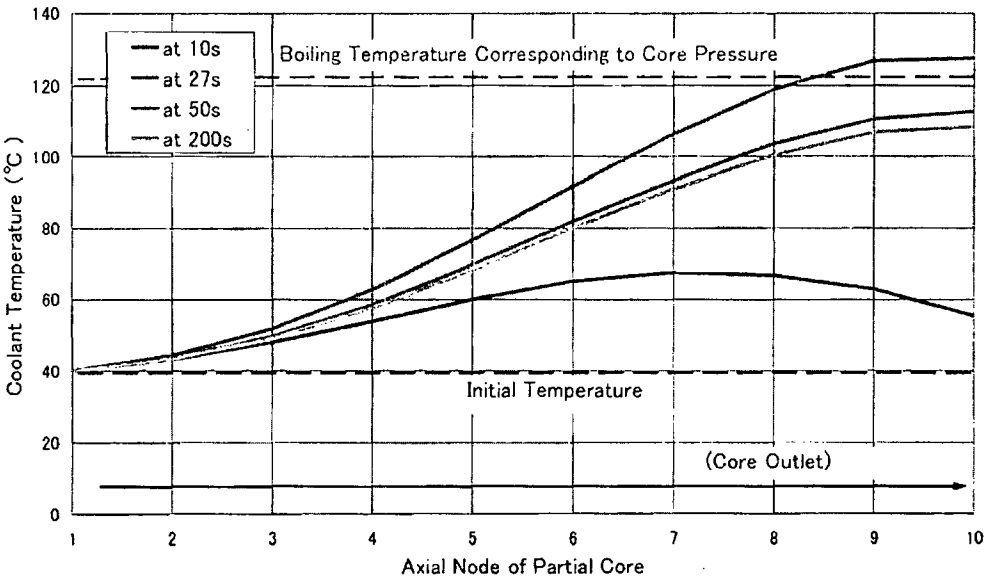


Figure 4-4 Trend of Pellet Temperature (Standard Case)



(Note) As higher core pressure value was used to avoid boiling, portion of coolant temperature appears to be above boiling temperature.

Figure 4-5 Axial Distribution of Coolant Temperature in Partial Core (Standard Case)

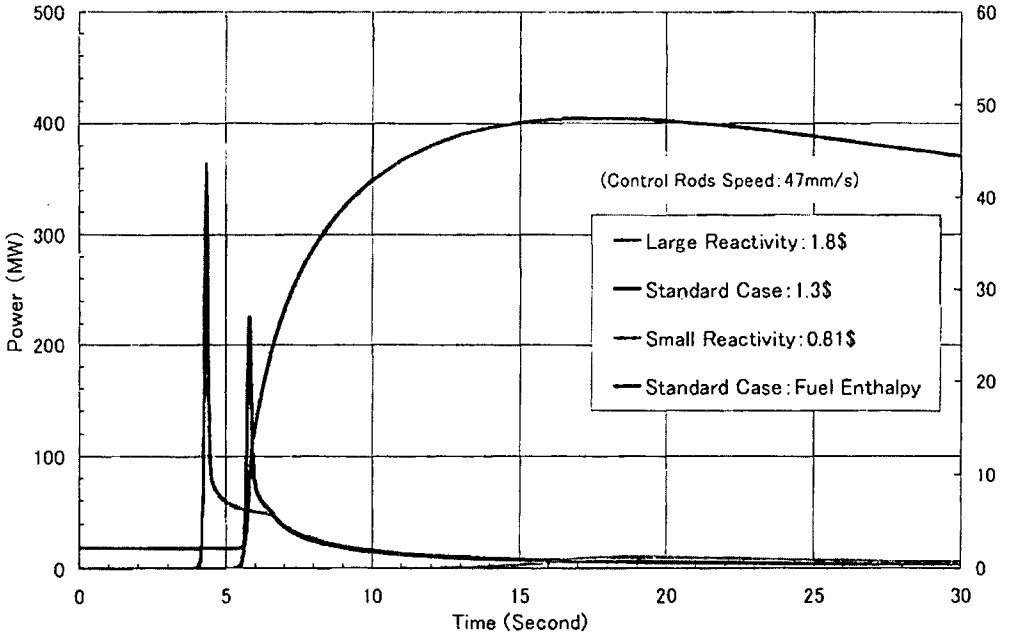


Figure 5-1 Trend of Power (Affect of Reactivity Inserted to the Core)

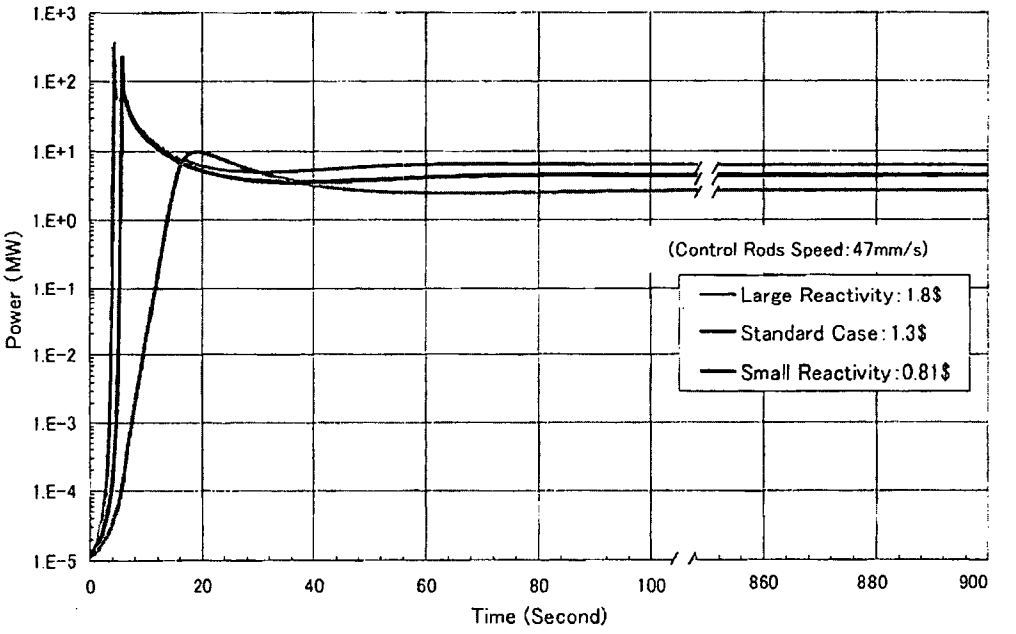


Figure 5-2 Trend of Power (Affect of Reactivity Inserted to the Core)

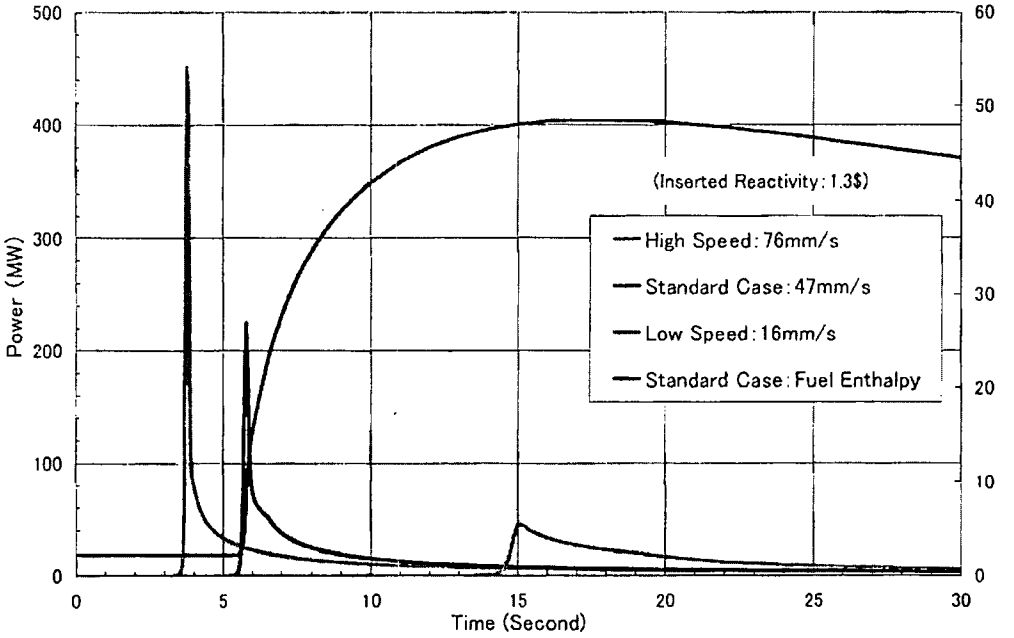


Figure 6-1 Trend of Power (Affect of Control Rod Withdrawal Speed)

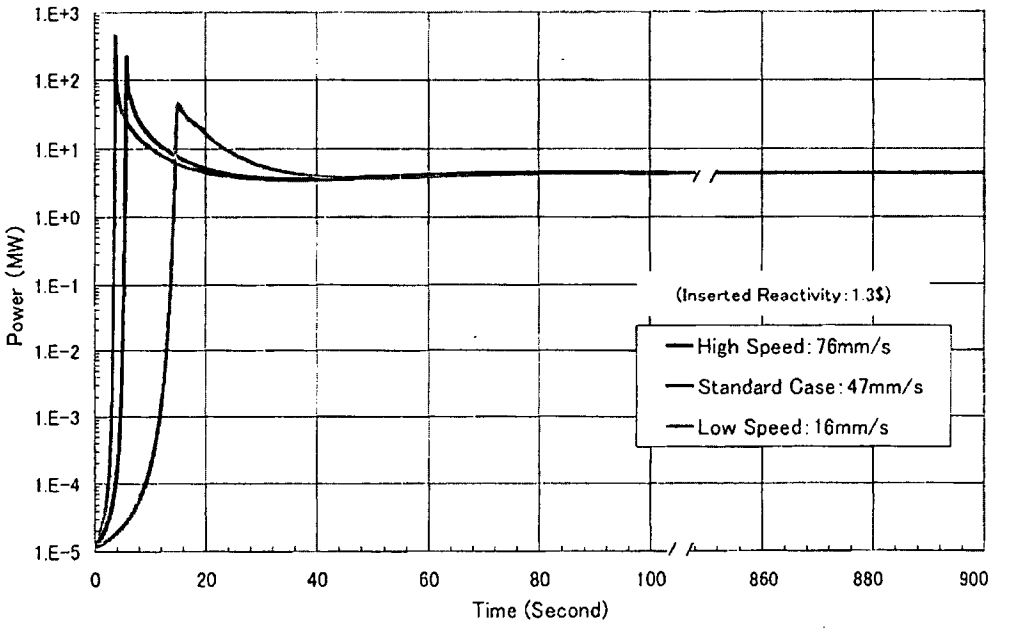


Figure 6-2 Trend of Power (Affect of Control Rod Withdrawal Speed)

Attachment 1

Summary of "Treatment of High Burn-up Fuels in Reactivity Insertion Accident of Light Water Reactor Generation Facilities"

This document was approved by Nuclear Safety Commission of Japan on April 13, 1998. For reference, summary of this document was translated as follows;

Background

For the future safety review, consideration was made on treatment of high burn-up fuels in reactivity insertion accident of light water reactors based on detailed investigation result of domestic research outcome and overseas examination results by safety standard sub-committee of nuclear safety commission to finalize the conclusion in this report.

Threshold Value of Fuel Failure

The threshold value of fuel failure due to PCMI (Pellet-Cladding Mechanical Interaction) is estimated as shown in the following table. The threshold values are presented as maximum enthalpy increase during peak power in conjunction with the associated pellet burn-up.

Pellet Burn-up	Maximum Enthalpy Increase During Peak Power
Below 25,000MWd/t	110cal/g·UO_2
Between 25,000MWd/t & 40,000MWd/t	85cal/g·UO_2
Between 40,000MWd/t & 65,000MWd/t	50cal/g·UO_2
Between 65,000MWd/t & 75,000MWd/t	40cal/g·UO_2

"Threshold Value Used in JANTI Analyses"

85cal/g·UO_2 was used based on the report by Hokuriku EPCO.

Attachment 2

Summary of "Safety Analyses Review Guide for Light Water Reactor Generation Facilities"

This review guide was approved by Nuclear Safety Commission of Japan on August 30, 1990, and revised on March 29, 2001. For reference, summary of this review guide was translated as follows;

II Safety Analysis Review

1. Purpose of Safety Analysis Review

Appropriateness of fundamental principle for safety design of nuclear facilities is reviewed per "Safety Design Review Guide." "Safety Design Review Guide" requires that structures, systems and components of nuclear facilities should function as expected to maintain safety both during normal operation and during abnormal condition. Therefore, review and analyses of "abnormal transients during operation" and "accidents" are needed to confirm appropriateness of fundamental principle for safety design of nuclear facilities. This guide presents events to be considered for safety design review, threshold of analyses results, and conditions to be considered in analyses.

2. Scope of Analyses

2.1 Abnormal Transients during Operation

During reactor operation, events resulted from single failure/ malfunction of equipment or single operator error that is expected during operational life of nuclear facilities, or resulted from another contributors to be expected in equivalent frequency are considered.

2.2 Accidents

"Accidents" are the abnormal conditions that exceed "abnormal transients during operation." In spite of low frequency, events should be regarded as "accidents" if there is potential of nuclear material release from the facility, and consideration is needed in the standpoint of safety review.

3. Selection of Events to be Reviewed

For both "abnormal transients during operation" and "accidents", events for safety review should be selected appropriately in accordance with above mentioned purpose and scope of safety design review.

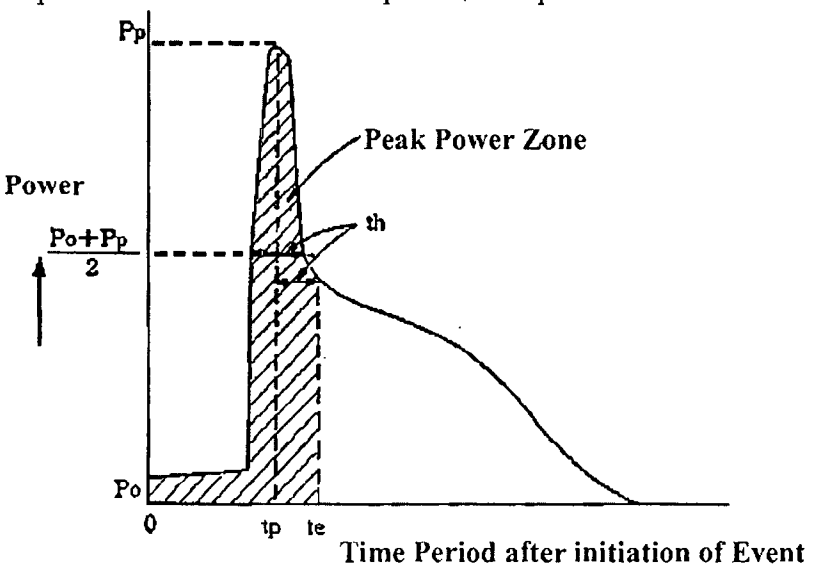
Attachment 3

Summary of "Reactivity Insertion Accident Review Guide for Light Water Reactor Generation Facilities"

This review guide was approved by Nuclear Safety Commission of Japan on January 19, 1984, and revised on August 30, 1990. For reference, summary of this review guide was translated as follows;

Definition of Terms

- Reactivity Insertion Accidents: Events accompanied by increase of reactor power and the associated increase of fuel enthalpy due to rapid insertion of basically more than 1$ of reactivity into reactor in or near criticality.
- Fuel Enthalpy: Radial average enthalpy of pellet. Summation of initial enthalpy and increased enthalpy obtained by analysis of the event. Fuel enthalpy is base value at 0℃.
- Definition of "peak power" period is shown in (Figure 1). "Po" is initial power, and "Pp" is peak power. "th" is the period while power is above (Po+Pp)/2. "tp" is the time of peak power. Peak power period "te" is defined as tp+th (time period of slashed zone.)



(Figure 1) Definition of "peak power" period in reactivity insertion accidents

Purpose

Analyze increase of reactor power and the associated increase of fuel enthalpy due to rapid insertion of basically more than 1$ of reactivity into reactor in or near criticality in order to confirm integrity of core and reactor coolant pressure boundary during "abnormal transient during operation" and "accident".

Threshold

(1) "Abnormal Transient during Operation"

1) Maximum fuel enthalpy should be within "Fuel Design Limit" shown in (Figure 2).

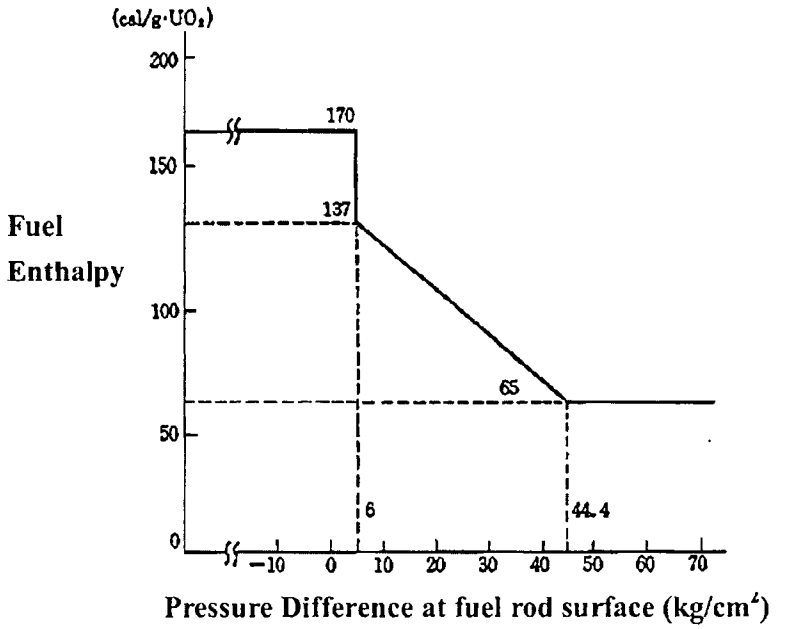
2) Pressure at reactor coolant pressure boundary should be within 110% of Maximum Operational Pressure.

(2) "Accident"

1) Maximum fuel enthalpy should be within 230cal/g · UO_2.

2) Pressure at reactor coolant pressure boundary should be within 120% of Maximum Operational Pressure.

(3) During "abnormal transient during operation" and "accident", reactor shutdown capability and integrity of reactor pressure vessel should not be affected by disturbance such as pressure impact resulted from rupture of fuel with water intrusion.



(Figure 2) Fuel design limit at reactivity insertion accident

Attachment 4

Definition of Terms

Terms	Explanation
Criticality	Status of generated neutron from fission and disappeared neutron from the core is in balance, and chain reaction is maintained. Status when Effective Criticality Factor (Keff) is 1.
Effective Criticality Factor (Keff)	Number of generated neutron from fission divided by number of neutron disappeared from the core.
Prompt Criticality	Status when criticality is maintained with no contribution of delayed neutron.
Delayed Criticality	Status when criticality is maintained with contribution of both prompt and delayed neutrons.
Prompt Neutron	Neutron emitted almost simultaneously (within 10^{-4} second) during fission.
Delayed Neutron	Neutron emitted from collapse of fission products after 0.4 second to 50-60 seconds of the original fission.
Delayed Neutron Fraction	Fraction of Delayed Neutron from total number of neutrons emitted from fission.
Reactivity	Value of (Keff-1)/Keff, indicator of deviation from criticality.
Reactivity Excess	Value of (Keff-1), reactivity of over criticality.

Inserted Reactivity	Reactivity inserted in the core.
Net Inserted Reactivity	Inserted reactivity subtracted by feedback reactivity.
Feedback Reactivity	Reactivity such as Doppler Reactivity and Moderator Temperature Reactivity which has suppression effect on the inserted reactivity.
Reactivity Coefficient	Coefficient of reactivity change due to change of fuel temperature or moderator temperature.
Doppler (Reactivity) Coefficient	Reactivity change per fuel temperature change. When fuel temperature increases, reactivity tends to decrease because of increased neutron absorption rate isotopes such as U-238.
Moderator Temperature (Reactivity) Coefficient	Reactivity change per moderator temperature change.
Core Inherent Safety Feature (Self Control Feature)	When reactor power increases, reactivity will decrease due to Doppler effect and others, which will lead to decrease of reactor power.
Fuel Enthalpy	Amount of heat accumulated per weight of fuel.
Power Peaking	Maximum power divided by average power.

From: Hoc, PMT12
Sent: Sunday, March 27, 2011 12:27 PM
To: PMT03 Hoc
Subject: FW: Please Review - High Priority
Attachments: Summary of Air Sample Analyses Submited by CMOC 25 Mar WORKING DRAFT.xlsx

From: OST01 HOC
Sent: Sunday, March 27, 2011 11:08 AM
To: ET07 Hoc; LIA06 Hoc; LIA08 Hoc; PMT01 Hoc; PMT02 Hoc; PMT11 Hoc; Hoc, PMT12
Subject: FW: Please Review - High Priority

Please forward to applicable personnel, if necessary.

From: HOO Hoc [mailto:HOO.Hoc@nrc.gov]
Sent: Sunday, March 27, 2011 11:05 AM
To: LIA07 Hoc; OST01 HOC; OST02 HOC; OST03 HOC
Subject: FW: Please Review - High Priority

From: NITOPS[SMTP:NITOPS@NNSA.DOE.GOV]
Sent: Sunday, March 27, 2011 11:04:58 AM
To: DL-Policy Working Group; CMHT; HOO Hoc; NARAC; PMT01 Hoc; PMT02 Hoc; Hoc, PMT12
Subject: FW: Please Review - High Priority
Auto forwarded by a Rule

FYI

From: Reed, Alexis L (NST)
Sent: Sunday, March 27, 2011 11:03 AM
To: NITOPS; CMHT
Subject: Please Review - High Priority

Please review the attached summary spreadsheet of air samples taken by the CMRT field teams. Target values are daily whole-body dose (mrem) and daily thyroid dose (mrem) at each location.

****

Alexis L. Reed, Ph.D. (Contractor)
DOE CM Home Team
702-794-1671

Air Sample Data

Embassy Area Only - Not reported previously

DAC thy
DAC WB
Blank ->

Date	Type	Team	Sample Number	Lattitude	Longitude	Exposure Rate (uR)
3/19/2011	Paper	Roof	SCF-00013	35.668738	139.743319	25
3/19/2011	Charcoal	Roof	SCF-00015	35.668738	139.743319	25
3/19/2011	Paper	Harris	SCF-00016	35.668738	139.743319	25
3/19/2011	Charcoal	Harris	SCF-00018	35.668738	139.743319	25
3/18/2011	Cartridge	Roof	SCF-08994	35.668738	139.743319	16
3/18/2011	Paper	Roof	SCF-08987	35.668738	139.743319	16
3/18/2011	Cartridge	Harris	SCF-08993	35.668738	139.743319	17
3/18/2011	Paper	Harris	SCF-08989	35.668738	139.743319	17
3/16/2011	Paper	Roof	2011_03_17_13_02_020	35.668738	139.743319	17
3/16/2011	Cartridge	Roof	2011_03_17_13_22_400	35.668738	139.743319	17
3/17/2011	Paper	Roof	2011_03_17_16_14_370	35.668738	139.743319	17
3/17/2011	Cartridge	Roof	2011_03_17_16_33_270	35.668738	139.743319	17
3/24/2011	Paper	Harris	SCF-00055	35.668738	139.743319	26
3/24/2011	Cartridge	Harris	SCF-00056	35.668738	139.743319	26
3/23/2011	Paper	Harris	SCF-00126	35.668738	139.743319	30
3/23/2011	Cartridge	Harris	SCF-00127	35.668738	139.743319	30
3/24/2011	Paper	Roof	SCF-00128	35.668738	139.743319	23
3/24/2011	Cartridge	Roof	SCF-00129	35.668738	139.743319	23
3/25/2011	Paper	Roof	SCF-00300	35.668738	139.743319	31
3/25/2011	Cartridge	Roof	SCF-00301	35.668738	139.743319	31
3/25/2011	Paper	Harris	SCF-00302	35.668738	139.743319	23
3/25/2011	Cartridge	Harris	SCF-00303	35.668738	139.743319	23

8.00E-08	3.75E-06	3.00E-07			(uCi/ml)
2.00E-08	3.00E-06	1.00E-07	4.00E-08	6.00E-08	(uCi/ml)
2.93E-03	1.18E-03	0	8.06E-04	3.22E-04	(uCi)

I-131 (uCi)	I-132 (uCi)	I-133 (uCi)	Cs-134 (uCi)	Cs-137 (uCi)	Sample Volume (cf)	I-131 Conc (uCi/ml)	I-132 Conc (uCi/ml)	I-133 Conc (uCi/ml)
0.00E+00	1.03E-02	0.00E+00	8.19E-03	0.00E+00	1.05E+03	0.00E+00	3.07E-10	0.00E+00
2.43E-04	2.49E-03	0.00E+00	0.00E+00	0.00E+00	1.05E+03	0.00E+00	4.41E-11	0.00E+00
5.23E-03	7.14E-05	0.00E+00	0.00E+00	0.00E+00	1.47E+03	5.53E-11	0.00E+00	0.00E+00
2.02E-02	0.00E+00	0.00E+00	1.12E-04	0.00E+00	1.47E+03	4.16E-10	0.00E+00	0.00E+00
1.73E-03	3.03E-04	1.77E-04	1.23E-04	0.00E+00	1327.2	0.00E+00	0.00E+00	4.71E-12
2.06E-03	4.18E-04	0.00E+00	0.00E+00	0.00E+00	1327.2	0.00E+00	0.00E+00	0.00E+00
5.41E-03	0.00E+00	0.00E+00	5.81E-03	0.00E+00	1733.82	5.05E-11	0.00E+00	0.00E+00
2.01E-03	4.36E-04	0.00E+00	0.00E+00	0.00E+00	1733.82	0.00E+00	0.00E+00	0.00E+00
2.08E-03	4.44E-04	0.00E+00	4.37E-05	0.00E+00	4.62E+01	0.00E+00	0.00E+00	0.00E+00
2.03E-03	4.88E-04	0.00E+00	1.06E-04	0.00E+00	4.62E+01	0.00E+00	0.00E+00	0.00E+00
2.23E-03	5.16E-04	5.35E-05	8.91E-05	0	9.91E+02	0.00E+00	0.00E+00	1.91E-12
2.21E-03	4.81E-04	9.07E-05	9.95E-05	0	9.91E+02	0.00E+00	0.00E+00	3.23E-12
5.48E-03	2.61E-04	8.82E-05	7.94E-03	2.21E-04	1.77E+03	5.08E-11	0.00E+00	1.76E-12
6.09E-03	4.34E-04	7.42E-05	7.55E-03	2.46E-04	1.77E+03	6.30E-11	0.00E+00	1.48E-12
1.65E-02	7.87E-04	1.98E-04	0	0	1.51E+03	3.17E-10	0.00E+00	4.62E-12
2.04E-02	1.16E-03	0	8.40E-03	1.74E-03	1.51E+03	4.08E-10	0.00E+00	0.00E+00
4.86E-03	1.01E-03	0	8.31E-04	2.59E-04	1.29E+03	5.29E-11	0.00E+00	0.00E+00
5.26E-03	8.19E-04	0	7.48E-04	3.35E-04	1.29E+03	6.39E-11	0.00E+00	0.00E+00
3.52E-03	2.17E-04	0	0	0	1113.08	1.87E-11	0.00E+00	0.00E+00
3.98E-03	4.12E-04	0	7.18E-04	1.77E-04	1113.08	3.33E-11	0.00E+00	0.00E+00
3.47E-03	1.94E-04	0	8.21E-04	0	1287.5	1.48E-11	0.00E+00	0.00E+00
4.18E-03	2.05E-04	0	0	0	1287.5	3.43E-11	0.00E+00	0.00E+00

Cs-134 Conc (uCi/ml)	Cs-137 Conc (uCi/ml)	Int WB Dose (mrem/hr)	Combined WM Dose Rate	Thyroid Dose (mrem/hr)	Combined Thyroid Dose Rate	Paper/Cartridge
2.49E-10	0.00E+00	1.58E-02		2.05E-03		
0.00E+00	0.00E+00	3.68E-05	1.58E-02	2.94E-04	2.34E-03	0.0
0.00E+00	0.00E+00	6.92E-03		1.73E-02		
0.00E+00	0.00E+00	5.19E-02	5.89E-02	1.30E-01	1.47E-01	0.3
0.00E+00	0.00E+00	1.18E-04		3.92E-04		
0.00E+00	0.00E+00	0.00E+00	1.18E-04	0.00E+00	3.92E-04	1.2
1.02E-10	0.00E+00	1.27E-02		1.58E-02		
0.00E+00	0.00E+00	0.00E+00	1.27E-02	0.00E+00	1.58E-02	0.4
0.00E+00	0.00E+00	0.00E+00		0.00E+00		
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.0
0.00E+00	0.00E+00	4.77E-05		1.59E-04		
0.00E+00	0.00E+00	8.08E-05	1.28E-04	2.69E-04	4.28E-04	1.0
1.42E-10	0.00E+00	1.53E-02		1.60E-02		
1.34E-10	0.00E+00	1.63E-02	3.16E-02	1.98E-02	3.58E-02	0.9
0.00E+00	0.00E+00	3.97E-02		9.94E-02		
1.77E-10	3.31E-11	6.35E-02	1.03E-01	1.28E-01	2.27E-01	0.8
6.86E-13	0.00E+00	6.66E-03		1.65E-02		
0.00E+00	3.57E-13	8.00E-03	1.47E-02	2.00E-02	3.65E-02	0.9
0.00E+00	0.00E+00	2.34E-03		5.85E-03		
0.00E+00	0.00E+00	4.16E-03	6.50E-03	1.04E-02	1.63E-02	0.9
4.11E-13	0.00E+00	1.88E-03		4.63E-03		
0.00E+00	0.00E+00	4.29E-03	6.16E-03	1.07E-02	1.53E-02	0.8

From: RST01 Hoc
Sent: Friday, April 01, 2011 4:40 PM
To: GE Hitachi; INPO EmergencyResponseCtr (INPO); EventResponse@epri.com
Cc: ROB.VERSLUIS@nuclear.energy.gov; RST01B Hoc
Subject: FW: Coordination of contaminated water cleanup efforts

Forwarded per DOE request

-----Original Message-----
From: Versluis, Rob [mailto:ROB.VERSLUIS@nuclear.energy.gov]
Sent: Friday, April 01, 2011 2:03 PM
To: RST01 Hoc
Cc: RST01B Hoc; Regalbuto, Monica; Golub, Sal; Versluis, Rob
Subject: Coordination of contaminated water cleanup efforts

Monica is the person in charge of the DOE NE team on contaminated water cleanup.
Coordinates: Monica.regalbuto@nuclear.energy.gov (202) 586-6692

Please provide return contact info on the industry side concerned with cleanup of contaminated water.

Rob Versluis, PhD, DOE NE-71, 301-903-1890 (o) (b)(6) (m)
****

-----Original Message-----
From: Golub, Sal
Sent: Friday, April 01, 2011 11:56 AM
To: Regalbuto, Monica
Cc: Schneider, Steve; Versluis, Rob; Caponiti, Alice; Kelly, John E (NE)
Subject: TMI cleanup

Monica

There are some good sources of information on the EPRI site regarding contaminated water cleanup at TMI....and other D&D activities....

For example:

http://my.epri.com/portal/server.pt?Abstract_id=NP-6931

NRC RST and Industry folks are also looking at this water management issue at Fukushima 1. Your team should definitely link in. Rob Versluis can be the match-maker...

Sal

Sal Golub, PMP

Associate Deputy Assistant Secretary
for Nuclear Reactor Technologies (NE-7)
Tel: 301-903-1636
Cell: (b)(6)
Fax: 301-903-0180
sal.golub@hq.doe.gov

Bano, Mahmooda

From: Scott, Michael
Sent: Friday, April 01, 2011 5:53 PM
To: Taylor, Robert; Blamey, Alan; Giessner, John; Monninger, John; Dorman, Dan
Subject: FW: ACTION - REVIEW AND CONSIDERATION OF COMPILED SET OF MITIGATING STRATEGIES IDENTIFIED BY THE SCIENCE GROUP
Attachments: Accident management strategies.ppt

From: Collins, Elmo
Sent: Friday, April 01, 2011 5:32 PM
To: Scott, Michael
Subject: Fw: ACTION - REVIEW AND CONSIDERATION OF COMPILED SET OF MITIGATING STRATEGIES IDENTIFIED BY THE SCIENCE GROUP

From: Weber, Michael
To: Boger, Bruce; Thaggard, Mark
Cc: RST01 Hoc; PMT01 Hoc; Hoc, PMT12; LIA06 Hoc; LIA08 Hoc; ET01 Hoc; ET05 Hoc; OST02 HOC; FOIA Response.hoc Resource; Casto, Chuck; Collins, Elmo; Dorman, Dan; Sheron, Brian; Leeds, Eric; Carpenter, Cynthia
Sent: Fri Apr 01 16:31:02 2011
Subject: ACTION - REVIEW AND CONSIDERATION OF COMPILED SET OF MITIGATING STRATEGIES IDENTIFIED BY THE SCIENCE GROUP

(b)(5)

From: Sheron, Brian
Sent: Friday, April 01, 2011 3:59 PM
To: Weber, Michael
Subject: FW: Framing

Not sure what this means. It is a good list of all the topics the science group pontificated on over the past few weeks. (b)(5)

(b)(5)

From: Kelly, John E (NE) [mailto:JohnE.Kelly@Nuclear.Energy.Gov]
Sent: Friday, April 01, 2011 3:53 PM
To: DL-NITsolutions
Cc: 'ellisjo@inpo.org'; 'mortensengk@inpo.org'
Subject: Framing

Attached is slide deck that we're developing to frame how the work of our team and science experts is addressing the variety of accident management response strategies. This is a draft, but wanted to share for comment. Note that we have many more analyses that we have in our log.
John

Dr. John E. Kelly
Deputy Assistant Secretary for Nuclear Reactor Technologies
NE-7
U.S. Department of Energy
1000 Independence Ave. SW
Washington, DC 20585
phone: 202-586-5458
fax: 202-586-0541
mobile: (b)(6)

Draft for Comment

(b)(5)

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(b)(5)

Lee, Richard

From: Lee, Richard
Sent: Monday, April 04, 2011 10:27 AM
To: Wagner, Katie
Subject: FW: Monday telecon: NARAC-NRC-USFJ-DOE-USAF discussion on new prediction requests

Importance: High

Please log in. Charlie and/or Jason will participate in today conference call with NARAC.

Richard

From: PMT11 Hoc
Sent: Monday, April 04, 2011 10:17 AM
To: Tinkler, Charles; Schaperow, Jason
Cc: Lee, Richard; FOIA Response.hoc Resource; Hoc, PMT12; PMT02 Hoc; PMT11 Hoc
Subject: FW: Monday telecon: NARAC-NRC-USFJ-DOE-USAF discussion on new prediction requests
Importance: High

Charlie and Jason,

This email follows up on recent voice messages re: a telephone conference call with NARAC and others at 11:00 AM this morning.
Please confirm that you'll be able to support this call.
Our PMT shift just learned of this meeting – sorry for the last minute request.

Tony
PMT Ops Center

From: Nasstrom, John S. [mailto:Nasstrom1@llnl.gov]
Sent: Sunday, April 03, 2011 11:02 PM
To: Hoc, PMT12; (b)(6); daniel.blumenthal@nnsa.doe.gov; dblumenthal@ofda.gov; nitops@nnsa.doe.gov; (b)(6); Aoki_Steven (Steven.Aoki@nnsa.doe.gov); (b)(6); Sugiyama, Gayle; Baskett, Ron; Nasstrom, John S.; Garino, Gerard
Subject: Monday telecon: NARAC-NRC-USFJ-DOE-USAF discussion on new prediction requests

You are invited to participate in a Telephone Conference to continue our discussions on the path forward in response to recent requests for updated consequence management planning calculations by NARAC for hypothetical future Japan reactor accidents.

Telecon time: 08:00 am Pacific, April 4, 2011
(We may not catch participants in Japan, but will have follow up calls to catch everyone)
Toll Free Dial-In Number: 866-914-3976
International Access/Caller Paid Dial-In Number: 925-424-8105
Participant Code (b)(6)

Agenda:
A. Review the objectives of requests for updated consequence management planning calculations for hypothetical future Japan reactor accidents:

1. Reactor scenarios (source terms for plume model)
2. Meteorological cases

B. Determine action items and next steps

Questions for Discussion

What are the objectives for reactor scenarios in recent DoD/USFJ request, and for US Embassy request?

What levels of conservatism and plausibility are desired in the source terms?

What (already developed) reactor scenario source terms can possibly be used, and do they meet the objectives? If not, what scenarios need to be developed and who is tasked to develop these?

What are the objectives of the meteorological cases?

Detailed questions (for background, and follow-up discussion)

Source term questions:

What are the assumptions and the level of conservatism in the recently developed NRC reactor scenario source term (the latest MELCOR source term provided by NRC PMT to the NIT on March 31, 2011, which appears to account for decay until April 15, 2011). Are these source term and assumed release rates from containment consistent with current understanding of the extent of containment damage and the observed leak and venting pathways?

Is the March 31 NRC MELCOR source term appropriate to meet DoD objectives?

Do other source terms need to be developed for different time frames, e.g., DoD/USFJ has asked for "what if" analysis for May time frame as well as April?

For a conservative hypothetical source term, does a spent fuel pool source term need to be included, in addition to reactor release?

Are all radionuclides of concern in March 31 MELCOR source term? (Note: Some radionuclides that were in the previous NRC source term are not included in the March 31 MELCOR source term and the list does not include all of the top 20 dose contributors provided by the DOE CMHT from prior NRC source term analyses)

Can some of the radionuclides in the March 31 MELCOR source term be neglected because the activities are extremely low (e.g., 9.28E-283)?

Can some of the radionuclides be neglected because they do not contribute significantly to dose pathways of concern for early or intermediate phase dose?

Meteorology questions:

What meteorological data is needed to meet the objectives – model forecast, observational data?

What meteorological data is available from the Air Force?

For climatological / observation data, will the Air Force be able to provide this data in a format suitable for use by NARAC?

