

**From:** Sheron, Brian  
**To:** Johnson, Michael  
**Subject:** FW: seismic question for today  
**Date:** Saturday, March 19, 2011 10:33:00 PM  
**Attachments:** Fact sheet on the seismic hazard and nuclear plants-Draft 1.docx  
Seismic Questions for Incident Response 3-19-11 8am.pdf

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**From:** Kammerer, Annie  
**Sent:** Saturday, March 19, 2011 9:36 PM  
**To:** Batkin, Joshua  
**Cc:** Sheron, Brian; Borchardt, Bill; Brenner, Eliot; HOO Hoc; RST07 Hoc  
**Subject:** RE: seismic question for today

Josh,

To follow up on my earlier email, please see the attached write up. It is very preliminary but at least it is something for the chairman to work with.

As I mentioned, the answer to this question is open to interpretation, but this is staff's preliminary consensus interpretation. The figures are all very draft, but I hope it gives you an indication of the plots we are developing. As I mentioned, we intend to develop a 2 to 3 public friendly fact sheet to thoroughly and clearly answer the questions that the chairman is getting.

Also, you can refer to the Seismic Q&As and there is a one page high level overview of our seismic regs that Cliff wrote yesterday that may be of help. That is found on page 66.

Please feel free to call me with any questions or if I may be of further assistance.

(b)(6)

If someone would have told me a month ago I'd be sending such a draft document for the chairman to see, I wouldn't have believed it. But I guess desperate times call for desperate measures.

Good luck with the preparations.

Cheers,  
Annie

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**From:** Batkin, Joshua  
**Sent:** Saturday, March 19, 2011 4:35 PM  
**To:** Sheron, Brian; HOO Hoc  
**Cc:** Borchardt, Bill; Brenner, Eliot  
**Subject:** seismic question for today

The Chairman keeps getting asked a question along the lines of 'how many of our plants are in/near seismically active areas.' Is there a specific numerical way to answer this i.e maybe like there are X number in high seismic areas or near faults etc.? Thank you Josh

CH/148

Josh,

Here's some information we've compiled, but it is very preliminary. We have not run this by everyone who may want to weigh in. However, it may help for tomorrow.

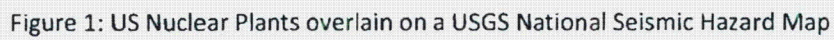
We are working on getting this information written up properly so that we can publish it as a fact sheet as soon as possible.

Some Key Points:

(b)(5)







(b)(5)



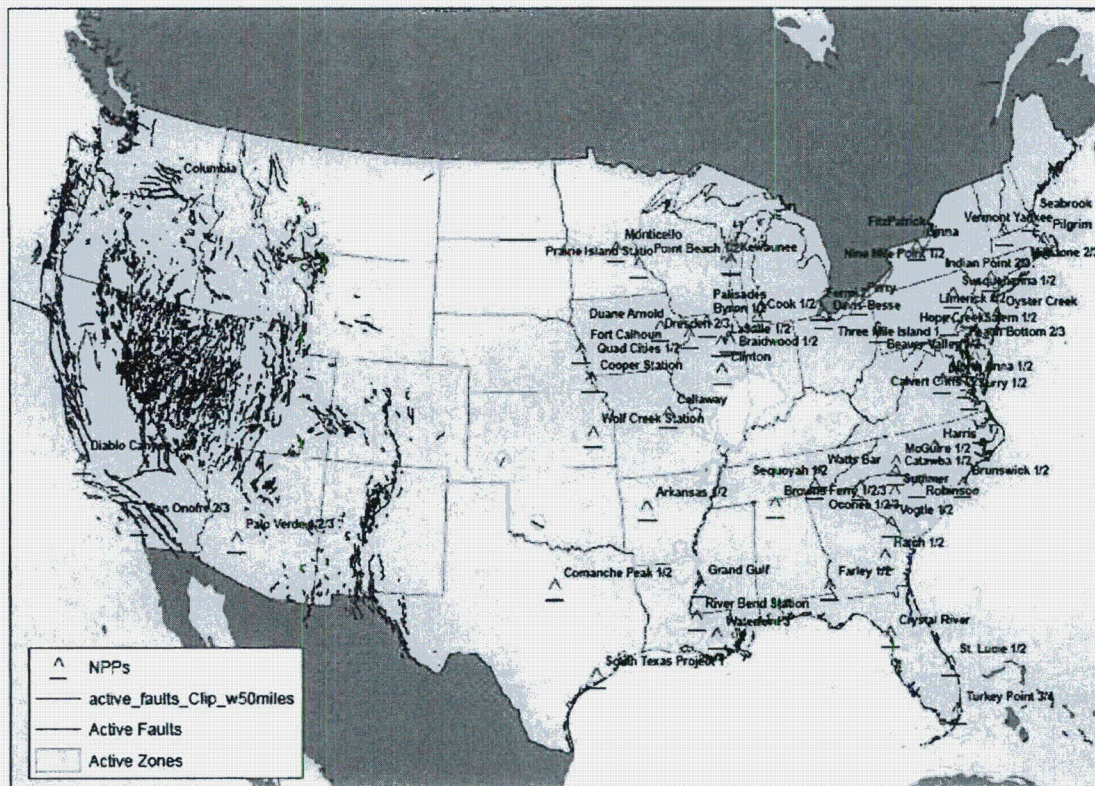


Figure 2: This figure shows mapped active faults and US Nuclear plants

(b)(5)



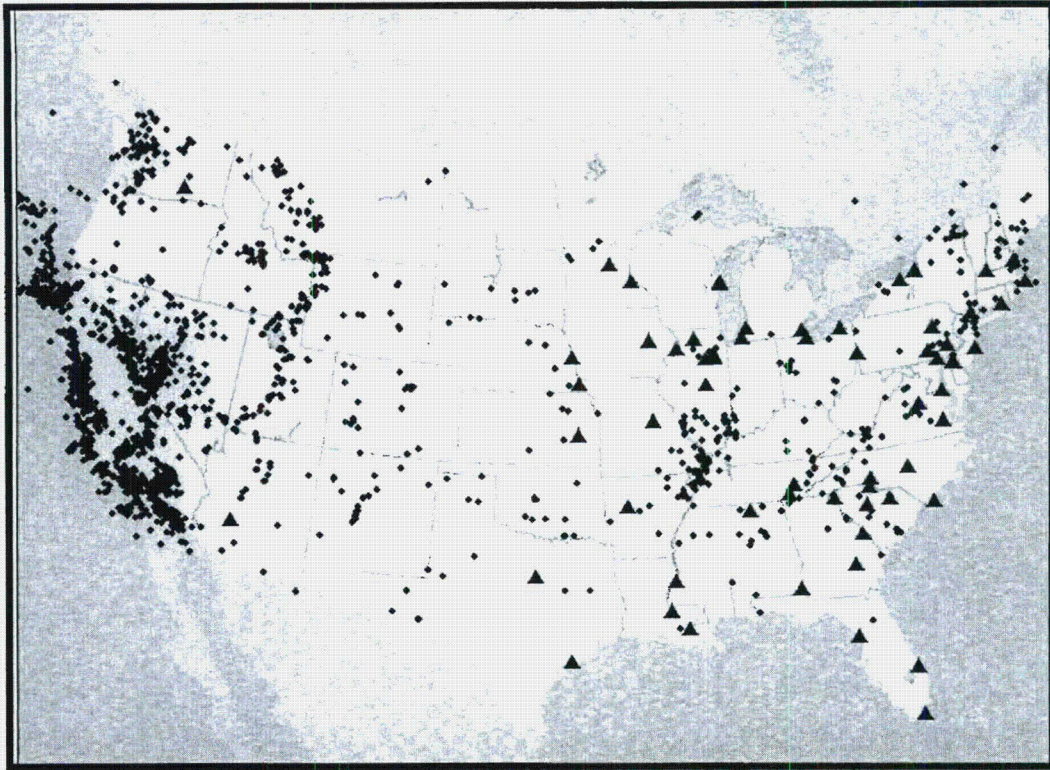


Figure 3: Earthquakes versus US Nuclear Plants

(b)(5)

(b)(5)

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# Compiled Seismic Questions for NRC Response to the March 11, 2011 Japanese Earthquake and Tsunami

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**This is current as of 3-19-11 at 8am.**

***The keeper of this file is Annie Kammerer. Please provide comments, additions and updates to Annie with CC to Clifford Munson and Jon Ake.***

***A SharePoint site has been set up so that anyone can download the latest Q&As. The site is found at NRC>NRR>NRR TA or at  
<http://portal.nrc.gov/edo/nrr/NRR%20TA/FAQ%20Related%20to%20Events%20Occuring%20in%20Japan/Forms/AllItems.aspx>***

***A list of topics is shown in the Table of Contents at the front of this document.***

***A list of all questions is provided at the end of the document.***

***A list of terms and definitions is included at the end of the document.***

***We greatly appreciate the assistance of the many people who have contributed to this document. Please do not distribute beyond the NRC.***

Printed 3/19/2011 8:25 AM

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**CONTENTS**

<b>Natural Hazards and Ground Shaking Design Levels .....</b>	<b>1</b>
<b>Design Against Natural Hazards &amp; Plant Safety in the US.....</b>	<b>6</b>
<b>Seismically Induced Internal Flooding.....</b>	<b>12</b>
<b>Seismically Induced Internal Flooding.....</b>	<b>13</b>
<b>About Japanese Hazard, Design and Earthquake Impact.....</b>	<b>14</b>
<b>What Happened to US Nuclear Power Plants During the March 11, 2011 Earthquake and Tsunami? .....</b>	<b>17</b>
<b>Response and Future Licensing Actions .....</b>	<b>18</b>
<b>Reassessment of US Plants and GI-199 .....</b>	<b>19</b>
<b>Seismic Probabilistic Risk Assessment (SPRA) .....</b>	<b>29</b>
<b>Plant-Specific Questions .....</b>	<b>30</b>
San Onofre Nuclear Generating Station (SONGS) Questions .....	30
Diablo Canyon Nuclear Power Plant (DCNPP) Questions .....	34
Indian Point Questions.....	37
<b>Pending and Unanswered Questions from Members of Congress.....</b>	<b>38</b>
<b>Questions for the Japanese .....</b>	<b>43</b>
<b>Additional Information: Useful Tables .....</b>	<b>45</b>
Table of Design Basis Ground Motions for US Plants .....	45
Table of SSE, OBE and Tsunami Water Levels.....	47
Table of Plants Near Known Active Faults .....	52
Table From GI-199 Program Containing SSE, SSE Exceedance Frequencies, Review Level Earthquakes, and Seismic Core Damage Frequencies .....	53
Design Basis Ground Motions and New Review Level Ground Motions Used for Review of Japanese Plants.....	58
Status of Review of Japanese NPPs to New Earthquake Levels Based on 2006 Guidance.....	59
<b>Additional Information: Useful Plots .....</b>	<b>60</b>
Plot of Mapped Active Quaternary Faults and Nuclear Plants in the US.....	60
Nuclear Plants in the US Compared to the USGS National Seismic Hazard Maps.....	61
USGS US National Seismic Hazard Maps.....	61
UCERF Map of California Earthquake Probabilities for Northern versus Southern California .....	62
Plot of Nuclear Plants in the US Compared to Recent Earthquakes.....	63
Plot of Tsunami Wave Heights at the Japanese Plants (NOAA) .....	64

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<b>Additional Information: Fact Sheets .....</b>	<b>66</b>
Fact Sheet: Summarization of the NRC's Regulatory Framework for Seismic Safety (High level overview) .....	66
Fact Sheet: Summarization of the NRC's Regulatory Framework for Seismic Safety (The policy work version) .....	68
Fact Sheet: Summarization of the NRC's Regulatory Framework for Seismic Safety (The cliff notes)... ..	70
Fact Sheet: Summarization of the NRC's Regulatory Framework for Tsunami .....	71
Fact Sheet: Summarization of the NRC's Regulatory Framework for Flooding .....	73
Fact Sheet: Summarization of Seismological Information from Regional Instrumentation .....	75
Fact Sheet: Protection of Nuclear Power Plants against Tsunami Flooding .....	76
Fact Sheet: Seismicity of the Central and Eastern US .....	78
Fact Sheet: US Portable Array Information.....	80
<b>Additional Information: Terms and Definitions.....</b>	<b>82</b>
<b>List of Questions.....</b>	<b>87</b>

## Natural Hazards and Ground Shaking Design Levels

### 1) Does the NRC consider earthquakes of magnitude 9?

**Public response:** This earthquake was caused by a "subduction zone" event, which is the type of earthquake that can produce the largest magnitudes. A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate. In the continental US, the only subduction zone is the Cascadia subduction zone which lies off the coast of northern California, Oregon and Washington. As a result, magnitude 9 events would only be considered for this particular seismic source. The NRC requires all credible earthquakes that may impact a site to be considered.

**Additional, technical, non-public information:** I changed the above somewhat from a "standard" answer we already had...it would be great if Cliff would review!

### 2) Did the Japanese underestimate the size of the maximum credible earthquake that could affect the plants?

**Public response:** The magnitude of the earthquake was somewhat greater than was expected for that part of the subduction zone. (A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate.) However, the Japanese nuclear plants were recently reassessed using ground shaking levels similar to those that are believed to have occurred at the sites. The review level ground motions were expected to result from earthquakes that were smaller, but were much closer to the sites. The NRC does not currently have information on the height of the tsunami that was expected for the site.