From: ET02 Hoc
Sent: Thursday, April 07, 2011 5:13 PM
To: ET07 Hoc
Subject: FW: White paper - Options to Mitigate Contaminated Water
Attachments: DOE Options for Contaminated Wate treatment 7 Apr2011.docx

---

From: ET01 Hoc
Sent: Thursday, April 07, 2011 5:13:17 PM
To: ET02 Hoc
Subject: FW: White paper - Options to Mitigate Contaminated Water
Auto forwarded by a Rule

From: Sheron, Brian
Sent: Thursday, April 07, 2011 5:13:06 PM
To: ET01 Hoc; Zimmerman, Roy; RST01 Hoc
Cc: Weber, Michael; Virgilio, Martin
Subject: FW: White paper - Options to Mitigate Contaminated Water
Auto forwarded by a Rule

FYI.

From: Larzelere, Alex [mailto:alex.larzelere@nuclear.energy.gov]
Sent: Thursday, April 07, 2011 5:09 PM
To: DL-NITsolutions; Lee, Richard
Cc: 'busbyjt@ornl.gov'; 'Douglas.Burns@inl.gov'
Subject: Fw: White paper - Options to Mitigate Contaminated Water

Sent from my BlackBerry, which you can call @ (b)(6)

From: Regalbuto, Monica
To: Onishi, Yasuo; Lyons, Peter; Larzelere, Alex; Schneider, Steve; Bisconti, Giulia; Duncan, Aleshia (State Dept); Caponiti, Alice
Cc: Reid, Bruce D; Kelly, John E (NE) (b)(6)
Sent: Thu Apr 07 17:01:31 2011
Subject: White paper - Options to Mitigate Contaminated Water

Enclosed is DOE's white paper. Please send comments to Steve Schneider (EM) and Monica Regalbuto (NE).

Thanks

Monica

From: PMT02 Hoc
Sent: Thursday, April 07, 2011 7:22 PM
To: PMT11 Hoc
Subject: FW: White paper - Options to Mitigate Contaminated Water
Attachments: DOE Options for Contaminated Wate treatment 7 Apr2011.docx

---

From: Hoc, PMT12
Sent: Thursday, April 07, 2011 6:44 PM
To: PMT02 Hoc; PMT09 Hoc
Subject: FW: White paper - Options to Mitigate Contaminated Water

Can you look at this??

From: Zimmerman, Roy
Sent: Thursday, April 07, 2011 5:35 PM
To: Hoc, PMT12; LIA06 Hoc
Subject: FW: White paper - Options to Mitigate Contaminated Water

---

From: Sheron, Brian
Sent: Thursday, April 07, 2011 5:13 PM
To: ET01 Hoc; Zimmerman, Roy; RST01 Hoc
Cc: Weber, Michael; Virgilio, Martin
Subject: FW: White paper - Options to Mitigate Contaminated Water

FYI.

From: Larzelere, Alex [mailto:alex.larzelere@nuclear.energy.gov]
Sent: Thursday, April 07, 2011 5:09 PM
To: DL-NITsolutions; Lee, Richard
Cc: 'busbyjt@ornl.gov'; 'Douglas.Burns@inl.gov'
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From: Regalbuto, Monica
To: Onishi, Yasuo; Lyons, Peter; Larzelere, Alex; Schneider, Steve; Bisconti, Giulia; Duncan, Aleshia (State Dept); Caponiti, Alice
Cc: Reid, Bruce D; Kelly, John E (NE) (b)(6)
Sent: Thu Apr 07 17:01:31 2011
Subject: White paper - Options to Mitigate Contaminated Water

Enclosed is DOE's white paper. Please send comments to Steve Schneider (EM) and Monica Regalbuto (NE).

Thanks

Monica

From:	Russ Morales
To:	Taylor, Robert; Tony Ulses; Trapp, James
Subject:	Fwd: NHK: Water Leaks at 5 Locations Found at Onagawa Nuke Plant After Quake 07 Apr
Date:	Friday, April 08, 2011 1:01:24 AM

All
See how much sloshed out of the Onagawa NPP SPFs in this last M7.4 quake. I think the big one would have caused more maybe even 10 times or a 100 times more...but that would still just be a drop to the overall amount of water in the tank.

Also, the last message I sent you came from newsfeed@earthtabi.com. That is the email account that I receive the feed from OSC.GOV on...it is very useful to have the info send directly to me like this. I will next make a feed that brings up just Fukushima-related articles. Hope the previous email I sent didn't cause confusion or make you think you were being spammed!

Let me know if you want to set up the same. Its not hard--just go to www.opensource.gov, get an account, and then read about subscriptions. You can send it to your work account and easily set up a rule to pull it all into one folder.

Russ

Begin forwarded message:

> **From:** OSCINFO@rccb.osis.gov
> **Date:** April 8, 2011 1:19:31 PM GMT+09:00
> **Subject: OSC: NHK: Water Leaks at 5 Locations Found at Onagawa Nuke Plant After Quake 07 Apr**
> **Reply-To:** OSCINFO@rccb.osis.gov
>
> Note: The following OSC material is being emailed to you based on a subscription.
>
> UNCLASSIFIED
>
>
>
> NHK: Water Leaks at 5 Locations Found at Onagawa Nuke Plant After Quake 07 Apr

JPP20110408134006 Tokyo NHK Online in English 0259 GMT 08 Apr 11

[Unattributed report: "Thursday's Quake Damages Onagawa Nuclear Plant"]

Tohoku Electric Power Company says Thursday night's strong earthquake caused
water to overflow from spent fuel storage pools at one of its nuclear power
plants.

The power company reported on Friday that water had spilled onto the floor at
all 3 reactors at the Onagawa nuclear power plant in Miyagi Prefecture. The
amount of water spilled was 3.8 liters at the most.

The utility firm also found water leaks at 5 locations in the plant, including
inside buildings housing the reactors.

The company added that blowout panels--devices designed to control pressure
inside the buildings--were damaged at the turbine building of the Number 3
reactor.

The newly reported problems add to the downing of 3 of 4 external power lines
at the Onagawa plant. The plant is maintaining its cooling capabilities with
the remaining power line.

Tohoku Electric Power Company is continuing its efforts to determine the extent
of the damage caused by the latest quake. But it says no change has yet been
seen in radiation levels around the plant.

Friday, April 08, 2011 11:59 +0900 (JST)

[Description of Source: Tokyo NHK Online in English -- Website of Japan's public broadcast network Nippon Hoso Kyokai (NHK); URL: http://www.nhk.or.jp/daily/english]

Related Items:
1. JPP20110408969032 Kyodo: No New Abnormalities Observed at Troubled Fukushima Nuke Plant

Lee, Richard

From: Lee, Richard
Sent: Saturday, April 09, 2011 3:08 PM
To: Gauntt, Randall O
Subject: RE: SNL draft analysis of PB and PWR LEU/MOX ST analysis

Randy:

Please send a copy to (b)(6)

Thanks, Richard
The attachment under gmail cannot be saved.

From: Gauntt, Randall O [rogaunt@sandia.gov]
Sent: Friday, April 08, 2011 9:07 PM
To: Kelly, John E (NE)
Cc: Lee, Richard
Subject: RE: SNL draft analysis of PB and PWR LEU/MOX ST analysis

Here's the published version.

Randy

From: Kelly, John E (NE) [JohnE.Kelly@Nuclear.Energy.Gov]
Sent: Friday, April 08, 2011 4:00 PM
To: DL-NERT-All
Subject: FW: SNL draft analysis of PB and PWR LEU/MOX ST analysis

From: Lee, Richard (NRC)
Sent: Friday, April 08, 2011 5:29 PM
To: Kelly, John E (NE)
Cc: Larzelere, Alex
Subject: SNL draft analysis of PB and PWR LEU/MOX ST analysis

John:

Attached 2 documents are supporting analysis which are undergoing peer review for revising the NUREG -1465 for high burnup LEU fuel and for PWR mixed-oxide fuel.

If you look at the long term station black out for Peach Bottom, it give you some idea on duration of in-vessel, ex-vessel, late in-vessel release. The PWR LEU vs. PWR LEU/MOX gives you some comparisons between LEU and LEU/MOX.

Hope these give some insights on

Richard

Lee, Richard

From: Lee, Richard
Sent: Monday, April 11, 2011 10:17 AM
To: 'Petti, Jason P'
Subject: RE: Risk Informed Assessment of Degraded Containment Vessels

Jason:
I was told that NRC took care of this. Sorry that I did not get back to you last week.
Richard

From: Petti, Jason P [mailto:jppetti@sandia.gov]
Sent: Monday, April 11, 2011 9:59 AM
To: Lee, Richard
Subject: RE: Risk Informed Assessment of Degraded Containment Vessels

Richard

Have you any response to this?

Jason

From: Lee, Richard [mailto:Richard.Lee@nrc.gov]
Sent: Friday, April 01, 2011 1:04 PM
To: Petti, Jason P
Subject: RE: Risk Informed Assessment of Degraded Containment Vessels

Jason:

Let me ask DE to advice on how to proceed. Will get back to you soon.

Richard

From: Petti, Jason P [mailto:jppetti@sandia.gov]
Sent: Friday, April 01, 2011 12:16 PM
To: Lee, Richard
Subject: FW: Risk Informed Assessment of Degraded Containment Vessels

Richard

I have another request for you to advise on. Ben Spencer was contacted by a staffer for Congressman Waxman regarding a NUREG Ben and I authored (NUREG/CR-6920). They were requesting to speak with someone about the findings. Again, Herman Graves in NRC/Research was the NRC PM for this NUREG. Please advise as how to proceed.

Jason

From: "Cassady, Alison" <Alison.Cassady@mail.house.gov>

Date: March 31, 2011 1:21:50 PM MDT
To: "'bwspenc@sandia.gov'" <bwspenc@sandia.gov>
Subject: Risk Informed Assessment of Degraded Containment Vessels

Hello,

My colleagues and I are interested in speaking with someone about the findings of the 2006 Sandia report entitled "Risk-Informed Assessment of Degraded Containment Vessels." I saw your name as one of the authors. Are you the best person to speak to this report's findings?

Thanks,

Alison Cassady

Alison Cassady
Senior Professional Staff
Committee on Energy and Commerce
U.S. House of Representatives
Rep. Henry A. Waxman, Ranking Member
(202) 226-3400

Lee, Richard

From: Lee, Richard
Sent: Monday, April 11, 2011 11:38 AM
To: 'Gauld, Ian C.'
Cc: Wagner, John C.
Subject: RE: Spent Fuel Pool Info

Great.
Thx, Richard

From: Gauld, Ian C. [mailto:gauldi@ornl.gov]
Sent: Monday, April 11, 2011 11:15 AM
To: Lee, Richard
Cc: Wagner, John C.
Subject: RE: Spent Fuel Pool Info

Richard

The Fukushima pool heating rates were updated recently using the actual SFP loadings and discharge dates for all assemblies in the pool. The results are attached. The results for units 1-3 are lower based on the more detailed loading information. Unit 4 is near the same value as earlier estimates (dominated by full core offload). Summarizing the updated SFP heat loads:
F1 0.189 MW (3/11/2010)
F2 0.542 MW (3/11/2010)
F3 0.472 MW (3/11/2010)
F4 2.316 MW (3/15/2010)

If consortium results differ much from these values we need to resolve. We have seen differences due to assumptions (operating and decay) and also due to methods, e.g. very conservative applications of the decay heat standard.

Thanks

Ian

From: Lee, Richard [mailto:Richard.Lee@nrc.gov]
Sent: Monday, April 11, 2011 8:16 AM
To: Gauld, Ian C.
Cc: Wagner, John C.
Subject: FW: Spent Fuel Pool Info
Importance: High

Hi, Ian:

Please see the e-mail. We need to reconcile the differences between ORNL and the one consortium provided one.

Thanks, Richard

From: Salay, Michael
Sent: Monday, April 11, 2011 12:33 AM
To: Lee, Richard

Cc: 'Gauntt, Randall O'
Subject: RE: Spent Fuel Pool Info

Richard,

Has there been any update on the decay powers provided by ORNL? The numbers provided below are somewhat different than the numbers the consortium has been working with. There are significant differences between the two sets.

Do the numbers below reflect the detailed SFP loadings that we were provided with? If not, do we have updated numbers for the SFP powers?

Because it is a concern if water additions are being based on powers that are lower than actual decay power, this has been an issue identified as a potential issue to discuss with NISA/TEPCO at our daily meetings. Therefore it is essential that we have these numbers right.

How sure are we about these numbers?

Thanks,
-Mike

From: Gauntt, Randall O [mailto:rogaunt@sandia.gov]
Sent: Saturday, April 09, 2011 9:32 PM
To: Salay, Michael
Subject: FW: Spent Fuel Pool Info

From: Gauntt, Randall O
Sent: Tuesday, March 22, 2011 3:25 PM
To: charles.tinkler@nrc.gov; kcw@dycoda.com; jason.schaperow@nrc.gov
Subject: FW: Spent Fuel Pool Info

Other info from ORNL on pools.

From: Lee, Richard [Richard.Lee@nrc.gov]
Sent: Monday, March 21, 2011 12:05 PM
To: Tinkler, Charles; Gauntt, Randall O
Subject: FW: Spent Fuel Pool Info

fyi

From: Gauld, Ian C. [mailto:gauldi@ornl.gov]
Sent: Monday, March 21, 2011 10:53 AM
To: Lee, Richard
Cc: Parks, Cecil V.; Wagner, John C.; Aissa, Mourad
Subject: FW: Spent Fuel Pool Info

Richard

Attached are inventory and decay heat data prepared for the pools in Fukushima units 1-4 generated using more complete inventory information and actual discharged dates (in table of attached doc file). The heat load for F4 is slightly higher than before (2.3 -> 2.4 MW) due to more assemblies in the pool than previously considered (1207 -> 1331).

The inventories include the decay since the last reload (or offload), plus each additional reload using 13 month intervals and 1/3 of core for until each pool reaches the stated inventory. The estimated decay heat loads for each pool, in MW, are

F1 0.322
F2 0.788
F3 0.597
F4 2.434

In the previous figures sent by Cecil, I removed too many assemblies. Results don't change much but it's confusing. Curves should have stopped at pool inventory minus the number that remain in the pool (the hottest ones). It was late. I can quickly regenerate this figure if needed.

Thanks

Ian

Lee, Richard

From: Joy L Rempe [Joy.Rempe@inl.gov]
Sent: Thursday, April 14, 2011 2:12 AM
To: Gauntt, Randall O
Cc: Lee, Richard; Tinkler, Charles; Joy.Rempe@inl.gov; Powers, Dana A; Salay, Michael; Esmaili, Hossein. kcw@dycoda.com; Mark Leonard; Burns, Shawn; Orrell, Stanley A; Pickering, Susan Y; Goldmann, Andrew S; Lachance, Jeffrey Lynn; Kelly, John E (NE)
Subject: Re: FW: Unit 4 Spent Fuel Pool

hmmm.. you must be in trouble if you're asking me to check your sanity??? Perhaps pictures would help?

http://www3.nhk.or.jp/daily/english/13_37.html

has some good photos and the following:

TEPCO says most of the spent fuel in the storage pool of the No. 4 reactor is apparently undamaged.

TEPCO says it found 220 becquerels of iodine-131 per cubic centimeter of water, as well as 88 becquerels of cesium-134 and 93 becquerels of cesium-137. The firm says the materials are usually produced by nuclear fission.

Yes, a Bq is 1 disintegration per second and a Curie is 3.7x10^10.

I hope that you are wrong about criticality...they are only citing Cs and I. Could the junk that fell into the pool or whatever exploded in this building (or from the U3 building) have caused a small number of particulates from a leaking/damaged assembly to be floating or deposited on debris that is now at locations near the surface of the pool, but a larger amount to be near the bottom of the pool?

Also, can they 'see' the water depth accurately? Are you contact with folks that believe that they 'see that **most** of the spent fuel is undamaged'? If 'most ' isn't damaged, does that mean that some has been observed to be damaged? . Is it possible that the water is a bit shallower due to all the junk at some locations (e.g., does some of the rubble lead to voids)?

I noticed that you have some good insights about 'event chronology' in your earlier writeup.. If you can send the latest along (or at least a summary of the events with some refs), I'll include it...There seems to be some scattered information about manually opening valves, etc. that I'd like to include-- Just have not yet had the time.

Joy

Joy Rempe · Idaho National Laboratory
Phone: (208) 526-2897 ◀ Cell: (b)(6) Fax: (208) 526-2930 •
Email: Joy.Rempe@inl.gov

"Gauntt, Randall O" <rogaunt@sandia.gov>

04/13/2011 09:12 PM

To "Lee, Richard" <richard.lee@nrc.gov>, "charles.tinkler@nrc.gov" <charles.tinkler@nrc.gov>, "Joy.Rempe@inl.gov" <Joy.Rempe@inl.gov>, "Powers, Dana A" <dapower@sandia.gov>

cc "Salay, Michael" <Michael.Salay@nrc.gov>, "Hossein Esmaili" <HXE1@nrc.gov>,

"kcw@dycoda.com" <kcw@dycoda.com>, "Mark Leonard" <mtl@dycoda.com>, "Burns, Shawn" <spburns@sandia.gov>, Orrell, Stanley A" <sorrell@sandia.gov>, "Pickering, Susan Y" <sypicke@sandia.gov>, "Goldmann, Andrew S" <asgoldm@sandia.gov>, "Lachance, Jeffrey Lynn" <jllacha@sandia.gov>, "Kelly, John E (NE)" <JohnE.Kelly@Nuclear.Energy.Gov>

Subject FW: Unit 4 Spent Fuel Pool

Hard to imagine how any fuel from unit 4 pool contributed to the recently announced measured water activity. Perhaps there is a lot of dilution going on up to now - still, we are orders of magnitude off from significant release from a SFP assembly - would probably require hundreds of dilutions to get down to 5 curies.

What's wrong with this picture?

Is the reported specific activity of 400 Bq/cc missing a 1E4 exponent?

A Bq is 1 disintigration per second and a Curie is 3.7x10^10 right?

400 Bq/cc is 0.01 curies/cu meter.

Perhaps they did not actually sample the pool water.

Looking for additional sanity check.

I'm not going to look at this any more until I get some feedback or comment.

Randy

From: Gauntt, Randall O
Sent: Wednesday, April 13, 2011 8:10 PM
To: Kelly, John E (NE); Orrell, Stanley A
Cc: Pickering, Susan Y; Burns, Shawn; Lachance, Jeffrey Lynn; kcw@dycoda.com
Subject: Unit 4 Spent Fuel Pool

The reported water activity of the spent fuel pool 4 is total: 400 Bq/cc

If this is the specific activity of all of the pool water (approximately 6x10^5 liters), then the total activity is only 6 curies. This is literally nothing.

The reported ratio of I131/Cs134 in the water sample is: 220/88 = 2.7

One fuel assembly has about 30,000 curies iodine 131 and Cs 134/137

One Assembly of 105 day offload fuel: I-131 - 14 curies, Cs-134 - 34,000 curies, Cs-137 - 28,000 curies

Note: I131/Cs134 ratio for 105 day offload fuel is 4E-4

I131/Cs134 ratio for fuel 7 days after shutdown is 2.3

So the pool isotopic does not look like decayed spent fuel.

It looks like reactor source.

Not sure it could be pool criticality origin because probably not time to build in iodine.

My usual dosclaimer - someone by all means check me.

Randy

From: Kelly, John E (NE) [JohnE.Kelly@Nuclear.Energy.Gov]
Sent: Wednesday, April 13, 2011 9:07 AM
To: Gauntt, Randall O; Orrell, Stanley A
Cc: Pickering, Susan Y; Burns, Shawn
Subject: RE: Fukushima summary for Aioki

Latest news regarding pool #4 is rather disturbing. See link below

http://www3.nhk.or.jp/daily/english/13_35.html

From: Gauntt, Randal
Sent: Wednesday, April 13, 2011 9:19 AM
To: Kelly, John E (NE); Orrell, Stanley A
Cc: Pickering, Susan Y; Burns, Shawn
Subject: RE: Fukushima summary for Aioki

We intend to conduct a number of analyses for each plant and don't really want any one of them at this point selected as the answer. I am including a range of releases expected from these sequences giving consideration of suppression pool subcooling or not and other known changes we are making to the calculations. We will adjust 1F3 the most.

We understand that they were not able to vent on the line that they wanted for 1F1. Vented from the drywell.

We will have to triple check things and do not intend to give the impression that we have showed up after a week and have final answers for all scenarios. That said, I don;t think things are going to change drastically. Releases will probably go up on the accidents in retrospect as we more fully account for containment performance issues such as head flange leakage (1F1) and likely siesmically induced wet well bellows leak (1F2).

I evaluated the ground dose rates reported by the AMS overflights and come up with 5x10^5 curies - there must be more actually released as the main land deposition was to the north west and likely from unit 1 owing to the direction the wind was blowing. This number is in the ballpark of numbers reported by the IAEA and the regulator.

The spent fuel pool 4 is probably damaged in some way - seems that full these days is 6 meters from the operations floor.

I think that the pool fire must have been limited in extent and localized, and took place with water near the tops of the assemblies. I think that there may have been some kind of geysering effect involving subcooled boiling that flashes as overlying head loss from varying void fraction takes place.

Randy

From: Kelly, John E (NE) [JohnE.Kelly@Nuclear.Energy.Gov]
Sent: Tuesday, April 12, 2011 8:04 PM
To: Orrell, Stanley A
Cc: Pickering, Susan Y; Burns, Shawn; Gauntt, Randall O
Subject: RE: Fukushima summary for Aioki

Thanks

We had a question from our science experts about drywell venting. There wanted to know the source of this info. They thought venting would have been through wetwell vent.

I'd ask that you double check everything and consider how the calculation might be in error, since people tend to believe them once they see the results. I see this type of analysis as very different from the usual risk studies, where people accept bounding behaviors

with little questioning, since the accidents are allowed to proceed without mitigation.

From: Orrell, Stanley A [mailto:sorrell@sandia.gov]
Sent: Tuesday, April 12, 2011 7:11 PM
To: Kelly, John E (NE)
Cc: Pickering, Susan Y; Burns, Shawn; Gauntt, Randal
Subject: FW: Fukushima summary for Aioki

John,

Attached is a very quick attempt at trying to summarize some modeling insights and what they might mean (environmental consequence) if certain events unfold going forward. It needs some explanation, so don't hesitate to ask. I'm asking to have some of this cross-checked against other 'ground truth' information (e.g. reported total est. Bq released thus far, etc.), so I wouldn't take action on it until we've had a chance to calibrate. We should have that mid-morning I hope, but wanted to give this to you as a result of the thinking that occurred after the Aoiki meeting today.

Andrew

Weaver, Tonna

From: Architzel, Ralph
Sent: Thursday, April 14, 2011 11:29 AM
To: Smith, Stephen
Subject: RE: OSC: Japan: Events of Fukushima Nuclear Crisis Re-examined Month After Quake Hits

Thanks Steve

Very interesting read

From: Smith, Stephen
Sent: Thursday, April 14, 2011 11:11 AM
To: Architzel, Ralph
Subject: FW: OSC: Japan: Events of Fukushima Nuclear Crisis Re-examined Month After Quake Hits

FYI.

Steve

From: Klein, Paul
Sent: Thursday, April 14, 2011 9:56 AM
To: Smith, Stephen; Lehning, John
Subject: FW: OSC: Japan: Events of Fukushima Nuclear Crisis Re-examined Month After Quake Hits

From: Taylor, Robert
Sent: Wednesday, April 13, 2011 12:08 PM
To: Hunt, Christopher; Johnson, Andrew; Klein, Paul; Morgan, Thomas; Murphy, Emmett; Obodoako, Aloysius; Wong, Emma; Yoder, Matthew
Cc: Lubinski, John; Thomas, Brian; Mitchell, Matthew; Lupold, Timothy; Karwoski, Kenneth; McMurtray, Anthony; Hardies, Robert; Evans, Michele
Subject: FW: OSC: Japan: Events of Fukushima Nuclear Crisis Re-examined Month After Quake Hits

Fascinating insights into the early decision making regarding Fukushima Daiichi.

From: NPP News [mailto:russ@earthtabi.com]
Sent: Wednesday, April 13, 2011 11:38 AM
To: Collins, Elmo; Tony Ulses; Trapp, James; Taylor, Robert
Subject: Fwd: OSC: Japan: Events of Fukushima Nuclear Crisis Re-examined Month After Quake Hits

Begin forwarded message:

From: OSCINFO@rccb.osis.gov
Date: April 13, 2011 11:43:51 PM GMT+09:00
Subject: OSC: Japan: Events of Fukushima Nuclear Crisis Re-examined Month After Quake Hits
Reply-To: OSCINFO@rccb.osis.gov

Japan: Events of Fukushima Nuclear Crisis Re-examined Month After Quake Hits

JPP20110413176001 Tokyo Asahi Shimbun Online in English 0138 GMT 13 Apr 11

[Unattributed article: "Asahi: What Went Wrong: Fukushima Flashback a Month After Crisis Started"]

One month after the Great East Japan Earthquake struck, Asahi Shimbun re-examined the events surrounding the accident at the Fukushima No. 1 nuclear power plant to determine what exactly happened.

* * *

At 3:42 p.m. March 11, 56 minutes after the Great East Japan Earthquake struck, all but one of the emergency diesel generators at the Fukushima No. 1 nuclear power plant were knocked out after a tsunami that exceeded 14 meters engulfed the six reactors at the plant.

An official at the emergency response center of the Nuclear and Industrial Safety Agency (NISA), located in the annex building of the Ministry of Economy, Trade and Industry, ran out into the hallway and read out a memo in a loud voice.

"All AC power sources lost at the No. 1 to No. 5 reactors at the Fukushima No. 1 nuclear power plant! Only the B emergency diesel generator at the No. 6 reactor is working!"

All lights and instruments at the central control rooms of the Fukushima No. 1 plant had gone out. Workers connected car batteries to the instruments and used flashlights to read the data that showed what was happening in the reactor cores.

At the headquarters of Tokyo Electric Power Co., the plant operator, in Tokyo's Uchisaiwaicho district, executives were ashen-faced when they were told, "The reactor cores cannot be cooled without power sources."

TEPCO President Masataka Shimizu was in the Kansai region on a business trip, and Chairman Tsunehisa Katsumata was also in China on a business trip.

The seven NISA officials who were at the Fukushima No. 1 plant headed for the off-site center located about five kilometers away. The center is where the

headquarters is set up locally to deal with any natural disaster that hits the nuclear plant and is designed to allow for constant monitoring of the plant.

However, the power outage and the loss of communications channels in the immediate aftermath of the quake and tsunami meant no data was reaching the officials at the center.

At 5:45 p.m., NISA official Koichiro Nakamura said at a news conference, "While water continues to be pumped into (the reactor cores), we do not know what the water level is."

The reactor cores were, in fact, gradually heading out of control.

When the earthquake struck, Prime Minister Naoto Kan was facing a crisis of a political nature.

At an Upper House Audit and Oversight of Administration Committee session, Kan was asked about political donations his political fund management organization had received from a foreigner.

While he was responding, the chandelier in the committee room began swaying wildly. Committee Chairman Yosuke Tsuruho said, "Please take cover under the desks."

The committee session immediately went into recess.

At about 2:50 p.m., Chief Cabinet Secretary Yukio Edano arrived at the Prime Minister's Official Residence and ran to the crisis management center in the basement. A few minutes later, Kan also returned from the Diet.

Goshi Hosono, Kan's special adviser, told reporters, "All the Cabinet ministers will be called together."

Although the ministers began arriving, a few minutes later Edano instructed all the ministers except himself and Ryu Matsumoto, the state minister in charge of disaster management, to return to their respective ministry offices.

As the ministers left the Prime Minister's Official Residence, Justice Minister Satsuki Eda said, "I don't know who gave the instruction (to return to the ministries)."

There were already signs of confusion from the very beginning within the chain of command.

The No. 1 to No. 3 reactors at the Fukushima No. 1 nuclear power plant that were operating stopped automatically immediately after the earthquake hit.

About an hour later came the announcement that all AC power sources to the No. 1 to No. 5 reactors had been lost. At about 4:30 p.m., cooling water was no longer being pumped into the No. 1 and No. 2 reactors.

At about that time, TEPCO officials issued a report to those at the Prime Minister's Official Residence that said in part, "There will be no problem for eight hours even if no cooling (of the reactors) occurs."

The eight hours is the length of time emergency batteries can be used if all AC power sources are lost.

TEPCO officials likely believed that the cooling function could be restored within that time frame.

That evening, Haruki Madarame, chairman of the Nuclear Safety Commission of Japan, visited the Prime Minister's Official Residence and said, "The situation is not one in which radiation is leaking to the outside atmosphere. While there are problems with the power source, the nuclear chain reaction has been completely stopped. The only thing left is to cool the reactors."

At about 5 p.m., Kan addressed the nation and said, "While some of the nuclear power plants automatically stopped operations, there has been no confirmation so far of any effects from the radioactive materials to the outside atmosphere."

His comment clearly reflects the opinions of experts within the government.

At a news conference at 7:45 p.m., Edano explained why the government had issued a declaration of a state of emergency at the nuclear power plant.

"If a response can be made within a certain amount of time, concerns and problems will be resolved," Edano said. "At present, the situation is not one in which damage is likely. Because the effects from what might remotely occur are so severe, we have responded by issuing the declaration to ensure that nothing wrong happens."

Meanwhile, Fukushima prefectural government officials said they could no longer wait for a decision by the central government and asked residents living within a 2-kilometer radius of the Fukushima plant to evacuate at 8:50 p.m.

The cooling functions had not been restored even after the eight-hour time frame mentioned by TEPCO officials.

The remote possibility of severe consequences that Edano touched upon was moving toward reality by the minute.

At 1:30 a.m. March 12, Madarame and TEPCO officials visited the Prime Minister's Official Residence and informed Kan and Banri Kaieda, the industry minister, that pressure was rising within the No. 1 reactor at the Fukushima No. 1 plant.

A large volume of steam had accumulated within the reactor's containment vessel.

Madarame said, "In order to secure the soundness of the containment vessel, there is a need to implement a measure to release internal pressure."

If the pressure within the containment vessel continued to increase, there was the danger of damage to the vessel. One way to avoid that was to vent the steam inside the vessel to decrease the pressure.

While there was the strong possibility such a move would release radioactive materials into the outside atmosphere, Kan and other government officials agreed that such a move was unavoidable.

At a news conference from about 3 a.m., Edano touched upon the venting process. He also announced that Kan would inspect the nuclear plant site.

Edano was asked if the venting process would be completed before Kan's visit.

"TEPCO is now conducting final preparations and the measure will be conducted in the near future," Edano said.

No word about the start of venting reached the Prime Minister's Official Residence by 6 a.m. When TEPCO officials were asked about when the venting would start, they said, "The power source for the venting has been cut off" and "Workers cannot approach the site to manually vent the pressure because of the high level of radiation."

At 7 a.m., Kan decided he could not wait any longer and flew to the Fukushima No. 1 plant on a Self-Defense Forces helicopter.

In a van at the site, Kan sat next to TEPCO Executive Vice President Sakae Muto.

In an angry tone, Kan asked Muto, "Why don't you hurry with the venting?"

Failing to receive a clear answer from Muto, Kan's anger remained as he entered the local headquarters to deal with the natural disaster.

Banging a desk with his hand, Kan shouted, "Do you know why I decided to come here?"

Kan calmed down when Masao Yoshida, the head of the Fukushima No. 1 plant, told the prime minister the situation would be handled appropriately.

After that exchange, officials of the Prime Minister's Official Residence began dealing directly with Yoshida and others at the Fukushima plant. That led to a growing gap with TEPCO headquarters in Tokyo.

TEPCO officials began the venting process after 9 a.m., about an hour after Kan left the Fukushima site.

The actual work of opening valves began from after 10 a.m. With pressure within

the No. 1 reactor containment vessel falling, the venting process appeared to have worked.

However, at 3:36 p.m., a hydrogen explosion occurred at the No. 1 reactor, blowing away the ceiling of the building housing the reactor.

At a meeting on the evening of March 13 of the Fukushima prefectural government, which was dealing with the natural disaster, Fukushima Governor Yuhei Sato turned his anger on TEPCO officials.

"This is a problem that involves the entire electric power industry," Sato said. "I hope you will lay your life on the line to deal with the situation."

In the end, it was unclear who and when the decision to begin venting was made.

At an April 9 news conference at TEPCO headquarters, Muto avoided giving a clear answer, only saying, "Amid a very serious situation, there was a need to make a number of different actions. A clear answer will require further study."

Opposition party members intend to press the government about when the decision was made as they feel an error was made at the initial stages of dealing with the reactor situation.

On the evening of March 14, officials working at the off-site center near the Fukushima No. 1 plant received word of abnormalities at the No. 2 reactor.

At 6:22 p.m., word was received about the possibility that fuel rods had become exposed above water.

At 8:22 p.m., officials were told of the possibility of a core meltdown.

At 10:22 p.m., word came about the possibility of damage to the core containment vessel.

At about that time, officials at the Prime Minister's Official Residence were told informally by TEPCO officials that they wanted to evacuate their employees from the Fukushima No. 1 plant.

When he heard that, Kan raised his voice and said, "Is TEPCO planning to abandon its role as an electric power company? Call the company president."

At about 3:30 p.m. March 15, Kan gathered a few Cabinet ministers and staff members at the Prime Minister's Official Residence to discuss whether he should go to TEPCO headquarters.

While some participants at the meeting raised legal questions, Edano told Kan, "We shouldn't be concerned about laws now. You should go to the company headquarters."

The decision was made at that meeting to set up an integrated headquarters to deal with the nuclear accident. The body would be established at TEPCO headquarters.

Shortly thereafter, Kan met with Shimizu, the TEPCO president.

"What do you intend to do?" Kan asked.

"We will make every effort to protect Fukushima," Shimizu replied.

"We will set up an integrated headquarters between the government and TEPCO," Kan said. "Do you agree?"

"Fine," Shimizu replied.

Shimizu never openly said anything about pulling out of the Fukushima plant.

However, when Kan went to TEPCO headquarters at about 5:30 a.m. and faced company executives in a meeting room, he raised his voice and said, "Pulling out is not an option. We want you to decide on your resolve. If you do decide to pull out, that will mean the total collapse of TEPCO."

Kan remained at TEPCO headquarters for about three hours. Moving to another room, Kan fell asleep while seated.

Ever since the earthquake, Kan had remained at his office and did not return to his living quarters, working almost around the clock .

From about that time, Kan began taking on more work, telling his aides, "Bring all information to me. I will make the decision" and "I will contact that individual directly."

That led to a situation described by one high-ranking industry ministry official of "not releasing any information before it was first submitted to the Prime Minister's Official Residence."

There was the possibility that such an arrangement affected cooperation among the central government ministries.

Letting Kan sleep for a while at TEPCO headquarters, his staff members finally returned with the prime minister to his official residence at about 8:30 a.m.

In the meantime, strange noises and white smoke emerged from the No. 2 reactor of the Fukushima No. 1 plant. That led to suspicions of damage to the suppression pool.

On the morning of March 14, the upper part of the building housing the No. 3 reactor at the Fukushima No. 1 plant was blown away by a hydrogen

explosion.

On the following day, an explosion was heard at the suppression pool of the No. 2 reactor and the building housing the No. 4 reactor was damaged by fire.

White smoke was observed rising from the storage pools containing spent nuclear fuel rods at the No. 3 and No. 4 reactors.

Large volumes of radioactive materials continued to be spewed into the atmosphere.

On March 15, Defense Minister Toshimi Kitazawa held a meeting with high-ranking ministry officials about whether SDF helicopters should be used to dump water on the reactors.

One participant said, "We can estimate how much remains in the storage pool by the way in which steam rises after spraying water."

Another participant said, "However, if the storage pool is close to empty, a steam explosion could occur if water was suddenly sprayed into it."

While different opinions were raised, the general mood was to proceed with the water dumping operation.

There was some hesitation, however, because U.S. officials had said that dumping water from the air would be inefficient.

What finally pushed Kitazawa to give the go-ahead was a comment from Kan.

Kitazawa visited the Prime Minister's Official Residence at about noon on March 16. Kan told him, "I want you to first use SDF helicopters."

Kitazawa decided to go ahead with the water dumping and agreed with Kan that the sooner the better.

At 4 p.m., Ground SDF helicopters dangling large buckets approached the Fukushima plant, but had to abandon the operation because of unexpectedly high radiation levels.

On the morning of March 17, two helicopters dumped a total of 30 tons of water from above the No. 3 reactor on the condition that each helicopter would only be in the area for about 40 minutes.

At about 7 p.m. March 17, a high-pressure water cannon of the Tokyo Metropolitan Police Department's riot police began spraying the reactors from the ground. About 44 tons of water was sprayed toward the No. 3 reactor over about 10 minutes. Five SDF firefighting trucks also took part.

On the evening of March 17, Kan asked Tokyo Governor Shintaro Ishihara to deploy units from the Tokyo Fire Department.

Anticipating such a request, the fire department had conducted a training session the previous day along the banks of the Arakawa river. The exercise was conducted to determine the best way to deploy firefighters to minimize their exposure to radiation.

At 3:20 p.m. March 18, 30 units, including a special rescue unit, with a total of 139 members left Tokyo for Fukushima.

The members were, in principle, all above 40 years in age and had given their approval to take part in the operation.

Water spraying at the No. 3 reactor continued for 13 and a half hours and a total of 2,400 tons of seawater was sprayed.

A news conference was held March 19 by three high-ranking officers of the Tokyo Fire Department after they returned to Tokyo.

With tears in hi s eyes, Toyohiko Tomioka, the head of the special rescue unit, said, "Eve ryone did their utmost. I want to apologize to the family members who were left behind. I want to use this opportunity to offer my apology and gratitude to them."

Meanwhile, U.S. government officials became increasingly concerned at the Japanese response to the Fukushima accident.

Earlier on March 17, at about 10 a.m., Kan received a call from U.S. President Barack Obama.

The first thing Obama said was that the conversation would not be a perfunctory one.

Obama said the United States was prepared to provide every form of assistance, from the dispatch of nuclear energy experts to support from the mid- to long term for the rebuilding process.

That was in sharp contrast to the telephone conversation early on March 12, soon after the earthquake struck. According to Foreign Minister Takeaki Matsumoto, Obama only offered his condolences without going into specific assistance measures.

In the initial stages of the twin disasters, Kan told an acquaintance, "Should we always depend on the United States when something goes wrong? If it is a crisis for Japan, the Japanese should first try to handle the matter. We should depend on the United States only after we have made the effort."

A high-ranking government official admitted that when the Fukushima nuclear accident first broke out, from the very beginning, the government posture was not one of depending on foreign governments. The official added, "That may have been taken as a sign of our refusal (of help)."

When officials of NISA and TEPCO held a meeting with officials of the U.S.

Nuclear Regulatory Commission (NRC), U.S. officials were visibly angered at the failure of TEPCO to provide sufficient information.

Those factors led to increasing concerns among U.S. government officials.

On March 17, a high-ranking NRC official met with Kitazawa and told him that water had to be pumped into the storage pool for spent fuel rods at the No. 4 reactor because it was empty of water.

The comment was made based on aerial photos taken by the unmanned reconnaissance aircraft Global Hawk.

The following day, U.S. Ambassador John Roos met with a lawmaker close to Kan at a Tokyo hotel and complained that serious information was not being shared by Japan with the United States.

On the evening of March 19, Kan invited Roos to the Prime Minister's Official Residence and told him, "We will continue to share information with the international community."

On March 20, Kan instructed a lawmaker close to him to create a framework for cooperation between Japan and the United States.

From March 21, full-fledged discussions began to deal with the Fukushima nuclear accident. Among the representatives in the panel were those from the U.S. military, the NRC, the U.S. Embassy, while from the Japanese side were officials of the prime minister's staff, NISA and TEPCO. Officials in the nuclear energy sector from both nations also took part in the talks.

At a news conference on April 1, Kan was asked if he had shifted his emphasis toward one of seeking greater international cooperation.

In a strong tone, Kan said, "We received various proposals from the United States from an early stage and it is my understanding that we took the position of asking for almost all the measures that were considered necessary."

[Description of Source: Tokyo Asahi Shimbun Online in English -- Website of Asahi Shimbun, Japan's second-largest daily; URL: http://www.asahi.com/english]

From: NITOPS <NITOPS@nnsa.doe.gov>
Sent: Tuesday, April 19, 2011 3:15 PM
To: Hoc, PMT12
Cc: LIA07 Hoc; PMT02 Hoc; PMT01 Hoc; NITOPS
Subject: RE: Request-->RE: 0430 EDT (April 9, 2011) USNRC Earthquake/Tsunami Status Update

PMT,

We are still interested in the below request. Any timeframe when we will be receiving?

Dave Young

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration
U.S. Department of Energy
nitops@nnsa.doe.gov
nit@doe.sgov.gov
202-586-8100

From: NITOPS
Sent: Saturday, April 16, 2011 8:52 AM
To: 'Hoc, PMT12'; NITOPS
Cc: LIA07 Hoc; 'pmt02.hoc@nrc.gov'; 'pmt01.hoc@nrc.gov'
Subject: RE: Request-->RE: 0430 EDT (April 9, 2011) USNRC Earthquake/Tsunami Status Update

PMT,

We are interested in also receiving a copy of "Guidance for Return (Short Term and Permanent Re-Entry) of US Citizens to Areas around Fukushima Daiichi NPP."

We would greatly appreciate any assistance you can provide.

Thanks,

David Young

Nuclear Incident Team
Office of Emergency Response
National Nuclear Security Administration
US Department of Energy
202-586-8100
nitops@nnsa.doe.gov
nit@doe.sgov.gov

From: Hoc, PMT12 [mailto:PMT12.Hoc@nrc.gov]
Sent: Saturday, April 09, 2011 5:51 PM
To: NITOPS

Cc: LIA07 Hoc
Subject: RE: Request-->RE: 0430 EDT (April 9, 2011) USNRC Earthquake/Tsunami Status Update

Perry (NIT)

I have enclosed a copy of the "Summary of Radiological Hazards in Japan" which was provided to our Japan Team for inclusion in a briefing book, but the document should not be shared further. The other document requested, "Guidance for Return (Short Term and Permanent Re-Entry) of US Citizens to Areas around Fukushima Daiichi NPP", is still under developed. At this time, we hope to share the document and reach alignment with the federal family on Monday.

Sandi
PMT-PAAD
NRC Operations Center

From: LIA07 Hoc
Sent: Saturday, April 09, 2011 5:09 PM
To: RST01 Hoc; Hoc, PMT12; OST01 HOC; OST02 HOC
Subject: FW: Request-->RE: 0430 EDT (April 9, 2011) USNRC Earthquake/Tsunami Status Update

I'm not sure who has the documents noted below. Please respond. Thanks.
Yen
EBT Coordinator

From: NITOPS [mailto:NITOPS@nnsa.doe.gov]
Sent: Saturday, April 09, 2011 8:57 AM
To: LIA07 Hoc; Anderson, James
Cc: NITOPS
Subject: Request-->RE: 0430 EDT (April 9, 2011) USNRC Earthquake/Tsunami Status Update

Mr. Anderson,

The DOE Nuclear Incident Team would like a copy of the "Summary of Radiological Hazards in Japan" and a copy of the "Guidance for Return (Short Term and Permanent Re-Entry) of US Citizens to Areas around Fukushima Daiichi NPP" referenced in the April 9, 2011 "USNRC Earthquake/Tsunami Status Update."

Can you please e-mail the documents to this e-mail address?

Thanks,

Perry
Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration
U.S. Department of Energy
nitops@nnsa.doe.gov
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202-586-8100

From: LIA07 Hoc [mailto:LIA07.Hoc@nrc.gov]
Sent: Saturday, April 09, 2011 4:47 AM

To: LIA07 Hoc
Subject: 0430 EDT (April 9, 2011) USNRC Earthquake/Tsunami Status Update

Attached, please find a 0430 EDT, April 9, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

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

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

-Jim

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

From: OST01 HOC
Sent: Wednesday, April 20, 2011 10:41 PM
To: Hiland, Patrick; Skeen, David; Casto, Chuck; Reynolds, Steven; Zimmerman, Roy; Boger, Bruce; Uhle, Jennifer; Holonich, Joseph; Gibson, Kathy; Case, Michael
Subject: FW: 4/20 DOE Science Council handouts
Attachments: 0420 S-1 Briefing rev1.pdf; TEPCO Roadmap to Restoration.pdf

Forwarded per ET Director (Glenn Tracy)

From: Lee, Richard
Sent: Wednesday, April 20, 2011 4:51 PM
To: OST01 HOC
Cc: Uhle, Jennifer
Subject: 4/20 DOE Science Council handouts

Please note the Muon Tomography discussions from page 7 to 10.

Roadmap towards Restoration from the Accident
at Fukushima Daiichi Nuclear Power Station

April 17th, 2011
Tokyo Electric Power Company

With regard to the accident at Fukushima Daiichi Nuclear Power Station due to the Tohoku-Chihou-Taiheiyo-Oki Earthquake occurred on Friday, March 11th, 2011, we are currently making our utmost effort to bring the situation under control. This announcement is to notify the roadmap that we have put together towards restoration from the accident.

1. Basic Policy

By bringing the reactors and spent fuel pools to a stable cooling condition and mitigating the release of radioactive materials, we will make every effort to enable evacuees to return to their homes and for all citizens to be able to secure a sound life.

2. Targets

Based on the basic policy, the following two steps are set as targets: "Radiation dose is in steady decline" as "Step 1" and "Release of radioactive materials is under control and radiation dose is being significantly held down" as "Step 2." Target achievement dates are tentatively set as follows: "Step 1" is set at around 3 months and "Step 2" is set at around 3 to 6 months after achieving Step 1.

3. Immediate Actions

Immediate actions were divided into three groups, namely, "I. Cooling", "II. Mitigation", "III. Monitoring and Decontamination." For the following five issues—"Cooling the Reactors," "Cooling the Spent Fuel Pools," "Containment, Storage, Processing, and Reuse of Water Contaminated by Radioactive Materials (Accumulated Water)," "Mitigation of Release of Radioactive Materials to Atmosphere and from Soil," and "Measurement, Reduction and Announcement of Radiation Dose in Evacuation Order/Planned Evacuation/ Emergency Evacuation Preparation Areas"—targets are set for each of the five issues and various countermeasures will be implemented simultaneously.

Please see the attachment for detailed actions.

We would like to deeply apologize again for the grave inconvenience and anxiety that the broad public has been suffering due to the accident at the Fukushima Daiichi Nuclear Power Station. We will continue to make every endeavor to bring the situation under control.

April 17, 2011

Tokyo Electric Power Company

Roadmap towards Restoration from the Accident at Fukushima Dalichi Nuclear Power Station

1. Basic Policy

By bringing the reactors and spent fuel pools to a stable cooling condition and mitigating the release of radioactive materials, we will make every effort to enable evacuees to return to their homes and for all citizens to be able to secure a sound life.

2. Targets

- Based on the basic policy, the following two steps are set as targets.
  - Step 1: Radiation dose is in steady decline.
  - Step 2: Release of radioactive materials is under control and radiation dose is being significantly held down.
  - (Note) Issues after Step 2 will be categorized as "Mid-term issues"
- Target achievement dates are tentatively set as follows, although there will still be various uncertainties and risks:
  - Step 1: around 3 months
  - Step 2: around 3 to 6 months (after achieving Step 1)
  - (Note) Announcements will be made as soon as timing of step-wise target achievement or quantitative prospects are determined, as well as if revisions to the targets or achievement dates become necessary.

3. Immediate Actions

- In order to achieve the above targets, immediate actions were divided into 3 groups with targets set for each of the 5 issues. Various countermeasures will be implemented simultaneously (see the table in right.)
- In order to achieve Step 1, overcoming the following two issues that are currently being addressed will be critical:

① Prevention of hydrogen explosion inside the primary containment vessel (hereafter, PCV) (Units 1 to 3.)

- Cooling the reactor by injecting fresh water into the reactor increases the chance of steam condensation, leading to a concern of potentially triggering a hydrogen explosion.

→Nitrogen gas will be injected into the PCV of each unit to keep the concentration of hydrogen and oxygen below flammability limit.

② Prevention of release of contaminated water with high radiation level outside of the site boundary (Unit 2.)

- While cooling the reactor by injecting fresh water, accumulation of contaminated water with high radiation level in the turbine building is increasing (possible release to outside of the site boundary.)

→Actions will be taken against accumulated water to (1) secure several storage places and (2) install facilities to process the contaminated water and reduce the radiation dose, among others.

Roadmap for Immediate Actions

Areas	Issues	Targets and Countermeasures	
		Step 1	Step 2
I. Cooling	(1) Cooling the Reactors	① **Maintain stable cooling** ・Nitrogen gas injection ・Flooding up to top of active fuel ・Examination and implementation of heat exchange function ② **(Unit 2) Cool the reactor while controlling the increase of accumulated water until the PCV is sealed**	③ **Achieve cold shutdown condition (sufficient cooling is achieved depending on the status of each unit.)** ・Maintain and reinforce various countermeasures in Step 1
	(2) Cooling the Spent Fuel Pools	④ **Maintain stable cooling** ・Enhance reliability of water injection ・Restore coolant circulation system ・(Unit 4) Install supporting structure	⑤ **Maintain more stable cooling function by keeping a certain level of water.** ・Remote control of coolant injection operation ・Examination and implementation of heat exchange function
II. Mitigation	(3) Containment, Storage, Processing, and Reuse of Water Contaminated by Radioactive Materials (Accumulated Water)	⑥ **Secure sufficient storage place to prevent water with high radiation level from being released out of the site boundary.** ・Installation of storage / processing facilities. ⑦ **Store and process water with low radiation level** ・Installation of storage facilities/decontamination processing.	⑧ **Decrease the total amount of contaminated water.** ・Expansion of storage/processing facilities ・Decontamination/Desalt processing (reuse), etc.
	(4) Mitigation of Release of Radioactive Materials to Atmosphere and from Soil	⑨ **Prevent scattering of radioactive materials on buildings and ground** ・Dispersion of inhibitor ・Removal of debris ・Installing reactor building cover	⑩ **Cover the entire buildings (as temporary measure).**
III. Monitoring/ Decontamination	(5) Measurement, Reduction and Announcement of Radiation Dose in Evacuation Order/Planned Evacuation/ Emergency Evacuation Preparation Areas	⑪ **Expand/enhance monitoring and inform of results fast and accurately** ・Examination and implementation of monitoring methods.	⑫ **Sufficiently reduce radiation dose in evacuation order / planned evacuation / emergency evacuation preparation areas** ・Decontamination/monitoring of homecoming residences.
		(Note) With regard to radiation dose monitoring and reduction measures in evacuation order/planned evacuation/emergency evacuation preparation areas, we will take every measure through thorough coordination with the national government and by consultation with the prefectural and municipal governments.	

Attachment ①

Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station

Basic Policy: By bringing the reactors and spent fuel pools to a stable cooling condition and mitigating the release of radioactive materials, we will make every effort to enable evacuees to return to their homes and for all citizens to be able to secure a sound life.

Areas	Issues	Current Status (as of April 16th)	Targets, Countermeasures and Risks <Step 1 (around 3 months)> Radiation dose is in steady decline.	<Step 2 (around 3 to 6 months*)> Release of radioactive materials is under control and radiation dose is being significantly held down. * After achieving Step 1	Mid-term Issues
I. Cooling	(1) Cooling the Reactors	**Current Status [1] (Units 1 to 3) Cooling achieved by water injection while there is partial damage to fuel pellets.** ⇒Continued injection of fresh water and further cooling measures are required. Countermeasure [1]: Injecting fresh water into the RPV by pumps. Risk [1]: Possibility of hydrogen explosion due to condensation of steam in the PCV when cooled, leading to increased hydrogen concentration Countermeasure [2]: Injecting nitrogen gas into the PCV (start from Unit 1.) Countermeasure [3]: Consideration of flooding the PCV up to the top of active fuel. **Current Status [2] (Units 1 to 3) High likelihood of small leakage of steam containing radioactive materials through the gap of PCV caused by high temperature.** ⇒Lowering the amount of steam through cooling and implementation of leakage prevention are required. Countermeasure [4]: Lower the amount of steam generated by sufficiently cooling the reactor (to be achieved by measures in Steps 1 and 2.) Countermeasure [5]: Consideration of shielding the leakage by covering the reactor building (coordinate with issue [4].) **Current Status [3] (Unit 2) Large amount of water leakage, indicating high likelihood of PCV damage.** ⇒Repairing the damaged location is required. ⇒Need to control the amount of water injection since leakage increases as injection increases. Countermeasure [6]: Consideration of sealing the damaged location (e.g., filling with grout (glutinous cement)) Countermeasure [7]: Cooling at minimum water injection rate (control the leakage of contaminated water.) Risk[2]: Possibility of prolonged work of sealing the damaged location (→countermeasures [12] and [14]) **Current Status [4] Secured multiple off-site power (1 system each from TEPCO and Tohoku EPCO) and deployed backup power (generator cars / emergency generators)** Risk [3]: Possibility of (partial) loss of power from the grid caused by ensuring aftershocks and lightning in summer. Countermeasure [8]: Install interconnecting lines of offsite power lines.	**Target [1] (Unit 1 to 3) Maintain stable cooling.** Countermeasure [9]: Flood the PCV up to the top of active fuel. Countermeasure [10]: Reduce the amount of radioactive materials (utilization of standby gas treatment system (filter), etc.) when PCV venting (release of steam containing radioactive materials into the atmosphere). Countermeasure [11]:Continue preventing hydrogen explosion by injecting nitrogen into the PCV. Risk [4]: Increase in water leakage into the turbine building in the process of flooding the PCV. Countermeasure [12]: Consideration and implementation of measures to hold down water inflow (e.g., circulating the water back into the RPV by storing and processing the accumulated water in the turbine building.) Countermeasure [13]: Consideration of recovering heat exchange function for the reactor (installing heat exchangers). Risk [5]: Possibility of prolonged work in high dose level area (→keep countermeasures [9] and [12]) **Target [2] (Unit 2) Cool the reactor while controlling the increase of accumulated water until PCV is sealed.** Countermeasure [14]: Continue cooling by current minimum injection rate. Countermeasure [15]: Continue prevention of hydrogen explosion by nitrogen injection into the PCV. Countermeasure [16]: Continue consideration and implementation of sealing measure at damaged location. Implement cooling measures similar to those for Units 1 and 3 once the damaged location is sealed. Risk[2]: Possibility of prolonged work of sealing the damaged location (→continue countermeasures [12] and [14])	**Target [3] Achieve cold shutdown condition (sufficient cooling is achieved depending on the status of each unit.)** Countermeasure [17]: Maintain and enhance countermeasures in Step 1 if needed.	**Issue [1] Prevention of breakage, clogging and water leakage of structural materials (reactor and pipes, etc.) due to corrosion caused by salt.**

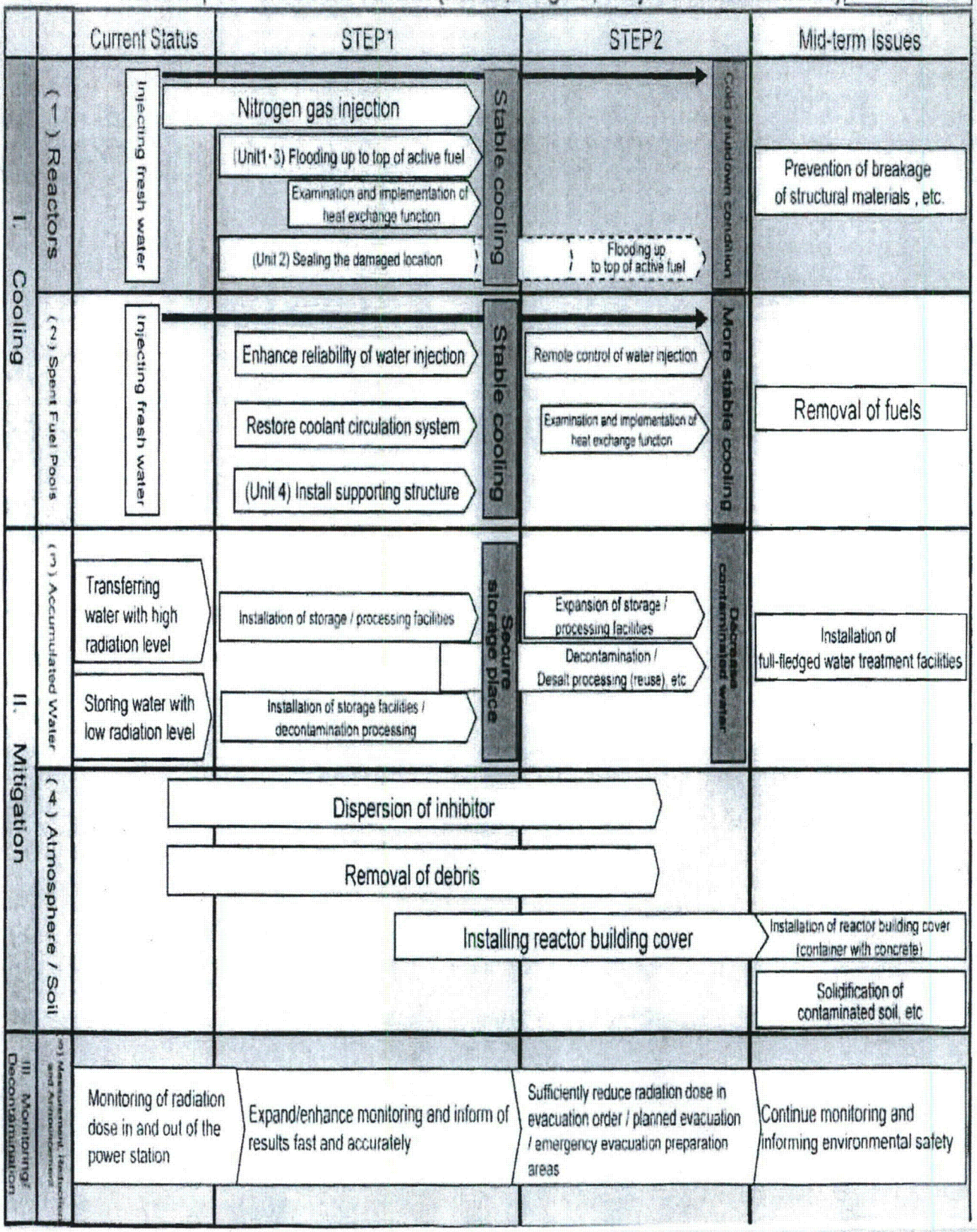
Note: Reactor pressure vessel is denoted as "RPV" and primary containment vessel is denoted as "PCV."

Areas	Issues	Current Status (as of April 16th)	Targets, Countermeasures and Risks <Step 1 (around 3 months)> Radiation dose is in steady decline.	Targets, Countermeasures and Risks <Step 2 (around 3 to 6 months*)> Release of radioactive materials is under control and radiation dose is being significantly held down. * After achieving Step 1	Mid-term Issues
I. Cooling	(2) Cooling the Spent Fuel Pools	**Current Status [5] Fresh water is injected from outside for Units 1, 3, 4 and through normal cooling line for Unit 2.** ⇒Reduction of worker exposure and countermeasures for aftershocks are required. Countermeasure [18]: Consideration/implementation of improving reliability of external water injection by concrete pumpers ("Giraffe", etc.)/switch to remote-controlled operation. **Current Status [6]: Confirmation of release of radioactive materials from the pool** Countermeasure [19]: Sampling and measurement of steam/pool water by "Giraffe", etc. ⇒Most fuels in Unit 4 have been confirmed intact according to the result of pool water analysis. **Current Status [7]: Walls of the building supporting the pool have been damaged.** ⇒Tolerance evaluation is especially needed for Unit 4. Countermeasure [20]: Seismic tolerance assessment of Unit 4. ⇒A certain level of seismic tolerance has been confirmed. Countermeasure [21]: Continue monitoring and examine necessary countermeasures (→ countermeasure [26].)	**Target [4]: Maintain stable cooling.** Countermeasure [22]: Continuation of water injection by "Giraffe", etc (reliability improvement (enhanced durability of hoses)/switch to remote-controlled operation.) Countermeasure [23]: Add cooling function to normal Fuel Pool Cooling system and continue injecting water for Unit 2. Countermeasure [24]: Examination and implementation of restoration of normal cooling system for Units 1, 3, and 4. Risk [6]: Possibility of inability to restore normal cooling line due to damages to the building. Countermeasure [25]: Examination and implementation of installing heat exchangers. Countermeasure [26]: (Unit 4) Installation of supporting structure under the bottom of the pool.	**Target [5]: Maintain more stable cooling function by keeping a certain level of water.** Countermeasure [27]: Cooling by installation of heat exchangers. Countermeasure [28]: Expansion of remote-controlled operation areas of "Giraffe", etc.	**Issue [2]: Removal of fuels (Including Units 5 & 6.)**
II. Mitigation	(3) Containment, Storage, Processing, and Reuse of Water Contaminated by Radioactive Materials (Accumulated Water)	**Current Status [8]: Leakage of high radiation-level contaminated water assumed to have originated from Unit 2 reactor occurred, but was subsequently stopped.** Countermeasure [29]: Identify leakage path and examine and implement preventive measures. - Placing sandbags with radioactive-materials absorption material (zeolite) in the bay - Installing fences in the bay to prevent contamination from spreading (silt fence) - Blockage between trenches and buildings, etc **Current Status [9]: Leakage and accumulation of high radiation level contaminated water at Unit 2's turbine building, vertical shafts and trenchs.** Countermeasure [30]: Transferring accumulated water to facilities that can store it (condenser and Centralized Waste Treatment Facility). Countermeasure [31]: Preparing decontamination and desalt of transferred accumulated water. (→Countermeasure [38]) Countermeasure [32]: Preparing to install tanks. **Current Status [10]: Increase of storage volume of water with low radiation level.** Countermeasure [33]: Preparing to store with tanks and barges. Countermeasure [34]: Preparing for decontamination and desalt of contaminated water (→Countermeasure [41]) Countermeasure [35]: Preparing to install a reservoir. **Current Status [11]: High likelihood of underground water around the building (sub-drainage water) to be contaminated.** Countermeasure [36]: Preparing to decontaminate sub-drainage water after being pumped up.	**Target [6]: Secure sufficient storage place to prevent water with high radiation level from being released out of the site boundary.** Countermeasure [37]: Utilization of "Centralized Waste Treatment Facility", etc. to store water. Countermeasure [38]: Install water processing facilities; decontaminate and desalt highly-contaminated water and store in tanks. Risk [7]: Possibility of delay in installing water processing facilities or poor operating performance of the facilities. Countermeasure [39]: Examination and implementation of backup measures (installment of additional tanks or pools or leakage prevention by coagulator, etc.) **Target [7]: Store and process water with low radiation level.** Countermeasure [40]: Increase storage capacity by adding tanks, barges, Megafloat, etc. Countermeasure [41]: Decontaminating contaminated water using decontaminants to below acceptable criteria.	**Target [8]: Decrease the total amount of contaminated water.** Countermeasure [42]: Expansion of additional tanks to store high radiation-level contaminated water. Countermeasure [43]: Continuation and reinforcement of decontamination and desalt of high radiation-level water. Countermeasure [44]: Continuation and reinforcement of decontamination and desalt of low radiation-level water. Countermeasure [45]: Reuse of processed water as reactor coolant. Countermeasure [46]: Decontamination to the level below criteria level.	**Issue [3] Installation of full-fledged water treatment facilities.**

Areas	Issues	Current Status (as of April 16th)	Targets, Countermeasures and Risks		Mid-term Issues
			<Step 1 (around 3 months)> Radiation dose is in steady decline.	<Step 2 (around 3 to 6 months*)> Release of radioactive materials is under control and radiation dose is being significantly held down. * After achieving Step 1	
II. Mitigation	(4) Mitigation of Release of Radioactive Materials to Atmosphere and from Soil	**Current Status [12]: Debris are scattered outside the buildings and radioactive materials are being scattered.** Countermeasure [47]: Inhibit scattering of radioactive materials by full-scale dispersion of inhibitor after confirming its performance by test. Countermeasure [48]: Prevent rain water contamination by dispersion of inhibitor. Countermeasure [49]: Removal of debris. Countermeasure [50]: Examination and implementation of basic design for reactor building cover and full-fledged measure (container with concrete roof and wall, etc.) Countermeasure [51]: Consideration of solidification, substitution and cleansing of contaminated soil (mid-term issues.)	**Target [9]: Prevent scattering of radioactive materials on buildings and ground.** Countermeasure [52]: Improvement of work condition by expanding application and dispersion of inhibitors to the ground and buildings. Countermeasure [53]: Continue removal of debris. Countermeasure [54]: Begin installing reactor building cover (with ventilator and filter.) Risk [5]: Considerable reduction of radiation dose is a prerequisite to launch construction (→continue countermeasure [52] and [53].)	**Target [10]: Cover the entire buildings (as temporary measure).** Countermeasure [55]: Complete installing reactor building covers (Units 1, 3, 4.) Risk [9]: Possibility of cover being damaged by a huge typhoon. Countermeasure [56]: Begin detailed design of full-fledged measure (container with concrete roof and wall, etc.)	**Issue [4]: Cover the entire building (as full-fledged measure)** Issue [5]: Solidification, substitution and cleansing of contaminated soil.
III. Monitoring/ Decontamination	(5) Measurement, Reduction and Announcement of Radiation Dose in Evacuation Order/Planned Evacuation/Emergency Evacuation Preparation Areas	**Current status [13]: Monitoring of radiation dose in and out of the power station is carried out.** Countermeasure [57]: Monitoring sea water, soil and atmosphere within the site boundary (25 locations.) Countermeasure [58]: Monitoring radiation dose at the site boundary (12 locations.) Countermeasure [59]: Consideration of monitoring methods in evacuation order/ planned evacuation/ emergency evacuation preparation areas. (→countermeasure [60] to [63])	**Target [11]: Expand/enhance monitoring and inform of results fast and accurately.** Countermeasure [60]: Consideration and implementation of monitoring methods in evacuation order / planned evacuation / emergency evacuation preparation areas (in cooperation and consultation with national/prefectural/municipal governments.) Countermeasure [61]: Announce accurately monitoring results of long half-life residue radioactive materials such as cesium 137.	**Target [12]: Sufficiently reduce radiation dose in evacuation order / planned evacuation / emergency evacuation preparation areas.** Countermeasure [62]: Monitoring of homecoming residences (in cooperation and consultation with national / prefectural / municipal governments.) Countermeasure [63]: Examination and implementation of necessary measures to reduce radiation dose (decontamination of homecoming residences and soil surface) (in cooperation and consultation with national/prefectural/municipal governments.)	Issue [6]: Continue monitoring and informing environmental safety.
		(Note) With regard to radiation dose monitoring and reduction measures in evacuation order/planned evacuation/emergency evacuation preparation areas, we will take every measure through thorough cooperation with the national government and by consultation with the prefectural and municipal governments.			

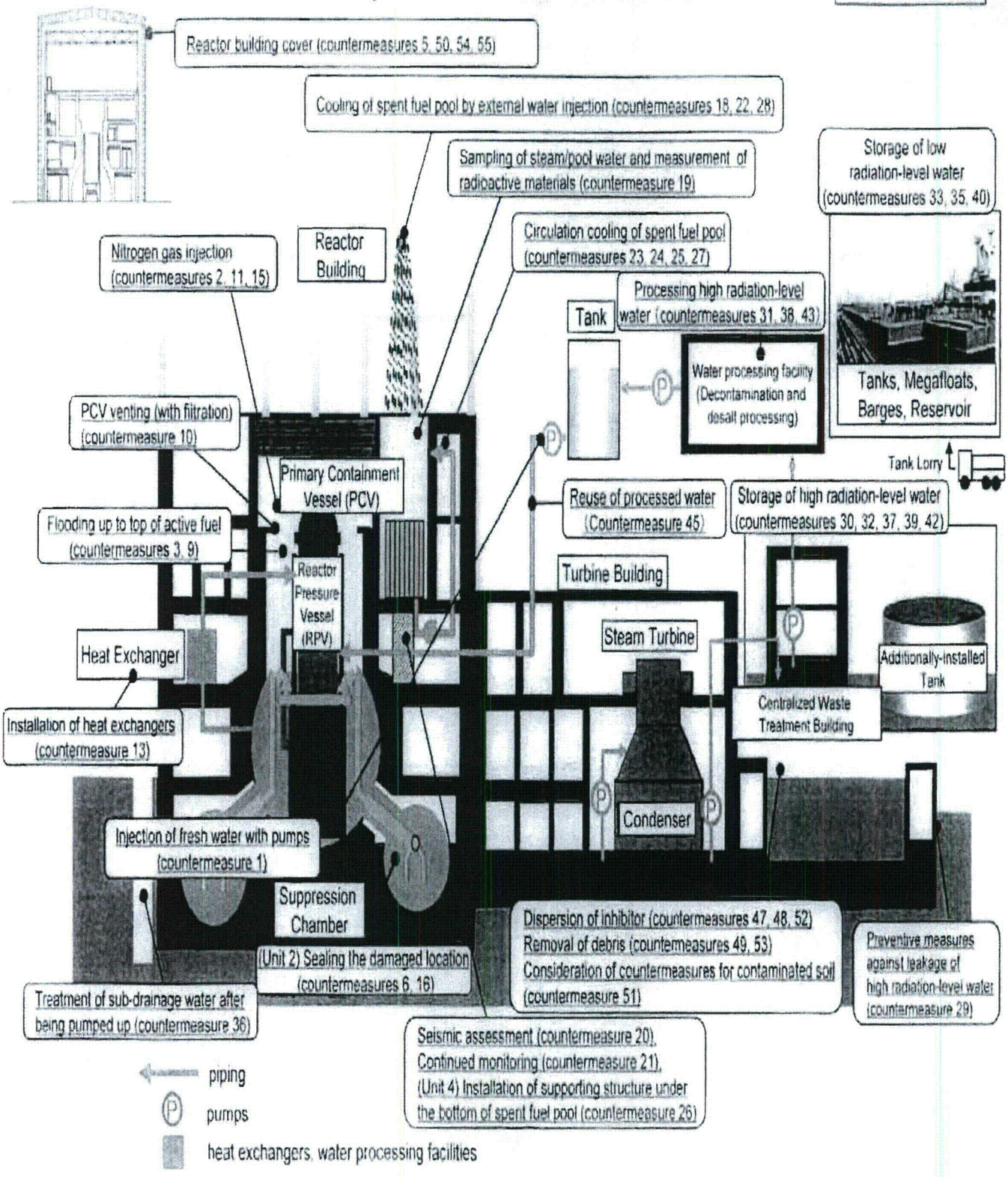
Roadmap for Immediate Actions (Issues / Targets / Major Countermeasures)

Reference 1



Reference 2

Overview of Major Countermeasures in the Power Station



From: Hoc, PMT12
Sent: Friday, April 22, 2011 7:01 AM
To: OST01 HOC
Subject: FW: DOE SitRep

Follow Up Flag: Follow up
Flag Status: Completed

From the DOE SitRep, there PMT identified one disparity (below in yellow & green). The disparity is explained in the full length article.

"The Nuclear Safe and Industry Agency explains that sea water containing highly dense radioactive material is piling up due to a special fence set up in the area to keep the leakage of the contaminated water from the Number 2 reactor water intake." (NHK News. April 22, 2011)

From: Hoc, PMT12
Sent: Friday, April 22, 2011 6:16 AM
To: OST01 HOC
Subject: FW: DOE SitRep- question for Liaison Team

Before posting the DOE SitRep to SharePoint Liaison Team will be looking into the issue I identified below.

Thanks.

Jessica Kratchman
-PMT PAAD

From: Hoc, PMT12
Sent: Friday, April 22, 2011 6:12 AM
To: LIA08 Hoc
Subject: DOE SitRep- question for Liaison Team

From today's DOE SitRep.

Radioactive level up at reactor water intake at No. 2. The operator of the troubled Fukushima nuclear power plant says it has detected higher levels of radioactive material in sea water samples near the water intake of one of the reactors. NISA says, however, there are no traces of highly radioactive water leaking into the sea from the plant.
TEPCO says it detected 160 becquerels of radioactive iodine-131 per cubic centimeter in samples of sea water collected near the water intake for the Number 2 reactor on Wednesday morning. The figure is 4,000 times the national limit and higher than the level detected on Tuesday. (0600 4/22 SITREP)
http://www3.nhk.or.jp/daily/english/22_01.html

I am a little confused by the statement I highlighted in green. Can you please look into this for me? The statement above almost makes it sound like there is no more plume in the ocean. I would like to confirm that NISA is saying there is still a plume of radioactive water in the ocean, but that the plant itself is no longer leaking radioactive water.

Thank you.

-Jessica Kratchman
PMT PAAD

From: OST01 HOC
Sent: Friday, April 22, 2011 3:09 PM
To: Kokajko, Lawrence
Subject: RE: Final Slides - NRC INTERIM COMPREHENSIVE ASSESSMENT OF FUKUSHIMA EVENT

Mr. Kokajko,

Where on the SP site did you want me to post these slides?

From: Kokajko, Lawrence
Sent: Friday, April 22, 2011 3:07 PM
To: OST01 HOC
Cc: Hoc, PMT12; RST12 Hoc
Subject: FW: Final Slides - NRC INTERIM COMPREHENSIVE ASSESSMENT OF FUKUSHIMA EVENT

Please place slides on sharepoint site – discussed with DEDO.

From: LIA08 Hoc
Sent: Friday, April 22, 2011 2:09 PM
To: Haney, Catherine; Franovich, Rani; Kokajko, Lawrence
Cc: OST01 HOC; RST01 Hoc; Hoc, PMT12
Subject: FW: Final Slides - NRC INTERIM COMPREHENSIVE ASSESSMENT OF FUKUSHIMA EVENT

The phrase "static but fragile" that was reported in the news media today, came from the attached presentation that Chuck Casto provided to the Ambassador's secretary as part of the briefing package for Secretary Clinton's Japan visit last week.

V/R,

Clyde Ragland

Liaison Team Coordinator
US Nuclear Regulatory Commission
email: lia08.hoc@nrc.gov
Desk Ph: 301-816-5185

From: RST01 Hoc
Sent: Friday, April 22, 2011 2:05 PM
To: LIA08 Hoc
Subject: FW: Final Slides - NRC INTERIM COMPREHENSIVE ASSESSMENT OF FUKUSHIMA EVENT

From: OST01 HOC
Sent: Sunday, April 17, 2011 2:05 AM
To: Weber, Michael; Virgilio, Martin; Castleman, Patrick; Orders, William; Franovich, Mike; Hipschman, Thomas; Snodderly, Michael
Cc: Tracy, Glenn; Zimmerman, Roy; LIA08 Hoc; RST01 Hoc; Hoc, PMT12; Moore, Scott; Reynolds, Steven
Subject: Final Slides - NRC INTERIM COMPREHENSIVE ASSESSMENT OF FUKUSHIMA EVENT

These are the final slides that were provided by the site team for the SoS briefing package.

The attachments are ~~OUO.~~

From: Casto, Chuck
Sent: Saturday, April 16, 2011 10:57 PM
To: ET07 Hoc; HOO Hoc
Cc: Moore, Scott; Zimmerman, Roy; Virgilio, Martin; Reynolds, Steven
Subject: Final slides for the ET - please pass along

Attached are the final slides I sent to the Ambassador's secretary. They will have them for the on-site briefing package. If SoS wants a few minutes we will give quick verbal. Otherwise Ast. Sec. Donohue (DOE) is traveling with her and will have these details. We've briefed him and his staff previously so he is up to speed. It is expected that she will at least say something to the NRC folks.....The ambassador recommended to her that she discuss the NRC.

Thanks
chuck

From: HOO Hoc
Sent: Tuesday, April 26, 2011 2:44 AM
To: LIA07 Hoc; LIA08 Hoc; OST01 HOC
Subject: FW: DOE Science Experts Briefing Slides 25 April 2011
Attachments: 0425 S-1 Briefing rev1.pptx

-----Original Message-----
From: Sheron, Brian
Sent: Monday, April 25, 2011 4:39 PM
To: HOO Hoc; ET01 Hoc; RST01 Hoc
Cc: Weber, Michael; Virgilio, Martin
Subject: FW: DOE Science Experts Briefing Slides 25 April 2011

FYI.

-----Original Message-----
From: Peko, Damian [mailto:Damian.Peko@Nuclear.Energy.gov]
Sent: Monday, April 25, 2011 4:29 PM
To: Kelly, John E (NE); Larzelere, Alex; DL-NITsolutions; Shields, Martha; Schneider, Steve
Subject: DOE Science Experts Briefing Slides 25 April 2011

Attached are the slides for today's 05:00 Science briefing.