**Additional, technical, non-public information:** A PDF file provided by John Anderson (prepared by Japanese colleagues) indicates that the majority of the recorded ground motions during the main shock were below the attenuation curve by Si & Midorikawa (1999). Most of the recorded motions fit well to median minus 1 sigma of their GMPE. There are also about a dozen stations with the recorded ground motions above 1g. The highest recorded PGA (~3g) is at the K-Net station MYG004. We can use this information to try to estimate motions at the plants as soon as someone catches a breath.

### 3) Can this kind of very large earthquake and tsunami happen here?

**Public response:** See below.

### 4) What if an earthquake like the Sendai earthquake occurred near a US plant?

**Public response:** This earthquake was caused by a "subduction zone" event, which is the type of earthquake that can produce the largest magnitudes. A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate. In the continental US, the only subduction zone is the Cascadia subduction zone which lies off the coast of northern California, Oregon and Washington. In addition, only subduction zone earthquakes cause the kind of massive tsunami seen in Japan. So, an earthquake and tsunami this large could only happen in that region. The only plant in that area is Columbia, which is far from the coast and the subduction zone. Outside of the Cascadia subduction zone, earthquakes are not expected to exceed a magnitude of approximate 8. Magnitude is measured on a log scale and so a magnitude 9 earthquake is ten times larger than a magnitude 8 earthquake.

**Additional, technical, non-public information:** None.



**5) What magnitude earthquake are US plants designed to?**

**Public Answer:** Each plant is designed to a ground-shaking level that is appropriate for its location, given the possible earthquake sources that may affect the site and its tectonic environment. Ground shaking is a function of both the magnitude of an earthquake and the distance from the fault to the site. So actually nuclear plants, and in fact all engineer structures, are actually designed based on ground shaking levels, not magnitudes. The existing plants were designed on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquakes expected in the area around the plant. Several tables that include plant design ground motions are provided as the first table in the "additional information" section of this document.

**Additional, technical non-public information:** In the past, "deterministic" or "scenario based" analyses were used to determine ground shaking (seismic hazard) levels. Now a probabilistic method is used that accounts for possible earthquakes of various magnitudes that come from potential sources (including background seismicity) and the likelihood that each particular hypothetical earthquake occurs. The ground motions that are used as seismic design bases at US nuclear power plants are called the Safe Shutdown Earthquake ground motion (SSE) and are described mathematically through use of a response spectrum. On the west coast of the US, the two nuclear power plants are designed to specific ground motions that are determined from earthquakes of about magnitude 7 (SONGS) and 7.5 (Diablo) on faults located just offshore of the plants. Because the faults are well characterized, the magnitude and distances are known. However the design and licensing bases are still the ground motions...not the earthquakes. The earthquakes on these faults are mainly strike-slip (horizontal motion) type earthquakes, not subduction zone earthquakes. Therefore, the likelihood of a tsunami from these faults is remote.

**6) How many US reactors are located in active earthquake zones (and which reactors)?**

**Public Answer:** Although we often think of the US as having "active" and "non-active" earthquake zones, earthquakes can actually happen almost anywhere. Seismologists typically separate the US into low, moderate, and high seismicity zones. The NRC requires that every plant be designed for site-specific ground motions that are appropriate for their locations. In addition, the NRC has specified a minimum ground shaking level to which plants must be designed.

**Additional, technical non-public information:** Generally, seismic activity in the regions surrounding most US plants is much lower than that for Japan since most US plants are located in the interior of the stable continental US. However, the most widely felt earthquakes within the continental US were the 1811-12 New Madrid sequence and the 1886 Charleston, SC, which were estimated to be between about magnitude 7.0 to 7.75. There are also two plants that are in highly seismically active areas of California.

**7) Has this changed our perception of earthquake risk to the plants in the US?**

**Public Answer:** This does not change the NRC's perception of earthquake hazard (i.e. ground shaking) at US plants. It is too early to tell what the lessons from this earthquake are from an engineering perspective. The NRC will look closely at all aspects of response of the plants to the earthquake and tsunami to determine if any actions need to be taken in US plants and if any changes are necessary to NRC regulations.

**Additional, technical, non-public information:** We expect that there would be lessons learned and we may need to seriously relook at common cause failures, including dam failure and tsunami.

**8) Can this happen here (i.e., an earthquake that significantly damages a nuclear power plant)? Are the Japanese plants similar to US plants?**

**Public Answer:** All US nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants that are located within areas with low and moderate seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety-significant structures, systems, and components be designed to take into account even rare and extreme seismic and tsunami events. In addition to the design of the plants, significant effort goes into emergency response planning and accident mitigation. This approach is called defense-in-depth.

The Japanese facilities are similar in design to several US facilities.

**Additional technical, non-public information:** Currently operating reactors were designed using a "deterministic" or "maximum credible earthquake" approach. Seismic hazard for the new plants is determined using a probabilistic seismic hazard assessment approach that explicitly addresses uncertainty and the potential for beyond-design-basis earthquakes, as described in Regulatory Guide 1.208. The NRC requires that adequate margin beyond the design basis ground shaking levels is assured. The NRC further enhances seismic safety for beyond-design-basis events through the use of a defense-in-depth approach.

In addition, the NRC reviews the seismic risk at operating reactors as needed when information may have changed. Over the last few years the NRC has undertaken a program called Generic Issue 199, which is focused on assessing hazard for plants in the central and eastern US using the latest techniques and data and determining the possible risk implications of any increase in the anticipated ground shaking levels. This program will help us assure that the plants are safe under exceptionally rare and extreme ground motions that represent beyond-design-basis events.

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

**Public response:** *Discuss in terms of: IPEEE, Seismic PRA to be provided by Niles*

**Additional, technical, non-public information:** ADD

**10) What level of earthquake hazard are the US reactors designed for?**

**Public Answer:** Each reactor is designed for a different ground motion that is determined on a site-specific basis. The existing plants were designed on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquake expected in the area around the plant. New reactors are designed using probabilistic techniques that characterize the hazard (i.e. ground shaking levels) and uncertainty at the proposed site. Ground motions from all potential seismic sources in the region are estimated and used to develop an appropriate site specific ground motion. Technically speaking this is the ground motion with an annual frequency of  $1 \times 10^{-4}$ ; but this can be thought of as the ground motion that occurs every 10,000 years on average.

**Additional technical, non-public information:** Note to OPA: This may perhaps seem like an oddly worded general question because the word "hazard" has several meanings, but in fact it is a specific technical question. If you see "earthquake hazard levels" or similar language, check with the seismic staff.

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### **11) What is the likelihood of the design basis or "SSE" ground motions being exceeded over the life of the plant?**

**Public response:** The ground motions that are used as seismic design bases at US nuclear power plants are called the Safe Shutdown Earthquake ground motion (SSE) and are described mathematically through use of a response spectrum. To estimate the probability of exceeding any specified ground motion level, such as an SSE, during a given time interval, the Poisson model is generally used. The NRC recently performed these types of estimates as part of its Generic Issue 199 (GI-199) program. The mean probability value for ground motions exceeding the SSE for the plants in the Central and Eastern United States is less than 2%, with values ranging from a low of 0.1% to a high of 6%.

It is important to remember that structures, systems and components are required to have "adequate margin", meaning that they must be able withstand shaking levels that are above the plant's design basis. In the mid to late 1990s, the NRC staff reviewed the potential for ground motions beyond the design basis as part of the Individual Plant Examination of External Events (IPEEE). From this review, the staff determined that seismic designs of operating plants in the United States have adequate safety margins for withstanding earthquakes built into the designs. Currently, the NRC is in the process of conducting the GI-199 to again assess the resistance of US nuclear plants to earthquake.

**Additional technical, non-public information:** There is a section of this document focused on questions related to GI-199.

### **12) What is magnitude anyway? What is the Richter Scale? What is intensity?**

An earthquake's magnitude is a measure of the strength of the earthquake as determined from seismographic observations. Magnitude is essentially an objective, quantitative measure of the size of an earthquake. The magnitude can be expressed in various ways based on seismographic records (e.g., Richter Local Magnitude, Surface Wave Magnitude, Body Wave Magnitude, and Moment Magnitude). Currently, the commonly used magnitude measurement is the Moment Magnitude, Mw, which is based on the strength of the rock that ruptured, the area of the fault that ruptured, and the average amount of slip. Moment magnitude is, therefore, a direct measure of the energy released during an earthquake. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology and was based on the behavior of a specific seismograph that was manufactured at that time. The instruments are no longer in use and the magnitude scale, therefore, is no longer used in the technical community. However, the Richter Scale is a term that is so commonly used by the public that scientists generally just answer questions about "Richter" magnitude by substituting moment magnitude without correcting the misunderstanding.

The intensity of an earthquake is a qualitative assessment of effects of the earthquake at a particular location. The intensity assigned is based on observed effects on humans, on human-built structures, and on the earth's surface at a particular location. The most commonly used scale in the US is the Modified Mercalli Intensity (MMI) scale, which has values ranging from I to XII in the order of severity. MMI of I indicates an earthquake that was not felt except by a very few, whereas MMI of XII indicates total damage of all works of construction, either partially or completely. While an earthquake has only one magnitude, intensity depends on the effects at each particular location.

**13) How do magnitude and ground motion relate to each other?**

ADD from public documents

**14) How many reactors are along coastal areas that could be affected by a tsunami (and which ones)?**

**Public Answer:** Many plants are located in coastal areas that could potentially be affected by tsunami. Two plants, Diablo Canyon and San Onofre, are on the Pacific Coast, which is known to have tsunami hazard. There are also two plants on the Gulf Coast, South Texas and Crystal River. There are many plants on the Atlantic Coast or on rivers that may be affected by a tidal bore resulting from a tsunami. These include St. Lucie, Turkey Point, Brunswick, Oyster Creek, Millstone, Pilgrim, Seabrook, Calvert Cliffs, Salem/Hope Creek, and Surry. Tsunami on the Gulf and Atlantic Coasts occur, but are very rare. Generally the flooding anticipated from hurricane storm surge exceeds the flooding expected from a tsunami for plants on the Atlantic and Gulf Coast. Regardless, all nuclear plants consider tsunami in their designs.

**Additional, technical non-public information:** A table with information on tsunami design levels is provided in the "Additional Information" section of this document.

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

**Public response:** *Request for answer by Henry Jones, Goutam Bagchi and/or Richard Raione (once the tsunami fact sheet is done and you have time).*

**Additional, technical, non-public information:** ADD

**16) How are combined seismic and tsunami events treated in risk space? Are they considered together?**

The PRA Standard (ASME/ANS-Ra-Sa2009) does address the technical requirements for both seismic events and tsunamis (tsunami hazard under the technical requirements for external flooding analysis). But together? The standard does note that uncertainties associated with probabilistic analysis of tsunami hazard frequency are large and that an engineering analysis can usually be used to screen out tsunamis.

**17) How are aftershocks treated in terms of risk assessment?**

Seismic PRAs do not consider the affect of aftershocks since there are not methods to predict equipment fragility after the first main shock.

## **Design Against Natural Hazards & Plant Safety in the US**

### **19) Are nuclear power plants designed for tsunamis?**

**Public Answer:** Yes. Plants are built to withstand a variety of environmental hazards and those plants that might face a threat from tsunami are required to withstand large waves and the maximum wave height at the intake structure (which varies by plant.)

**Additional, technical, non-public information:** Tsunami are considered in the design of US nuclear plants. Nuclear plants are designed to withstand flooding from not only tsunami, but also hurricane and storm surge; therefore there is often significant margin against tsunami flooding. However, it should be noted that Japanese experience has shown that drawdown can be a significant problem.

Currently the US NRC has a tsunami research program that is focused on developing modern hazard assessment techniques and additional guidance through cooperation with the National Oceanic and Atmospheric Administration and the United States Geological Survey. This has already lead to several technical reports and an update to NUREG 0-800. The NOAA and USGS contractors are also assisting with NRO reviews of tsunami hazard. A new regulatory guide on tsunami hazard assessment is currently planned in the office of research, although it is not expected to be available in draft form until 2012.

### **20) What level of tsunami are use nuclear plants designed for?**

**Public Answer:** Like seismic hazard, the level of tsunami that each plant is designed for is site-specific and is appropriate for what may occur at each location.

**Additional, technical, non-public information:** None.

### **21) Which plants are close to known active faults? What are the faults and how far away are they from the plants?**

**Public Answer:** Jon to develop answer with Dogan's help. I created a placeholder table for your use "Table of Plants Near Known Active Faults" to be populated in the additional information section. The plots that Dogan made are in the additional information section under "Plot of Mapped Active Quaternary Faults and Nuclear Plants in the US". This is really high priority after the congressional hearings.

**Additional, technical, non-public information:** ADD

### **22) How was the seismic design basis for an existing nuclear power plant established?**

**Public Answer:** The seismic ground motion used for the design basis was determined from the evaluation of the maximum historic earthquake within 200 miles of the site, without explicitly considering the time spans between such earthquakes; safety margin was then added beyond this maximum historic earthquake to form a hypothetical *design basis earthquake*. The relevant regulation for currently operating plants is 10 CFR Part 100, Appendix A, "Seismic and Geologic Siting Criteria for Nuclear Power Plants" (<http://www.nrc.gov/reading-rm/doc-collections/cfr/part100/part100-appa.html>).