From: HOO Hoc
Sent: Tuesday, April 26, 2011 6:57 PM
To: LIA07 Hoc; LIA08 Hoc; OST01 HOC
Subject: FW: Pls provide to onshift ET director
Attachments: image001.jpg; 0425 S-1 Briefing rev1.pptx

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
Protecting People and the Environment

From: McDermott, Brian
Sent: Tuesday, April 26, 2011 6:51 PM
To: HOO Hoc
Subject: Pls provide to onshift ET director

Thx,
Brian

Brian J. McDermott
(b)(6) (mobile)

From: Lee, Richard
To: McDermott, Brian
Sent: Tue Apr 26 08:01:57 2011
Subject: FW: Nuclear science group call schedule

Dear Brian:

Brian Sheron informed me that from now on NSIR going to participate in the DOE Science Council calls. The next one will be on Thursday and the call in number is indicated in the following e-mail. Yesterday, briefing is also attached.

<<0425 S-1 Briefing rev1.pptx>>

Best regards,

Richard

From: Adams, Ian [mailto:Ian.Adams@Hq.Doe.Gov]
Sent: Sunday, April 24, 2011 8:20 PM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Brinkman, Bill; Budnitz, Bob; Butnitz, Bob (pacbell.net); DAgostino, Thomas; Ellis, Jim; Finck, Phillip; Garwin, Dick (EOP); Garwin, Dick (IBM); Grossenbacher, John (INL); Hobbs, David (SRNL); Hurlbut, Brandon; John Holdren; Kelly, John E (NE); Koonin, Steven; Lee, Richard; Lyons, Peter; McFarlane, Harold; Miller, Neile; Mortensen, George; Mustin, Tracy; NITSolutions; Owens, Missy; Peterson, Per; Poneman, Daniel; Power, Dana (Sandia); Regalbuto, Monica; Sheron, Brian; Steve Fetter; Szilard, Ronaldo
Cc: Busby, Jeremy T; Caponiti, Alice; Burns, Douglas
Subject: Nuclear science group call schedule

Good evening,

This week, there will be 2 nuclear science calls: Tomorrow (Monday) and Thursday, both at 5:00pm EDT. Monday's call will be a status update, and Thursday will be a science briefing.

Call schedule:

Monday, 4/25 – 5:00pm EDT

Thursday, 4/28 – 5:00pm EDT

Call-in number: 202-586-2535

Ian

Ian Adams

Office of the Secretary

Department of Energy

(202) 586-9585

ian.adams@hq.doe.gov

U.S. DEPARTMENT OF
ENERGY | Nuclear Energy

Science Experts Briefing on Fukushima Nuclear Plant Status

John E. Kelly
Steve Binkley
Steve Aoki

April 25, 2011

U.S. DEPARTMENT OF
ENERGY
Nuclear Energy

Table of Contents

1. Recent developments
2. Radioactive water release information
3. Possible outbrief on USG response to Fukushima

Backup slides: individual unit status diagrams and data

Sources: DOE-NNSA SITREP report, METI press releases, TEPCO press releases

U.S. DEPARTMENT OF ENERGY

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Recent developments at Fukushima site: unit stabilization

- Units 1,2, 3 and 4 reactor buildings and spent fuel pools generally stable and continue to receive fresh water injections
- TEPCO said it will inject 2-3 times the volume of water into the SFP#4 on Monday, after finding on Sunday evening that the temperature in the pool had risen to 81°C. TEPCO had earlier limited the amount of water injected into the pool to 70 tons a day, saying water weight could weaken the reactor building.
  - 4/22: 91°C, water ~ 2 m above fuel
  - 4/23: 66°C, water ~ 3.7 m above fuel
  - 4/24: 81°C, water ~ 4.5 m above fuel
  - 4/25: 83°C, water ~ 4 m above fuel
- TEPCO is thinking about setting up a heat exchanger to hasten the full-scale recovery of the cooling system at the Unit 1 reactor. TEPCO wants the water level in the containment vessel to reach the top of active fuel.

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Recent developments at Fukushima site: site planning and stabilization

- TEPCO plans to begin broader spraying of a chemical hardening agent on top of debris near the reactor buildings on April 26 (limited tests to date)
- TEPCO is rewiring the power grid at its Fukushima Daiichi nuclear plant to secure offsite electricity supply in case of another strong quake
- Radiation levels outside Unit 3 reactor building, damaged by hydrogen explosion, are higher than in other locations; 300 mSv/hr was detected in nearby debris
- Removal of rubble using remote-control heavy machinery was carried out. (From 9:00 till 16:00 April 24th)

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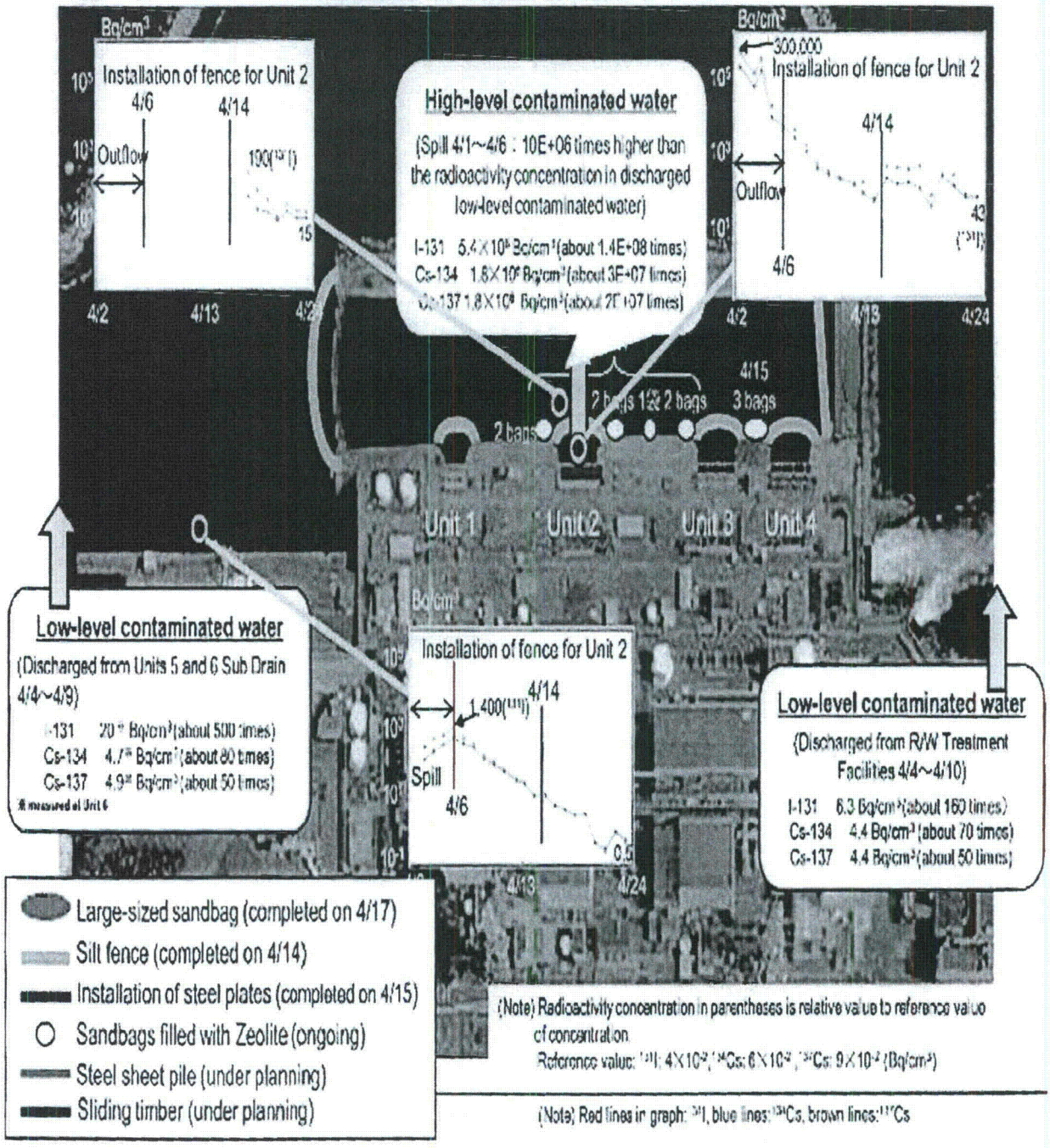
New details on release to seawater have been provided

- On 4/25/11, NISA/METI released more details on contaminated water releases from Fukushima Daiichi
- New estimate for total release of contamination to the environment is 4.7×10^{15} Bq
- Low-level water intentionally discharged included 1.5×10^{11} Bq
- Countermeasures, dilution, and currents have resulted in reduced measured concentrations in the sea water.
- Data (shown in following excerpts) indicates
  - Countermeasures are helping
  - Radioactivity concentration is decreasing
  - Radioactivity is higher at surface layers than in deeper water

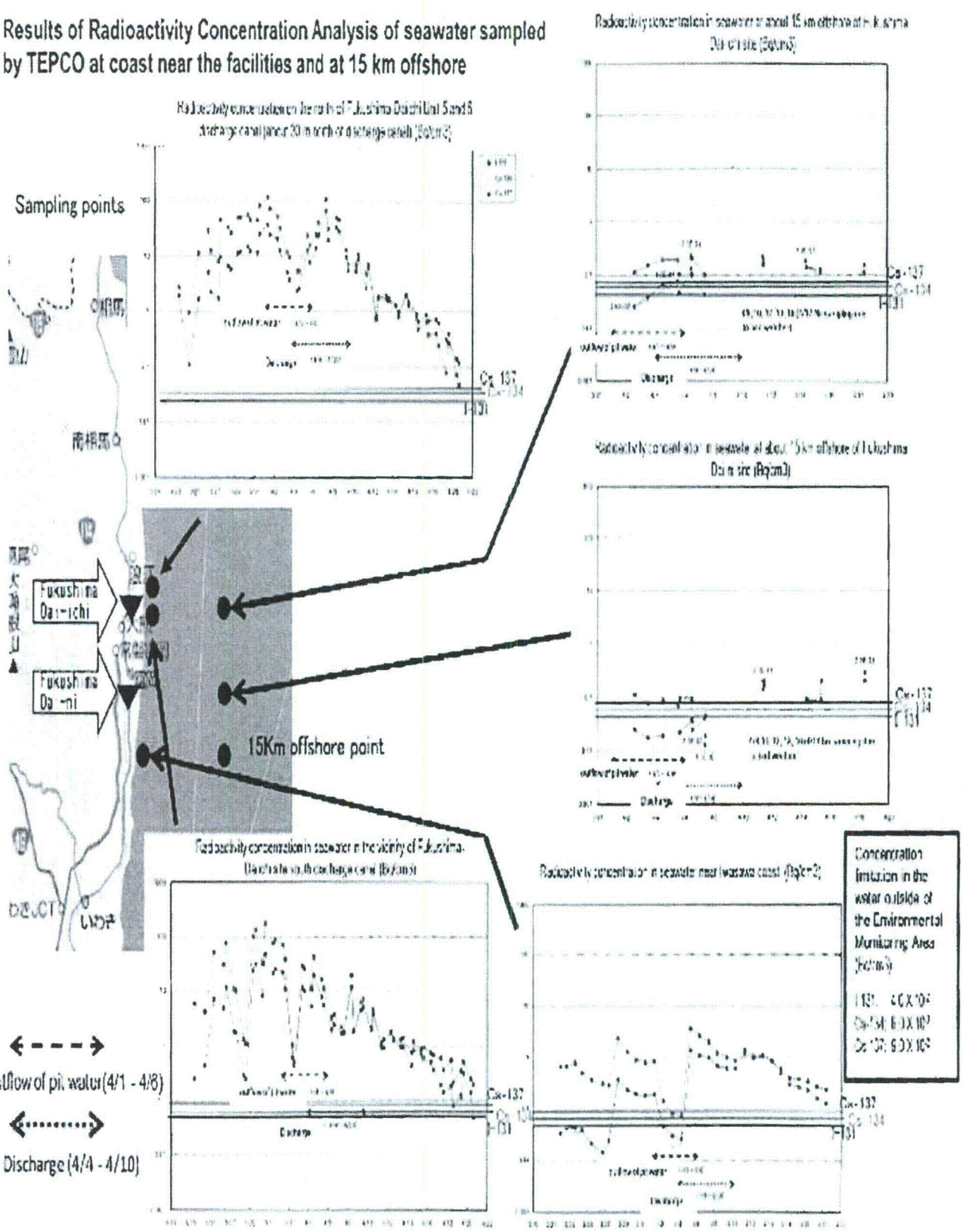
Measures for preventing spread of the liquid including radioactive materials



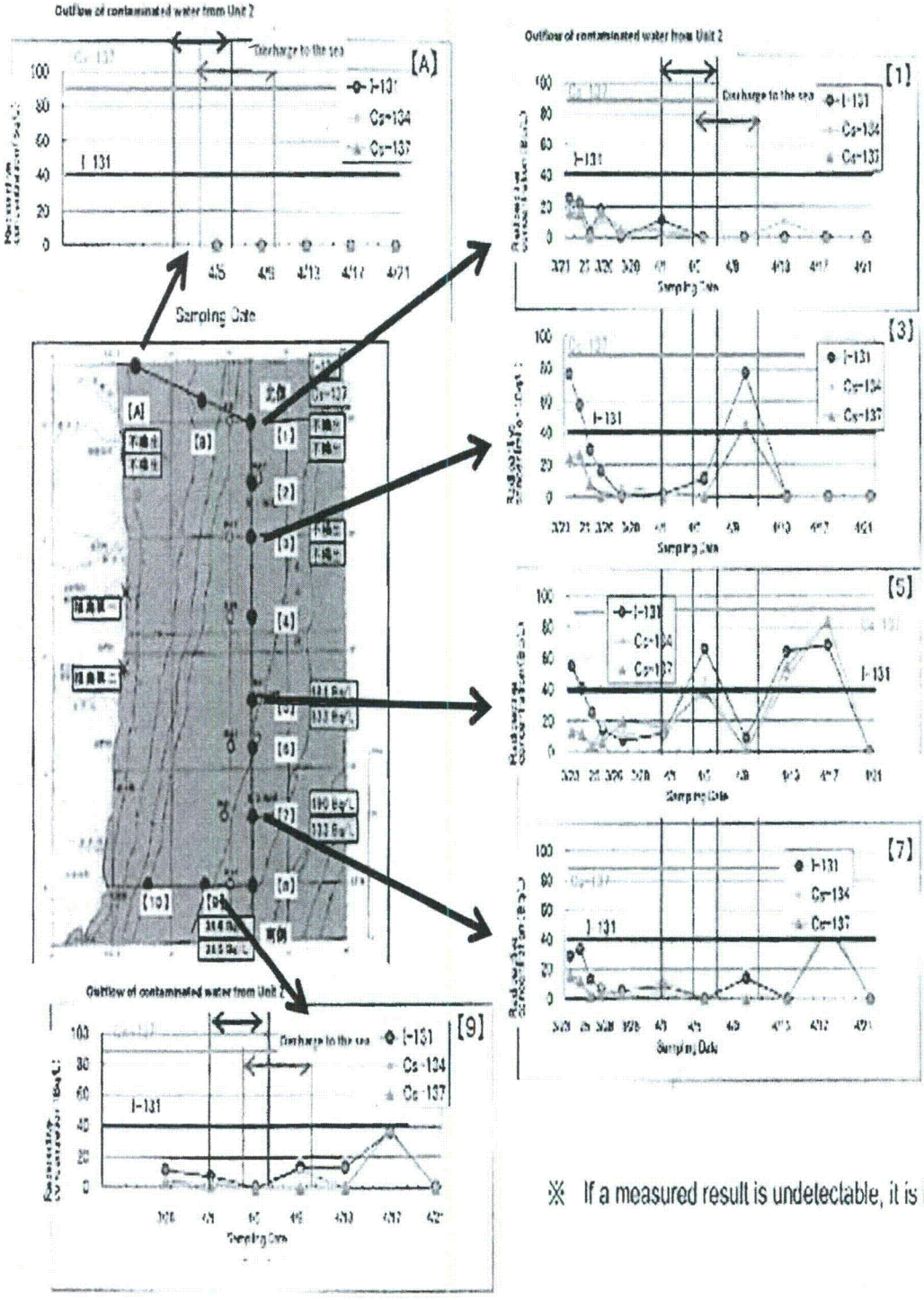
(Note) Radioactivity concentration in parentheses is relative value to reference value of concentration
Reference value: ^{131}I: 4×10^{-2}, ^{134}Cs: 6×10^{-2}, ^{137}Cs: 9×10^{-2} (Bq/cm³)

(Note) Red lines in graph: ^{131}I, blue lines: ^{134}Cs, brown lines: ^{137}Cs

Results of Radioactivity Concentration Analysis of seawater sampled by TEPCO at coast near the facilities and at 15 km offshore

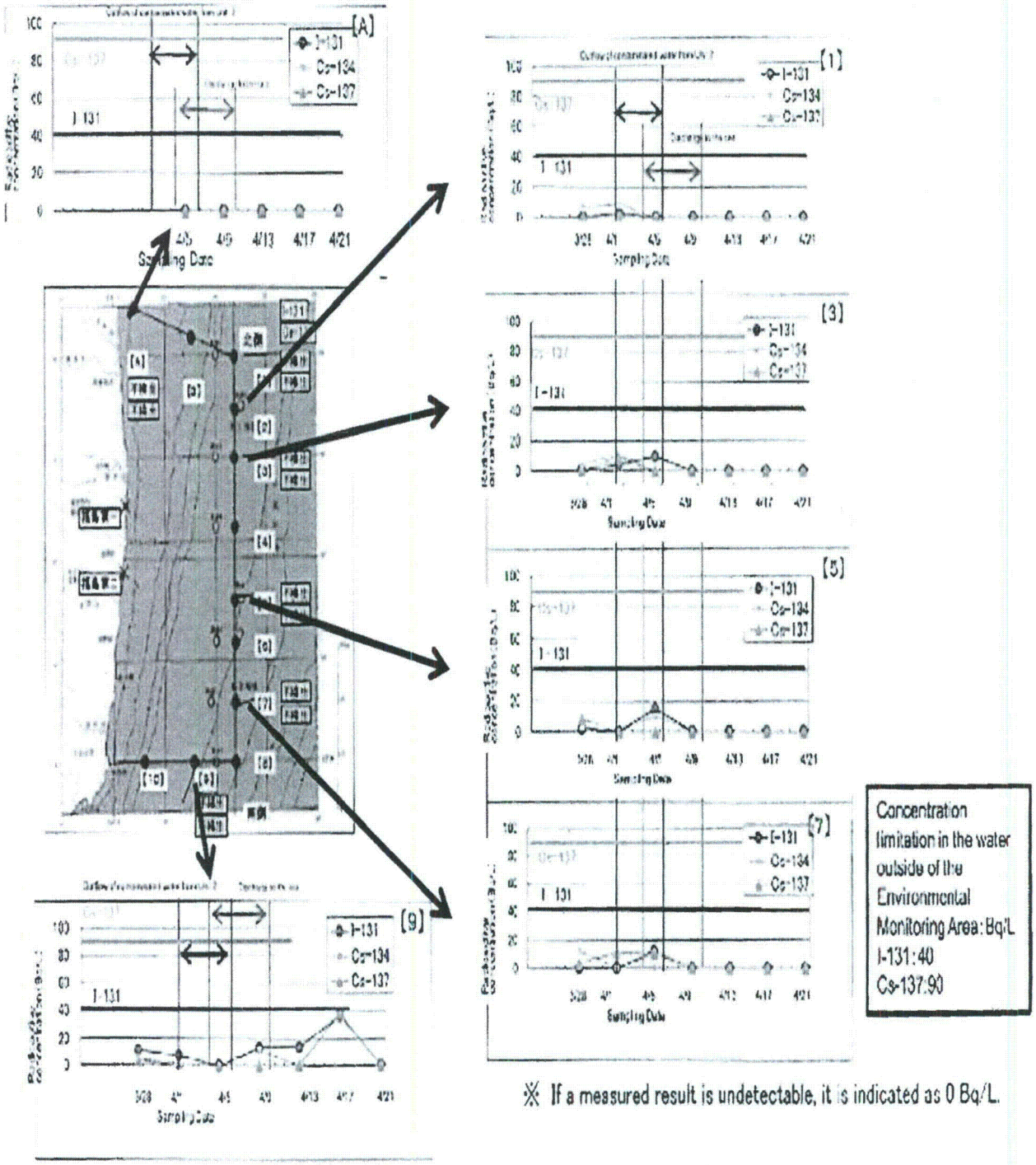


Sea area monitoring around Fukushima Dai-ichi Nuclear Power Station (30 km offshore)
Measurement results of radioactivity concentration in the sea water (surface layer) (sampled by MEXT on April 21st)



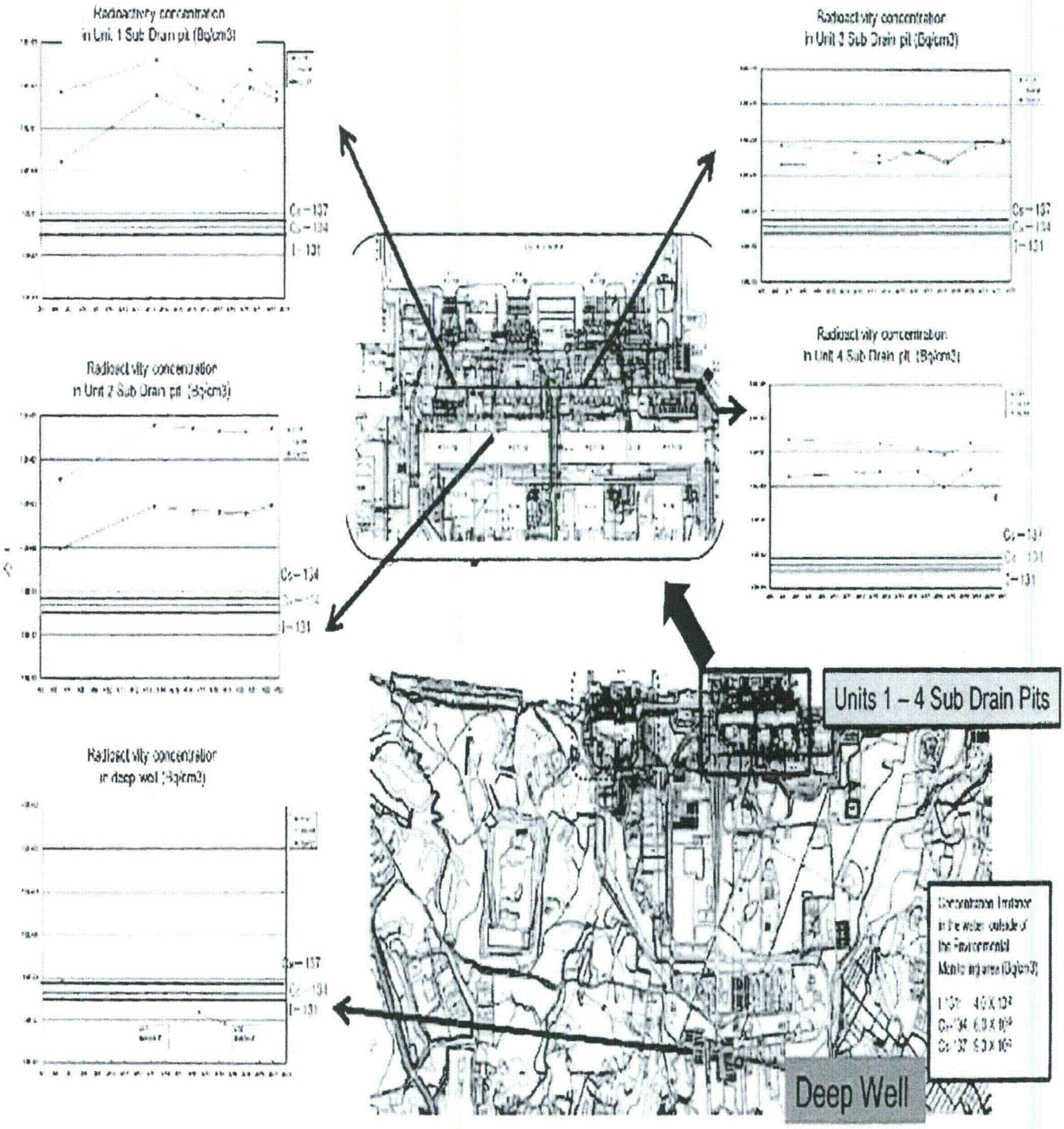
※ If a measured result is undetectable, it is indicated as 0 Bq/L.

Sea area monitoring around Fukushima Dai-ichi Nuclear Power Station (30km offshore)
Measurement results of radioactivity concentration in the sea water (lower layer) (sampled by MEXT on April 21st)



※ If a measured result is undetectable, it is indicated as 0 Bq/L.

Results of radioactivity concentration measurement of Fukushima Dai-ichi Units 1 – 4 Sub Drain Pits and Deep Well



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Future actions for minimizing water releases are being pursued

- **Strengthening countermeasures**
  - Silt fences
  - Sandbags with Zeolite
  - In near term, TEPCO will also steadily process radioactive stagnant water in turbine building
- **Strengthen monitoring (more measuring points at sea and in coastal waters)**
- **Processing of contaminated water from tanks, condensers, etc.**

U.S. DEPARTMENT OF ENERGY

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DOE and NRC are discussing a detailed outbrief on events at Fukushima

- This meeting would be an opportunity to share information on events at Fukushima and discuss future needs
- Topics might include
  - Accident analysis and reconstruction of events
  - Summary of DOE and NRC accomplishments to date
  - Path forward
- Dates and times are currently being evaluated.
- Additional comments on the TEPCO recovery roadmap are welcome by COB 4/26/2011.

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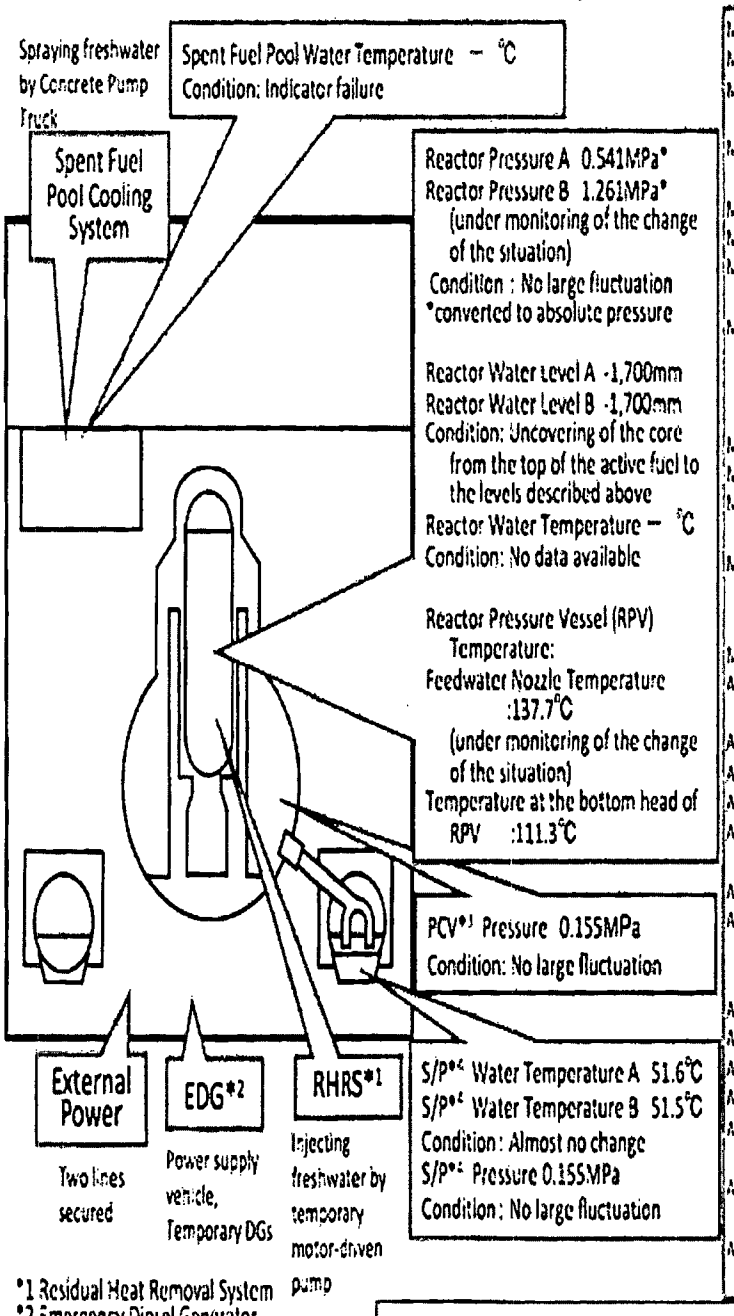
Back-up slides

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 1
(As of 2:00 April 25th, 2011)



*1 Residual Heat Removal System
*2 Emergency Diesel Generator
*3 Primary Containment Vessel
*4 Suppression Pool

Major Events after the Earthquake

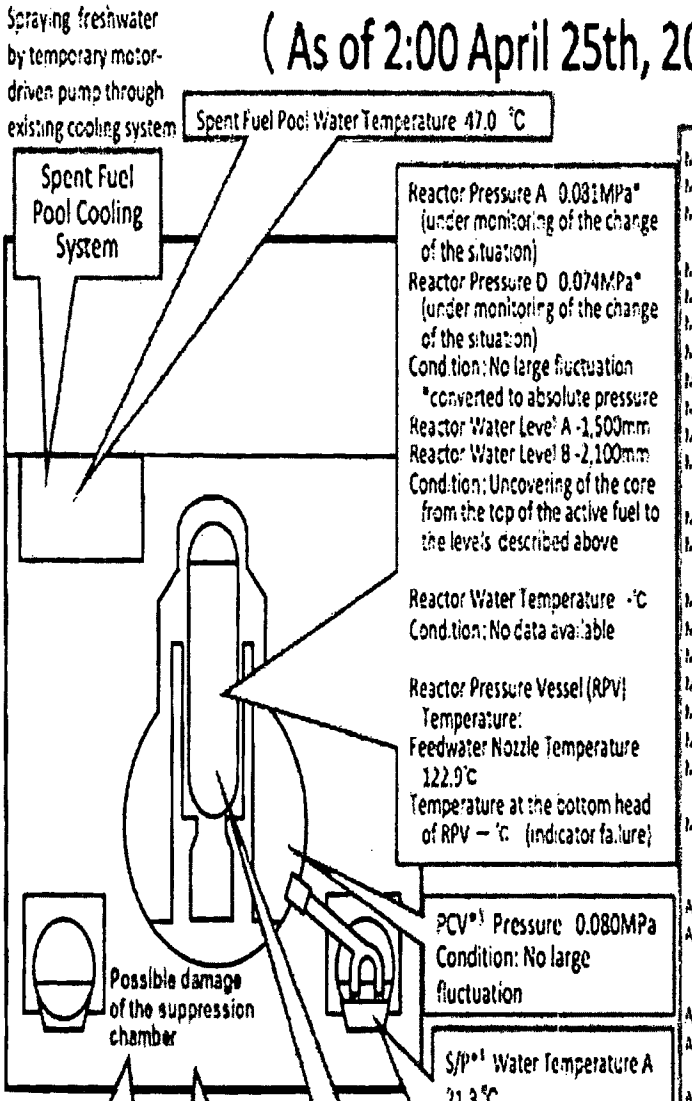
March 11th 14:46 Under operation, Automatic shutdown by the earthquake
March 11th 15:42 Report based on the Article 10 (Total loss of A/C power)
March 11th 16:36 Occurrence of the Article 15 event (Inability of water injection of the Emergency Core Cooling System)
March 12th 01:20 Occurrence of the Article 15 event (Unusual rise of the pressure in PCV)
March 12th 10:17 Started to vent.
March 12th 15:36 Sound of explosion
March 12th 20:20 Started to inject seawater and borated water to the Reactor Core.
March 23rd 02:33 The amount of injected water to the Reactor Core was increased utilizing the Feedwater Line in addition to the Fire Extinguish Line. (2m³/h → 18m³/h)
09:00 Switched to the Feedwater Line only (18m³/h → 11m³/h)
March 24th 11:30 Lighting in the Central Control Room was recovered.
March 25th 15:37 Started to inject fresh water.
March 29th 08:32 Switched to the water injection to the Reactor Core using the temporary motor-driven pump.
March 31st 12:00 ~ 2nd 15:26 Started to transfer the stagnant water from the Condensate Storage Tank (CST) to the Surge Tank of Suppression Pool Water (SPT)
March 31st 13:03 ~ 16:04 Water spray by Concrete Pump Truck (Fresh water)
April 3rd 12:02 The power supply to the temporary motor-driven pump was switched from the temporary power supply to the external power supply.
April 5th 13:55 Started to transfer the water from the Condenser to CST.
April 6th 22:30 Started the operation for the injection of nitrogen to PCV.
April 7th 01:31 Confirmed starting the injection of nitrogen to PCV.
April 9th 04:10 Started using highly pure nitrogen generator in the injection of nitrogen to PCV.
April 10th 09:30 Completed transferring the water from the Condenser to CST.
April 11th around 17:16 Loss of external power supply due to an earthquake occurred (at Hamadori in Fukushima Prefecture) and water injection to the Reactor Core and nitrogen injection to PCV were suspended.
April 11th 17:56 External power supply was recovered.
April 11th 18:04 Resumed injecting water to the Reactor Core.
April 11th 23:19 Restarted operation for injecting nitrogen to PCV.
April 11th 23:34 Confirmed starting injection of nitrogen to PCV.
April 17th 16:00 ~ 17:30 Confirmed the situation in the reactor building using an unmanned robot.
April 18th 11:50 ~ 12:12 Stopped the water injection into the reactor core to replace the current hose with a new one.
April 19th 10:23 Completed the work of strengthening connection of the power supplies between Units 1-2 and Units 3-4.

Current Conditions : Fresh water is being injected to the Spent Fuel Pool and the Reactor Core

(Editorial committee for Nuclear Energy Handbook, Nuclear Energy Handbook)

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 2

(As of 2:00 April 25th, 2011)



*1 Residual Heat Removal System
*2 Emergency Diesel Generator
*3 Primary Containment Vessel
*4 Suppression Pool

Current Conditions: Fresh water is being injected to the Spent Fuel Pool and the Reactor Core

(Editorial committee for Nuclear Energy Handbook, Nuclear Energy Handbook)

Major Events after the Earthquake 1/2

March 11th 14:46 Under operation, Automatic shutdown by the earthquake
March 11th 15:42 Report based on the Article 10 (Total loss of A/C power)
March 11th 16:36 Occurrence of the Article 15 event (Lowering of water injection of the Emergency Core Cooling System)
March 13th 11:00 Started to vent
March 14th 13:25 Occurrence of the Article 15 event (Loss of reactor cooling function)
March 14th 15:34 Started to inject seawater to the Reactor Core
March 14th 23:50 Occurrence of the Article 15 event (Unusual rise of the pressure in PCV)
March 15th 03:02 Started to vent
March 15th 06:10 Sound of explosion
March 15th around 06:20 Possible damage of the suppression chamber
March 20th 15:05～17:20 Approximately 40 ton seawater injection to the Spent Fuel Pool (SFP) via the Fuel Pool Cooling Line (FPC)
March 20th 15:46 Power Center received electricity
March 21st 18:22 White smoke generated. The smoke died down and almost invisible at 07:11 March 22nd
March 22nd 16:07 Injection of around 18 tons of seawater to SFP
March 25th 10:40～12:19 Sea water injection to SFP via FPC
March 25th 13:15 Started to inject fresh water to the Reactor Core.
March 26th 16:46 Lighting in the Central Control Room was recovered.
March 27th 18:31 Switched to the water injection to the core using the temporary motor-driven pump
March 29th 16:30～18:25 Switched to the temporary motor-driven pump injecting fresh water to SFP.
March 29th 16:45～Apr 1st 11:50 Transferred the water from the Condensate Storage Tank (CST) to the Surge Tank of Suppression Pool Water (SPT)
March 30th 9:25～23:50 Confirmed malfunction of the temporary motor driven pump injecting fresh water to SFP(9:45), Switched to the injection using the fire pump truck, but suspended as cracks were confirmed in the hose (12:47, 13:12) Resumed injection of fresh water(19:05)
April 1st 14:56～17:05 Freshwater injection to SFP via FPC using the temporary motor-driven pump.
April 2nd around 9:30 The water, of which the dose rate was at the level of more than 1,000mSv/h, was confirmed to be collected in the pit located near the Intake Channel of Unit 2. The outflow from the lateral surface of the pit into the sea was also confirmed
April 2nd 17:10 Started to transfer the water from the Condenser to the CST.
April 3rd 12:12 The power supply to the temporary motor driven pump was switched from the temporary power supply to the external power supply.
April 3rd 13:47～14:30 20 bags of sawdust, 80 bags of high polymer absorbent and 8 bags of cutting-processed newspaper were put into the Pit for the Concrete.
April 4th 7:05～7:11 Approximately 1 kg of tracer (bath agent) was put in from the Pit for the Duct for Seawater Pipe
April 4th 11:05～13:37 Freshwater injection to SFP via FPC using the temporary motor-driven pump
April 5th 14:15 Tracer is confirmed to outflow through the permeable layer around the pit into the sea
15:07 Started to inject coagulant.
April 6th around 5:38 The water outflow from the lateral surface of the pit was confirmed to stopped.
April 7th 13:28～14:14 Freshwater injection to SFP via FPC using the temporary motor driven pump.
April 9th 13:10 Completed transferring the water from the Condenser to CST
April 10th 10:17～11:38 Freshwater injection to SFP via FPC using the temporary motor-driven pump
April 11th around 17:16 Loss of external power supply due to an earthquake occurred (at Hamadori in Fukushima Prefecture) Water injection to the Reactor Core was suspended
April 11th 17:55 External power supply was recovered
April 11th 19:04 Resumed injecting water to the Reactor Core

U.S. DEPARTMENT OF ENERGY

Nuclear Energy

Major events for Unit 2

Major Events after the Earthquake 2/2

April 12th 19:35~April 13th 17:04 Transfer from the trench of the turbine building to the Condenser.

April 13th 11:00 Suspended the transfer for checking leaks, etc.

April 13th 13:15~14:55 Freshwater injection to SFP via FPC using the temporary motor-driven pump.

April 16th 10:13~11:54 Freshwater injection to SFP via FPC using the temporary motor-driven pump. (The temporary motor-driven pump stopped at 11:39 due to an earthquake that occurred at around 11:19. SFP was confirmed to be filled to capacity through observing a rise of the water level in the Skimmer Tank.)

April 16th around 11:19 An earthquake occurred (in the southern part of Ibaraki Prefecture).