**Additional, technical, non-public information:** See discussion at end of GI-199 section for discussion of safety margin and design basis.

**23) Is there margin above the design basis?**

**Public Answer:** Yes, there is margin beyond the design basis. In the mid to late 1990s, NRC staff reviewed the plants' assessments of potential consequences of severe earthquakes (earthquakes beyond the safety margin included in each plant's design basis), which licensees performed as part of the Individual Plant Examination of External Events (or IPEEE) program. From this review, the staff determined that seismic designs of operating plants in the United States have adequate safety margins, for withstanding earthquakes, built into the designs.

**Additional, technical, non-public information:** None.

**24) Are US plants safe?**

**Public Answer:** US plants are designed for appropriate earthquake shaking levels and are safe. Currently the NRC is also conducting a program called Generic Issue 199 (GI-199), which is reviewing the adequacy of earthquake design of US nuclear power plants in the central and eastern North America based on the latest data and analysis techniques.

**Additional, technical, non-public information:** None.

**25) Was the Japanese plant designed for this type of accident? Are US nuclear plants?**

**Public Answer:** Nuclear plants in both the US and Japan are designed for earthquake shaking. In addition to the design of the plants, significant effort goes into emergency response planning and accident mitigation. This approach is called defense-in-depth.

**Additional, technical, non-public information:** None.

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

**Public Answer:** Nuclear plants in both the US and Japan are designed for earthquake shaking. In addition to the design of the plants, significant effort goes into emergency response planning and accident mitigation. This approach is called defense-in-depth.

**Additional, technical, non-public information:** None.

**27) Can this happen here (i.e., an earthquake that significantly damages a nuclear power plant)? Are the Japanese plants similar to US plants?**

**Public Answer:** All US nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants that are located within areas with low and moderate seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety-significant structures, systems, and components be designed to take into account even rare and extreme seismic and tsunami events. Nuclear power plants are designed to be safe based on the most severe natural phenomena historically reported for the site and surrounding area. The Japanese facilities are similar in design to several US facilities.

**Additional technical, non-public information:** Currently operating reactors were designed using a "deterministic" or "maximum credible earthquake" approach. Seismic hazard for the new plants is determined using a probabilistic seismic hazard assessment approach that explicitly addresses uncertainty, as described in Regulatory Guide 1.208. The NRC requires that adequate margin beyond the design basis ground shaking levels is assured. The NRC further enhances seismic safety for beyond-design-basis events through the use of a defense-in-depth approach.

In addition, the NRC reviews the seismic risk at operating reactors as needed when information may have changed. Over the last few years the NRC has undertaken a program called Generic Issue 199, which is focused on assessing hazard for plants in the central and eastern US using the latest techniques and data and is determining the possible risk implications of any increase in the anticipated ground shaking levels. This program will help us assure that the plants are safe under exceptionally rare and extreme ground motions that represent beyond-design-basis events.

The reactor design is a Boiling Water Reactor that is similar to some US designs, including Oyster Creek, Nine Mile Point and Dresden Units 2 and 3.

**28) Could an accident sequence like the one at Japan's Fukushima Daiichi nuclear plants happen in the US?**

**Public response:** It is difficult to answer this question until we have a better understanding of the precise problems and conditions that faced the operators at Fukushima Daiichi. We do know, however, that Fukushima Daiichi Units 1-3 lost all offsite power and emergency diesel generators. This situation is called "station blackout." US nuclear power plants are designed to cope with a station blackout event that involves a loss of offsite power and onsite emergency power. The Nuclear Regulatory Commission's detailed regulations address this scenario. US nuclear plants are required to conduct a "coping" assessment and develop a strategy to demonstrate to the NRC that they could maintain the plant in a safe condition during a station blackout scenario. These assessments, proposed modifications and operating procedures were reviewed and approved by the NRC. Several plants added additional AC power sources to comply with this regulation.

In addition, US nuclear plant designs and operating practices since the terrorist events of September 11, 2001, are designed to mitigate severe accident scenarios such as aircraft impact, which include the complete loss of offsite power and all on-site emergency power sources.

US nuclear plant designs include consideration of seismic events and tsunamis'. It is important not to extrapolate earthquake and tsunami data from one location of the world to another when evaluating these natural hazards. These catastrophic natural events are very region- and location-specific, based on tectonic and geological fault line locations.

**Additional technical, non-public information:** None

**29) Should US nuclear facilities be required to withstand earthquakes and tsunamis of the kind just experienced in Japan? If not, why not?**

**Public response:** US nuclear reactors are designed to withstand an earthquake equal to the most significant historical event or the maximum projected seismic event and associated tsunami without any breach of safety systems.

The lessons learned from this experience must be reviewed carefully to see whether they apply to US nuclear power plants. It is important not to extrapolate earthquake and tsunami data from one location of the world to another when evaluating these natural hazards, however. These catastrophic natural events are very region- and location-specific, based on tectonic and geological fault line locations.

The United States Geological Survey (USGS) conducts continuous research of earthquake history and geology, and publishes updated seismic hazard curves for various regions in the continental US. These curves are updated approximately every six years. NRC identified a generic issue (GI-199) that is currently undergoing an evaluation to assess implications of this new information to nuclear plant sites located in the central and eastern United States. The industry is working with the NRC to address this issue.

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**Additional technical, non-public information:** None

**30) Can you summarize the plant seismic design basis for the US plants? Are there any special issues associated with seismic design?**

**Public response:** Please see one of the several tables provided in the "Additional information" section of this document.

**Additional, technical, non-public information:** None

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

**Public response:** All equipment important to safety (required to safely shutdown a nuclear power plant) is qualified to withstand earthquakes in accordance with plants' licensing basis and NRC regulations.

**Additional, technical, non-public information:** 10 CFR 50, Appendix A, General Design Criterion 2 and 4, 10 Part 100, and Appendix S. Guidance: Regulatory Guides 1.100, IEEE 344 and ASME QME-1

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

**Public response:** Nuclear plant systems are designed to mitigate a design basis earthquake which includes margin above the postulated site specific earthquake. (reviewers comment: this needs to be expanded)

**Additional, technical, non-public information:** See part 100 Reactor Site Criteria

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

**Public response:** NRC recognized that there is the possibility of a total loss of AC power at a site, called a 'Station Blackout', or SBO. Existing Regulations require the sites to be prepared for the possibility of an SBO. In addition to battery powered back-up system to immediately provide power for emergency systems, NRC regulations require the sites to have a detailed plan of action to address the loss of AC power while maintaining control of the reactor.

There has also been an understanding that sites can lose offsite power as well. Of course, this can be caused by earthquake. However, hurricane- or tornado-related high winds may potentially damage the transmission network in the vicinity of a nuclear plant as well. Flood waters can also affect transformers used to power station auxiliary system. These types of weather related events have the potential to degrade the offsite power source to a plant.

The onsite Emergency Diesel Generators need fuel oil stored in tanks that are normally buried underground. These tanks and associated pumps and piping require protection from the elements. Above ground tanks have tornado and missile protection.

In case both offsite and onsite power supplies fail, NRC has required all licensee to evaluate for a loss of all AC power (station blackout) scenario and implement coping measures to safely shutdown the plant law 10 CFR 50.63.

**Additional, technical, non-public information:** Some plants have safeguards equipment below sea level and rely on watertight doors or Bilge pumps to remove water from equipment required to support safe shutdown. Overflowing rivers can result in insurmountable volume of water flooding the vulnerable areas. SBO definition in 10CFR50.2, SBO plan requirements in 10CFR50.63



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**34) How do we know that the emergency diesel generators in Diablo Canyon and SONGS will not fail to operate like in Japan?**

**Public response:** Emergency Diesel Generators are installed in a seismically qualified structure. Even if these EDGs fail, plants can safely shutdown using station blackout power source law 10 CFR 50.63.

**Additional, technical, non-public information:** None.

**35) Is all equipment at the plant vulnerable to tsunami?**

**Public response:** Nuclear plants are designed to withstand protection against natural phenomena such as tsunami, earthquakes. (reviewers comment: this needs to be expanded. I need assistance with this)

**Additional, technical, non-public information:** ADD

**36) What protection measures do plants have against tsunami?**

**Public response:** Plants are designed to withstand protection against natural phenomena such as tsunami, earthquakes. (note from reviewer: add information on breakwater from songs and Diablo example. I need assistance with this)

**Additional, technical, non-public information:** ADD

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

**Public response:** *Goutam, Henry and Rich, can you guys answer this?*

**Additional, technical, non-public information:** ADD

**38) Are nuclear buildings built to withstand earthquakes? What about tsunami?**

**Public response:** *There is language elsewhere in this document that answers that...copy here.*

**Additional, technical, non-public information:** ADD

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

**Public response:** ADD

**Additional, technical, non-public information:** ADD

**40) Are there any special issues associated with seismic design at the plants? For example, Diablo Canyon has special requirements. Are there any others?**

**Public response:** Both SONGS and Diablo canyon are licensed with an automatic trip for seismic events. *(can this be expanded? any others?) Mike Markley, can your group assist with this?*

**Additional, technical, non-public information:** ADD

**41) Is the NRC planning to require seismic isolators for the next generation of nuclear power plants? How does that differ from current requirements and/or precautions at existing US nuclear power plants?**

**Public response:** The NRC would not require isolators for the next generation of plants. However, it is recognized that a properly designed isolation system can be very effective in mitigating the effect of earthquake. Currently the NRC is preparing guidance for plant designers considering the use of seismic isolation devices.

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**Additional, technical, non-public information:** A NUREG is in the works in the office of research. It is expected to be available for comment in 2011.

**42) Are there any US nuclear power plants that incorporate seismic isolators? What precautions are taken in earthquake-prone areas?**

**Public response:** No currently constructed nuclear power plants in the US use seismic isolators. However seismic isolation is being considered for a number of reactor designs under development. Currently seismic design of plants is focused on assuring that design of structures, systems, and components are designed and qualified to assure that there is sufficient margin beyond the design basis ground motion.

**Additional, technical, non-public information:** None.

**43) Do you think that the recent Japan disaster will cause any rethinking of the planned seismic isolation guidelines, particularly as it regards earthquakes and secondary effects such as tsunamis?**

**Public response:** Whenever an event like this happens, the NRC thoroughly reviews the experience and tries to identify any lessons learned. The NRC further considers the need to change guidance or regulations. In this case, the event will be studied and any necessary changes will be made to the guidance under development. However, it should be noted that Japan does not have seismically isolated nuclear plants.

**Additional, technical, non-public information:** None.

## Seismically Induced Fire

### **44) How does the NRC address seismic-induced fire?**

The NRC's rules for fire protection are independent of the event that caused the fire. The power plant operators are required to evaluate all the fire hazards in the plant and make sure a fire will not prevent a safe plant shutdown. The NRC's guidance says that power plant operators should assume that a fire can happen at any time. The rules do not require specific consideration of a fire that starts as a result of an earthquake. In addition, we do not require analysis of more than one fire at a time at one reactor.

### **45) Does the NRC require the fire protection water supply system be designed to withstand an earthquake?**

Yes, NRC's guidance recommends all areas of the plant that contain equipment required to safely shutdown have at least 2 standpipes for firefighting and a source of water that will work after a severe earthquake. NRC requires that there are enough pumps, even assuming the largest pump fails during a severe earthquake or there is a loss of power, to supply the fire protection system. This can be accomplished, for example, by providing either electric-motor-driven fire pumps and separate diesel-driven fire pumps or two or more electric-motor-driven fire pumps that can survive a severe earthquake or a loss of power.

The NRC's guidance recommends that fire detection, alarm, and suppression systems function as designed after less severe earthquakes that are expected to occur once every 10 years. The guidance recommends plant operators in areas of high seismic activity consider the need to design those fire protection systems to function after a severe earthquake.

### **46) How are safe shutdown equipment protected from an oil spill which can cause potential fire?**

The pumps that are used to pump water through the reactor use oil as a lubricant. The NRC requires that plants have a way to collect this oil. The NRC requires this oil collection system to be designed so that a severe earthquake does not cause the oil to start a fire.

### **47) How are safe shutdown equipment protected from a hydrogen fire?**

The NRC recommends that pipes that contain hydrogen are designed to withstand a severe earthquake. This design includes a separate pipe wrapped around the hydrogen pipe that vents any leaked hydrogen to the outside.

## Seismically Induced Internal Flooding

### **48) How does the NRC consider seismically induced equipment failures leading to internal flooding?**

10 CFR Part 50 Appendix A General Design Criterion (GDC) 2 requires, in part, that structures, systems, and components (SSCs) important to safety be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. 10 CFR Part 50 Appendix A, GDC 4 requires the SSCs important to safety being designed to accommodate the effects of the flooding associated with seismic events. NUREG-0800, Standard Review Plan, Section 3.4.1, "Internal Flood Protection for Onsite Equipment Failures," provide guidance for the NRC staff to consider seismically induced equipment failures (pipe breaks, tank failures) that could affect safety-related SSCs to perform their safety functions.