April 18th 13:42~ Confirmed the situation in the reactor building using an unmanned robot.

April 18th 12:13~12:37 Stopped the water injection into the reactor core to replace the current hose with a new one.

April 18th 09:30~17:40 Injected coagulant (soluble glass) into the power cable trench.

April 19th 08:00~15:30 Injected coagulant (soluble glass) into the power cable trench.

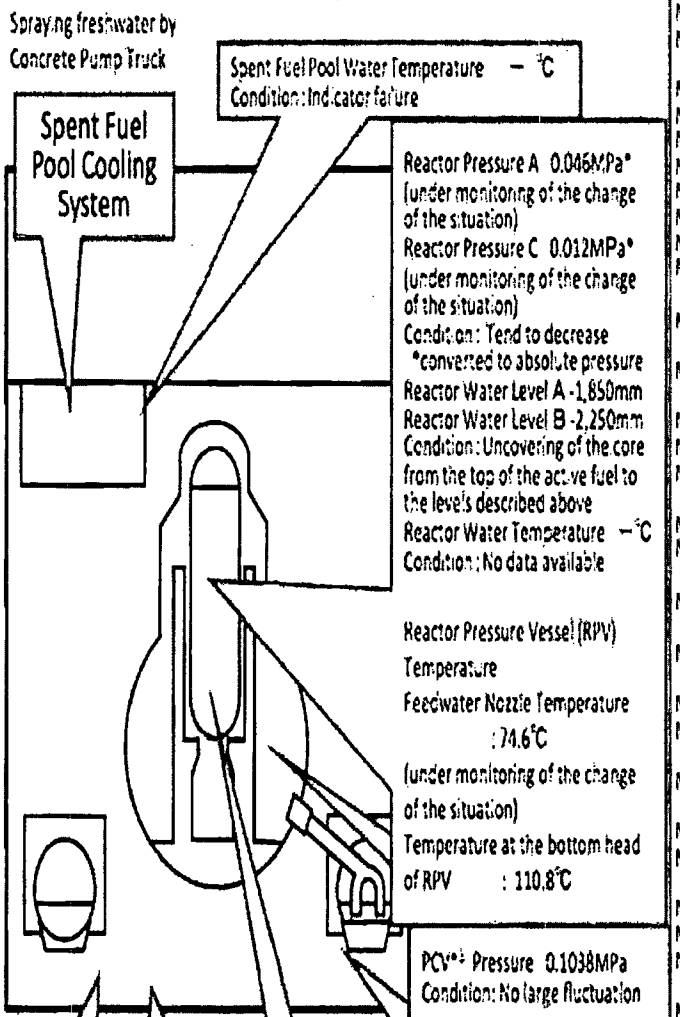
April 19th 10:08~ Started to transfer the stagnant water with high-level radioactivity from the trench of the turbine building to the buildings of radioactive waste treatment facilities.

April 19th 10:23 Completed the work of strengthening connection of the power supplies between Units 1-2 and Units 3-4.

April 19th 16:08~17:28 Injected freshwater to SFP via FPC using the temporary motor-driven pump.

April 22nd 15:55~17:40 Injected freshwater to SFP via FPC using the temporary motor-driven pump.

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 3
(As of 2:00 April 25th, 2011)



*1 Residual Heat Removal System
*2 Emergency Diesel Generator
*3 Primary Containment Vessel
*4 Suppression Pool

Current Conditions: Fresh water is being injected to the Spent Fuel Pool and the Reactor Core

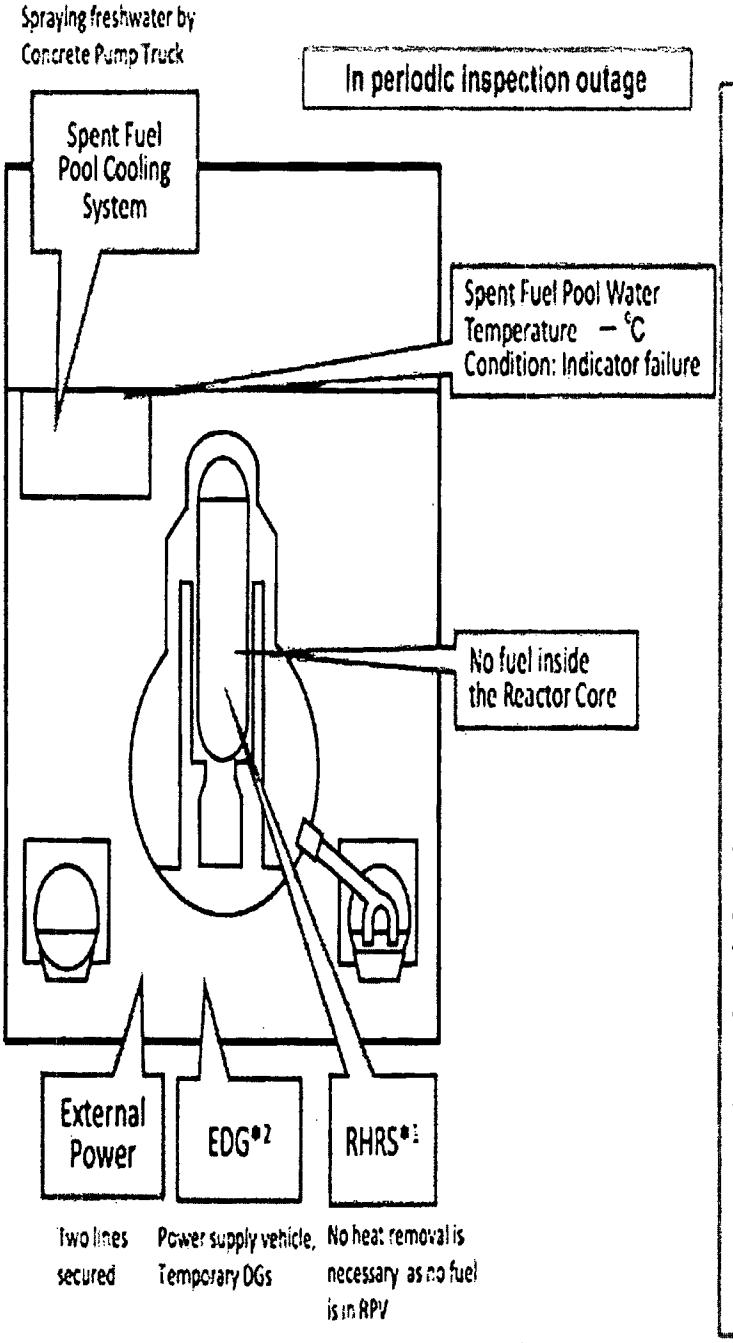
(Editorial committee for Nuclear Energy Handbook, Nuclear Energy Handbook)

Major Events after the Earthquake 1/2

March 11th 14:46 Under operation, Automatic shutdown by the earthquake
March 11th 15:42 Report based on the Article 10 (Total loss of A/C power)
March 13th 05:10 Occurrence of the Article 15 event (Inability of water injection of the Emergency Core Cooling System)
March 13th 08:41 Started to vent.
March 13th 13:12 Started to inject seawater and borated water to the Reactor Core.
March 14th 05:20 Started to vent.
March 14th 07:44 Occurrence of the Article 15 event (Unusual rise of the pressure in PCV)
March 14th 11:01 Sound of explosion
March 16th around 08:33 White smoke generated.
March 17th 09:48~10:01 Water discharge by the helicopters of Self-Defense Force
March 17th 19:05~19:15 Water spray from the ground by High pressure water-Cannon trucks of Police
March 17th 19:35~20:05 Water spray from the ground by fire engines of Self-Defense Force
March 18th before 14:00~14:33 Water spray from the ground by 6 fire engines of Self-Defense Force
March 18th ~14:45 Water spray from the ground by a fire engine of the US Military
March 19th 00:30 ~01:10 Water spray by Hyper Rescue Unit of Tokyo Fire Department
March 19th 14:10 ~ 20th 03:40 Water spray by Hyper Rescue Unit of Tokyo Fire Department
March 20th 11:00 Pressure of PCV rose(320kPa).Afterward fell.
March 20th 21:36 ~ 21st 03:58 Water spray by Hyper Rescue Unit of Tokyo Fire Department
March 21st around 15:55 Grayish smoke generated and was confirmed to be died down at 17:55.
March 22nd 15:10 ~16:30 Water spray by Hyper Rescue Unit of Tokyo Fire Department and Osaka City Fire Bureau.
March 22nd 22:46 Lighting in the Central Control Room was retovered.
March 23rd 11:03 ~13:20 Injection of about 35 ton of sea water to the Spent Fuel Pool (SFP) via the Fuel Pool Cooling Line (FPC)
March 23rd around 16:20 Black smoke generated and was confirmed to died down at around 23:30 and 24th 04:50.
March 24th 05:35~16:05 Injection of around 120 ton of sea water to SFP via FPC
March 25th 13:28~16:00 Water spray by Kawasaki City Fire Bureau supported by Tokyo Fire Department
March 25th 18:02 Started fresh water injection to the core.
March 27th 12:34~14:36 Water spray by Concrete Pump Truck
March 26th 17:40~31st around 8:40 Transferring the water from the Condensate Storage Tank (CST) to the Surge Tank of Suppression Pool Water (SPT)
March 28th 20:30 Switched to the water injection to the core using a temporary motor-driven pump.
April 3rd 12:18 The power supply to the temporary motor-driven pump was switched from the temporary power supply to the external power supply.
April 11th around 17:16 Loss of external power supply of Unit 1 and 2 due to an earthquake occurred (at Hamadori in Fukushima Prefecture) and water injection to the Reactor Core was suspended.
April 12th 18:04 External power supply of Units 1 and 2 recovered (April 11th 17:56). Returned injecting water to the Reactor Core.
April 17th 11:30~14:00 Confirmed the situation in the reactor building using unmanned robot.
April 18th 12:38~13:05 Stopped the water injection into the reactor core to replace the current hose with a new one
April 19th 10:23 Completed the work of strengthening connection of the power supplies between Units 1-2 and Units 3-4.
April 22nd 13:40~14:00 Tentatively injected freshwater to SFP via the Fuel Pool Coolant Purification Line.

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 4

(As of 2:00 April 25th, 2011)



*1 Residual Heat Removal System

*2 Emergency Diesel Generator

*3 Reactor Pressure Vessel

Major Events after the Earthquake

In periodic inspection outage when the earthquake occurred
March 14th 04:08 Water temperature in the Spent Fuel Pool (SFP), 84℃
March 15th 06:14 Confirmed the partial damage of wall in the 4th floor.
March 15th 09:38 Fire occurred in the 3rd floor. (12:25 extinguished)
March 16th 05:45 Fire occurred. TEPCO couldn't confirm any fire on the ground. (06:15)
March 20th 08:21~09:40 Water spray over SFP by Self-Defense Force
March 20th around 18:30~19:46 Water spray over SFP by Self-Defense Force
March 21st 06:37~08:41 Water spray over SFP by Self-Defense Force
March 21st around 15:00 Work for laying cable to Power Center was completed.
March 22nd 10:35 Power Center received electricity.

<Water spray by Concrete Pump Truck (Seawater)>
March 22nd 17:17~20:32, March 23rd 10:00~13:02, March 24th 14:36~17:30, March 25th 19:05~22:07, March 27th 16:55~19:25

March 25th 06:05~10:20 Sea water injection to SFP via the Fuel Pool Cooling Line (FPC)
March 29th 11:50 Lighting in the Central Control Room was recovered.
April 11th around 17:16 An earthquake occurred (at Hamadori in Fukushima Prefecture).
April 12th 12:00~13:04 Sampled the water in SFP.
April 19th 10:23 Completed the work of strengthening connection of the power supplies between Units 1-2 and Units 3-4.
April 22nd Measured the water level of SFP by a gauge hung on Concrete Pump Truck (62m class).

< Water spray by Concrete Pump Truck (Fresh water)>
March 30th 14:04~18:33, April 1st 08:28~14:14, April 3rd 17:14~22:16, April 5th 17:35~18:22, April 7th 18:23~19:40, April 9th 17:07~19:24, April 13th 0:30~6:57, April 15th 14:30~18:29, April 17th 17:39~21:22, April 19th 10:17~11:35, April 20th 17:08~20:31, April 21st 17:14~21:20, April 22nd 17:52~23:53, April 23rd 12:30~16:44, April 24th 12:25~17:07

Current Conditions: No fuel is in RPV*3.
Fresh water is being injected to the Spent Fuel Pool.

(Editorial committee for Nuclear Energy Handbook, Nuclear Energy Handbook)

From: ET01 Hoc
Sent: Thursday, April 28, 2011 3:14 PM
To: ET02 Hoc
Subject: FW: sieze the opportunity
Attachments: Consequence Management Asset Briefing.pptx

From: Sheron, Brian
Sent: Thursday, April 28, 2011 3:13:44 PM
To: HOO Hoc; ET01 Hoc
Subject: FW: sieze the opportunity
Auto forwarded by a Rule

FYI.

From: SCHU [mailto:SCHU@hq.doe.gov]
Sent: Thursday, April 28, 2011 8:28 AM
To: Aoki, Steven; Kelly, John E (NE); Binkley, Steve; Mueller, Stephanie; Leistikow, Dan; DAgostino, Thomas
Cc: Adams, Ian; Budnitz, Bob; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; John Holdren; Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Peterson, Per; Poneman, Daniel; Steve Fetter; Szilard, Ronaldo
Subject: sieze the opportunity

Steve Aoki, et al.

I put down on paper what I was saying on Tuesday.

I believe we can take the opportunity to use what happen in the Fukushima reactors to improve the predictive capability of the NARAC calculations. The purpose of NARAC modeling capability is outlined in slides 2 and 3.

Slide 2:

"Uses include:

- Assess dose and surface contamination downwind
- Provide guidance for the deployment of field teams
- Plan for AMS surveys

Develop PARs and make Protective Action Decisions"

Slide 3:
Event Information

- Weather data
- Nuclear, radiological, chemical, and biological source information
- Global terrain, land use, and population databases

Measurement data and observation"

As pointed out on slide 4, the AMS system is to be used "to confirm NARAC predictive computer models."

It is fair to say that the NARAC were not helpful in "providing protective guidance actions", in part because they did not take into account terrain and other relevant informaion.

We now know the time and wind direction history of the radiation releases at Fukushima. The local terrain is known. We also know where the contamination lies - in a narrow slice projecting northwest from the reactor. Still unknown, but could be estimated, are the details of how high the radioactive materials were thrown into the air. The time and local weather at the time of the largest radiation releases can be used to work backwards to get an idea of the mix of parameters: the amount and height of the aerosolized radioactive materials to understand the impact of the explosions and potential smoldering fires.

In short, the NARAC calculations can be upgraded so that they accurately predict the past events. WE will need better capabilities to provide

"**Actionable Information for Preparedness & Response**

- Hazard areas, health effects levels and exposed populations
- Casualty, fatality, and damage estimates
- Protective action guidance"

In the event a release of radiation, dangerous chemical contaminants, etc. occur in the US.

Steven Chu
Department of Energy

From: ET01 Hoc
Sent: Thursday, April 28, 2011 3:15 PM
To: ET02 Hoc
Subject: FW: Japan

From: Sheron, Brian
Sent: Thursday, April 28, 2011 3:15:22 PM
To: HOO Hoc; ET01 Hoc
Subject: FW: Japan
Auto forwarded by a Rule

Last one.....

From: Vicki Chandler [mailto:Vicki.Chandler@moore.org]
Sent: Thursday, April 28, 2011 11:54 AM
To: SCHU
Cc: Tji (tijcal@berkeley.edu); Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Peterson, Per; Poneman, Daniel; Steve Fetter; Szilard, Ronaldo
Subject: RE: Japan

Yes, there are some measures in the nearby oceans, prior to the incident. It is my understanding some of this data are in a manuscript that is currently in press (Japanese and US scientists contributed to this manuscript). Many thanks! Any advice or pubs you all can point me to would be much appreciated.

Vicki

From: SCHU [mailto:SCHU@hq.doe.gov]
Sent: Thursday, April 28, 2011 8:51 AM
To: Vicki Chandler
Cc: Tji (tijcal@berkeley.edu); Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Peterson, Per; Poneman, Daniel; Steve Fetter; Szilard, Ronaldo
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Vicki,

A baseline of data suggests to me that one would want to know what was the radioactivity before the accident at various distances and depths away from the reactor site and how the levels have changed after the accident.

My guess is there may/should be some data of radiation levels in the water before the accident that TEPCO of a regulatory agency may have. Accidental radioactive releases is a possibility, and one would want to monitor it.

The DOE is not willing to fund comprehensive data collection now.

It ***would*** be useful to know how quickly a given discharge into the ocean are diluted to levels that no longer pose a risk. There may already be studies on this question. I have copied the people on my science team, and they can contact you directly.

Steve

Steven Chu
Department of Energy

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Thanks so much for responding to me so quickly. What our Foundation is trying to figure out is whether the requested investment of ~$4M for a research cruise and analyses of samples collected on that cruise is needed in a time sensitive way to establish a baseline of data that can be compared with future studies. We can theoretically move quickly, but my Board wants to understand that this is in fact time critical, no US agency is willing or able to fund the proposed more comprehensive data collection NOW, compared to what has been done so far by the Japanese, and that in the future others will fund follow up experiments.

Regards,

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Vicki,

The Japanese have been taking ocean samples off the coast. Our nuclear group can give you access to the data we. You should ask relevant Japanese officials for their data, which may be more extensive.

I have copied John Holdren, Head of OSTP, and Admiral Donald, who is a 4-start in nuclear navy (and part of the DOE) as well/

I will look around in other parts of the DOE as well. NOAA has most of the govt. research surface ships, so I am not hopeful. Finally. There is the matter of who will pay for this.

Steve Chu

Steven Chu
Department of Energy

From: Steven Chu [mailto: (b)(6)
Sent: Thursday, April 28, 2011 8:55 AM
To: SCHU
Subject: Fwd: Japan

---------- Forwarded message ----------
From: **Vicki Chandler** <Vicki.Chandler@moore.org>
Date: Thu, Apr 28, 2011 at 7:35 AM
Subject: Re: Japan
To: (b)(6)

Dear Dr. Chu,

I'm following up on Tij's email. Our foundation has been approached by Ken Buesseler at WHOI regarding a time sensitive need to obtain early estimates of the radiochemistry and radioecology within a 200 km area in the oceans near the Fukushima Daiichi nuclear power plant.

(b)(5)

I am appreciative of any advice you can provide me.

Regards,

Vicki Chandler
Chief Program Officer Science
Gordon and Betty Moore Foundation

----- Original Message -----
From: Tjian PhD, Robert T [mailto:tjianr@hhmi.org]
Sent: Wednesday, April 27, 2011 05:56 PM
To: Steven Chu <(b)(6)
Cc: Vicki Chandler
Subject: Japan

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(b)(5)

Thanks, Tij

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Steven Chu
Department of Energy

From: ET02 Hoc
Sent: Thursday, April 28, 2011 3:15 PM
To: OST01 HOC
Subject: FW: Japan

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Sent: Thursday, April 28, 2011 3:15:24 PM
To: ET02 Hoc
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Department of Energy

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Gordon and Betty Moore Foundation

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Cc: Vicki Chandler
Subject: Japan

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(b)(5)

Thanks, Tij

--
Steven Chu
Department of Energy

From: Hoc, PMT12
Sent: Thursday, March 17, 2011 4:00 AM
To: PMTERDS Hoc
Subject: FW: shielding/dose calculations
Attachments: image003.png

From: DTRA Reachback [mailto (b)(6)
Sent: Thursday, March 17, 2011 3:58 AM
To: Hoc, PMT12
Cc: (b)(6)
Subject: FW: shielding/dose calculations

Respectfully,
rl
Defense Threat Reduction Agency
(703) 767-3448, (DSN 427-)
Unclass: (b)(6)
SIPR: (b)(6)
JWICS: reachback@dtra.ic.gov
R&D Enterprise
Innovation & Systems Engineering Office
Reachback Division

From: Bacon, Jeffrey \ MAJ USA [mailto (b)(6)
Sent: Wednesday, March 16, 2011 9:32 PM
To: morrisrh@ornl.gov
Cc: Phillips, Michael P. CONTRACTOR; Phillips, Mike (CNTTR); Reachback
Subject: FW: shielding/dose calculations

Bob,
Received dose/distance plot.
Jeff

-----Original Message-----
From: Morris, Robert Howard [mailto:morrisrh@ornl.gov]
Sent: Wednesday, March 16, 2011 9:25 PM
To: Bacon, Jeffrey \ MAJ USA; Reachback
Subject: FW: shielding/dose calculations

Maj,

Let me know if it makes it

Bob

Bob Morris

Oak Ridge National Laboratory

morrisrh@ornl.gov

865-576-5878

(b)(6) cell

From: Morris, Robert Howard
Sent: Wednesday, March 16, 2011 9:19 PM
To: (b)(6)
Subject: FW: shielding/dose calculations

Initial results for the gamma shine from the #4 reactor spent fuel pool.

Better results to follow tomorrow. Questions/comments welcome.

Bob

Bob Morris

ORNL

morrisrh@ornl.go

865-576-5878

(b)(6) cell

The initial results were for a "point source" which was a spherical source with a volume that approximated the actual spent fuel pool volume, but without any fuel assemblies (void). The results are quite high (a factor of 100 higher than the values shown below for a more reasonable approach).

The reasonable approach was based on a dry spent fuel pool assumed to be a rectangular body with dimensions 608x608x371 cm and containing 1385 spent fuel assemblies. These fuel assemblies were smeared over the entire spent fuel pool. The spent fuel was assumed to have 105 days cooling which is the worst case results that Ian Gauld supplied. Dose results were generated at 10, 100, 1000 m above the spent fuel pool.

These estimates are reasonable and should be conservative since the fuel decay was based on only 105 days decay (unit 4 minimum decay). These results will be refined as more information becomes available.

Bryan Broadhead and Joel Risner

Distance above Spent fuel pool (m)	Dose (rem/h)	<<image003.png>>	Dose (Sv/h)
10	22,360	223.6	
100	246	2.46	
1000	2.47	0.0247	

Lee, Richard

From: Carlson, Donald
Sent: Saturday, March 19, 2011 10:44 AM
To: Parks, Cecil V.; Gehin, Jess C.
Cc: Hopper, Calvin Mitchell; Wagner, John C.; Lee, Richard
Subject: RE: Entombment material issues...

Cecil,

Thanks. FYI - I again reminded the RST this morning that our friends at ORNL are a step ahead on considering entombment material issues, short and long term. They have taken note but still have other priorities. I'll be keeping in touch with the RST through the day and let you know as interest develops.

Don

-----Original Message-----
From: Parks, Cecil V. [mailto:parkscv@ornl.gov]
Sent: Saturday, March 19, 2011 10:36 AM
To: Gehin, Jess C.; Carlson, Donald
Cc: Hopper, Calvin Mitchell; Wagner, John C.
Subject: RE: Entombment material issues...

Don:
We've been primarily working with Richard.
Cecil

-----Original Message-----
From: Gehin, Jess C.
Sent: Saturday, March 19, 2011 9:32 AM
To: Carlson, Donald
Cc: Hopper, Calvin Mitchell; Wagner, John C.; Parks, Cecil V.
Subject: Re: Entombment material issues...

Don,

Thanks for the information. I have been primarily focused on activities within DOE and will need to let John, Cecil and Calvin comment on discussions within NRC.

-- Jess

--
Dr. Jess C. Gehin
Oak Ridge National Laboratory
Phone: 865-576-5093 | http://www.ornl.gov

On 3/19/11 8:26 AM, "Carlson, Donald" <Donald.Carlson@nrc.gov> wrote:

>Hi Jess,
>
>Thanks. It's great to have so much help at our disposal.
>

>I would be curious to know what other teams and efforts you guys are
>supporting and who else at NRC you are talking with. For example, I
>understand Charlie Tinkler (RES) is in contact with some of you. I
>haven't been able to touch base with Charlie.
>
>I'll keep checking with the Reactor Safety Team through the day, making
>sure they know we have ORNL resources for considering entombment issues.
>I'll also try to see what they've been getting from Charlie and other
>pool hazard experts like Jason Schaperow (RES). It would be great if we
>peripheral RST supporters could get more insights on how pool draining
>scenarios (i.e., fires, etc.) evolve.
>
>I'll add you to the loop on any more e-mails with John, Cecil, and Calvin
>(Cc'ed, see attachments) and would appreciate it if you could do likewise
>for me.
>
>Thanks again,
>Don
>Cell (b)(6) -
>
>-----Original Message-----
>From: Gehin, Jess C. [mailto:gehinjc@ornl.gov]
>Sent: Friday, March 18, 2011 9:05 PM
>To: Carlson, Donald
>Subject: Entombment material issues...
>
>Don,
>
>I understand from John Wagner that you are working in support of the NRC
>incident response. Call if you need anything, even just to discuss
>emerging issues. I'm going to work to get some ORNL input on the table
>of entombment issues for material selection. If you have any particular
>comments on needs you may have here, don't hesitate to call or email.
>I'm available anytime.
>
> -- Jess
>
>--
>Dr. Jess C. Gehin
>Oak Ridge National Laboratory
>Office: 865-576-5093 | Mobile: (b)(6) | http://www.ornl.gov

Lee, Richard

From: Aissa, Mourad
Sent: Saturday, March 19, 2011 4:00 PM
To: Lee, Richard; Algama, Don
Subject: RE: assessment of the potential risk of a criticality configuration

Thanks, Richard.

(b)(5)

Mourad

From: Lee, Richard
Sent: Friday, March 18, 2011 3:48 PM
To: Aissa, Mourad; Algama, Don
Subject: FW: assessment of the potential risk of a criticality configuration

fyi

-----Original Message-----
From: Carlson, Donald
Sent: Friday, March 18, 2011 3:40 PM
To: RST07 Hoc; RST01 Hoc
Cc: Parks, Cecil V.; Lee, Richard; Wagner, John C.
Subject: RE: assessment of the potential risk of a criticality configuration

Don Carlson (NRO), Richard Lee (RES), John Wagner (ORNL), and Cecil Parks (ORNL) concur on the following technical opinion:

(b)(5)

-----Original Message-----
From: Lee, Richard
Sent: Friday, March 18, 2011 3:01 PM
To: Wagner, John C.
Cc: Carlson, Donald; Parks, Cecil V.
Subject: RE: assessment of the potential risk of a criticality configuration

Great, thanks.
Richard

-----Original Message-----
From: Wagner, John C. [mailto:wagnerjc@ornl.gov]
Sent: Friday, March 18, 2011 2:44 PM
To: Lee, Richard

Cc: Carlson, Donald; Parks, Cecil V.
Subject: assessment of the potential risk of a criticality configuration

Richard,
Cecil indicated that you were interest in having an assessment of the potential risk of a critical configration resulting from various actions that may be taken to cool or confine the spent fuel in the spent fuel pools.

(b)(5)

Call if you want to discuss (b)(6)

Best Regards,

John

Lee, Richard

From: Kelly, John E (NE) [JohnE.Kelly@Nuclear.Energy.Gov]
Sent: Thursday, March 24, 2011 3:51 PM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Brinkman, Bill; Budnitz, Bob; DAgostino, Thomas; Finck, Phillip; Garwin, Dick (EOP); Garwin, Dick (IBM); Grossenbacher, John (INL); Hurlbut, Brandon; John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Miller, Neile; Mustin, Tracy; NITSolutions; Owens, Missy; Peterson, Per; Poneman, Daniel; SCHU; Sheron, Brian; Steve Fetter; Szilard, Ronalo
Cc: Lee, Richard
Subject: FW: Final Documents - Radiation Cameras
Attachments: Thermo Scientific - Rad Camera.pdf; Thermo Fisher Scientific - Rad Camera.pdf; Spec_Sheet_8710D1MX1.pdf; MegaRAD-camera.pdf; http___www.ahlberg-electronics.pdf; GammaCam.pdf; AquaRAD_Brochure.pdf; AquaRAD Underwater Camera.pdf; Ahlberg - Rad Camera.pdf; Ahlberg - Rad Camera - N620.pdf; Ahlberg - Rad Camera - N180.pdf; Radiation Camera Assistance (23 March 2011).docx; Cost for DOE Rad Camera Support (23 March 2011).docx; Potential Measurement Deployment Ideas from the DOE Labs.docx

attached is information related to sensors and instruments. The document to read is the one entitled "Potential Measurement Deployment Ideas from the DOE Labs". The others are related to rad hardened cameras.

From: McFarlane, Harold
Sent: Thursday, March 24, 2011 1:55 PM
To: Kelly, John E (NE)
Cc: Binder, Jeff; Derek C Wadsworth
Subject: Fw: Final Documents - Radiation Cameras

John,
As requested with larger font.
hfm

Harold F McFarlane
Deputy Associate Laboratory Director
Idaho National Laboratory
PO Box 1625, Idaho Falls, ID 83415-3855 USA
ID office: +1-208-526-3256 mobile: (b)(6)
fax: +1-208-526-2930 email: harold.mcfarlane@inl.gov
Technical Director, Generation-IV International Forum
US Dept. of Energy; Office of Nuclear Energy
DOE office: +1-202-586-9175
DOE email: harold.mcfarlane@nuclear.energy.gov

----- Forwarded by Harold Finley McFarlane/MCFAHF/CC01/INEEL/US on 03/24/2011 11:51 AM -----

Derek C Wadsworth/WCD/CC01/INEEL/US

03/24/2011 11:29 AM

To Harold Finley McFarlane/MCFAHF/CC01/INEEL/US@INEL, Douglas E Burns/DEB4/CC01/INEEL/US@INEL

cc Victor G Walker/WALKVG/CC01/INEEL/US@INEL, Cal Christensen/CAL2/CC01/INEEL/US@INEL

Subject Fw: Final Documents - Radiation Cameras

As requested.

DEREK WADSWORTH
ROBOTIC & HUMAN SYSTEMS
IDAHO NATIONAL LABORATORY
OFFICE: (208) 526-8514

MOBILE: (b)(6)
derek.wadsworth@inl.gov

----- Forwarded by Derek C Wadsworth/WCD/CC01/INEEL/US on 03/24/11 11:29 AM -----

"Harris, Kathryn S (CONTR)"
<Kathryn.Harris@nnsa.doe.gov>

To "Deeney, Chris" <Chris.Deeney@nnsa.doe.gov>
cc "'Derek C Wadsworth'" <Derek.Wadsworth@inl.gov>
Subject Final Documents - Radiation Cameras

03/23/11 09:24 PM

Hi Chris,

Sorry this is so late but it is ready for review and to send forward. There are three sets of attachments:

- "Radiation Camera Assistance (23 March 2011).docx" is to send to the Government of Japan with all the options available

(b)(5)

- The PDFs are "cut sheets" of the equipment. All of these can be shared with Japan. None show the identical cameras we have sitting in on our shelves though; they are industry standards of the type of cameras we offer in the paper. Tomorrow Derek can pull together the exact photo and specs of the specific items we've offered if that's helpful.

Please let us know if you have any questions. Sorry again this is so late; it was a lot of work for Derek to determine precisely how many and what type of equipment was available, but I think we pulled together a very useful document.

Kathryn

Esmaili, Hossein

From: Lee, Richard
Sent: Monday, March 21, 2011 1:46 PM
To: Esmaili, Hossein; Salay, Michael
Subject: FW: Fukushima data
Attachments: MOXvsUOX.JPG; MOXratio.jpg; Fukushima-reactor.txt; F4-pool.txt

fyi

From: Gauld, Ian C. [mailto:gauldi@ornl.gov]
Sent: Friday, March 18, 2011 1:26 PM
To: Lee, Richard
Cc: Parks, Cecil V.
Subject: FW: Fukushima data

Richard

Cecil asked me to forward this information to you. It will not help with the MELCOR studies, but I'm currently generating some MELCOR source data for you separately. This will follow shortly. Thanks

Ian

Richard:

(b)(4),(b)(5)

(b)(4),(b)(5)

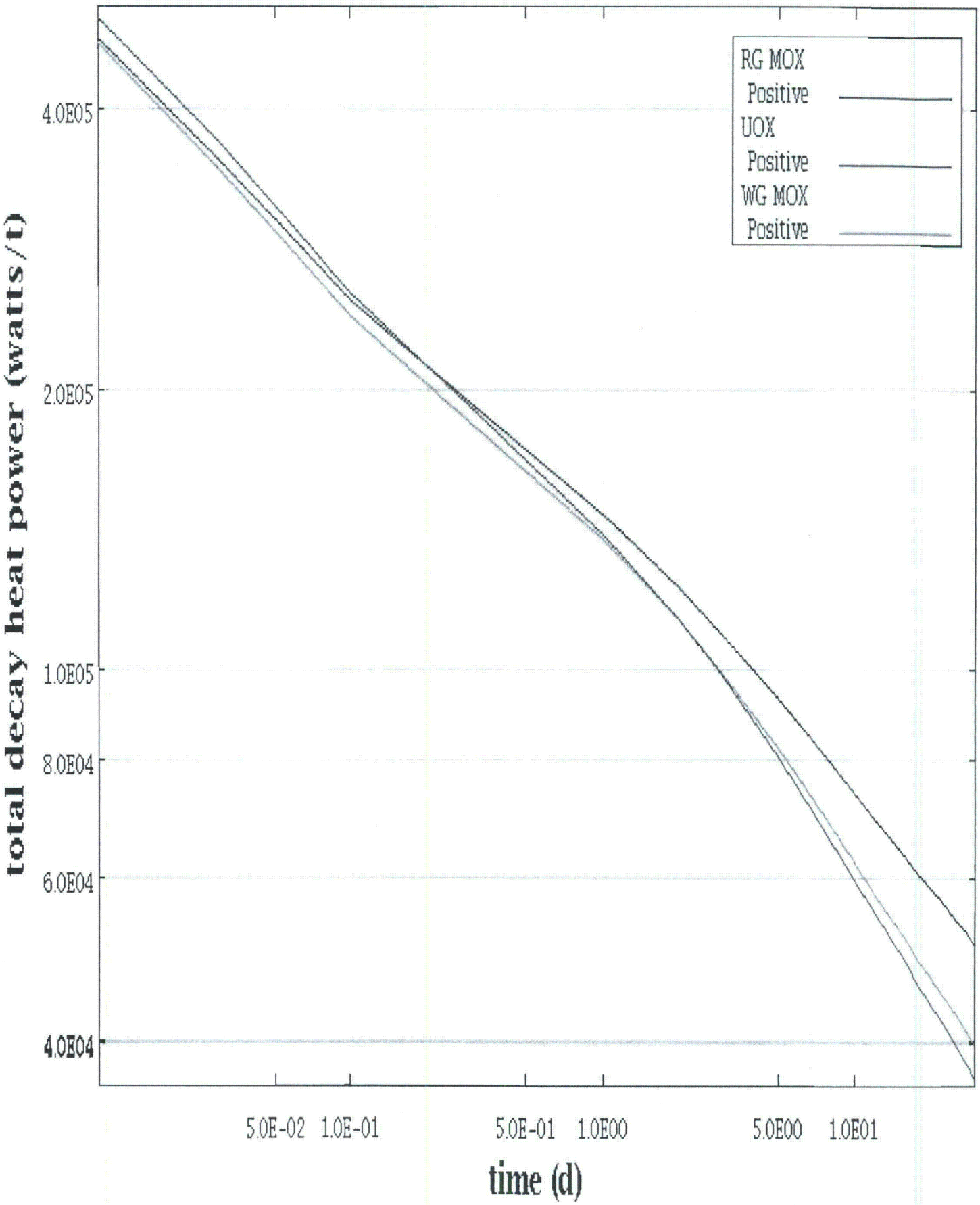
fuel inventory	(b)(4)
average discharge burnup	
total assemblies	
rods per assembly	
Fuel assembly	

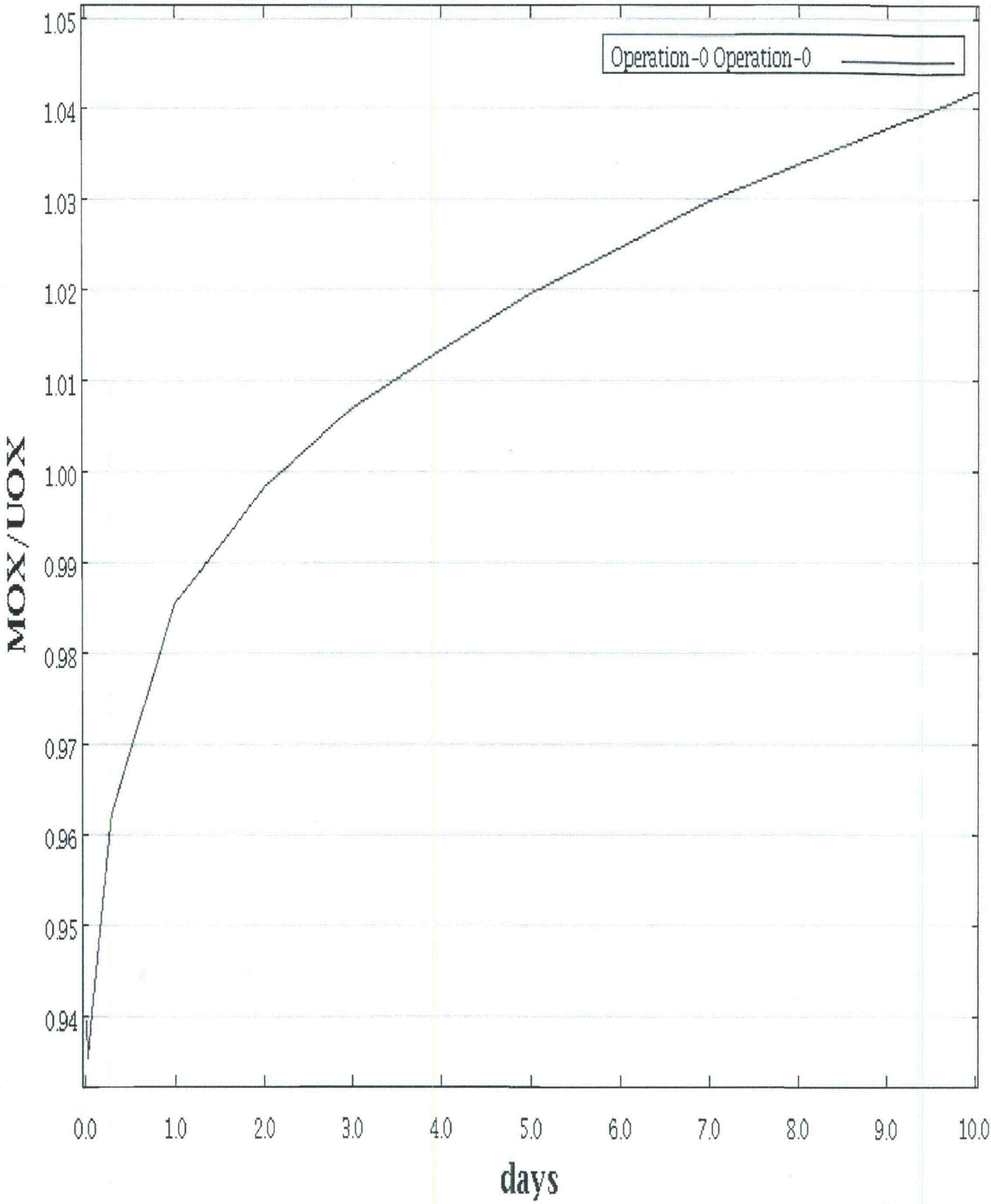
Cecil

****

Cecil V. Parks, Ph.D.
Director, Reactor and Nuclear Systems Division at ORNL
Phone: 865 574-5280