The specific areas of review include the following :

- Identify all safety-related SSCs that must be protected against flooding;
- The location of the safety-related SSCs relative to the **internal flood level** (from internal flood analysis) in various buildings, rooms, and enclosures that house safety-related SSCs;
- Possible flow paths from interconnected non-safety-related areas to rooms that house safety-related SSCs;
- The adequacy of the isolation, if applicable, from sources causing the flood (e.g., tank of water )
- Provisions for protection against possible in-leakage sources (from outside to inside of the structures)
- All SSCs that could be a potential source of internal flooding (e.g. pipe breaks and cracks, tank and vessel failures, backflow through drains), **which includes seismically induced equipment failures**, are included for the internal flood analysis – see Q&A (2);
- Design features that will be used to mitigate the effects of internal flooding (e.g., adequate drainage, sump pumps, etc.);
- Safety-related structures that are protected from below-grade groundwater seepage by means of a permanent dewatering system.

### **49) How is the potential source of internal flooding from the seismically induced equipment failures postulated in the internal flood analysis?**

All of the non-safety-related systems in the room are assumed to fail. However, the analysis systematically considers the flooding condition/level caused by only one system at a time. By considering the pipe size, volume of the source tank, and the isolation valves, the limiting case, which is the one that releases the largest volume of water, is used to determine the internal flood level. All of the safety-related SSCs are designed to be located above the calculated flood level caused by the limiting case.

### **50) Are the non-safety-related equipment failures assumed to occur at the same time?**

No. As stated earlier, for design basis flood analysis, it is assumed that a system (containing water source) fails one at a time. Then, the most limiting case, a system breach that causes highest level of flooding, is applied in the design of the location of the safety-related systems.

## About Japanese Hazard, Design and Earthquake Impact

### 51) Was the damage to the plants mostly from the earthquake or the tsunami?

**Public response:** Because this even happened in Japan, it is hard for NRC staff to make a full assessment necessary to tell exactly what happened. In the nuclear plants there seems to have been some damage from the shaking. However, the tsunami appears to have led to the biggest problems in terms of the loss of backup power (i.e., station blackout).

**Additional, technical, non-public information:** None

### 52) What was the disposition of the plant during the time after the earthquake struck and before the tsunami arrived? Was there indication of damage to the plant solely from the earthquake (if so, what systems) and did emergency procedures function during this time.

**Public response:** Given that the Fukushima plant is not in the US, the NRC does not yet have enough information to answer this question.

**Additional, technical, non-public information:** Typically there would be the opportunity to get this data, but given the situation it is not clear.

### 53) What magnitude earthquake was the plant designed to withstand? For example, what magnitude earthquake was the plant expected to sustain with damage but continued operation? And with an expected shutdown but no release of radioactive material?

**Public response:** There are two shaking levels relevant to the Fukushima plant, the original design level ground motion and a newer review level ground motion. As a result of a significant change in seismic regulations in 2006, NISA, the Japanese regulator initiated a program to reassess seismic hazard and seismic risk for all nuclear plants in Japan. This resulted in new assessments of higher ground shaking levels (i.e. seismic hazard) and a review of seismic safety for all Japanese plants. The program is still ongoing, but has already resulted in retrofit in some plants. Therefore, it is useful to discuss both the design level and a review level ground motion for the plants. A relevant table is found a few questions down, and also in the "Additional Information: Useful Tables" section.

Plant sites	Contributing earthquakes used for determination of hazard	New DBGGM $S_s$	Original DBGGM $S_1$
Fukushima	Magnitude 7.1 Earthquake near the site	600 gal (0.62g)	370 gal (0.37g)

**Additional, technical, non-public information:** Add

### 54) Did this reactor sustain damage in the July 16, 2007 earthquake, as the Kashiwazaki power plant did? What damage and how serious was it?

**Public response:** Neither Fukushima power plant was affected by the 2007 earthquake.

**Additional, technical, non-public information:** None.

**55) Was the Fukushima power plant designed to withstand a tsunami of any size? What sort of modeling was done to design the plant to withstand either seismic events or tsunamis? What specific design criteria were applied in both cases?**

**Public response:** Japanese plants are designed to withstand both earthquake and tsunami. An English explanation of how Tsunami hazard assessments are undertaken for Japanese plants is found in Annex II to IAEA Guidance on Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations Assessment of Tsunami Hazard: Current Practice in Some States in Japan. The design ground motions are as shown above. We do not have information on the design basis tsunami.

**Additional, technical, non-public information:** Annie has a copy of the draft annex and will put them into ADAMS

**56) What is the design level of the Japanese plants? Was it exceeded?**

**Public response:** As a result of a significant change in seismic regulations in 2006, the Japanese regulator initiated a program to reassess seismic hazard and seismic risk for all nuclear plants in Japan. This resulted in new assessments of higher ground shaking levels (i.e. seismic hazard) and a review of seismic safety for all Japanese plants. The program is still on-going, but has already resulted in retrofit in some plants. Therefore, it is useful to discuss both the design level and a review level ground motion for the plants, as shown below.

Currently we do not have official information. However, it appears that the ground motions (in terms of peak ground acceleration) are similar to the  $S_s$  shaking levels, although the causative earthquakes are different. Thus the design basis was exceeded, but the review level may not have been.

**Table: Original Design Basis Ground Motions ( $S_2$ ) and New Review Level Ground Motions ( $S_s$ ) Used for Review of Japanese Plants**

Plant sites	Contributing earthquakes used for determination of hazard	New DBGM $S_s$	Original DBGM $S_1$
Onagawa	Soutei Miyagiken-oki (M8.2)	580 gal (0.59g)	375 gal (0.38g)
Fukushima	Earthquake near the site (M7.1)	600 gal (0.62g)	370 gal (0.37g)
Tokai	Earthquakes specifically undefined	600 gal (0.62g)	380 gal (0.39g)
Hamaoka	Assumed Tokai (M8.0), etc.	800 gal (0.82g)	600 gal (0.62g)

**Additional, technical, non-public information:** None

**57) What are the Japanese  $S_1$  and  $S_s$  ground motions and how are they determined?**

**Public response:** Japanese nuclear power plants are designed to withstand specified earthquake ground motions, previously specified as  $S_1$  and  $S_2$ , but now simply  $S_s$ . The design basis earthquake ground motion  $S_1$  was defined as the largest earthquake that can reasonably be expected to occur at the site of a nuclear power plant, based on the known seismicity of the area and local faults that have shown activity during the past 10,000 years. A power reactor could continue to operate safely during an  $S_1$  level earthquake, though in practice they are set to trip at lower levels. The  $S_2$  level ground motion was

based on a larger earthquake from faults that have shown activity during the past 50,000 years and assumed to be closer to the site. The revised seismic regulations in May 2007 replaced  $S_1$  and  $S_2$  with  $S_5$ . The  $S_5$  design basis earthquake is based on evaluating potential earthquakes from faults that have shown activity during the past 130,000 years. The ground motion from these potential earthquakes are simulated for each of the sites and used to determine the revised  $S_5$  design basis ground motion level. Along with the change in definition, came a requirement to consider "residual risk", which is a consideration of the beyond-design-basis event.

**Additional, technical, non-public information:** None

**58) Did this earthquake affect the Kashiwazaki-Kariwa nuclear power plant?**

**Public response:** No, this earthquake did not affect Kashiwazaki-Kariwa nuclear power plant and all reactors remained in the state of operation prior to the March 11, 2011, Japan earthquake. It also did not trip during an earthquake of magnitude XX that occurred on the western side subsequent to the 8.9 earthquake. This is very important for the stability of Japan's energy supply due to the loss of production at TEPCO's Fukushima nuclear power plants.

**Additional, technical, non-public information:** None

**59) How high was the tsunami at the Fukushima nuclear power plants?**

**Public response:** The actual tsunami height at the plants is not currently known. However, NOAA has publically information on the recordings at sea for many areas.

**Additional, technical, non-public information:** A preliminary rough estimate of tsunami height at the plant locations was provided to NRC by NOAA shortly after the earthquake. This was developed using NOAA's global ocean model and is shown in the "additional information" section. Most notably, there was a 6 meter wave at Fukushima and the wave at Onogawa may have been between 18 and 23 meters.

**60) Wikileaks has a story that quotes US embassy correspondence and some un-named IAEA expert stating that the Japanese were warned about this ... Does the NRC want to comment?**

<http://www.dailymail.co.uk/news/article-1366721/Japan-tsunami-Government-warned-nuclear-plants-withstand-earthquake.html>

**Public response:** TBD Annie to explain the history of their recent retrofit program.

**Additional, technical, non-public information:** The article talks about that the plants and that they were checked for a magnitude 7, but the earthquake was a 9. The reality is that they assumed the magnitude 7 close in had similar ground motions to a 9 farther away. They did check (and retrofit) the plant to the ground motions that they probably saw (or nearly). The problem was the tsunami. We probably need a small write up so that staff understands, even if we keep it internal.

## **Impact at US Nuclear Power Plants During the March 11, 2011 Earthquake and Tsunami?**

**61) Was there any damage to US reactors from either the earthquake or the resulting tsunami?**

**Public Answer:** No

**Additional, technical non-public information:** Two US plants on the Pacific Ocean (Diablo Canyon and San Onofre) experienced higher than normal sea level due to tsunami. However, the wave heights were consistent with previously predicted levels and this had no negative impact to the plants. In response, Diablo Canyon Units 1 and 2 declared an "unusual event" based on tsunami warning following the Japanese earthquake. They have since exited the "unusual event" declaration, based on a downgrade to a tsunami advisory.

**62) Have any lessons for US plants been identified?**

**Public Answer:** The NRC is in the process of following and reviewing the event in real time. This will undoubtedly lead to the identification of issues that warrant further study. However, a complete understanding of lessons learned will require more information than is currently available to NRC staff.

**Additional, technical non-public information:** We need to take a closer look at common cause failures, such as earthquake and tsunami, and earthquake and dam failure.



## Response and Future Licensing Actions

**63) What is the NRC doing about the emergencies at the nuclear power plants in Japan? Are you sending staff over there?**

**Public Answer:** We are closely following events in Japan, working with other agencies of the federal government, and have been in direct contact with our counterparts in that country. In addition, we are ready to provide assistance if there is a specific request. An NRC staffer is participating in the USAID team headed to Japan.

**Additional technical, non-public information:** We are taking the knowledge that the staff has about the design of the US nuclear plants and we are applying this knowledge to the Japan situation. For example, this includes calculations of severe accident mitigation that have been performed.

**64) With NRC moving to design certification, at what point is seismic capability tested – during design or modified to be site-specific? If in design, what strength seismic event must these be built to withstand?**

**Public Answer:** During design certification, vendors propose a seismic design in terms of a ground motion spectrum for their nuclear facility. This spectrum is called a standard design response spectrum and is developed so that the proposed nuclear facility can be sited at most locations in the central and eastern United States. The vendors show that this design ground motion is suitable for a variety of different subsurface conditions such as hard rock, deep soil, or shallow soil over rock. Combined License and Early Site Permits applicants are required to develop a site specific ground motion response spectrum that takes into account all of the earthquakes in the region surrounding their site as well as the local site geologic conditions. Applicants estimate the ground motion from these postulated earthquakes to develop seismic hazard curves. These seismic hazard curves are then used to determine a site specific ground motion response spectrum that has a maximum annual likelihood of  $1 \times 10^{-4}$  of being exceeded. This can be thought of as a ground motion with a 10,000 year return period. This site specific ground motion response spectrum is then compared to the standard design response spectrum for the proposed design. If the standard design ground motion spectrum envelopes the site specific ground motion spectrum then the site is considered to be suitable for the proposed design. If the standard design spectrum does not completely envelope the site specific ground motion spectrum, then the COL applicant must do further detailed structural analysis to show that the design capacity is adequate. Margin beyond the standard design and site specific ground motions must also be demonstrated before fuel loading can begin.

**Additional technical, non-public information:** None.

## Reassessment of US Plants and Generic Issue 199 (GI-199)

### 65) Can we get the rankings of the plants in terms of safety? (Actually this answer should be considered any time GI-199 data is used to "rank" plants)

**Public Response:** The objective of the GI-199 Safety/Risk Assessment was to perform a conservative, screening-level assessment to evaluate if further investigations of seismic safety for operating reactors in the central and eastern US (CEUS) are warranted consistent with NRC directives. The results of the GI-199 SRA should not be interpreted as definitive estimates of plant-specific seismic risk. The nature of the information used (both seismic hazard data and plant-level fragility information) make these estimates useful only as a screening tool. The NRC does not rank plants by seismic risk.

Currently operating nuclear plants in the United States remain safe, with no need for immediate action. This determination is based on NRC staff reviews of updated seismic hazard information and the conclusions of the Generic Issue 199 Screening Panel. Existing plants were designed with considerable margin to be able to withstand the ground motions from the "deterministic" or "scenario earthquake" that accounted for the largest earthquake expected in the area around the plant. During the mid-to late-1990s, the NRC staff reassessed the margin beyond the design basis as part of the Individual Plant Examination of External Events (IPEEE) program. The results of the GI-199 assessment demonstrate that the probability of exceeding the design basis ground motion may have increased at some sites, but only by a relatively small amount. In addition, the Safety/Risk Assessment stage results indicate that the probabilities of seismic core damage are lower than the guidelines for taking immediate action.

**Additional, technical, non-public information:** None.

### 66) If the plants are designed to withstand the ground shaking why is there so much risk from the design level earthquake

Much of the risk in the total risk levels provided in the report comes from earthquakes stronger than the safe shutdown ground motion. The anything indicated in the geologic record used to determine the design requirements at these sites. The numbers are based on an evaluation of all of the potential seismic sources in the CEUS and are used to produce seismic hazard estimates (curves) for each site. The GI-199 effort to date has performed a screening assessment to determine if further, more detailed studies are warranted. This study has utilized information from plant-specific evaluation of external hazards, including earthquakes. That information was gathered to identify potential seismic vulnerabilities, not to produce robust risk estimates. Therefore, the GI-199 results should be viewed as preliminary and not definitive.

### 67) Does the NRC have a position on the MSNBC article that ranked the safety of US plants?

**Public Response:** The NRC is preparing to issue a press release responding to MSNBC article. The content below.

THE BELOW IS STILL DRAFT

A recent article by MSNBC (add reference) cites results of a US Nuclear Regulatory Commission study released in September, 2010. The study investigated the implications of updated seismic hazard estimates in the central and eastern United States. The study was prepared as a screening assessment to evaluate if further investigations of seismic safety for operating reactors in the central and eastern US (CEUS) are warranted, consistent with NRC directives. The report clearly states that "work to date supports a decision to continue ...; the methodology, input assumptions, and data are not sufficiently developed to support other regulatory actions or decisions." Accordingly, the results were not used to

rank or compare plants. The study produced plant-specific results of the estimated change in risk from seismic hazards. The study did not rely on the absolute value of the seismic risk except to assure that all operating plants are safe. The plant-specific results were used in aggregate to determine the need for continued evaluation and were included in the report for openness and transparency. The use of the absolute value of the seismic hazard-related risk, as done in the MSNBC article, is not the intended use, and the NRC considers it an inappropriate use of the results.

The report reached three main conclusions: 1) Seismic hazard estimates have increased at some operating plants in the central and eastern US; 2) there is no immediate safety concern, plants have significant safety margin and overall seismic risk estimates remain small; and 3) assessment of updated seismic hazards and plant performance should continue.

**Additional, technical, non-public information:** ADD:

**68) Overall, how would the NRC characterize the CDF numbers? A quirk of numbers? A serious concern?**

**Public Response:** The study is still underway and it is too early to predict the final outcome. However, staff has determined that there is no immediate safety concern and that overall seismic risk estimates remain small. If at any time the NRC determines that an immediate safety concern exists, action to address the issue will be taken. However, the NRC is focused on assuring safety during even very rare and extreme events. Therefore, the NRC has determined that assessment of updated seismic hazards and plant performance should continue.

**Additional, technical, non-public information:** None.

**69) Describe the study and what it factored in – plant design, soils, previous quakes, etc.**

**Public Response:** The study considers the factors that impact estimates of both the seismic hazard (i.e. ground shaking levels) at the site and the plants resistance to earthquakes (mathematically represented by the plant level fragility curve). Previous quakes, the tectonic environment, and the soils that underlie the site are all used in the development of the ground shaking estimates used in the analyses. Plant design and the seismic resistance of the important structures, systems, and components are all used in the development of plant level fragility curves.

**Additional, technical, non-public information:** None.

**70) Explain "seismic curve" and "plant level fragility curve".**

**Public Response:** A seismic curve is a graphical representation of seismic hazard. Seismic hazard in this context is the highest level of ground motion expected to occur (on average) at a site over different periods of time. Plant level fragility is the probability of damage to plant structures, systems and components as a function of ground shaking levels.

**Additional, technical, non-public information:** None.

**71) Explain the "weakest link model".**

**Public Response:** The weakest link model is a method for evaluating the importance of different frequencies of ground vibration to the overall plant performance. The model and its details are not integral to understanding the fundamental conclusions of the study.

**Additional, technical, non-public information:** None.

**72) What would constitute fragility at a plant?**

**Public Response:** Fragility is a term that relates the probability of failure of an individual structure, system or component to the level of seismic shaking it experiences. Plant level fragility is the probability of damage to sets of plant structures, systems and components as a function of ground shaking levels.

**Additional, technical, non-public information:** None.

**73) The 1-in-18,868 risk for Limerick: What is the risk for? A jostling? A crack? Significant core damage leading to a meltdown?**

**Public Response:** The objective of the GI-199 Safety/Risk Assessment was to perform a conservative, screening-level assessment to evaluate if further investigations of seismic safety for operating reactors in the central and eastern US (CEUS) are warranted consistent with NRC directives. The results of the GI-199 SRA should not be interpreted as definitive estimates of plant-specific seismic risk. The nature of the information used (both seismic hazard data and plant-level fragility information) make these estimates useful only as a screening tool. The use of the absolute value of the seismic hazard-related risk, as done in the MSNBC article, is not the intended use, and the NRC considers it an inappropriate use of the results.

**Additional, technical, non-public information:** None.

**74) Can someone put that risk factor into perspective, using something other than MSNBC's chances of winning the lottery?**

**Public Response:** As noted above, the risk factors determined in GI-199 were conservative estimates of risk intended for use as a screening tool. Use of these factors beyond this intended purpose is inappropriate.

**Additional, technical, non-public information:** None.

**75) What, if anything, can be done at a site experiencing such a risk? (Or at Limerick in particular.)**

**Public Response:** The probabilistic seismic risk analyses (SPRA) that are performed to determine the core damage frequency (CDF) numbers also provides a significant amount of information on what the plant vulnerabilities are. This allows the analyst to determine what can be done to the plant to address the risk.

**Additional, technical, non-public information:** None.

**76) Has anyone determined that anything SHOULD be done at Limerick or any of the other PA plants?**

**Public Response:** The fundamental conclusion of the report is that "work to date supports a decision to continue ...; the methodology, input assumptions, and data are not sufficiently developed to support other regulatory actions or decisions." The NRC is planning to issue a Generic Communication to operating reactor licensees in the CEUS requesting additional information. This includes the plants in PA.

**Additional, technical, non-public information:** None.

**77) I noted the language on Page 20 of the report: This result confirms NRR's conclusion that currently operating plants are adequately protected against the change in seismic hazard estimates because the guidelines in NRR Office Instruction LIC-504 "Integrated Risk-Informed Decision Making Process for Emergent Issues" are not exceeded. Can someone please explain?**

**Public response:** Can someone help with this?

**Additional, technical, non-public information:** None.

**78) Is the earthquake safety of US plants reviewed once the plants are constructed?**

**Public response:** Yes, earthquake safety is reviewed during focused design inspections, under the Generic Issues Program (GI-199) and as part of the Individual Plant Evaluation of External Events program (IPEEE) that was conducted in response to Generic Letter 88-20 Supplement 4.

**Additional, technical, non-public information:** None.

**79) Does the NRC ever review tsunami risk for existing plants?**

**Public Answer:** The NRC has not conducted a generic issue program on tsunami risk to date. However, some plants have been reviewed as a result of the application for a license for a new reactor. In the ASME/ANS 2009 seismic probabilistic risk assessment standard, all external hazards are included.

**Additional, technical, non-public information:** None.

**80) Does GI-199 consider tsunami?**

**Public response:** GI-199 stems from the increased in perceived seismic hazard focused on understanding the impact of increased ground motion on the risk at a plant. GI-199 does not consider tsunami

**Additional, technical, non-public information:** In the past there has been discussion about a GI program on tsunami, but the NRC's research and guidance was not yet at the point it would be effective. We are just getting to this stage and the topic should be revisited.

**81) What is Generic Issue 199 about?**

**Public Answer:** Generic Issue 199 (GI-199) investigates the safety and risk implications of updated earthquake-related data and models. These data and models suggest that the probability for earthquake ground shaking above the seismic design basis for some nuclear power plants in the Central and Eastern United States is still low, but larger than previous estimates.

**Additional, technical, non-public information:** See additional summary/discussion of GI-199 and terms below.

**82) Where can I get current information about Generic Issue 199?**

**Public Answer:** The public NRC Generic Issues Program (GIP) website (<http://www.nrc.gov/about-nrc/regulatory/gen-issues.html>) contains program information and documents, background and historical information, generic issue status information, and links to related programs. The latest Generic Issue Management Control System quarterly report, which has regularly updated GI-199 information, is publicly available at <http://www.nrc.gov/reading-rm/doc-collections/generic-issues/quarterly/index.html>. Additionally, the US Geological Survey provides data and results that are publicly available at <http://earthquake.usgs.gov/hazards/products/conterminous/2008/>.

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**Additional, technical, non-public information:** The GI-199 section of the NRC internal GIP website (<http://www.internal.nrc.gov/RES/projects/GIP/Individual%20GIs/GI-0199.html>) contains additional information about Generic Issue 199 (GI-199) and is available to NRC staff.

**83) How was the seismic design basis for an existing nuclear power plant established?**

**Public Answer:** The seismic ground motion used for the design basis was determined from the evaluation of the maximum historic earthquake within 200 miles of the site, without explicitly considering the time spans between such earthquakes; safety margin was then added beyond this maximum historic earthquake to form a hypothetical *design basis earthquake*. The relevant regulation for currently operating plants is 10 CFR Part 100, Appendix A, "Seismic and Geologic Siting Criteria for Nuclear Power Plants" (<http://www.nrc.gov/reading-rm/doc-collections/cfr/part100/part100-appa.html>).

**Additional, technical, non-public information:** See discussion at end of GI-199 section for discussion of safety margin and design basis.

**84) Is there margin above the design basis?**

**Public Answer:** Yes, there is margin beyond the design basis. In the mid to late 1990s, NRC staff reviewed the plants' assessments of potential ground motion beyond the safety margin included in each plant's design basis, which licensees performed as part of the Individual Plant Examination of External Events (or IPEEE) program. From this review, the staff determined that seismic designs of operating plants in the United States have adequate safety margins, for withstanding earthquakes, built into the designs.

**Additional, technical, non-public information:** The goal of seismic engineering is to design structures, systems and components that explicitly do not fail at the design level. The application of specific codes, standards, and analysis techniques results in margin beyond the design level. The assessments carried out as part of the IPEEE program demonstrated that margin exists in the operating reactors against seismic demand.

**85) Are all US plants being evaluated as a part of Generic Issue 199?**

**Public Answer:** The scope of the Generic Issue 199 (GI-199) Safety/Risk Assessment is limited to all plants in the Central and Eastern United States. Although plants at the Columbia, Diablo Canyon, Palo Verde, and San Onofre sites are not included in the GI-199 Safety/Risk Assessment, the Information Notice on GI-199 is addressed to all operating power plants in the US (as well as all independent spent fuel storage installation licensees). The staff will also consider inclusion of operating reactors in the Western US in its future generic communication information requests.

**Additional, technical, non-public information:** The staff is currently developing specific information needs to be included in a Generic Letter to licensees in the CEUS.

**86) Are the plants safe? If you are not sure they are safe, why are they not being shut down? If you are sure they are safe, why are you continuing evaluations related to this generic issue?**

**Public Answer:** Yes, currently operating nuclear plants in the United States remain safe, with no need for immediate action. This determination is based on NRC staff reviews associated with Early Site Permits (ESP) and updated seismic hazard information, the conclusions of the Generic Issue 199 Screening Panel (comprised of technical experts), and the conclusions of the Safety/Risk Assessment Panel (also comprised of technical experts).

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No immediate action is needed because: (1) existing plants were designed to withstand anticipated earthquakes with substantial design margins, as confirmed by the results of the Individual Plant Examination of External Events program; (2) the probability of exceeding the *safe shutdown earthquake* ground motion may have increased at some sites, but only by a relatively small amount; and (3) the Safety/Risk Assessment Stage results indicate that the probabilities of seismic core damage are lower than the guidelines for taking immediate action.

Even though the staff has determined that existing plants remain safe, the Generic Issues Program criteria (Management Directive 6.4) direct staff to continue their analysis to determine whether any cost-justified plant improvements can be identified to make plants enhance plant safety.

**Additional, technical, non-public information :** The Safety/Risk Assessment results confirm that plants are safe. The relevant risk criterion for GI-199 is total *core damage frequency* (CDF). The threshold for taking immediate regulatory action (found in NRR Office Instruction LIC-504, see below) is a total CDF greater than or on the order of  $10^{-3}$  (0.001) per year. For GI-199, the staff calculated seismic CDFs of  $10^{-4}$  (0.0001) per year and below for nuclear power plants operating in the Central and Eastern US (CEUS) (based on the new US Geological Survey seismic hazard curves). The CDF from internal events (estimated using the staff-developed Standardized Plant Analysis of Risk models) and fires (as reported by licensees during the IPEEE process and documented in NUREG-1742), when added to the seismic CDF estimates results in the total risk for each plant to be, at most,  $4 \times 10^{-4}$  (0.0004) per year or below. This is well below the threshold (a CDF of  $10^{-3}$  [0.001] per year) for taking immediate action. Based on the determination that there is no need for immediate action, and that this issue has not changed the licensing basis for any operating plant, the CEUS operating nuclear power plants are considered safe. In addition, as detailed in the GI-199 Safety/Risk Assessment there are additional, qualitative considerations that provide further support to the conclusion that plants are safe.