****


RG MOX
Positive
UOX
Positive
WG MOX
Positive
4.0E05
2.0E05
1.0E05
8.0E04
6.0E04
4.0E04
total decay heat power (watts / t)
5.0E-02
1.0E-01
5.0E-01
1.0E00
5.0E00
1.0E01
time (d)


Operation-0 Operation-0
MOX / UOX
1.05
1.04
1.03
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.95
0.94
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
days

Fukushima Daiichi
actinides page 81
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide concentrations, grams

basis = full core inventory (b)(4)

assemblies

charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d
(b)(5)											

(b)(5)

Fukushima Daiichi
actinides page 82
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide radioactivity, curies

basis = full core inventory (b)(4)

assemblies

charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d

(b)(5)

(b)(5)

(b)(5)

Fukushima Daiichi
fission products page 83
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide concentrations, grams

basis = full core inventory (b)(4)

assemblies

	charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d
6.0 d	7.0 d	8.0 d	9.0 d	10.0 d			

(b)(5)

(b)(5)

5.088E+00 5.088E+00 5.088E+00 5.088E+00 5.088E+00
as 75 9.313E-02 1.285E+01 1.285E+01 1.285E+01 1.285E+01 1.285E+01 1.285E+01
1.285E+01 1.285E+01 1.285E+01 1.285E+01 1.285E+01
ge 76 2.553E-01 3.486E+01 3.486E+01 3. (b)(4) 01
3.486E+01 3.486E+01 3.486E+01 3.486E+01 3.486E+01
as 76 2.447E-17 1.009E-03 5.365E-04 2.852E-04 1.516E-04 8.060E-05 4.285E-05
2.278E-05 1.211E-05 6.437E-06 3.422E-06 1.819E-06
se 76 1.876E-03 4.103E-01 4.108E-01 4.111E-01 4.112E-01 4.113E-01 4.113E-01
4.113E-01 4.113E-01 4.114E-01 4.114E-01 4.114E-01 (b)(4)
ge 77 3.529E-31 1.264E-02 2.902E-03 6.657E-04 1.527E-04 3.504E-05 8.040E-06
1.845E-06 4.232E-07 9.709E-08 2.228E-08 5.111E-09
as 77 2.831E-11 1.165E-01 8.343E-02 5.609E-02 3.694E-02 2.416E-02 1.576E-02

(b)(5)

decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide concentrations, grams

basis = full core inventory (b)(4)

assemblies

charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d

(b)(5)

(b)(5)

Fukushima Daiichi
fission products page 85
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide concentrations, grams

basis = full core inventory (b)(4)

assemblies

charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d
(b)(5)											

(b)(5)

(b)(5)

Fukushima Daiichi
fission products page 86
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide concentrations, grams

basis = full core inventory (b)(4)

assemblies

charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d

(b)(5)

(b)(5)

(b)(5)

Fukushima Daiichi
fission products page 87
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide concentrations, grams

basis = full core inventory (b)(4)

assemblies

charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d

(b)(5)

(b)(5)

(b)(5)

Fukushima Daiichi
fission products page 88
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide concentrations, grams
basis = full core inventory (b)(4)
assemblies

charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d

(b)(5)

(b)(5)

Fukushima Daiichi

fission products page 89

decay, following irradiation identified by: (b)(4)

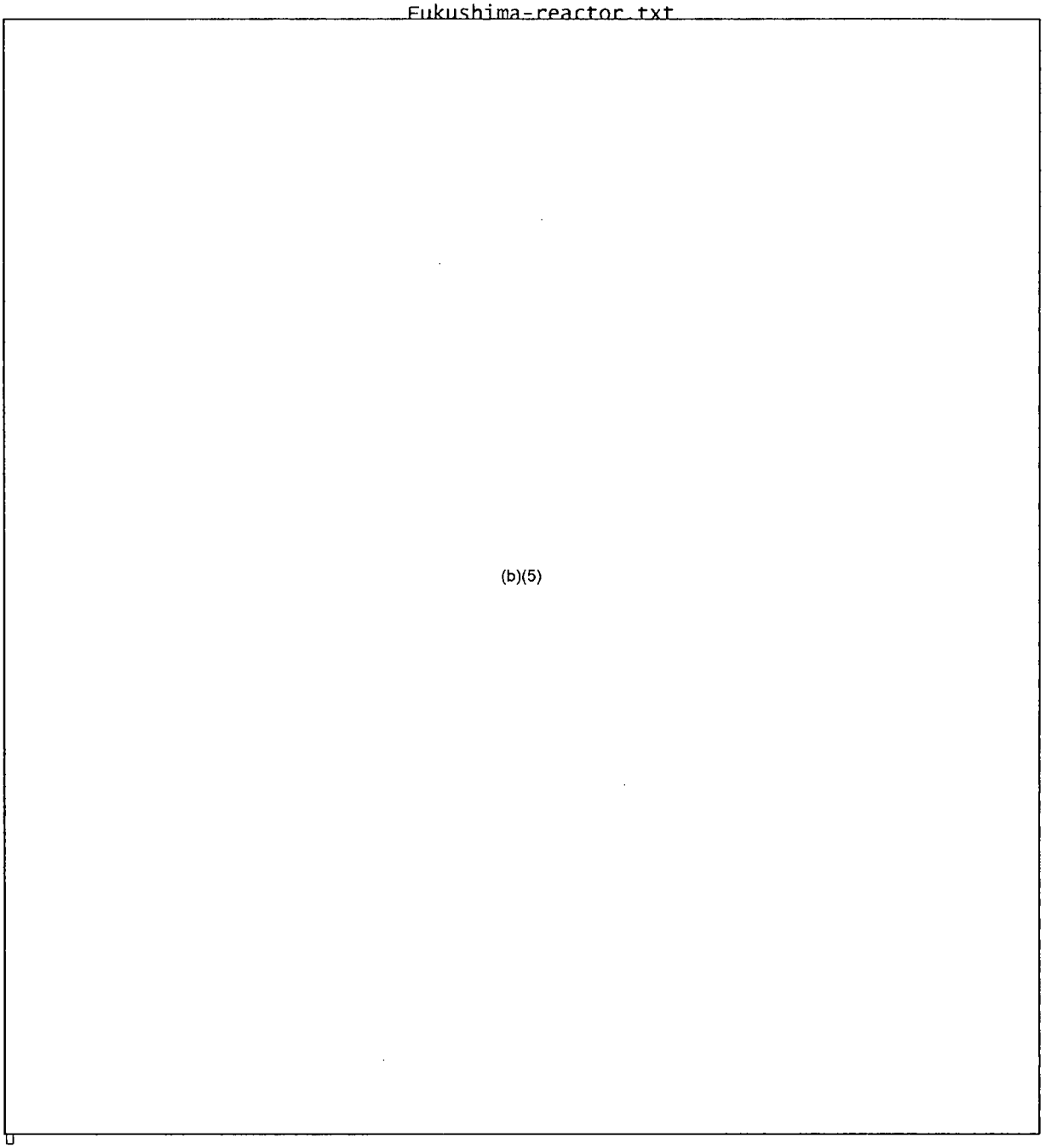
flux= 4.05E+13n/cm**2-sec

nuclide radioactivity, curies

basis = full core inventory (b)(4)

assemblies

	charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d
(b)(5)												



Fukushima Daiichi
fission products page 90
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide radioactivity, curies

basis = full core inventory (b)(4)

assemblies charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d

(b)(5)

(b)(5)

Fukushima Daiichi
fission products page 91
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide radioactivity, curies

basis = full core inventory (b)(4)

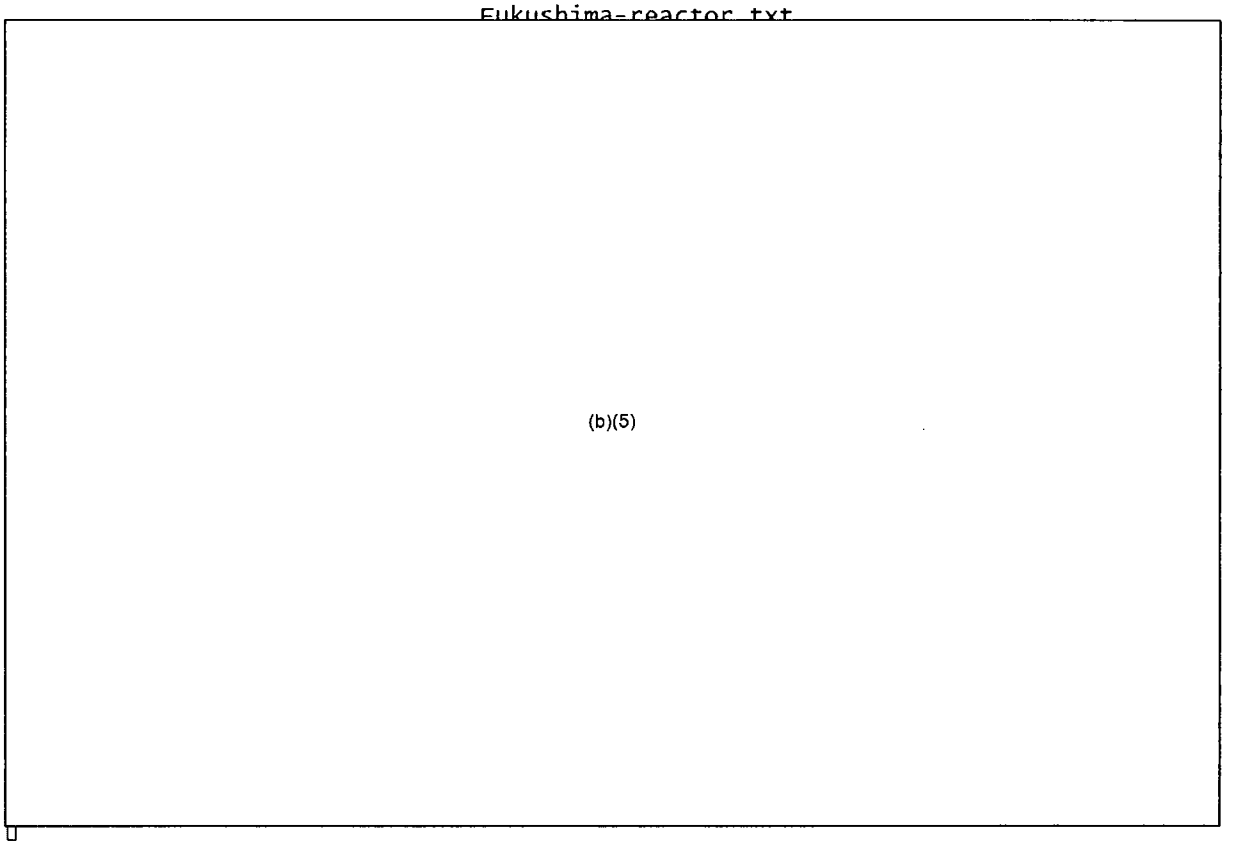
assemblies

	charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d

6.0 d 7.0 d 8.0 d 9.0 d 10.0 d

(b)(5)

(b)(5)



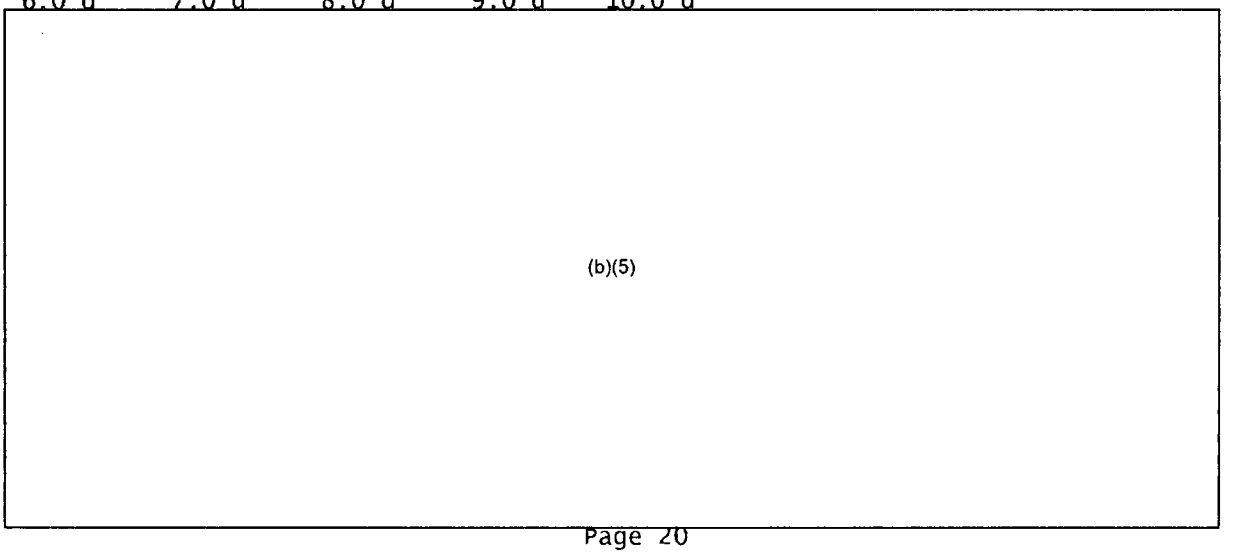
Fukushima Daiichi
fission products page 92
decay, following irradiation identified by: (b)(4)
flux= 4.05E+13n/cm**2-sec

nuclide radioactivity, curies

basis = full core inventory (b)(4)

assemblies

charge	discharge	1.0 d	2.0 d	3.0 d	4.0 d	5.0 d	6.0 d	7.0 d	8.0 d	9.0 d	10.0 d



(b)(5)

From: Hoc, PMT12
Sent: Saturday, March 26, 2011 10:10 AM
To: LIA06 Hoc
Cc: PMT03 Hoc
Subject: FW: Updated NARAC-NRC Plausible Realistic Scenario Calculation
Attachments: JapanImpact-PRC-V3-NARAC-Consequence Rept.pdf; Japan Plausible Realistic Case V3-NARAC-1600Z25Mar2011.pptx; JapanRctr_PRC-V3-(U1Exp)-NARAC-NRC_2011Mar25_1600Z.docx; Assumed Core Inventory for Low Enriched Uranium Fuel Operating Core.pdf

Importance: High

Per your request.

From: NITOPS [mailto:NITOPS@nnsa.doe.gov]
Sent: Friday, March 25, 2011 4:55 PM
To: 'steven.fine@noaa.gov'
Cc: PMT02 Hoc; Hoc, PMT12; HOO Hoc
Subject: FW: Updated NARAC-NRC Plausible Realistic Scenario Calculation
Importance: High

Sir,

This is our plausible and realistic modeling scenario. We believe this is the best scenario to use in your assessment of radiation levels in the ocean. Please let us know if you have any questions.

Nuclear Incident Team

From: NITOPS
Sent: Friday, March 25, 2011 4:26 PM
To: (b)(6); Steve Fetter; NITOPS
Cc: Aoki, Steven; Hoagland, David; Bowman, David
Subject: FW: Updated NARAC-NRC Plausible Realistic Scenario Calculation
Importance: High

Attached is the complete set of products (PDF consequence report, Powerpoint summary, Word docum., assumptions, and assumed core inventory) for the updated NARAC-NRC Plausible Realistic Scenario prediction ... V3". NRC PMT reviewed the activity release amounts and is in agreement with the values. Please let us know if you see any corrections needed.

Steve Aoki would like to hold a conference call after today's SVTC to discuss formal release of these products. Request you respond with your availability.

v/r

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)

National Nuclear Security Administration
U.S. Department of Energy
nitops@nnsa.doe.gov
nit@doe.sgov.gov
202-586-8100

~~OFFICIAL USE ONLY – Not Approved For Further Distribution~~

NARAC Plume Model Dose Projections for the
Updated NRC Plausible Realistic Scenario Based on Japan Reactor Information
Hypothetical Reactor Release
Issue Date: 1600 UTC March 25, 2011

Summary

(b)(5)

Source Term Summary

(b)(5)

(b)(5)

NARAC Modeling Assumptions

(b)(5)

NARAC Model Results

(b)(5)

Appendix 1. List of Radionuclide Atmospheric Release Amounts Used in NARAC Simulations

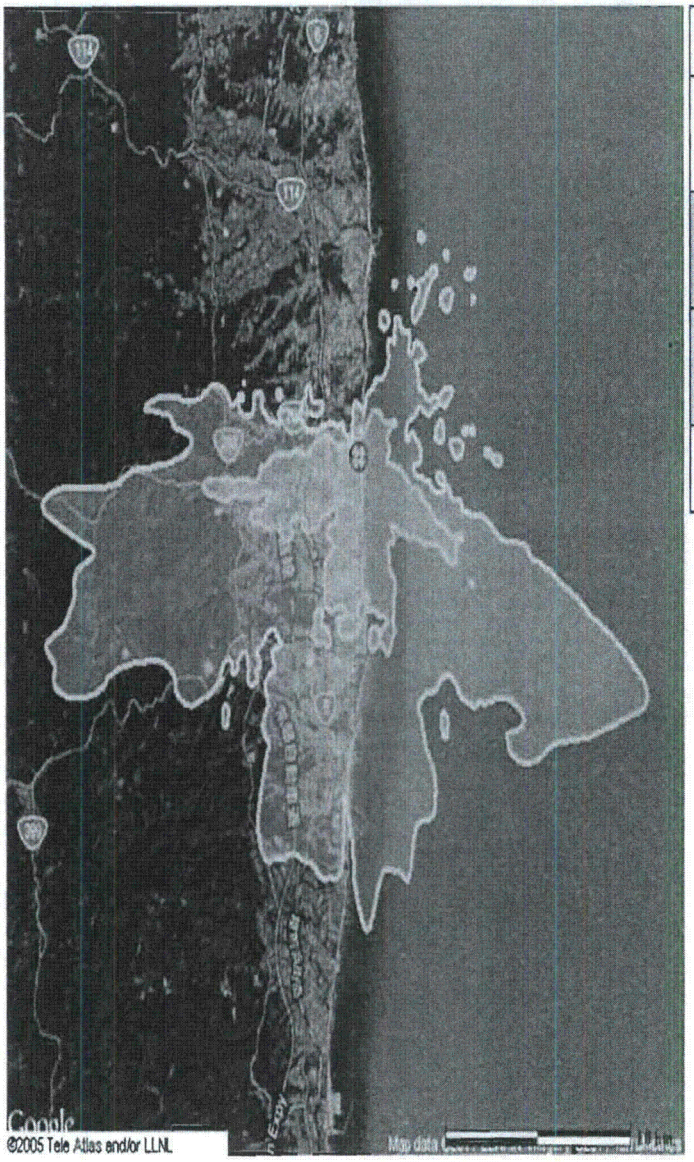
Quantities of Total Released Activity for the CMHT List of Top 20 Radionuclides for the Updated NRC Plausible Realistic Scenario (*PRC-V3*) (U1Exp)	
Radionuclide	**Total Release (Ci)**
Ba-140	1.39E+05
Ce-144	3.16E+03
Cm-242	4.02E+01
Cs-134	1.78E+05
Cs-136	6.15E+04
Cs-137	1.29E+05
I-131	1.20E+06
I-132	7.44E+05
I-133	3.12E+05
Pu-241	3.06E+02
Rb-86	2.28E+03
Ru-103	1.85E+04
Ru-106	5.40E+03
Sb-127	1.21E+04
Sr-89	8.36E+04
Sr-90	6.70E+03
Te-127M	3.54E+03
Te-129M	1.47E+04
Te-132	1.77E+05
Xe-133	8.33E+07

DOE/NARAC Simulations of a *"Plausible Realistic Case PRC-V3"* Japan Reactor Release

US EPA Protective Action Guides

	US EPA/FDA Protective Action Guide Values	US EPA/FDA Protective Actions Guides *to Consider*
Total Effective Dose	Greater than 1-5 rem	Evacuation or sheltering
Radioiodine Dose to *Child* Thyroid	Greater than 5 rem	Administration of Potassium Iodide (KI)
Radioiodine Dose to *Adult* Thyroid	Greater than 10 rem	Administration of Potassium Iodide (KI)

Early Phase Guidance (Radioiodine) (0-14 days)
(KI Administration based on Thyroid Radioiodine Dose)



Effects and Actions

	Description	(rem) Extent Area	Population
	Adult thyroid Committed Equivalent Dose - Early Phase FDA Guidance for KI administration to adults	>10 8.4km 34.7 km2	8,580
	Child thyroid Committed Equivalent Dose - Early Phase PAG for KI administration to children	>5 17.8km 252 km2	27,800

Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 12, 2011 06:25 UTC to March 26, 2011 06:25 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E
Material: I-131 + I-132 + TE-132 + I-133 + TE-129M
Generated On: March 25, 2011 03:52 UTC
Model: LODI
Comments: Doses shown are total accumulated from the beginning of release.
Plausible Realistic Scenario

Map Size: 36.4 km by 36.4 km

Early Phase Guidance (Radioiodine) (0-14 days)
(KI Administration based on Thyroid Radioiodine Dose)

Effects and Actions

	Description	(rem) Extent Area	Population
	Adult thyroid Committed Equivalent Dose - Early Phase FDA Guidance for KI administration to adults	>10 8.4km 34.7 km2	8,580
	Child thyroid Committed Equivalent Dose - Early Phase PAG for KI administration to children	>5 17.8km 252 km2	27,800

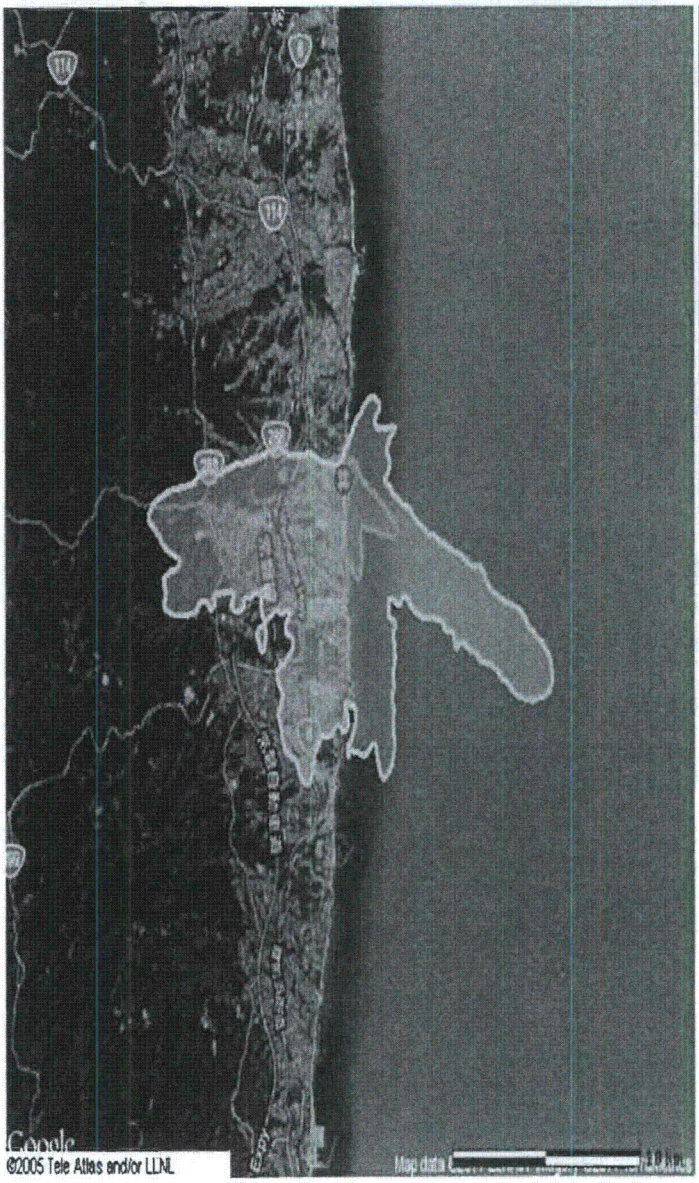
Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 12, 2011 06:25 UTC to March 26, 2011 06:25 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E
Material: I-131 + I-132 + TE-132 + I-133 + TE-129M
Generated On: March 25, 2011 03:52 UTC
Model: LODI
Comments: Doses shown are total accumulated from the beginning of release.
Plausible Realistic Scenario

Map Size: 294 km by 294 km

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release

Early Phase Dose (0-14 days)
(Total Effective Dose)



Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose.	>5 3.2km 8.5 km2	3,220
	Exceeds 1 rem total effective dose.	>1 12.6km 98.2 km2	14,900

Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 12, 2011 06:25 UTC to March 26, 2011 06:25 UTC at or near ground level.
Release Location: 37 421389 N, 141.032500 E
Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133
Generated On: March 25, 2011 03:52 UTC
Model: LODI
Comments: Doses shown are total accumulated from the beginning of release.
Plausible Realistic Scenario

Map Size: 36.4 km by 36.4 km

Background Information

Quantities of Total Released Activity for Updated NRC Plausible Realistic Scenario (*PRC-V3*)

Quantities of Total Released Activity for the CMHT List of Top 20 Radionuclides for the Updated NRC Plausible Realistic Scenario (*PRC-V3*) (U1Exp)	
Radionuclide	**Total Release (Ci)**
Ba-140	1.39E+05
Ce-144	3.16E+03
Cm-242	4.02E+01
Cs-134	1.78E+05
Cs-136	6.15E-04
Cs-137	1.29E+05
I-131	1.20E+06
I-132	7.44E-05
I-133	3.12E+05
Pu-241	3.06E+02
Rh-86	2.28E+03
Ru-103	1.85E+04
Ru-106	5.40E+03
Sb-127	1.21E+04
Sr-89	8.36E+04
Sr-90	6.70E+03
Te-127M	3.54E+03
Te-129M	1.47E+04
Te-132	1.77E+05
Xe-133	8.33E-07

Assumed Core Inventory for Low Enriched Uranium Fuel Operating Core

Nuclide	Core Inventory Ci/MWt	Inventory for 2350 MWt	Nuclide	Core Inventory Ci/MWt	Inventory for 2350 MWt	Nuclide	Core Inventory Ci/MWt	Inventory for 2350 MWt
Ba-139	4.74e+04	1.11E+08	La-141	4.33e+04	1.02E+08	Te-127	2.36e+03	5.55E+06
Ba-140	4.76e+04	1.12E+08	La-142	4.21e+04	9.89E+07	Te-127m	3.97e+02	9.33E+05
Ce-141	4.39e+04	1.03E+08	Mo-99	5.30e+04	1.25E+08	Te-129	8.26e+03	1.94E+07
Ce-143	4.00e+04	9.40E+07	Nb-95	4.50e+04	1.06E+08	Te-129m	1.68e+03	3.95E+06
Ce-144*	3.54e+04	8.32E+07	Nd-147	1.75e+04	4.11E+07	Te-131m	5.41e+03	1.27E+07
Cm-242	1.12e+03	2.63E+06	Np-239	5.69e+05	1.34E+09	Te-132	3.81e+04	8.95E+07
Cs-134	4.70e+03	1.10E+07	Pr-143	3.96e+04	9.31E+07	Xe-131m	3.65e+02	8.58E+05
Cs-136	1.49e+03	3.50E+06	Pu-241	4.26e+03	1.00E+07	Xe-133	5.43e+04	1.28E+08
Cs-137*	3.25e+03	7.64E+06	Rb-86	5.29e+01	1.24E+05	Xe-133m	1.72e+03	4.04E+06
I-131	2.67e+04	6.27E+07	Rh-105	2.81e+04	6.60E+07	Xe-135	1.42e+04	3.34E+07
I-132	3.88e+04	9.12E+07	Ru-103	4.34e+04	1.02E+08	Xe-135m	1.15e+04	2.70E+07
I-133	5.42e+04	1.27E+08	Ru-105	3.06e+04	7.19E+07	Xe-138	4.56e+04	1.07E+08
I-134	5.98e+04	1.41E+08	Ru-106*	1.55e+04	3.64E+07	Y-90	2.45e+03	5.76E+06
I-135	5.18e+04	1.22E+08	Sb-127	2.39e+03	5.62E+06	Y-91	3.17e+04	7.45E+07
Kr-83m	3.05e+03	7.17E+06	Sb-129	8.68e+03	2.04E+07	Y-92	3.26e+04	7.66E+07
Kr-85	2.78e+02	6.53E+05	Sr-89	2.41e+04	5.66E+07	Y-93	2.52e+04	5.92E+07
Kr-85m	6.17e+03	1.45E+07	Sr-90	2.39e+03	5.62E+06	Zr-95	4.44e+04	1.04E+08
Kr-87	1.23e+04	2.89E+07	Sr-91	3.01e+04	7.07E+07	Zr-97*	4.23e+04	9.94E+07
Kr-88	1.70e+04	4.00E+07	Sr-92	3.24e+04	7.61E+07			
La-140	4.91e+04	1.15E+08	Tc-99m	4.37e+04	1.03E+08			

Source Table 1.1 Assumed Core Inventory During Operation for Low Enriched Uranium Fuel from RASCAL 4: Description of Models and Methods, corrected for a 2350 MWt core

Consequence Report

Japan Impacts - NRC PRC V3 (U1Exp)

NARAC Report - Potential Release

Issued: March 25, 2011 15:18 UTC

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Early Phase Dose (0-4d) : (Total Effective Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Dose (4-8d) : (Total Effective Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Dose (8-12d) : (Total Effective Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Dose (0-14d) : (Total Effective Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Guidance (Radioiodine) (0-14 d) : (KI Administration based on Thyroid Radioiodine Dose)

Material: I-131 + I-132 + TE-132 + I-133 + TE-129M

The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when protective actions should be considered/implemented to protect the population. These Guides correspond to specific dose levels and are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime. Thus the health effects produced by these doses may develop over a period of years. In the event radioiodines are released into the atmosphere, the PAG level is based on the projected dose to a child's thyroid which may be avoided by the administering of potassium iodide. Additional levels based on guidance from the U.S. Food and Drug Administration for adults may also be shown. (Note that the PAG level for potassium iodide administration to pregnant women is 5 rem to the adult thyroid.) These model predictions are based on the effects of radiation from the material inhaled and retained by the body, and use the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. Estimates of the number of exposed individuals expected to experience these effects may be given in the legend. If so, the counts given for all illnesses include those leading to pre-mature death. Note that the counts and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Worker Protection Dose Rate at 4 d : (Groundshine Dose Rate at 03/16/2011 15:25:00 JST)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services. These limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health

effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population. NCRP and NRC administrative control areas are also shown. Note: EPA and NRC guidelines are based on a total dose limit. These contoured dose rate values, if constant over the indicated exposure period, will deliver the equivalent limiting dose. For rapidly-decaying dose rates, these predictions will be conservative. The dose associated with potential inhalation of resuspended material is not included in these estimates. The relative importance of any committed inhalation dose from resuspended material is dependent on a variety of factors (e.g. weather, radionuclides, etc.). Note that the population count and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Worker Protection Dose Rate at 8 d : (Groundshine Dose Rate at 03/20/2011 15:25:00 JST)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services. These limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population. NCRP and NRC administrative control areas are also shown. Note: EPA and NRC guidelines are based on a total dose limit. These contoured dose rate values, if constant over the indicated exposure period, will deliver the equivalent limiting dose. For rapidly-decaying dose rates, these predictions will be conservative. The dose associated with potential inhalation of resuspended material is not included in these estimates. The relative importance of any committed inhalation dose from resuspended material is dependent on a variety of factors (e.g. weather, radionuclides, etc.). Note that the population count and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Worker Protection Dose Rate at 12 d : (Groundshine Dose Rate at 03/24/2011 15:25:00 JST)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services. These limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population. NCRP and NRC administrative control areas are also shown. Note: EPA and NRC guidelines are based on a total dose limit. These contoured dose rate values, if constant over the indicated exposure period, will deliver the equivalent limiting dose. For rapidly-decaying dose rates, these predictions will be conservative. The dose associated with potential inhalation of resuspended material is not included in these estimates. The relative importance of any committed inhalation dose from resuspended material is dependent on a variety of factors (e.g. weather, radionuclides, etc.). Note that the population count and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Deposition at 14 d : (Surface Contamination from Deposited Radionuclides)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
This product identifies the more highly contaminated areas due to fallout and deposition of the radioactive material. This material, depending upon the type of radiation emitted, may continue to give significant doses to individuals in these areas through inhalation of resuspended radioactive material or from direct external radiation. These levels of deposited radioactivity should be confirmed by monitoring surverys.