Note: The NRC has an integrated, risk-informed decision-making process for emergent reactor issues (NRR Office Instruction LIC-504, ADAMS Accession No. ML100541776 [not publically available]). In addition to deterministic criteria, LIC-504 contains risk criteria for determining when an emergent issue requires regulatory action to place or maintain a plant in a safe condition.

### **87) What do you mean by “increased estimates of seismic hazards” at nuclear power plant sites?**

**Public Answer:** *Seismic hazard* (earthquake hazard) represents the chance (or probability) that a specific level of ground shaking could be observed or exceeded at a given location. Our estimates of seismic hazard at some Central and Eastern United States locations have changed based on results from recent research, indicating that earthquakes occurred more often in some locations than previously estimated. Our estimates of seismic hazard have also changed because the models used to predict the level of ground shaking, as caused by a specific magnitude earthquake at a certain distance from a site, changed. The increased estimates of seismic hazard at some locations in the Central and Eastern United States were discussed in a memorandum to the Commission, dated July 26, 2006. (The memorandum is available in the NRC Agencywide Documents Access and Management System [ADAMS] under Accession No. ML052360044).

**Additional, technical, non-public information:** See additional discussion of terms at the end of the document.

### **88) Does the SCDF represent a measurement of the risk of radiation RELEASE or only the risk of core damage (not accounting for secondary containment, etc.)?**

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**Public Response:** Seismic CDF is the probability of damage to the core resulting from a seismic initiating event. It does not imply either a meltdown or the loss of containment, which would be required for radiological release to occur. The likelihood of radiation release is far lower.

**89) Did an NRC spokesperson tell MSNBC's Bill Dedman that the weighted risk average was invalid and useless? He contends to us that this is the case.**

**Public Response:** No. See Answers below.

**90) 3. If it was "invalid" as he claims, why would the USGS include that metric?**

**Public Response:** The weighted average is not invalid (see Answer 5 below). All of the values in Appendix D were developed by NRC staff. Table D-1 in Appendix D uses the (2008) US Geological Survey (USGS) seismic source model, but the Seismic Core Damage Frequency results were developed by US NRC staff. The USGS seismic source model is the same one used to develop the USGS National Seismic Hazard Maps.

**91) Can you explain the weighted average and how it compares to the weakest link average?**

**Public Response:** Tables D-1 through D-3 in Appendix D of the US NRC study show the "simple" average of the four spectral frequencies (1, Hz, 5 Hz, 10 Hz, peak ground acceleration (PGA)), the "IPEEE weighted" average and the "weakest link" model. These different averaging approaches are explained in Appendix A.3 (simple average and IPEEE weighted average) and Appendix A.4 (weakest link model). The weighted average uses a combination of the three spectral frequencies (1, 5, and 10 Hz) at which most important structures, systems, and components of nuclear power plants will resonate. The weakest link is the largest SCDF value from among the four spectral frequencies noted above.

**92) Ultimately would you suggest using one of the models (average, weighted, weakest link) or to combine the information from all three?**

**Public Response:** Most nuclear power plant structures, systems, and components resonate at frequencies between 1 and 10 Hz, so there are different approaches to averaging the Seismic Core Damage Frequency (SCDF) values. By using multiple approaches, the NRC staff gains a better understanding of the uncertainties involved in the assessments.

**93) Were there any other factual inaccuracies or flaws in Mr. Dedman's piece you would like clarify/point out.**

**Public Response:** The US Nuclear Regulatory Commission study, released in September, 2010, was prepared as a screening assessment to evaluate if further investigations of seismic safety for operating reactors in the central and eastern US (CEUS) are warranted, consistent with NRC directives. The report clearly states that "work to date supports a decision to continue ...; the methodology, input assumptions, and data are not sufficiently developed to support other regulatory actions or decisions." Accordingly, the results were not used to rank or compare plants. The study produced plant-specific results of the estimated change in risk from seismic hazards. The study did not rely on the absolute value of the seismic risk except to assure that all operating plants are safe. The plant-specific results were used in aggregate to determine the need for continued evaluation and were included in the report for openness and transparency. The use of the absolute value of the seismic hazard-related risk, as done in the MSNBC article, is not the intended use, and the NRC considers it an inappropriate use of the results.



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- 94) Mr. Dedman infers that the plant quake risk has grown (between the 1989 and 2008 estimates) to the threshold of danger and may cross it in the next study. Is this the NRC's position?**

**Public Response:** The US NRC evaluation is still underway and it is too early to predict the final outcome. However, staff has determined that there is no immediate safety concern and that overall seismic risk estimates remain small. If at any time the NRC determines that an immediate safety concern exists, action to address the issue will be taken. However, the NRC is focused on assuring safety during even very rare and extreme events. Therefore, the NRC has determined that assessment of updated seismic hazards and plant performance should continue

- 95) Let's say there's an estimate expressed as "2.5E-06." (I'm looking at Table D-2 of the safety/risk assessment of August 2010.) I believe that this expression means the same as  $2.5 \times 10^{-6}$ , or 0.0000025, or 2.5 divided by one million. In layman's terms, that means an expectation, on average, of 2.5 events every million years, or once every 400,000 years. Similarly, "2.5E-05" would be 2.5 divided by 100,000, or 2.5 events every 100,000 years, on average, or once every 40,000 years. Is this correct?**

**Public Response:** Yes, at least partly. In the subject documents the frequencies for core damage or ground motion exceedance have been expressed in the form "2.5E-06". As you noted this is equivalent to  $2.5 \times 10^{-6}$ , or 0.000025 per year. If, for example, the core damage frequency was estimated as 2.5E-06, this would be equivalent to an expectation of 2.5 divided by a million per year. It is not really correct to think of these values as "once every 400,000 years," the two numbers are mathematically equivalent but do not convey the same statistical meaning within this context. Rather, you could characterize it as 1 in 400,000 per year of something occurring.

**Additional, technical, non-public information:** None

- 96) The GI-199 documents give updated probabilistic seismic hazard estimates for existing nuclear power plants in the central and eastern US What document has the latest seismic hazard estimates (probabilistic or not) for existing nuclear power plants in the western US?**

**Public Response:** At this time the staff has not formally developed updated probabilistic seismic hazard estimates for the existing nuclear power plants in the Western US However, NRC staff during the mid- to late-1990's reviewed the plants' assessments of potential consequences of severe ground motion from earthquakes beyond the plant design basis as part of the Individual Plant Examination of External Events (IPEEE) program. From this review, the NRC staff determined that the seismic designs of operating plants in the US have adequate safety margin. NRC staff has continued to stay abreast of the latest research on seismic hazards in the Western US and interface with colleagues at the US Geological Survey. The focus of Generic Issue 199 has been on the CEUS. However, the Information Notice that summarized the results of the Safety/Risk Assessment was sent to all existing power reactor licensees. The documents that summarize existing hazard estimates are contained in the Final Safety Analysis Reports (FSARS) and in the IPEEE submittals. It must be noted that following 9/11 the IPEEE documents are no longer publicly available.

**Additional, technical, non-public information:** None

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

**Public Response:** The new consensus hazard curves are being developed in a cooperative project that has NRC, US Department of Energy, US Geological Survey (USGS) and Electric Power Research Institute (EPRI) participation. The title is: The Central and Eastern US Seismic Source Characterization (CEUS-SSC) project. The project is being conducted following comprehensive standards to ensure quality and regulatory defensibility. It is in its final phase and is expected to be publicly released in the fall of 2011. The project manager is Larry Salamone (Lawrence.salamone@srs.gov, 803-645-9195) and the technical lead on the project is Dr. Kevin Coppersmith (925-974-3335, [kcoppersmith@earthlink.net](mailto:kcoppersmith@earthlink.net)). Additional information on this project can be found at: <http://mydocs.epri.com/docs/ANT/2008-04.pdf>, and [http://my.epri.com/portal/server.pt?open=512&objID=319&&PageID=218833&mode=2&in\\_hi\\_us\\_erid=2&cached=true](http://my.epri.com/portal/server.pt?open=512&objID=319&&PageID=218833&mode=2&in_hi_us_erid=2&cached=true).

**Additional, technical, non-public information:** None

98) What is the timetable now for consideration of any regulatory changes from the GI-199 research?

**Public Response:** The NRC is working on developing a Generic Letter (GL) to request information from affected licensees. The GL will likely be issued in a draft form within the next 2 months to stimulate discussions with industry in a public meeting. After that it has to be approved by the Committee to Review Generic Requirements, presented to the Advisory Committee on Reactor Safeguards and issued as a draft for formal public comments (60 days). After evaluation of the public comments it can then be finalized for issuance. We expect to issue the GL by the end of this calendar year, as the new consensus seismic hazard estimates become available. The information from licensees will likely require 3 to 6 months to complete. Staff's review will commence after receiving licensees' responses. Based on staff's review, a determination can be made regarding cost beneficial backfits where it can be justified.

**Additional, technical, non-public information:** None

1. Please explain in plain language how the NRC determined plants are safe with regard to the results of our GI199 assessment report..
2. The GI199 Safety/Risk Assessment states 24 plants "lie in the continue zone" (pg 23) These plants "need more assessment." What are these 24 plants? Why are these plants that require further evaluation safe? (pg 23 and Figure 8)
3. Why is the list of plants identified by the NRC for further evaluation under GI199 different than those identified by MSNBC as the "top 10" likely to fail due to seismic event?
4. Why are plants safe when MSNBC calculations indicate several hundred percent increases in the risk of a seismic event that damages the core?
5. Why do Indian Point 2 and Indian Point 3 plants have different probabilities of failing due to a seismic event when the plants are located next to each other? Is IP3 calculated to be the most

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likely to fail due to a seismic event? Why? Why is IP2 different? Aren't these plant at the same location and very similar design?

6. Why is Pilgrim not in the NRC "continue to evaluate zone" but second on the MSNBC list as most likely to fail due to a seismic event?

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## Seismic Probabilistic Risk Assessment (SPRA)

99) The NRC increasingly uses risk-information in regulatory decisions. Are risk-informed PRAs useful in assessing an event such as this?

Public response: Niles Chokshi to provide Q&As on SPRA

Additional, technical, non-public information: None

## **Plant-Specific Questions**

### **San Onofre Nuclear Generating Station (SONGS) Questions**

**100) SONGS received a white finding in 2008 for 125VDC battery issue related to the EDGs that went undetected for 4 years. NRC issued the white finding as there was increased risk that one EDG may not have started due to a low voltage condition on the battery on one Unit (Unit 2). Aren't all plants susceptible to the unknown? Is there any assurance the emergency cooling systems will function as desired in a Japan-like emergency?**

**Public response:** The low voltage condition was caused by a failure to properly tighten bolts on a electrical breaker that connected the battery to the electrical bus that would be relied on to start the EDG in case of a loss of off-site power. This was corrected immediately on identification and actions taken to prevent its reoccurrence. The 3 other EDGs at SONGS were not affected.

**Additional, technical, non-public information:** None

**101) Has the earthquake hazard at SONGS been reviewed like Diablo Canyon nuclear power plant (DCNPP) is doing? Are they planning on doing an update before relicensing?**

**Public Answer:** Relicensing does not evaluate the potential change to seismic siting of a plant. If there is a seismic design concern, it would be addressed for the plant as it is currently operating.

The closest active fault is approximately five miles offshore from San Onofre, a system of folds and faults exist called the OZD need to write out full name. The Cristianitos fault is ½ mile southeast, but is an inactive fault. Other faults such as the San Andreas and San Jacinto, which can generate a larger magnitude earthquake, are far enough away that they would produce ground motions much less severe than the OZD for San Onofre.

Past history relative to nearby major quakes have been of no consequences to San Onofre. In fact, three major earthquakes from 1992 to 1994 (Big Bear, Landers and Northridge), ranging in distance from 70-90 miles away and registering approximately 6.5 to 7.3 magnitude, did not disrupt power production at San Onofre. The plant is expected to safely shutdown if a major earthquake occurs nearby. Safety related structures, systems and components have been designed and qualified to remain functional and not fail during and after an earthquake.

**Additional, technical, non-public information:** None

**102) Is possible to have a tsunami at songs that is capable of damaging the plant?**

**Public Information:** The San Onofre Units 2 and 3 plant grade is elevation +30.0 feet MLLW. The controlling tsunami for San Onofre occurring during simultaneous high tide and storm surge produces a maximum runup to elevation +15.6 feet MLLW at the Unit 2 and 3 seawall. When storm waves are superimposed, the predicted maximum runup is to elevation +27 MLLW. Tsunami protection for the SONGS site is provided by a reinforced concrete seawall constructed to elevation +30.0 MLLW. A tsunami greater than this height is extremely unlikely.

**Additional, technical, non-public information:** None

**103) Does SONGS have an emergency plan for tsunami?**

**Public Response:** The SONGS emergency plan does initiate the emergency response organization and results in declaration of emergency conditions via their EALs. The facility would then make protective

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action recommendations to the Governor, who would then decide on what protective actions would be ordered for the residents around SONGS.

**Additional, technical, non-public information:** None

**104) Has evacuation planning at SONGS considered tsunami?**

**Public Response:** These considerations would be contained in the State and local (City, County) emergency plans, which are reviewed by FEMA. FEMA then certifies to the NRC that they have "reasonable assurance" that the off-site facilities can support operation of SONGS in an emergency.

**Additional, technical, non-public information:** None

**105) Is SONGS designed against tsunami and earthquake?**

**Public Response:** Yes. SONGS is designed against both tsunami and earthquake.

**Additional, technical, non-public information:** None

**106) What is the height of water that SONGS is designed to withstand?**

**Public Response:** 30 feet (9.1 meters). Information for all plants can be found in the "Additional Information" section of this document.

**Additional, technical, non-public information:** None

**107) What about drawdown and debris?**

**Public Response:** Good question...can HQ answer? Goutam, Henry, or Rich...can you help with this one?

**Additional, technical, non-public information:** None

**108) Will this be reviewed in light of the Japan earthquake.**

**Public Response:** The NRC will do a thorough assessment of the lessons learned from this event and will review all potential issues at US nuclear plants as a result.

**Additional, technical, non-public information:** None

**109) Could all onsite and offsite power be disrupted from SONGS in the event of a tsunami, and if that happened, could the plant be safely cooled down if power wasn't restored for days after?**

**Public Response:** Seismic Category I equipment is equipment that is essential to the safe shutdown and isolation of the reactor or whose failure or damage could result in significant release of radioactive material. All Seismic Category I equipment at SONGS is designed to function following a DBE with ground acceleration of 0.67g.

The operating basis earthquake (1/2 of the DBE) is characterized by maximum ground shaking of 0.33g. Historically, even this level of ground shaking has not been observed at the site. Based on expert analysis, the average recurrence interval for 0.33g ground shaking at the San Onofre site would be in excess of 1000 years and, thus, the probability of occurrence in the 40-year design life of the plant would be less than 1 in 25. The frequency of the DBE would be much more infrequent, and very unlikely to occur during the life of the plant. Even if an earthquake resulted in greater than the DBE movement/acceleration at SONGS, the containment structure would ultimately protect the public from harmful radiation release, in the event significant damage occurred to Seismic category 1 equipment.

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**Additional, technical, non-public information:** None

**110) Are there any faults nearby SONGS that could generate a significant tsunami?**

**Public Response:** Current expert evaluations estimate a magnitude 7 earthquake about 4 miles (6.4 km) from SONGS. This is significantly less than the Japan earthquake, and SONGS has been designed to withstand this size earthquake without incident. Should discuss the different tectonic nature (not a subduction zone like Japan)?

**Additional, technical, non-public information:** None

**111) What magnitude or shaking level is SONGS designed to withstand? How likely is an earthquake of that magnitude for the SONGS site?**

**Public Response:** The design basis earthquake (DBE) is defined as that earthquake producing the maximum vibratory ground motion that the nuclear power generating station is designed to withstand without functional impairment of those features necessary to shut down the reactor, maintain the station in a safe condition, and prevent undue risk to the health and safety of the public. The DBE for SONGS was assessed during the construction permit phase of the project. The DBE is postulated to occur near the site (5 miles (8km)), and the ground accelerations are postulated to be quite high (0.67g), when compared to other nuclear plant sites in the U.S (0.25g or less is typical for plants in the eastern US). Based on the unique seismic characteristics of the SONGS site, the site tends to amplify long-period motions, and to attenuate short-period motions. These site-specific characteristics were accounted for in the SONGS site-specific seismic analyses.

**Additional, technical, non-public information:** None

**112) Could SONGS withstand an earthquake of the magnitude of the Japanese earthquake?**

**Public Response:** We do not have current information on the ground motion at the Japanese reactors. SONGS was designed for approximately a 7.0 magnitude earthquake 4 miles (6.4 km) away. The Japanese earthquake was much larger (8.9), but was also almost 9 miles (14.5 km) away. The local ground motion at a particular plant is significantly affected by the local soil and bedrock conditions. SONGS was designed (0.67g) to withstand more than 2 times the design motion at average US plants.

**Additional, technical, non-public information:** None

**113) What about the evacuation routes at SONGS? How do we know they are reasonable?**

**Public Response:** FEMA reviews off-site evacuation plans formally every 2 years during a biennial emergency preparedness exercise. NRC evaluates on-site evacuation plans during the same exercise. Population studies are formally done every 10 years, and evacuation time estimates are re-evaluated at that time. FEMA reviews these evacuation plans, and will conclude their acceptability through a finding of "reasonable assurance" that the off-site facilities and infrastructure is capable of protecting public health and safety in the event of an emergency at SONGS. The next such exercise is planned for April 12, 2011.

**Additional, technical, non-public information:** None

**114) Regarding tsunami at DCNPP and SONGS, is the tsunami considered separately from flooding in licensing? And from the design perspective, is the flood still the controlling event for those plants rather than the tsunami?**

**Public response:** See below

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

**Public response:** Both the Diablo Canyon (main plant) and SONGS are located above the flood level associated with tsunami. However, the intake structures and Auxiliary Sea Water System at Diablo canyon are designed for combination of tsunami-storm wave activity. SONGS has reinforced concrete cantilevered retaining seawall and screen well perimeter wall designed to withstand the design basis earthquake, followed by the maximum predicted tsunami with coincident storm wave action

**Additional, technical, non-public information:** None

**116) Is there potential linkage between the South Coast Offshore fault near SONGS and the Newport-Inglewood Fault system and/or the Rose Canyon fault? Does this potential linkage impact the maximum magnitude that would be assigned to the South Coast Offshore fault and ultimately to the design basis ground motions for this facility?**

**Public response:** Stephanie and Jon to answer (you may want to change the question) based on the discussions in the articles sent by Lara U.

**Additional, technical, non-public information:** Proposed action is to check the FSAR for San Onofre and read the discussion on characterization of the offshore fault. A quick look at discussion of the Newport Inglewood from other sources suggest this is part of the "system". It would be helpful to check the basis for segmenting the fault in the FSAR. Probably have to dig on this a bit, may need to look at the USGS/SCEC/ model for this area.



## Diablo Canyon Nuclear Power Plant (DCNPP) Questions

**117) Now after the Japan tragedy, will the NRC finally hear us (A4NR) and postpone DC license renewal until seismic studies are complete? How can you be sure that what happened there is not going to happen at Diablo with a worse cast earthquake and tsunami?**

**Public response:** ADD

**Additional, technical, non-public information:** ADD

**118) The evacuation routes at DCNPP see are not realistic. Highway 101 is small...and can you imagine what it will be like with 40K people on it? Has the evacuation plan been updated w/ all the population growth?**

**Public Response:** FEMA reviews off-site evacuation plans formally every 2 years during a biennial emergency preparedness exercise. NRC evaluates on-site evacuation plans during the same exercise. Population studies are formally done every 10 years, and evacuation time estimates are re-evaluated at that time. FEMA reviews these evacuation plans, and will conclude their acceptability through a finding of "reasonable assurance" that the off-site facilities and infrastructure is capable of protecting public health and safety in the event of an emergency at DCNPP.

**Additional, technical, non-public information:** None

**119) Are there local offshore fault sources capable of producing a tsunami with very short warning times?**

**Public Response:** ADD- question forwarded to region

**Additional, technical, non-public information:** ADD

**120) Are there other seismically induced failure modes (other than tsunami) that would yield LTSBO? Flooding due to dam failure or widespread liquefaction are examples.**

**Public Response:** ADD question forwarded to region

**Additional, technical, non-public information:** ADD

**121) Ramifications of beyond design basis events (seismic and tsunami) and potential LTSBO on spent fuel storage facilities?**

**Public Response:** ADD question forwarded to region

**Additional, technical, non-public information:** ADD

**122) Why did the Emergency Warning go out for a 'tsunami' that was only 6 ft (1.8 m) high? Do these guys really know what they're doing? Would they know it if a big one was really coming? Crying wolf all the time doesn't instill a lot of confidence.**

**Public Response:** The warning system performed well. The 6 foot (1.8 meters) wave was predicted many hours before and arrived at the time it was predicted. Federal officials to accurately predicted the tsunami arrival time and size; allowing local official to take appropriate measures as they saw necessary to warn and protect the public. It should be understood that even a 6 foot tsunami is very dangerous. Tsunamis have far more energy and power than wind-driven waves.

**Additional, technical, non-public information:** ADD

123) How big did the Japanese think an earthquake and tsunami could be before March 11, 2011? Why were they so wrong (assuming this earthquake/tsunami was bigger than what they had designed the plant for)?

Public Response: ADD can HQ answer?

Additional, technical, non-public information: ADD

The Japanese were supposed to have one of the best tsunami warning systems around. What went wrong last week (both with the reactors and getting the people out...see #1, evacuation plan above)?

Public Response: ADD can HQ answer?

Additional, technical, non-public information: ADD

124) Regarding the tsunami at DCNPP and SONGS, is the tsunami considered separately from flooding in licensing? And from the design perspective, is the flood still the controlling event for those plants rather than the tsunami?

Public Response: Both the Diablo Canyon (main plant) and SONGS are located above the flood level associated with tsunami. However, the intake structures and Auxiliary Sea Water System at Diablo canyon are designed for combination of tsunami-storm wave activity. SONGS has reinforced concrete cantilevered retaining seawall and screen well perimeter wall designed to withstand the design basis earthquake, followed by the maximum predicted tsunami with coincident storm wave action

Additional, technical, non-public information: ADD

*NOTE: need to add to SONGS and DCNPP... Canyon and San Onofre IPEEEs - based on the Technical Evaluation Reports, Diablo did consider a locally induced tsunami in a limited way (the aux service water pumps were assumed to become flooded following a seismic event) while SONGS did not consider a coupled seismic/tsunami event.*

125) Shouldn't the NRC make licensees consider a Tsunami coincident with a seismic event that triggers the Tsunami?

ADD

126) Given that SSCs get fatigued over time, shouldn't the NRC consider after-shocks in seismic hazard analyses?

ADD

127) Did the Japanese also consider an 8.9 magnitude earthquake and resulting tsunami "way too low a probability for consideration"?

ADD

- 128) GI-199 shows that the scientific community doesn't know everything about the seismicity of CEUS. And isn't there a prediction that the West coast is likely to get hit with some huge earthquake in the next 30 years or so? Why does the NRC continue to license plants on the west coast?

Work the following into Q&As as time permits.

After an earthquake, in order to restart, In practice a licensee needs to determine from engineering analysis that the stresses on the plant did not exceed their licensed limits. That would be a very tall order for a plant that experienced a beyond design basis earthquake, and probably is why it had taken Japan so long to restore the KK plants following the earlier earthquake.

- 129) Has industry done anything on tsunami hazards? Also, has anyone done work to look at the effect of numerous cycles of low amplitude acceleration following a larger event. I would expect we would have some information because how do we know a plant would be fit to start back up after an event? We cannot possibly do NDE on everything to determine if flaws have propagated to the point where they need to be replaced.

## Indian Point Questions

### 130) Why is Indian Point safe if there is a fault line so close to it?

**Public Response:** The Ramapo fault system, located near the Indian Point Nuclear Power Plant, is an example of an old fault system that, based on geologic field evidence, has not been active in the last 65.5 million years. The Ramapo fault system extends primarily from southeastern New York to northern New Jersey and is made up of a series of northeast-oriented faults. Even though there is minor earthquake activity in the vicinity of the Ramapo faults, this earthquake activity cannot be directly correlated with any individual fault within the Ramapo fault system.

US nuclear power plants are designed and built to withstand the largest expected earthquake in the site region, based on observed historical seismicity and field evidence for prehistoric earthquakes, and are also designed to incorporate seismic safety margins. A potential earthquake in and around the vicinity of the Ramapo fault system was taken into account during the NRC licensing process for the Indian Point plants, and the plant design incorporated the largest expected earthquake in the site region. In summary, the Ramapo fault system exhibits no definitive evidence for recent fault displacement (i.e., no evidence for fault activity in the last 65.5 million years) and the Indian Point nuclear power plant was designed and built to safely shutdown in the event of an earthquake having the highest magnitude observed in the site region. Therefore, the NRC concluded that the risk of significant damage to the Indian Point reactors due to a potential earthquake is acceptable.

**Additional, technical, non-public information:** The information above and following is consistent with the literature and the UFSAR for IP related to the Ramapo fault. The Ramapo fault system, which passes through the Indian Point area, is a group of Mesozoic age faults, extending from southeastern New York to northern New Jersey, as well as further southwest. The fault system is composed of a series of southeast-dipping, northeast-striking faults. Various faults of the system contain evidence of repeated slip in various directions since Proterozoic time, including Mesozoic extensional reactivation. However, the USGS staff, who reviewed 31 geologic features in the Appalachian Mountains and Coastal Plain and compiled a National Database on Quaternary Faulting (Crone and Wheeler, 2000), listed the Ramapo fault system as low risk because the fault system lacks evidence for Quaternary slip. They further pointed out that the Ramapo fault system, and 17 other geologic features, "have little or no published geologic evidence of Quaternary tectonic faulting that could indicate the likely occurrence of earthquakes larger than those observed historically" (Wheeler and Crone, 2004). Among these faults, the Ramapo fault system is one of the three that underwent a paleoseismological study. In two trenches excavated across the Ramapo fault, no evidence of Quaternary tectonic faulting was found (Wheeler and Crone, 2000). Because the Ramapo fault system is relatively inactive, , and because the plants are designed to safely shutdown in the event of an earthquake of the highest intensity ever recorded in that area, the NRC has concluded that the risk of significant damage to the reactors due to a probable earthquake in the area is extremely small.