SOURCE INFORMATION:

Release Start Time:	March 12, 2011 06:25 UTC
Release Stop Time:	March 26, 2011 06:25 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	Early Phase Dose (0-4d)

Early Phase Dose (4-8d)
Early Phase Dose (8-12d)
Early Phase Dose (0-14d)
138969 Ci of BA-140 (100% respirable) over 1036800 sec
3162.34 Ci of CE-144 (100% respirable) over 1036800 sec
40.1641 Ci of CM-242 (100% respirable) over 1036800 sec
177591 Ci of CS-134 (100% respirable) over 1036800 sec
61424.6 Ci of CS-136 (100% respirable) over 1036800 sec
129073 Ci of CS-137 (100% respirable) over 1036800 sec
1.1998e+06 Ci of I-131 (100% respirable) over 1036800 sec
743463 Ci of I-132 (100% respirable) over 1036800 sec
312127 Ci of I-133 (100% respirable) over 1036800 sec
305.666 Ci of PU-241 (100% respirable) over 1036800 sec
2277.81 Ci of RB-86 (100% respirable) over 1036800 sec
18478.1 Ci of RU-103 (100% respirable) over 1036800 sec
5395.12 Ci of RU-106 (100% respirable) over 1036800 sec
12057.3 Ci of SB-127 (100% respirable) over 1036800 sec
83562.2 Ci of SR-89 (100% respirable) over 1036800 sec
6698.63 Ci of SR-90 (100% respirable) over 1036800 sec
3537.12 Ci of TE-127M (100% respirable) over 1036800 sec
14672.2 Ci of TE-129M (100% respirable) over 1036800 sec
177062 Ci of TE-132 (100% respirable) over 1036800 sec
8.3307e+07 Ci of XE-133 (100% respirable) over 1036800 sec
Early Phase Guidance (Radioiodine) (0-14 d)
1.1998e+06 Ci of I-131 (100% respirable) over 1036800 sec
743463 Ci of I-132 (100% respirable) over 1036800 sec
312127 Ci of I-133 (100% respirable) over 1036800 sec
14672.2 Ci of TE-129M (100% respirable) over 1036800 sec
177062 Ci of TE-132 (100% respirable) over 1036800 sec
Worker Protection Dose Rate at 4 d
Worker Protection Dose Rate at 8 d
Worker Protection Dose Rate at 12 d
Deposition at 14 d
138969 Ci of BA-140 (100% respirable) over 1036800 sec
3162.34 Ci of CE-144 (100% respirable) over 1036800 sec
40.1641 Ci of CM-242 (100% respirable) over 1036800 sec
177591 Ci of CS-134 (100% respirable) over 1036800 sec
61424.6 Ci of CS-136 (100% respirable) over 1036800 sec
129073 Ci of CS-137 (100% respirable) over 1036800 sec

1.1998e+06 Ci of I-131 (100% respirable) over 1036800 sec
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312127 Ci of I-133 (100% respirable) over 1036800 sec
305.666 Ci of PU-241 (100% respirable) over 1036800 sec
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18478.1 Ci of RU-103 (100% respirable) over 1036800 sec
5395.12 Ci of RU-106 (100% respirable) over 1036800 sec
12057.3 Ci of SB-127 (100% respirable) over 1036800 sec
83562.2 Ci of SR-89 (100% respirable) over 1036800 sec
6698.63 Ci of SR-90 (100% respirable) over 1036800 sec
3537.12 Ci of TE-127M (100% respirable) over 1036800 sec
14672.2 Ci of TE-129M (100% respirable) over 1036800 sec
177062 Ci of TE-132 (100% respirable) over 1036800 sec

Source Geometry: gaussian cloud top at 200 m

Particle Size Distribution: All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/11/2011 21:00:00 JST to 03/26/2011 15:00:00 JST at 2 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 11, 2011 12:00 UTC
ADAPT	March 11, 2011 14:00 UTC
ADAPT	March 11, 2011 16:00 UTC
ADAPT	March 11, 2011 18:00 UTC
ADAPT	March 11, 2011 20:00 UTC
ADAPT	March 11, 2011 22:00 UTC
ADAPT	March 12, 2011 00:00 UTC
ADAPT	March 12, 2011 02:00 UTC
ADAPT	March 12, 2011 04:00 UTC
ADAPT	March 12, 2011 06:00 UTC
ADAPT	March 12, 2011 08:00 UTC
ADAPT	March 12, 2011 10:00 UTC
ADAPT	March 12, 2011 12:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 12, 2011 13:00 UTC
ADAPT	March 12, 2011 15:00 UTC
ADAPT	March 12, 2011 16:00 UTC
ADAPT	March 12, 2011 18:00 UTC
ADAPT	March 12, 2011 20:00 UTC
ADAPT	March 12, 2011 22:00 UTC
ADAPT	March 13, 2011 00:00 UTC
ADAPT	March 13, 2011 02:00 UTC
ADAPT	March 13, 2011 04:00 UTC
ADAPT	March 13, 2011 06:00 UTC
ADAPT	March 13, 2011 08:00 UTC
ADAPT	March 13, 2011 10:00 UTC
ADAPT	March 13, 2011 12:00 UTC
ADAPT	March 13, 2011 14:00 UTC
ADAPT	March 13, 2011 16:00 UTC
ADAPT	March 13, 2011 18:00 UTC
ADAPT	March 13, 2011 19:00 UTC
ADAPT	March 13, 2011 22:00 UTC
ADAPT	March 14, 2011 00:00 UTC
ADAPT	March 14, 2011 02:00 UTC
ADAPT	March 14, 2011 04:00 UTC
ADAPT	March 14, 2011 06:00 UTC
ADAPT	March 14, 2011 08:00 UTC
ADAPT	March 14, 2011 10:00 UTC
ADAPT	March 14, 2011 12:00 UTC
ADAPT	March 14, 2011 14:00 UTC
ADAPT	March 14, 2011 16:00 UTC
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 22:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 20:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 10:00 UTC
ADAPT	March 16, 2011 12:00 UTC
ADAPT	March 16, 2011 14:00 UTC
ADAPT	March 16, 2011 16:00 UTC
ADAPT	March 16, 2011 18:00 UTC
ADAPT	March 16, 2011 20:00 UTC
ADAPT	March 16, 2011 22:00 UTC
ADAPT	March 17, 2011 00:00 UTC
ADAPT	March 17, 2011 02:00 UTC
ADAPT	March 17, 2011 04:00 UTC
ADAPT	March 17, 2011 06:00 UTC
ADAPT	March 17, 2011 08:00 UTC
ADAPT	March 17, 2011 10:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 17, 2011 12:00 UTC
ADAPT	March 17, 2011 14:00 UTC
ADAPT	March 17, 2011 16:00 UTC
ADAPT	March 17, 2011 18:00 UTC
ADAPT	March 17, 2011 20:00 UTC
ADAPT	March 17, 2011 22:00 UTC
ADAPT	March 18, 2011 00:00 UTC
ADAPT	March 18, 2011 02:00 UTC
ADAPT	March 18, 2011 04:00 UTC
ADAPT	March 18, 2011 06:00 UTC
ADAPT	March 18, 2011 08:00 UTC
ADAPT	March 18, 2011 10:00 UTC
ADAPT	March 18, 2011 12:00 UTC
ADAPT	March 18, 2011 14:00 UTC
ADAPT	March 18, 2011 16:00 UTC
ADAPT	March 18, 2011 21:00 UTC
ADAPT	March 18, 2011 23:00 UTC
ADAPT	March 19, 2011 01:00 UTC
ADAPT	March 19, 2011 03:00 UTC
ADAPT	March 19, 2011 05:00 UTC
ADAPT	March 19, 2011 07:00 UTC
ADAPT	March 19, 2011 10:00 UTC
ADAPT	March 19, 2011 12:00 UTC
ADAPT	March 19, 2011 14:00 UTC
ADAPT	March 19, 2011 16:00 UTC
ADAPT	March 19, 2011 17:00 UTC
ADAPT	March 19, 2011 21:00 UTC
ADAPT	March 19, 2011 23:00 UTC
ADAPT	March 20, 2011 01:00 UTC
ADAPT	March 20, 2011 03:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 20, 2011 05:00 UTC
ADAPT	March 20, 2011 07:00 UTC
ADAPT	March 20, 2011 09:00 UTC
ADAPT	March 20, 2011 11:00 UTC
ADAPT	March 20, 2011 13:00 UTC
ADAPT	March 20, 2011 15:00 UTC
ADAPT	March 20, 2011 17:00 UTC
ADAPT	March 20, 2011 19:00 UTC
ADAPT	March 20, 2011 21:00 UTC
ADAPT	March 20, 2011 23:00 UTC
ADAPT	March 21, 2011 01:00 UTC
ADAPT	March 21, 2011 03:00 UTC
ADAPT	March 21, 2011 05:00 UTC
ADAPT	March 21, 2011 07:00 UTC
ADAPT	March 21, 2011 09:00 UTC
ADAPT	March 21, 2011 11:00 UTC
ADAPT	March 21, 2011 13:00 UTC
ADAPT	March 21, 2011 15:00 UTC
ADAPT	March 21, 2011 17:00 UTC
ADAPT	March 21, 2011 19:00 UTC
ADAPT	March 21, 2011 21:00 UTC
ADAPT	March 21, 2011 23:00 UTC
ADAPT	March 22, 2011 01:00 UTC
ADAPT	March 22, 2011 03:00 UTC
ADAPT	March 22, 2011 05:00 UTC
ADAPT	March 22, 2011 07:00 UTC
ADAPT	March 22, 2011 09:00 UTC
ADAPT	March 22, 2011 11:00 UTC
ADAPT	March 22, 2011 13:00 UTC
ADAPT	March 22, 2011 15:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 22, 2011 17:00 UTC
ADAPT	March 22, 2011 19:00 UTC
ADAPT	March 22, 2011 21:00 UTC
ADAPT	March 22, 2011 23:00 UTC
ADAPT	March 23, 2011 00:00 UTC
ADAPT	March 23, 2011 02:00 UTC
ADAPT	March 23, 2011 04:00 UTC
ADAPT	March 23, 2011 06:00 UTC
ADAPT	March 23, 2011 08:00 UTC
ADAPT	March 23, 2011 10:00 UTC
ADAPT	March 23, 2011 12:00 UTC
ADAPT	March 23, 2011 14:00 UTC
ADAPT	March 23, 2011 16:00 UTC
ADAPT	March 23, 2011 18:00 UTC
ADAPT	March 23, 2011 20:00 UTC
ADAPT	March 23, 2011 22:00 UTC
ADAPT	March 24, 2011 00:00 UTC
ADAPT	March 24, 2011 02:00 UTC
ADAPT	March 24, 2011 04:00 UTC
ADAPT	March 24, 2011 06:00 UTC
ADAPT	March 24, 2011 08:00 UTC
ADAPT	March 24, 2011 10:00 UTC
ADAPT	March 24, 2011 12:00 UTC
ADAPT	March 24, 2011 14:00 UTC
ADAPT	March 24, 2011 16:00 UTC
ADAPT	March 24, 2011 18:00 UTC
ADAPT	March 24, 2011 20:00 UTC
ADAPT	March 24, 2011 22:00 UTC
ADAPT	March 25, 2011 00:00 UTC
ADAPT	March 25, 2011 02:00 UTC

Gridded Met Source	Obs Time
ADAPT	March 25, 2011 04:00 UTC
ADAPT	March 25, 2011 06:00 UTC
ADAPT	March 25, 2011 08:00 UTC
ADAPT	March 25, 2011 10:00 UTC
ADAPT	March 25, 2011 12:00 UTC
ADAPT	March 25, 2011 14:00 UTC
ADAPT	March 25, 2011 16:00 UTC
ADAPT	March 25, 2011 18:00 UTC
ADAPT	March 25, 2011 20:00 UTC
ADAPT	March 25, 2011 22:00 UTC
ADAPT	March 26, 2011 00:00 UTC
ADAPT	March 26, 2011 02:00 UTC
ADAPT	March 26, 2011 04:00 UTC
ADAPT	March 26, 2011 06:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 25, 2011 04:00 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100

Email: narac@llnl.gov
Approved on: March 25, 2011 04:14 UTC

Classification: ~~Official Use Only - Not Approved for Further Distribution~~

DISCLAIMER:

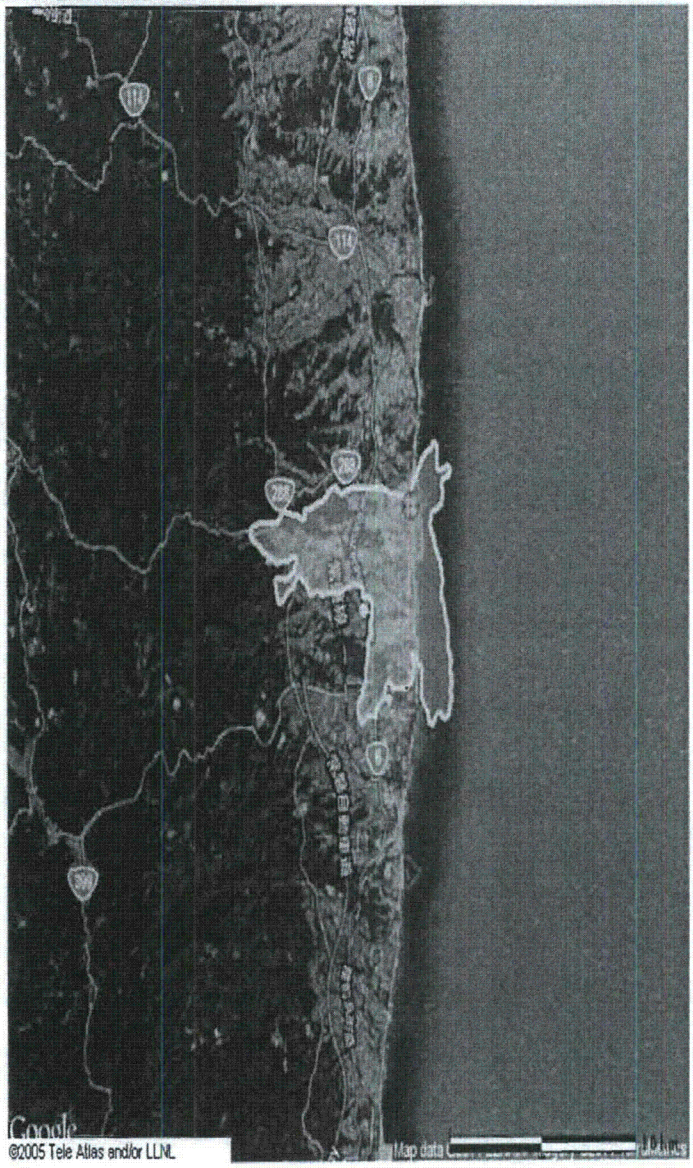
These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Dose (0-4d)
(Total Effective Dose)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose.	>5 1.8 km 2.3 km2	2,380
	Exceeds 1 rem total effective dose.	>1 8.6 km 41.2 km2	10,200

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 12, 2011 06:25 UTC to March 16, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

Generated On: March 25, 2011 03:51 UTC

Model: LODI

Comments:

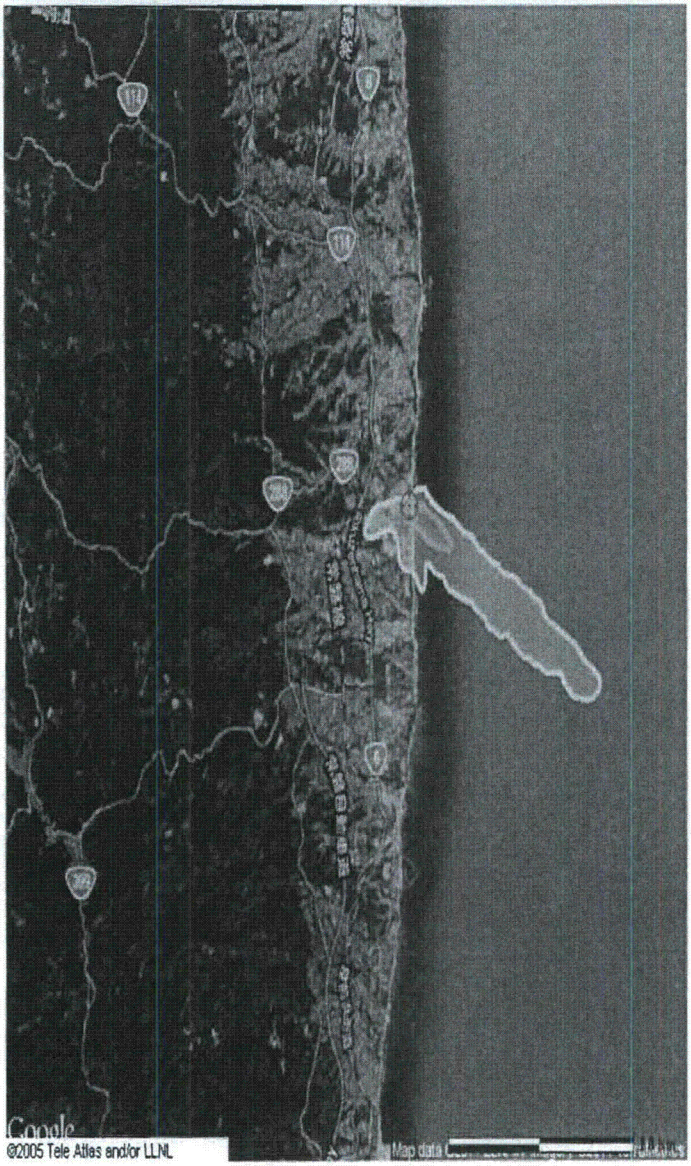
Doses shown are total accumulated from the beginning of release.

Plausible Realistic Scenario

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Dose (4-8d)
(Total Effective Dose)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose.	>5 2.6 km 1.7 km2	730
	Exceeds 1 rem total effective dose.	>1 11.6 km 21.6 km2	3,080

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 16, 2011 06:25 UTC to March 20, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

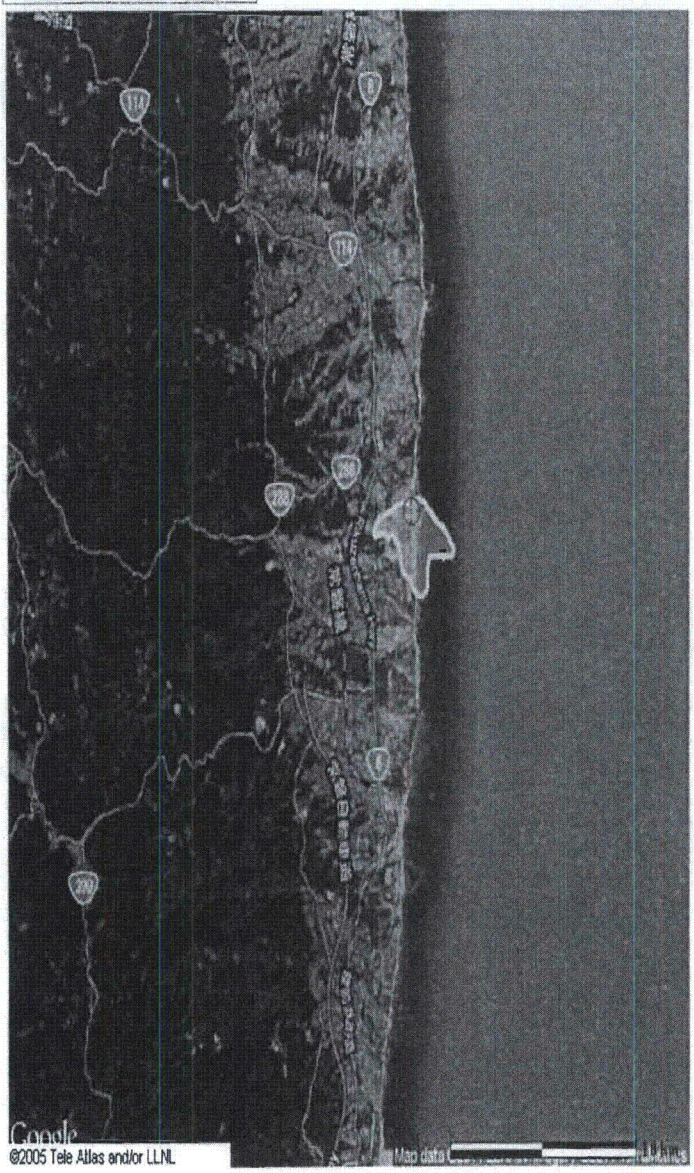
Doses shown are accrued after 03/16/2011 06:25:00 UTC and can be avoided by protective actions

Plausible Realistic Scenario

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Dose (8-12d)
(Total Effective Dose)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose.	>5 0.5 km 0.4 km2	540
	Exceeds 1 rem total effective dose.	>1 2.7 km 6.0 km2	2,970

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 20, 2011 06:25 UTC to March 24, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Doses shown are accrued after 03/20/2011 06:25:00 UTC and can be avoided by protective actions

Plausible Realistic Scenario

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Dose (0-14d)
(Total Effective Dose)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release

Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: { onDuty Assessor }; narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose.	>5 3.2 km 8.5 km2	3,220
	Exceeds 1 rem total effective dose.	>1 12.6 km 98.2 km2	14,900

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 12, 2011 06:25 UTC to March 26, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

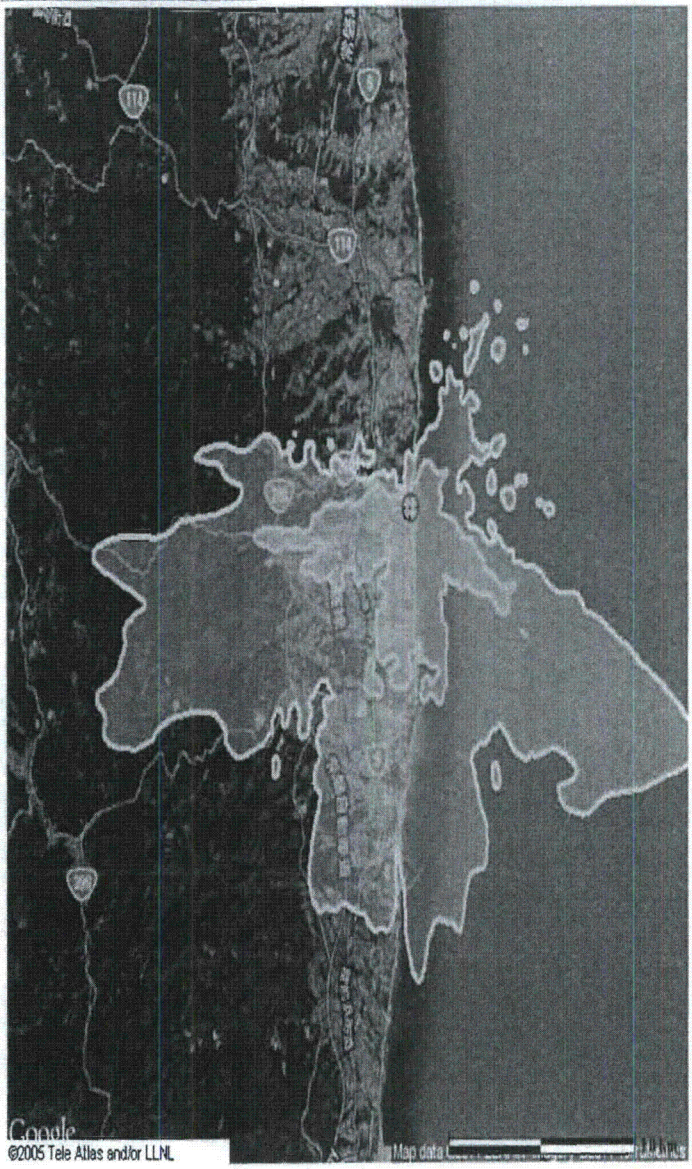
Doses shown are total accumulated from the beginning of release.

Plausible Realistic Scenario

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Guidance (Radioiodine) (0-14 d)
(KI Administration based on Thyroid Radioiodine Dose)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Effects and Actions

	Description	(rem) Extent Area	Population
	Adult thyroid Committed Equivalent Dose - Early Phase FDA Guidance for KI administration to adults	>10 8.4 km 34.7 km2	8,580
	Child thyroid Committed Equivalent Dose - Early Phase PAG for KI administration to children.	>5 17.8 km 252 km2	27,800

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 12, 2011 06:25 UTC to March 26, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: I-131 + I-132 + TE-132 + I-133 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Doses shown are total accumulated from the beginning of release.

Plausible Realistic Scenario

APPROVED PRODUCT
NARAC

Worker Protection Dose Rate at 4 d
(Groundshine Dose Rate at 03/16/2011 15:25:00 JST)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release

Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Acute (Short-Term) Effects			
	Description	(mrem/hr) Extent Area	Population
	Limit for all occupational exposures exceeded by exposure for 50 hours or less.	>100 0.2 km 0.02 km2	50
	U.S. NCRP radiological control boundary.	>10 3.5 km 7.1 km2	3,120
	U.S. NRC public exclusion zone	>2 10.2 km 76.3 km2	13,600
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination at March 16, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Plausible Realistic Scenario

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

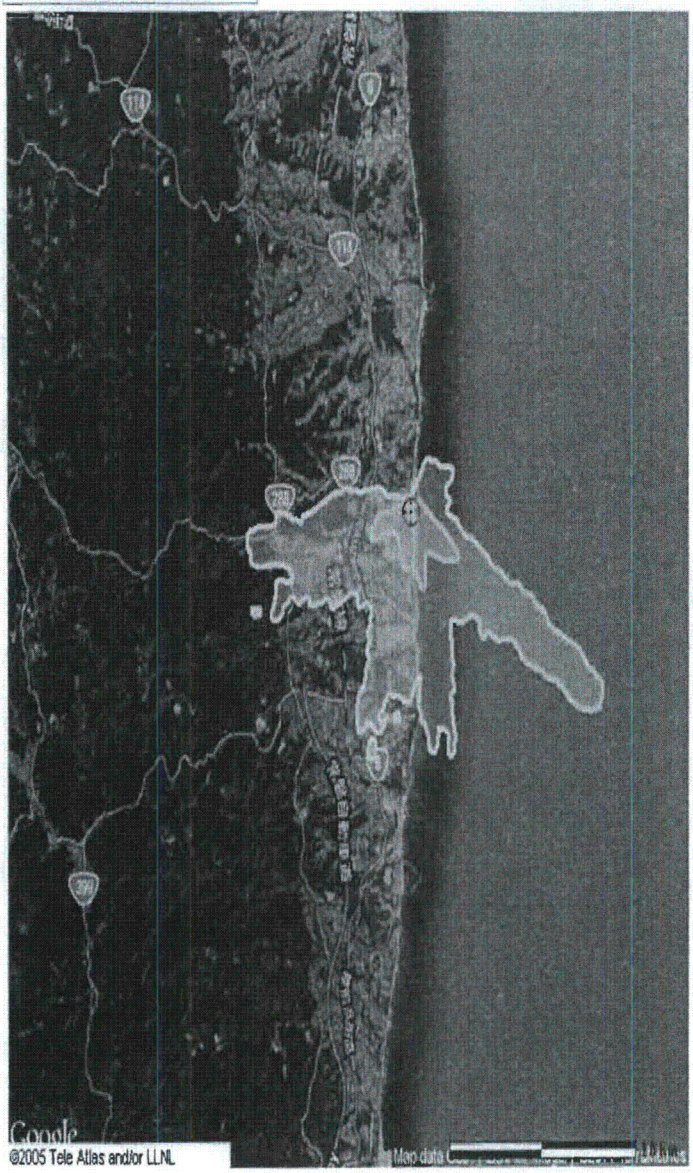
Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Worker Protection Dose Rate at 8 d
(Groundshine Dose Rate at 03/20/2011 15:25:00 JST)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Acute (Short-Term) Effects			
	Description	(mrem/hr) Extent Area	Population
	U.S. NCRP radiological control boundary.	>10 2.9 km 5.5 km2	2,910
	U.S. NRC public exclusion zone	>2 11.9 km 64.7 km2	10,800
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination at March 20, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

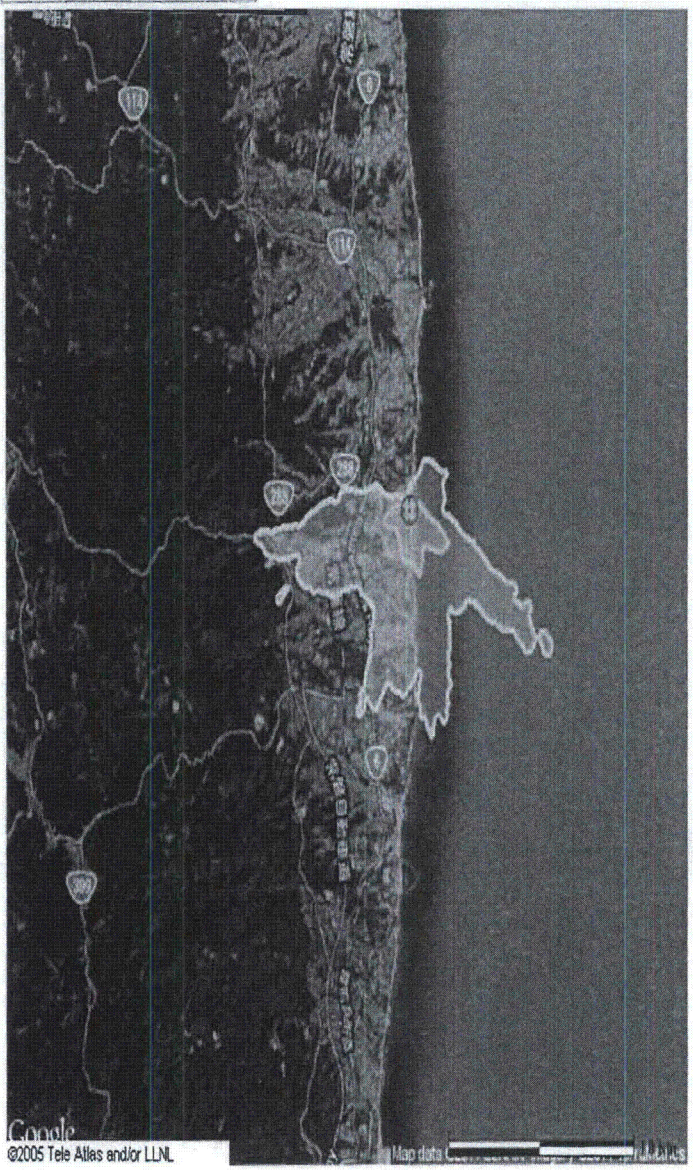
Comments:

Plausible Realistic Scenario

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Worker Protection Dose Rate at 12 d
(Groundshine Dose Rate at 03/24/2011 15:25:00 JST)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Acute (Short-Term) Effects			
	Description	(mrem/hr) Extent Area	Population
	U.S. NCRP radiological control boundary.	>10 2.3 km 3.9 km2	2,560
	U.S. NRC public exclusion zone	>2 8.8 km 48.7 km2	10,100
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination at March 24, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Plausible Realistic Scenario

APPROVED PRODUCT NARAC

Deposition at 14 d
(Surface Contamination from Deposited Radionuclides)

Japan Impacts - NRC PRC V3 (U1Exp)
NARAC Report - Potential Release

Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Effects and Actions

	Description	(Ci/m2) Extent Area	Population
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.01 0.2 km 0.07 km2	120
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0010 3.5 km 8.3 km2	3,150
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0001 16.4 km 217 km2	25,800

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination at March 26, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Plausible Realistic Scenario

From: OST01 HOC
Sent: Saturday, March 26, 2011 10:24 AM
To: RST01 Hoc
Cc: FOIA Response.hoc Resource
Subject: FW: Intermediate Phase Supercore
Attachments: Intermediate Phase Supercore 26 March 2011.pdf

-----Original Message-----
From: HOO Hoc [mailto:HOO.Hoc@nrc.gov]
Sent: Saturday, March 26, 2011 10:22 AM
To: LIA07 Hoc; OST01 HOC; OST02 HOC; OST03 HOC
Subject: FW: Intermediate Phase Supercore

From: NITOPS[SMTP:NITOPS@NNSA.DOE.GOV]
Sent: Saturday, March 26, 2011 10:21:52 AM
To: Hoc, PMT12; PMT02 Hoc; HOO Hoc
Cc: NITOPS
Subject: FW: Intermediate Phase Supercore Auto forwarded by a Rule

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration U.S. Department of Energy nitops@nnsa.doe.gov nit@doe.sgov.gov 202-586-8100

-----Original Message-----
From: NITOPS
Sent: Saturday, March 26, 2011 10:12 AM
To: Aoki, Steven; (b)(6) Steve Fetter
Cc: NITOPS
Subject: Intermediate Phase Supercore

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration U.S. Department of Energy nitops@nnsa.doe.gov nit@doe.sgov.gov 202-586-8100

Consequence Report

Tokyo Supercore63 Intermediate Phase

NARAC Report - Potential Release

Issued: March 26, 2011 14:07 UTC

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Intermediate Phase Relocation PAGs : (Relocation based on Avoidable Groundshine and Resuspension Dose)

Material: AM-241 + PU-241 + BA-140 + LA-140 + CE-141 + LA-141 + CE-143 + PR-143 + CE-144 + PR-144 + CM-242 + PU-238 + CS-134 + CS-136 + CS-137 + I-131 + TE-131 + TE-131M + I-132 + TE-132 + I-133 + I-135 + MO-99 + TC-99M + NB-95 + ZR-95 + NB-97 + ZR-97 + ND-147 + PM-147 + NP-239 + PU-239 + RB-86 + RB-88 + RH-103M + RU-103 + RH-105 + RU-105 + RU-106 + SB-127 + TE-127M + TE-127 + SB-129 + TE-129 + TE-129M + SR-89 + SR-90 + Y-90 + SR-91 + Y-91M + Y-91 + SR-92 + Y-92 + Y-93

The following figure illustrates the model-predicted regions in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over a period of many years from the radioactive material that has been deposited on the surface. There are two primary pathways by which individuals will continue to receive a radiological dose while they remain in these areas. Individuals in these regions will be exposed to radiation by direct exposure from radioactive material on surfaces and by exposure from material that has been resuspended into the air and subsequently inhaled. The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when relocation (long-term removal) of individuals should be considered. These Guides are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime, and thus the health effects produced by the doses may develop over a period of several years. Note that the PAGs were developed based on avoidable dose (i.e. the dose that will be avoided once protective actions have been implemented). These model predictions are based on the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. If protective actions have not been implemented by the beginning of this exposure period, the avoidable dose will be less than that shown for the unsheltered population, and accumulated dose will continue to rise at an undiminished rate. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. The contours that may be displayed include the first-year relocation contour where individuals are projected to receive a dose in excess of 2 rem over the remainder of the first year following the release, and the second-year relocation contour where individuals are projected to receive a dose in excess of 0.5 rem during the second year following the release. (Doses received over each of the subsequent years are normally less than those received during the second-year.)

SOURCE INFORMATION:

Release Start Time:	March 14, 2011 02:00 UTC
Release Stop Time:	March 18, 2011 08:00 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	0.463083 Ci of AM-241 (100% respirable)

DOE Memo 3/30, 3/24, 4th report

NARAC Contact Information email: narac@llnl.gov or phone (925) 424-6465

Official Use Only - Not Approved for Further Distribution

283333 Ci of BA-140 (100% respirable)
7092.65 Ci of CE-141 (100% respirable)
1065.42 Ci of CE-143 (100% respirable)
6320.47 Ci of CE-144 (100% respirable)
85.2655 Ci of CM-242 (100% respirable)
1.49569e+07 Ci of CS-134 (100% respirable)
480071 Ci of CS-136 (100% respirable)
1.63461e+07 Ci of CS-137 (100% respirable)
7.26957e+06 Ci of I-131 (100% respirable)
2.23484e+06 Ci of I-132 (100% respirable)
386233 Ci of I-133 (100% respirable)
670.308 Ci of I-135 (100% respirable) over 75600 sec
11734.9 Ci of LA-140 (100% respirable)
0.000524748 Ci of LA-141 (100% respirable) over 36900 sec
16473.2 Ci of MO-99 (100% respirable)
3461.47 Ci of NB-95 (100% respirable)
4.3703 Ci of NB-97 (100% respirable) over 64800 sec
955.668 Ci of ND-147 (100% respirable)
32714.6 Ci of NP-239 (100% respirable)
6.09274 Ci of PM-147 (100% respirable)
2282.17 Ci of PR-143 (100% respirable)
4122.68 Ci of PR-144 (100% respirable)
0.110802 Ci of PU-238 (100% respirable)
0.0211017 Ci of PU-239 (100% respirable)
692.159 Ci of PU-241 (100% respirable)
26294.7 Ci of RB-86 (100% respirable)
0.00286759 Ci of RB-88 (100% respirable) over 48600 sec
34912 Ci of RH-103M (100% respirable)
4848.57 Ci of RH-105 (100% respirable)
35066.9 Ci of RU-103 (100% respirable)
0.0270184 Ci of RU-105 (100% respirable) over 46800 sec
10839.6 Ci of RU-106 (100% respirable)
20946.8 Ci of SB-127 (100% respirable)
0.104652 Ci of SB-129 (100% respirable) over 50400 sec
199583 Ci of SR-89 (100% respirable)
36133.8 Ci of SR-90 (100% respirable)
326.253 Ci of SR-91 (100% respirable) over 74700 sec
3.54368e-05 Ci of SR-92 (100% respirable) over 28800 sec
15895.5 Ci of TC-99M (100% respirable)

39879.6 Ci of TE-127 (100% respirable)
17134.2 Ci of TE-127M (100% respirable)
32992.8 Ci of TE-129 (100% respirable)
50674 Ci of TE-129M (100% respirable)
2678.84 Ci of TE-131 (100% respirable)
11897.1 Ci of TE-131M (100% respirable)
295410 Ci of TE-132 (100% respirable)
5798.47 Ci of Y-90 (100% respirable)
2274.94 Ci of Y-91 (100% respirable)
41.1262 Ci of Y-91M (100% respirable) over 72900 sec
0.000311006 Ci of Y-92 (100% respirable) over 35100 sec
4.00239 Ci of Y-93 (100% respirable) over 63000 sec
3190.53 Ci of ZR-95 (100% respirable)
76.4213 Ci of ZR-97 (100% respirable) over 72000 sec

Source Geometry: gaussian cloud top at 200 m

Particle Size Distribution: All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

WRF Gridded Metdata from 03/14/2011 11:00:00 JST to 03/22/2011 10:00:00 JST at 1 hr intervals were used in this calculation

Gridded Met Source	Obs Time
WRF	March 14, 2011 02:00 UTC
WRF	March 14, 2011 03:00 UTC
WRF	March 14, 2011 04:00 UTC
WRF	March 14, 2011 05:00 UTC
WRF	March 14, 2011 06:00 UTC
WRF	March 14, 2011 07:00 UTC
WRF	March 14, 2011 08:00 UTC
WRF	March 14, 2011 09:00 UTC
WRF	March 14, 2011 10:00 UTC
WRF	March 14, 2011 11:00 UTC
WRF	March 14, 2011 12:00 UTC
WRF	March 14, 2011 13:00 UTC

Gridded Met

Source	Obs Time
WRF	March 14, 2011 14:00 UTC
WRF	March 14, 2011 15:00 UTC
WRF	March 14, 2011 16:00 UTC
WRF	March 14, 2011 17:00 UTC
WRF	March 14, 2011 18:00 UTC
WRF	March 14, 2011 19:00 UTC
WRF	March 14, 2011 20:00 UTC
WRF	March 14, 2011 21:00 UTC
WRF	March 14, 2011 22:00 UTC
WRF	March 14, 2011 23:00 UTC
WRF	March 15, 2011 00:00 UTC
WRF	March 15, 2011 01:00 UTC
WRF	March 15, 2011 02:00 UTC
WRF	March 15, 2011 03:00 UTC
WRF	March 15, 2011 04:00 UTC
WRF	March 15, 2011 05:00 UTC
WRF	March 15, 2011 06:00 UTC
WRF	March 15, 2011 07:00 UTC
WRF	March 15, 2011 08:00 UTC
WRF	March 15, 2011 10:00 UTC
WRF	March 15, 2011 11:00 UTC
WRF	March 15, 2011 12:00 UTC
WRF	March 15, 2011 13:00 UTC
WRF	March 15, 2011 14:00 UTC
WRF	March 15, 2011 16:00 UTC
WRF	March 15, 2011 17:00 UTC
WRF	March 15, 2011 18:00 UTC
WRF	March 15, 2011 19:00 UTC
WRF	March 15, 2011 20:00 UTC
WRF	March 15, 2011 21:00 UTC

Gridded Met Source	Obs Time
WRF	March 15, 2011 22:00 UTC
WRF	March 15, 2011 23:00 UTC
WRF	March 16, 2011 00:00 UTC
WRF	March 16, 2011 01:00 UTC
WRF	March 16, 2011 02:00 UTC
WRF	March 16, 2011 03:00 UTC
WRF	March 16, 2011 04:00 UTC
WRF	March 16, 2011 05:00 UTC
WRF	March 16, 2011 06:00 UTC
WRF	March 16, 2011 07:00 UTC
WRF	March 16, 2011 08:00 UTC
WRF	March 16, 2011 09:00 UTC
WRF	March 16, 2011 10:00 UTC
WRF	March 16, 2011 11:00 UTC
WRF	March 16, 2011 12:00 UTC
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WRF	March 16, 2011 14:00 UTC
WRF	March 16, 2011 15:00 UTC
WRF	March 16, 2011 16:00 UTC
WRF	March 16, 2011 17:00 UTC
WRF	March 16, 2011 18:00 UTC
WRF	March 16, 2011 19:00 UTC
WRF	March 16, 2011 20:00 UTC
WRF	March 16, 2011 21:00 UTC
WRF	March 16, 2011 22:00 UTC
WRF	March 16, 2011 23:00 UTC
WRF	March 17, 2011 00:00 UTC
WRF	March 17, 2011 01:00 UTC
WRF	March 17, 2011 02:00 UTC
WRF	March 17, 2011 03:00 UTC

Gridded Met Source	Obs Time
WRF	March 17, 2011 04:00 UTC
WRF	March 17, 2011 05:00 UTC
WRF	March 17, 2011 06:00 UTC
WRF	March 17, 2011 07:00 UTC
WRF	March 17, 2011 08:00 UTC
WRF	March 17, 2011 09:00 UTC
WRF	March 17, 2011 10:00 UTC
WRF	March 17, 2011 11:00 UTC
WRF	March 17, 2011 12:00 UTC
WRF	March 17, 2011 13:00 UTC
WRF	March 17, 2011 14:00 UTC
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WRF	March 17, 2011 19:00 UTC
WRF	March 17, 2011 20:00 UTC
WRF	March 17, 2011 21:00 UTC
WRF	March 17, 2011 22:00 UTC
WRF	March 17, 2011 23:00 UTC
WRF	March 18, 2011 00:00 UTC
WRF	March 18, 2011 01:00 UTC
WRF	March 18, 2011 02:00 UTC
WRF	March 18, 2011 03:00 UTC
WRF	March 18, 2011 04:00 UTC
WRF	March 18, 2011 05:00 UTC
WRF	March 18, 2011 06:00 UTC
WRF	March 18, 2011 07:00 UTC
WRF	March 18, 2011 08:00 UTC
WRF	March 18, 2011 09:00 UTC

Gridded Met

Source	Obs Time
WRF	March 18, 2011 10:00 UTC
WRF	March 18, 2011 11:00 UTC
WRF	March 18, 2011 12:00 UTC
WRF	March 18, 2011 13:00 UTC
WRF	March 18, 2011 14:00 UTC
WRF	March 18, 2011 15:00 UTC
WRF	March 18, 2011 16:00 UTC
WRF	March 18, 2011 17:00 UTC
WRF	March 18, 2011 18:00 UTC
WRF	March 18, 2011 19:00 UTC
WRF	March 18, 2011 20:00 UTC
WRF	March 18, 2011 21:00 UTC
WRF	March 18, 2011 22:00 UTC
WRF	March 18, 2011 23:00 UTC
WRF	March 19, 2011 00:00 UTC
WRF	March 19, 2011 01:00 UTC
WRF	March 19, 2011 02:00 UTC
WRF	March 19, 2011 03:00 UTC
WRF	March 19, 2011 04:00 UTC
WRF	March 19, 2011 05:00 UTC
WRF	March 19, 2011 06:00 UTC
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WRF	March 19, 2011 08:00 UTC
WRF	March 19, 2011 09:00 UTC
WRF	March 19, 2011 10:00 UTC
WRF	March 19, 2011 11:00 UTC
WRF	March 19, 2011 12:00 UTC
WRF	March 19, 2011 13:00 UTC
WRF	March 19, 2011 14:00 UTC
WRF	March 19, 2011 15:00 UTC

Gridded Met Source	Obs Time
WRF	March 19, 2011 16:00 UTC
WRF	March 19, 2011 17:00 UTC
WRF	March 19, 2011 18:00 UTC
WRF	March 19, 2011 19:00 UTC
WRF	March 19, 2011 20:00 UTC
WRF	March 19, 2011 21:00 UTC
WRF	March 19, 2011 22:00 UTC
WRF	March 19, 2011 23:00 UTC
WRF	March 20, 2011 00:00 UTC
WRF	March 20, 2011 01:00 UTC
WRF	March 20, 2011 02:00 UTC
WRF	March 20, 2011 03:00 UTC
WRF	March 20, 2011 04:00 UTC
WRF	March 20, 2011 05:00 UTC
WRF	March 20, 2011 06:00 UTC
WRF	March 20, 2011 07:00 UTC
WRF	March 20, 2011 08:00 UTC
WRF	March 20, 2011 09:00 UTC
WRF	March 20, 2011 10:00 UTC
WRF	March 20, 2011 11:00 UTC
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WRF	March 20, 2011 16:00 UTC
WRF	March 20, 2011 17:00 UTC
WRF	March 20, 2011 18:00 UTC
WRF	March 20, 2011 19:00 UTC
WRF	March 20, 2011 20:00 UTC
WRF	March 20, 2011 21:00 UTC

Gridded Met

Source	Obs Time
WRF	March 20, 2011 22:00 UTC
WRF	March 20, 2011 23:00 UTC
WRF	March 21, 2011 00:00 UTC
WRF	March 21, 2011 01:00 UTC
WRF	March 21, 2011 02:00 UTC
WRF	March 21, 2011 03:00 UTC
WRF	March 21, 2011 04:00 UTC
WRF	March 21, 2011 05:00 UTC
WRF	March 21, 2011 06:00 UTC
WRF	March 21, 2011 07:00 UTC
WRF	March 21, 2011 08:00 UTC
WRF	March 21, 2011 09:00 UTC
WRF	March 21, 2011 10:00 UTC
WRF	March 21, 2011 11:00 UTC
WRF	March 21, 2011 12:00 UTC
WRF	March 21, 2011 13:00 UTC
WRF	March 21, 2011 14:00 UTC
WRF	March 21, 2011 15:00 UTC
WRF	March 21, 2011 16:00 UTC
WRF	March 21, 2011 17:00 UTC
WRF	March 21, 2011 18:00 UTC
WRF	March 21, 2011 19:00 UTC
WRF	March 21, 2011 20:00 UTC
WRF	March 21, 2011 21:00 UTC
WRF	March 21, 2011 22:00 UTC
WRF	March 21, 2011 23:00 UTC
WRF	March 22, 2011 00:00 UTC
WRF	March 22, 2011 01:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 25, 2011 22:41 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 26, 2011 00:26 UTC

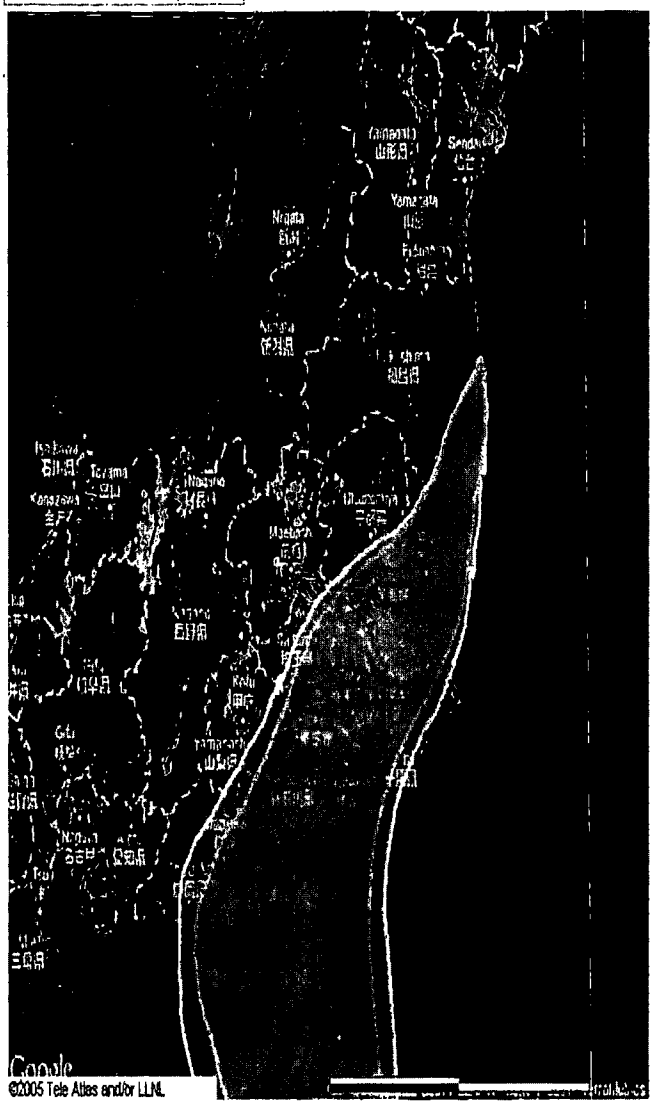
Classification: ~~Official Use Only - Not Approved for Further Distribution~~

DISCLAIMER:

These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Intermediate Phase Relocation PAGs
(Relocation based on Avoidable Groundshine and Resuspension Dose)



Map Size: 590 km by 590 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: { onDuty Assessor }; narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds first-year relocation PAG (5 d to 1 yr 5 d).	>2 494 km 51,877 km2	3.82E7
	Exceeds second-year relocation PAG.	>0.5 505 km 64,156 km2	4.02E7

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 19, 2011 02:00 UTC to March 19, 2012 02:00 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: AM-241 + PU-241 + BA-140 + LA-140 + CE-141 + LA-141 + CE-143 + PR-143 + CE-144 + PR-144 + CM-242 + PU-238 + CS-134 + CS-136 + CS-137 + I-131 + TE-131 + TE-131M + I-132 + TE-132 + I-133 + I-135 + MO-99 + TC-99M + NB-95 + ZR-95 + NB-97 + ZR-97 + ND-147 + PM-147 + NP-239 + PU-239 + RB-86 + RB-88 + RH-103M + RU-103 + RH-105 + RU-105 + RU-106 + SB-127 + TE-127M + TE-127 + SB-129 + TE-129 + TE-129M + SR-89 + SR-90 + Y-90 + SR-91 + Y-91M + Y-91 + SR-92 + Y-92 + Y-93

Generated On: March 25, 2011 22:39 UTC

Model: ADAPT/LODI

Comments:

Doses shown are accrued after 03/19/2011 02:00:00 UTC and can be avoided by protective actions

Tokyo Supercore 63 nuclides for U2 U3 U4a U4b

ICRP30 and ICRP60 DCF's were used for this plot

From: Uhle, Jennifer
Sent: Sunday, March 27, 2011 4:20 AM
To: LIA06 Hoc
Subject: FW: Plume Model Slides -- Releasable to Japan
Attachments: PlausibleReleases_relJapan 3-25-11--FINAL.ppt

-----Original Message-----
From: Virgilio, Martin
Sent: Sunday, March 27, 2011 4:13 AM
To: Uhle, Jennifer; Miller, Chris
Subject: FW: Plume Model Slides -- Releasable to Japan

-----Original Message-----
From: Dorman, Dan
Sent: Sunday, March 27, 2011 3:43 AM
To: Virgilio, Martin
Subject: Fw: Plume Model Slides -- Releasable to Japan

These are the slides. They'll be faxing the two pager. DOE here is giving Steve Aoki a heads up.

----- Original Message -----
From: Angelov, Bonnie A <AngelovBA@state.gov>
To: Dorman, Dan
Sent: Sun Mar 27 00:56:17 2011
Subject: FW: Plume Model Slides -- Releasable to Japan

Dan - these are the slides Suzanne mentioned. Meeting at 3pm in the Ambassador's office.
Thanks, Bonnie

This email is UNCLASSIFIED

-----Original Message-----
From: Aoki, Steven [mailto:Steven.Aoki@nnsa.doe.gov]
Sent: Sunday, March 27, 2011 5:24 AM
To: Cherry, Ronald C
Cc: Wilber, Deborah; Blumenthal, Daniel; NITOPS; DAgostino, Thomas; PWG; Poneman, Daniel; Zumwalt, James P; 'Russel, Daniel R.'; Steve Fetter; John Holdren
Subject: Plume Model Slides -- Releasable to Japan

Ron:
Attached is a package of slides for use in briefing GOJ officials on our plume modeling efforts. Instructions to the embassy to deliver the slides and talking points are coming separately through State Dept channels.

Considerable care has been put into the captions and descriptive material accompanying the slides so we request that no modifications be made without checking with DOE and OSTP.

Please confirm receipt of this message.

Thanks very much,

Steve

U.S. Atmospheric Release Simulations

Fukushima Dai-ichi

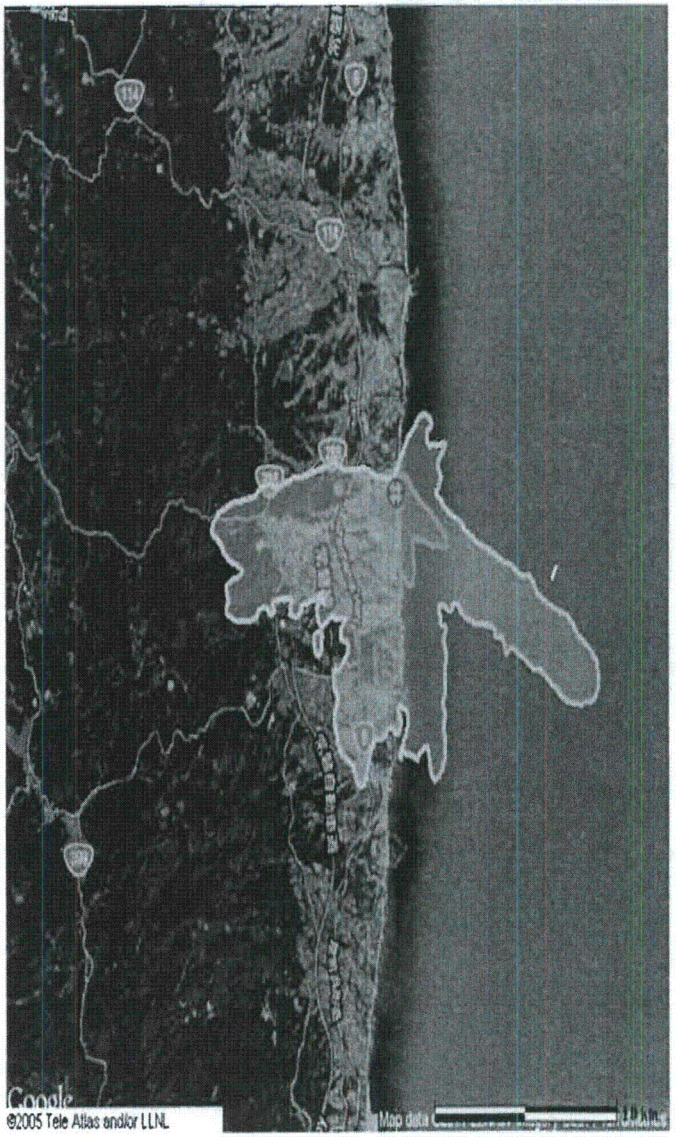
March 25, 2011

Framing the Discussion

Radiological Release from Fukushima Daiichi

- The attached materials contain three computer simulations that are based on HYPOTHETICAL radionuclide releases:
  1. Moderate releases from three reactors over 12 days
     Historical weather for 12-day period
  2. Large release from one reactor over 1 day
     Weather chosen to direct plume toward Tokyo
  3. Large release from 2 spent fuel pools over 1 day
     Weather chosen to direct plume toward Tokyo
- These materials are provided ONLY to assist planning for responding to ongoing events in Japan. They do not represent a prediction of the most likely course of events.
- These simulations were conducted by the National Atmospheric Release Advisory Capability (NARAC).

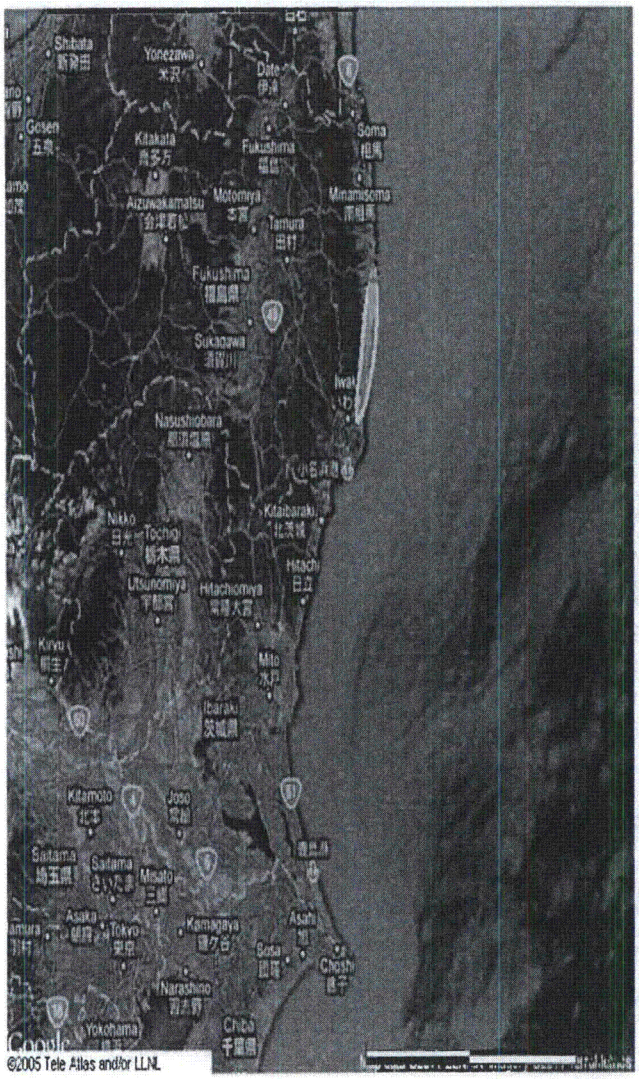
1. Moderate Releases from 3 Damaged Reactors over 12 days



The graphic indicates where the 14-day total effective dose including plume passage exceeds 1 rem (yellow) and 5 rem (orange) (map size 36.4 x 36.4 km)

- In this hypothetical scenario, the US EPA Protective Action Guidelines for the total effective dose will NOT be exceeded in Tokyo, but are exceeded at locations much closer to the release point.
- In this hypothetical scenario, the US EPA Protective Action Guidelines for both the adult and child thyroid dose will NOT be exceeded in Tokyo, but are exceeded at locations closer to the release point

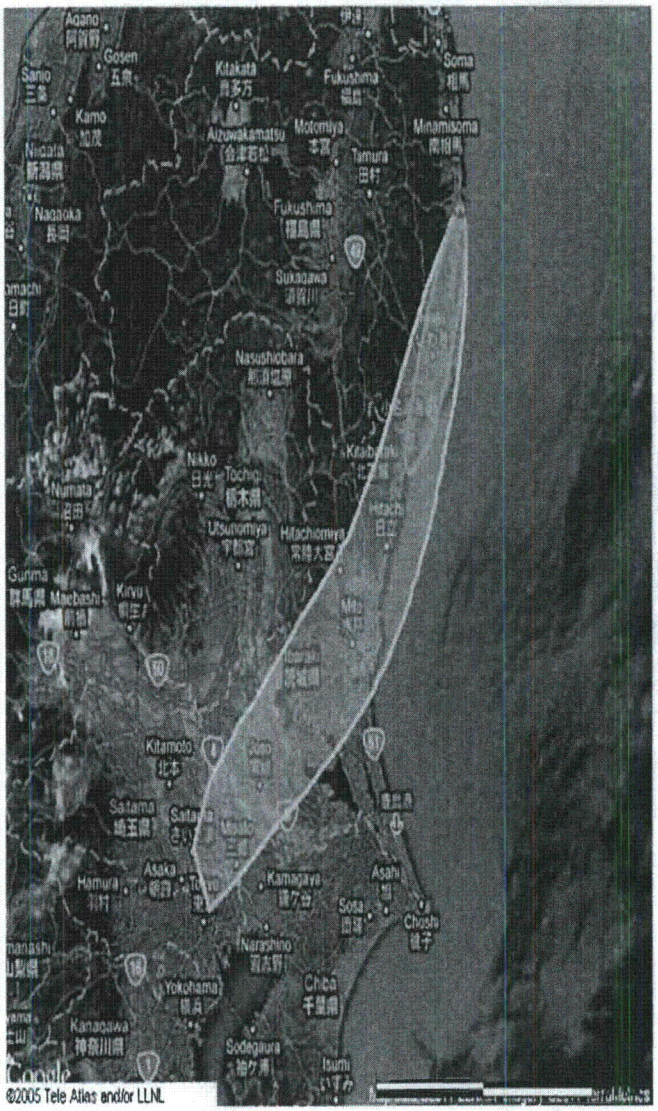
2. Large Release from 1 Damaged Reactor over 1 Day



The graphic indicates where the 96-hour total effective dose including plume passage exceeds 1 rem (yellow) and 5 rem (orange) (map size 295 x 295 km)

- In this hypothetical scenario, the US EPA Protective Action Guidelines for the total effective dose will NOT be exceeded in Tokyo, but are exceeded at locations much closer to the release point.
- In this hypothetical scenario, the US EPA Protective Action Guidelines for both the adult and child thyroid dose will NOT be exceeded in Tokyo, but are exceeded at locations closer to the release point

3. Large Releases from 2 Spent Fuel Pools over 1 day



The graphic indicates where the 96-hour total effective dose including plume passage exceeds 1 rem (yellow) and 5 rem (orange) (map size 295 x 295 km)

- In this hypothetical scenario, the US EPA Protective Action Guidelines for the total effective dose MAY be exceeded in Tokyo, as well as at locations closer to the release point.
- In this hypothetical scenario, the US EPA Protective Action Guidelines for both the adult and child thyroid dose will NOT be exceeded in Tokyo, but are exceeded at locations closer to the release point

Assumed Releases of I-131 and Cs-137 (kCi)

Hypothetical Scenario	I-131	Cs-137
1. Moderate releases from 3 reactors over 12 days	1,200	129
2. Large release from 1 reactor over 1 day	2,690	296
3. Large releases from 2 spent fuel pools	0	16,000

Additional contributors to the dose are also included in the results.

From: Hoc, PMT12
Sent: Wednesday, March 30, 2011 2:03 AM
To: PMTERDS Hoc
Attachments: PlausibleReleases_relJapan 3-25-11--FINAL.ppt; NIT Response.txt

From: NITOPS [NITOPS@nnsa.doe.gov]
Sent: Wednesday, March 30, 2011 1:32 AM
To: Hoc, PMT12
Cc: NITOPS
Attachments: PlausibleReleases_re1Japan 3-25-11--FINAL.ppt

Ref our conversation 0125 EDT, we are unable to identify the exact briefing
that AMB Roos provided Goshi Hosono. The attached power point is provided as
an example of what was likely presented however we understand that AMB Roos
may have changed or deleted some of the content prior to the meeting. Please
keep close-hold.

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration U.S. Department of Energy
nitops@nnsa.doe.gov nit@doe.sgov.gov 202-586-8100

U.S. DEPARTMENT OF ENERGY

NNSA

Radiological Assessment

- of effects from -

Fukushima Daiichi Nuclear Power Plant

April 22, 2011

U.S. DEPARTMENT OF ENERGY

NNSA

Operations Summary

- Aerial Measuring Systems have totaled more than 400 flight hours in support of aerial monitoring operations
- NNSA's Consequence Management Response Teams have collected approximately 160,000 total field measurements taken by DOE, DoD, and Japanese monitoring assets
- 559 total air samples taken at U.S. facilities throughout Japan undergoing lab analysis in the United States

U.S. DEPARTMENT OF ENERGY

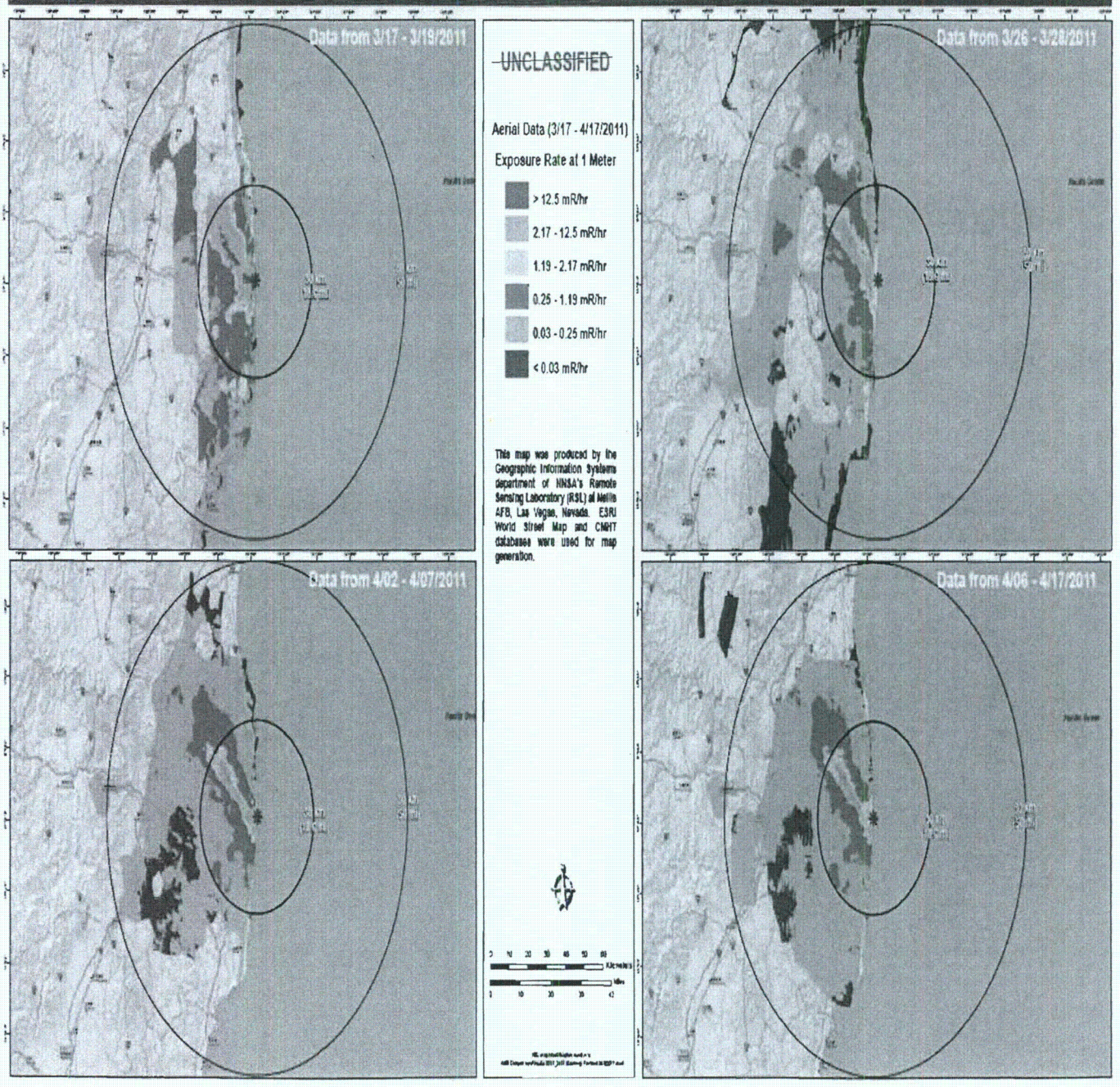
NNSA

Survey Data Over Time

Aerial Monitoring Survey Areas

FUKUSHIMA DAIICHI JAPAN

Overview Aerial Monitoring Contoured Results (3/17 - 04/17/2011)



U.S. DEPARTMENT OF ENERGY

NNSA

Assessment

An assessment of measurements gathered through April 20 continues to show:

- Radiation levels continue to decrease
- No measurable deposit of radiological material since March 19
- US bases and facilities all measure dose rates below 32 microrem/hr (32 millionths of a REM) – a level with no known health risks
- Agricultural monitoring and possible intervention will be required for several hundred square kilometers surrounding the site:
    - Soil and water samples are the only definitive method to determine agricultural countermeasures
    - Ground monitoring can give better fidelity to identify areas that require agricultural sampling

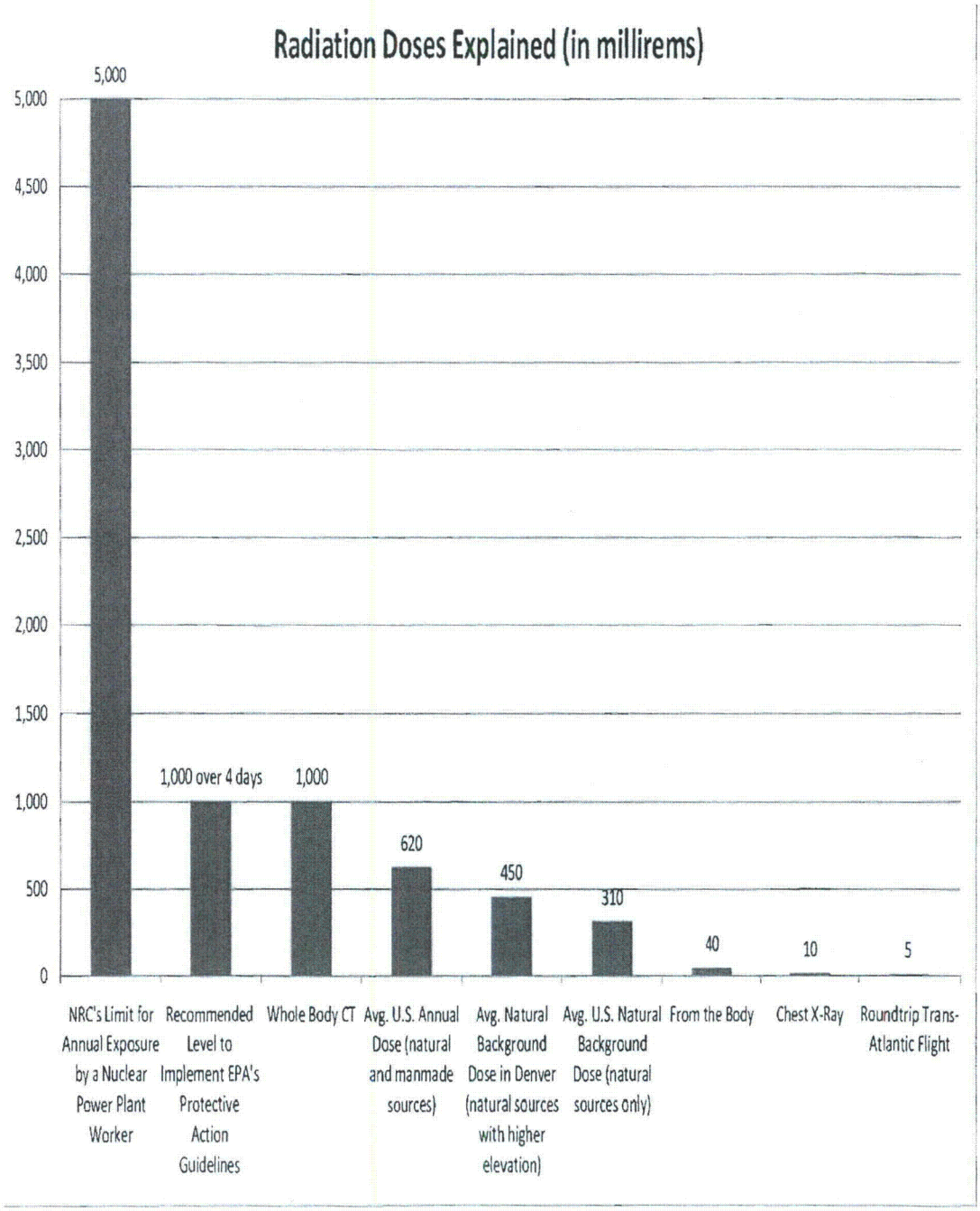
U.S. DEPARTMENT OF ENERGY

NNSA

Context

- The Nuclear Regulatory Commission estimates that the average American absorbs 620 mRem a year* (or 0.071 mRem/hour)
- An average transatlantic flight produces an exposure of 2.5 mRem*
- A typical chest x-ray produces 10 mRem per image
- EPA guidelines call for public health actions if exposure exceeds 1000 mRem over 4 days

* Source: NRC: http://nrc.gov/images/about-nrc/radiation/factoid2-lrg.gif


Radiation Doses Explained (in millirems)
5,000
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,000 over 4 days
1,000
620
450
310
40
10
5
NRC's Limit for Annual Exposure by a Nuclear Power Plant Worker
Recommended Level to Implement EPA's Protective Action Guidelines
Whole Body CT
Avg. U.S. Annual Dose (natural and manmade sources)
Avg. Natural Background Dose in Denver (natural sources with higher elevation)
Avg. U.S. Natural Background Dose (natural sources only)
From the Body
Chest X-Ray
Roundtrip Trans-Atlantic Flight

From: PMT01 Hoc
Sent: Thursday, April 07, 2011 8:14 AM
To: PMT02 Hoc; PMT11 Hoc
Subject: FW: 3 - 6 Month Plans
Attachments: image001.jpg; 3-6 months plans110406.pdf

From: Sheron, Brian
Sent: Thursday, April 07, 2011 7:43 AM
To: ET01 Hoc; RST01 Hoc; PMT01 Hoc; Weber, Michael; Virgilio, Martin
Subject: FW: 3 - 6 Month Plans

FYI, in case you hadn't seen this. Alex sent a follow-up e-mail indicating it was sensitive information that should not be distributed.

From: Larzelere, Alex [mailto:alex.larzelere@nuclear.energy.gov]
Sent: Wednesday, April 06, 2011 8:07 PM
To: DL-NITsolutions
Subject: 3 - 6 Month Plans

Everyone,

Another document – this one contains the Japanese plans to resolve the Fukushima reactor situation over the short, mid, and long term. This will also be a topic of discussion for the call.

Regards,

Alex

Alex R. Larzelere
Director, Advanced Modeling and Simulation Office
Office of Nuclear Energy (NE-71)
U.S. Department of Energy
202-586-1906
Alex.Larzelere@nuclear.energy.gov

AMSO
ADVANCED MODELING & SIMULATION OFFICE

(b)(4),(b)(5)

(b)(4),(b)(5)

Lee, Richard

From: Larzelere, Alex [alex.larzelere@nuclear.energy.gov]
Sent: Monday, April 25, 2011 1:24 PM
To: DL-NITsolutions
Cc: Busby, Jeremy T; Burns, Douglas; Peko, Damian; Shields, Martha; Schneider, Steve
Subject: Notes from the Last Science Experts Call
Attachments: image001.jpg; Sci_notes_042011.docx

Everyone,

Attached are the notes taken by Doug Burns of INL for the last Science Experts call. As a reminder, the next call will occur today (4/25) at 5pm EDT. The call in number is:

202-586-2535

This call will just be an update on the situation at Fukushima.

Regards,

Alex

Alex R. Larzelere
Director, Advanced Modeling and Simulation Office
Office of Nuclear Energy (NE-71)
U.S. Department of Energy
202-586-1906
Alex.Larzelere@nuclear.energy.gov

Doug Burns Notes/Science Experts Call/April 20, 2011

I. TEPCO Recovery Plan

1.
2.
3.

(b)(5)

4.
5.
6.

II. Muon Tomography Update

1.
2.
3.
4. (b)(5)
5.
6.
7.

V. Passive Cooling Update

1.
2.
3. (b)(5)
4.

V. Other Information

1. (b)(5)
2.
3. From here forward, meetings will be held at 5:00 EDT on Mondays and Thursdays. The Monday meetings will focus on discussion of updated plant conditions, and the Thursday meetings will focus on discussion of technical analyses completed during the past week.

Douglas E. Burns
INL Fuel Cycle Science & Technology
208-526-2051 (office)
(b)(6) (c

From: RST01 Hoc
Sent: Thursday, April 07, 2011 7:04 PM
To: RST09 Hoc; RST08 Hoc; RST07 Hoc; Hoc, RST16
Subject: FW: Support for Japan - SFP Criticality Potential Update
Attachments: ORNL_Fukushima-Criticality_Notes_31Mar2011.pptx

From: Carlson, Donald
Sent: Thursday, March 31, 2011 11:19 AM
To: RST01 Hoc
Cc: Taylor, Robert
Subject: FW: Support for Japan - SFP Criticality Potential Update

To RST: The latest input from our criticality experts at ORNL is provided below and attached.

(b)(5)

By the way: If the RST getting this information from others, please let me know so that we can avoid duplication of effort.

Thanks,
Don

From: Wagner, John C. [mailto:wagnerjc@ornl.gov]
Sent: Thursday, March 31, 2011 10:27 AM
To: Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

Rob,
Thanks for sharing this! Please see revised slide packet that includes analyses (by Don Mueller) that shows keff as a function of pitch for a representative design basis safety model. These analyses indicate that the rack dimensions you provided are believable from a criticality safety perspective for un-borated racks. Additional information/observations are included in the slides.

(b)(5)

Call if you have questions.

John C. Wagner, PhD
Oak Ridge National Laboratory
Phone: (865) 241-3570
Mobile: (b)(6)

From: Taylor, Robert [mailto:Robert.Taylor@nrc.gov]
Sent: Thursday, March 31, 2011 1:44 AM
To: Taylor, Robert; Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

We just realized that the pitch is different between the E-W direction and N-S directions. The numbers below are correct for the E-W direction. In the N-S direction, the pitch is slightly larger, 194mm.

From: Taylor, Robert
Sent: Thursday, March 31, 2011 1:28 AM
To: 'Wagner, John C.'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

John, Don, and others,

We have received hardcopy drawings of the spent fuel racks in Unit 4. As we read them, it looks like each cell is 152mm across and the center-to-center pitch is 168.5mm. They are high-density.

Rob

From: Wagner, John C. [mailto:wagnerjc@ornl.gov]
Sent: Tuesday, March 29, 2011 7:30 AM
To: Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

With attachment...

John C. Wagner, PhD
Oak Ridge National Laboratory
Phone: (865) 241-3570
Mobile: (b)(6)

From: Wagner, John C.
Sent: Tuesday, March 29, 2011 7:28 AM
To: 'Taylor, Robert'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

Rob,
Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have Al-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

John C. Wagner, PhD
Oak Ridge National Laboratory
Phone: (865) 241-3570
Mobile: (b)(6)

From: Taylor, Robert [mailto:Robert.Taylor@nrc.gov]
Sent: Tuesday, March 29, 2011 6:01 AM
To: Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony
Subject: RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,
Rob

From: Wagner, John C. [mailto:wagnerjc@ornl.gov]
Sent: Monday, March 28, 2011 11:32 PM
To: Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.
Subject: RE: Support for Japan - SFP Criticality Potential Update

Don,
As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):
"-->*Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*
Unit 4 has only non-borated stainless racks."
This information is consistent with the information you have below.

The above information raises questions/concerns

- Available information suggestions the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:
"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed

accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such."
Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

Questions for you:

1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

John C. Wagner, PhD
Oak Ridge National Laboratory
Phone: (865) 241-3570
Mobile: (b)(6)

From: Carlson, Donald [mailto:Donald.Carlson@nrc.gov]
Sent: Monday, March 28, 2011 9:14 PM
To: Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert
Subject: RE: Support for Japan - SFP Criticality Potential Update
Importance: High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1st cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted

- Fuel damage due to uncovery

Our NRC+ORNL technical opinion as of March 19 was as follows:
Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool. (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

Question: Do we now see a need to modify or expand the above technical opinion? If so, how?

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,
Don

Donald E. Carlson
NRO/ARP/ARB1
Cell: (b)(6)
Office: 301-415-0109

From: Taylor, Robert
Sent: Monday, March 28, 2011 6:59 PM
To: Carlson, Donald; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated
Switching to fresh water injection on 3/29
Shutdown last November with 1/3 of the core offload being 1st cycle fuel
204 fresh fuel assemblies were present in the pool
Japanese concerns that the racks may have shifted.
Fuel damage due to uncovery

Regards,
Rob

From: Carlson, Donald
Sent: Monday, March 28, 2011 6:23 PM
To: Taylor, Robert; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,
Don

From: Taylor, Robert
Sent: Monday, March 28, 2011 5:59 PM
To: Carlson, Donald; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

From: Carlson, Donald
Sent: Monday, March 28, 2011 1:07 PM
To: Brown, Frederick
Cc: Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher
Subject: RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----
From: Carlson, Donald
Sent: Monday, March 28, 2011 9:30 AM
To: Brown, Frederick
Cc: Taylor, Robert; Scott, Michael
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----
From: Brown, Frederick
Sent: Sunday, March 27, 2011 9:11 PM
To: Carlson, Donald
Cc: Taylor, Robert; Scott, Michael
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,
Fred