The letter that was sent to the NRC from Rep Lowey refers to the Ramapo seismic zone (RSZ) and the Dobbs Ferry fault. The letter incorrectly states that the Dobbs Ferry fault is located within the Ramapo seismic zone. Based on the literature, it is not. It is close, but it is considered to be in the Manhattan Prong more to the east (more like 10-15 miles away) while the Ramapo fault system is considered to be in the Reading Prong (a couple of miles away from IP). Also for clarification, the seismicity is considered to be within the Precambrian/Paleozoic basement at depths greater than the Mesozoic Newark Basin where the RSZ is situated.

## Pending and Unanswered Questions from Members of Congress

The below questions are gleaned from the congressional letters coming into the NRC. Because they generally cover different topics, they are being kept together as sets to assist the office assigned with response. Once a formal response is developed and sent, the questions will be moved to the appropriate sections.

### **131) Received 3/16/11 from Congresswoman Lowey**

The key elements of the congresswoman's letter are as follows:

The Ramapo Seismic Zone is a particular threat because the zone passes within two miles of Indian Point. The Ramapo Seismic zone includes the Dobbs Ferry fault in Westchester, which generated a 4.1 magnitude earthquake in 1955. The Columbia University study suggests that this pattern of subtle but active faults increases the risk to the New York City area and that an earthquake with a magnitude of 7.0 on the Richter scale is within reach. Disturbingly, Entergy measures the risk of an earthquake near Indian Point to be between 1.0 and 3.0 on the Richter scale, despite evidence to the contrary.

The NRC should study Indian Point's risk of, and ability to sustain a disaster, including the impact of earthquakes and hurricanes, as well as collateral impacts such as loss of power, inability to cool reactors and emergency evacuation routes. The NRC should evaluate how a similar incident in the New York metropolitan area could be further complicated due to a dramatically higher population and the effectiveness of the proposed evacuation routes.

**Public Response:** Please see technical elements in the above question. NRR has the lead for developing the formal response

**Additional, technical, non-public information:** please see the significant amount of information above

### **132) From 3/16/11 Press Release from Senators Boxer and Feinstein**

#### **Plant Design and Operations**

1. What changes to the design or operation of the Diablo Canyon and SONGS facilities have improved safety at the plants since they began operating in the mid-1980s?

**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

2. What emergency notification systems have been installed at California nuclear power plants? Has there ever been a lapse of these systems during previous earthquakes or emergencies?

**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

3. What safety measures are in place to ensure continued power to California reactors in the event of an extended power failure?

**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

#### **Type of Reactor**

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4. What are the differences and similarities between the reactors being used in California (pressurized water reactors) and those in Japan (boiling water reactors), as well as the facilities used to house the reactors, including the standards to which they were built and their ability to withstand natural and manmade disasters?

**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

**Earthquakes and Tsunamis**

5. We have been told that both Diablo Canyon and San Onofre Nuclear Generating Station are designed to withstand the maximum credible threat at both plants, which we understand to be much less than the 9.0 earthquake that hit Japan. What assumptions have you made about the ability of both plants to withstand an earthquake or tsunami? Given the disaster in Japan, what are our options to provide these plants with a greater margin for safety?

**Public Response:** Annie and Kamal developing response

**Additional, technical, non-public information:** ADD

6. Have new faults been discovered near Diablo Canyon or San Onofre Nuclear Generating Station since those plants began operations? If so, how have the plants been modified to account for the increased risk of an earthquake? How will the NRC consider information on ways to address risks posed by faults near these plants that is produced pursuant to state law or recommendations by state agencies during the NRC relicensing process?

**Public Response:** Annie and Kamal developing response

**Additional, technical, non-public information:** ADD

7. What are the evacuation plans for both plants in the event of an emergency? We understand that Highway 1 is the main route out of San Luis Obispo, what is the plan for evacuation of the nearby population if an earthquake takes out portions of the highway and a nuclear emergency occurs simultaneously?

**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

8. What is the NRC's role in monitoring radiation in the event of a nuclear accident both here and abroad? What is the role of EPA and other federal agencies?

**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

9. What monitoring systems currently are in place to track potential impacts on the US, including California, associated with the events in Japan?

**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

10. 6. Which federal agency is leading the monitoring effort and which agencies have responsibility for assessing human health impacts? What impacts have occurred to date on the health or environment of the US or are currently projected or modeled in connection with the events in Japan?

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**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

11. What contingency plans are in place to ensure that the American public is notified in the event that hazardous materials associated with the events in Japan pose an imminent threat to the US?

**Public Response:** NRR/DORL developing response

**Additional, technical, non-public information:** ADD

### **133) From 3/15/11 Press Release from Congresspeople Markey and Capps**

Note that these are only the seismic questions. There are other questions that are structural

1. Provide the Richter or moment magnitude scale rating for each operating nuclear reactor in the United States. If no such information exists, on what basis can such an assertion be made regarding the design of any single nuclear power plant?

**Public Response:** US nuclear power plants are designed for different ground motions determined on a site-specific basis, which are called the Safe Shutdown Earthquake ground motions (SSE). Each nuclear power plant is designed to a ground motion level that is appropriate for the geology and tectonics in the region surrounding the plant location. Ground motion, or shaking, is a function of both earthquake magnitude and distance from the fault to the site. The magnitude alone cannot be used to predict ground motions. Currently operating nuclear power plants developed their SSEs based on a "deterministic" or "scenario earthquake" basis that account for the largest earthquake expected in the area around the plant.

Please see the available table of Design Basis Ground Motions for US Plants in the Additional Information: Useful Tables.

**Additional, technical, non-public information:** ADD

2. The San Onofre reactor is reportedly designed to withstand a 7.0 earthquake, and the Diablo Canyon reactor is designed to withstand a 7.5 magnitude. According to the Southern California Earthquake Center (SCEC), there is an 82% probability of an earthquake 7.0 magnitude in the next 30 years, and a 37 percent probability that an earthquake of 7.5 magnitude will occur. Shouldn't these reactors be retrofitted to ensure that they can withstand a stronger earthquake than a 7.5? If not, why not?

**Public Response:** This needs to be edited and enhanced. The noted SCEC magnitudes and probabilities are sourced from Uniform California Earthquake Rupture Forecast (UCERF) Figure 2 (<http://www.scec.org/core/public/scecontext.php/3935/13662>). The value quoted describes the probability that an earthquake of that magnitude will occur somewhere in Southern California. The probability that earthquakes of those magnitudes occur near the plants is far smaller. Each nuclear power plant is designed to a ground motion level that is appropriate for the geology and tectonics in the region surrounding the plant location.

**Additional, technical, non-public information:** The colors in UCERF Figure 2 represent the probabilities of having a nearby earthquake rupture (within 3 or 4 miles) of magnitude 6.7 or larger in the next 30 years. Therefore, reading the colors off of Figure 2, the San Onofre and Diablo Canyon NPPs have a  $\leq 10\%$  probability of having a  $\geq M6.7$  earthquake rupture within 3 to 4 miles in the next 30 years. Therefore, retrofitting these reactors to withstand earthquakes of M7.5 or stronger based on the UCERF study would put an unnecessary burden on the licensees.

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3. Provide specific information regarding the differences in safety-significant structures between a nuclear power plant that is located in a seismically active area and one that is not. Provide, for each operating nuclear reactor in a seismically active area, a full list and description of the safety-significant design features that are included that are not included in similar models that are not located in seismically active areas.

**Public Response:** This is a rough draft. We need to get some reviews of this. Assumed NRR will have ultimate responsibility for the response.

There are no differences in safety requirements for nuclear power plants located in seismically active areas and ones that are not. Regardless of site seismicity, Appendix S to 10 CFR Part 50 requires for site-specific SSE ground motions, structures, systems, and components will remain functional and within applicable stress, strain, and deformation limits. The required safety functions of SSCs must be assured during and after the vibratory ground motion through design, testing, or qualification methods. The evaluation must take into account soil-structure interaction effects and the expected duration of the vibratory motions. Appendix S also requires that the horizontal component of the SSE ground motion in the free field at the foundation elevation of structures must be an appropriate response spectrum with peak ground acceleration (PGA) of at least 0.10g. Design basis loads for nuclear power plant structures, important to safety, include combined loads for seismic, wind, tornado, normal operating conditions (pressure and thermal), and accident conditions. Codes and standards, such as the American Institute of Concrete (ACI-349) and the American Institute of Steel Construction (AISC N690), are used in the design of nuclear power plant structures to ensure a conservative, safe design under design basis loads. In addition to the nominal seismic design, all new generation reactors have to demonstrate a seismic margin of 1.67 relative to the site-specific seismic demands.

For the current operating fleet of nuclear power reactors, site-to-site differences in structural design can result from differences in external site hazards such as seismic, wind, tornado, and tsunami. For a low-seismicity region, wind or tornado loads may control the design. Conversely, for a high-seismicity region, seismic loads will likely control. Structures in high-seismicity regions have robust designs with typically higher capacity shear walls, as an example. Systems and components will also be more robust and are designed and tested to higher levels of acceleration.

**Additional, technical, non-public information:** ADD

4. In your opinion, can any operating nuclear reactors in the United States withstand an earthquake of the magnitude experience in Japan?

**Public Response:** The March 11, 2011, magnitude 9 earthquake that recently affected Japan is different than earthquakes that could affect US nuclear plants. Each US nuclear plant is designed to a ground-shaking level that is appropriate for its location, given the possible earthquake sources that may affect the site and its tectonic environment. The Japan earthquake was caused by a "subduction zone" event, which is the type of mechanism that produces the largest possible magnitude earthquakes. In the continental US, the only subduction zone is the Cascadia subduction zone which lies off the coast of northern California, Oregon and Washington, so an earthquake this large could only happen in that region. The only plant in that area is Columbia Generating Station, which is approximately 225 miles (363 km) from the coast and the subduction zone. Outside of the Cascadia subduction zone, earthquakes are not



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expected to exceed a magnitude of approximate 8, which is 10 times smaller than a magnitude 9.

**Additional, technical, non-public information: ADD**

## Questions for the Japanese

**NOTE:** These were all collected from what we produced after the KKNPP earthquake. These need to be gone through and revised for this event. We should separate into high, medium and low priorities:

The below is pulled from an KKNPP summary...to be reviewed...

What seismic monitoring equipment exists at the plants? Can we get the recordings from the  
Are there recordings of the tsunami at the plant location?  
What is the geology and soil profile at the plants?  
NOAA has a prediction of very large tsunami waves at Onagawa. Are these accurate?

The below is pulled from an KKNPP summary...to be reviewed...

**DESIGN BASES:** Exactly what is the design basis ground motion for each of the plants? Did it change through time (i.e. from the first plant to the seventh)? Where was the design basis motion defined, at the top of rock, at the ground surface, at the floor level or somewhere else? Were the site-specific geotechnical properties used in the development of the design basis ground motions for each plant?

**SEISMIC HAZARDS:** What assumptions were used in the seismic hazard evaluation to arrive at the design basis ground motions? What faults were considered, what magnitudes and geometries were assumed? What activity rates were assumed for both fault sources and "background" earthquakes?

**OBSERVATIONS-GROUND MOTIONS:** What ground motions were recorded and where were they recorded? Specifically, what free-field, in-structure and down-hole recordings were obtained? What are the locations of the instruments that obtained records? Did all the instruments respond as planned, or are there lessons to be learned? Can the digital data be shared with the NRC? Is there any way of evaluating how well the existing analysis methods predicted the observed motions at different points within the plant?

**OBSERVATIONS-DAMAGE:** What damage was observed at the plants? How well did equipment such as cranes perform? Were there observations of displacements of equipment from anchorages, were cracks observed in any of the buildings? How well did non-nuclear safety type of buildings and equipment perform? What types of geotechnical phenomena were observed, was there ground deformation/slope failures, lateral spreading or liquefaction near the facility? Did the ABWRs perform better or similar to the older designs?

**And another set from the KKNPP earthquake...to be reviewed...**

Please provide the following information in the time frame indicated:

Highest Priority Questions – as soon as possible

- A timeline describing the order of events and the individual plant responses to the earthquake
- Confirmation that all operating and shut down units achieved or maintained safe-shutdown conditions without manual operator intervention or complications. Did all safety-related systems respond to the seismic scram as designed? Please note if there were any unexpected plant responses to the event, including any spurious signals.
- A more detailed description of the impacts of the earthquake on the plant (e.g., what systems were involved, which pipes were damaged, where did the leakage occur (pipe wall, joints, fittings,,etc).
- A description of seismic instrumentation at the site and at each of the 7 units, soil/rock shear wave properties through depth, instrument location and mounting condition, all the recorded

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data on the basis of unified starting time, such that the coherency of motion through the surface or the foundations and at depth can be determined

- Full spectrum seismic design basis for the plant.
- What actually caused the Unit 3B house transformer fire?

Additional Questions – please provide answers as more information is developed

- Damage to buildings, slope failures, intake structure failure, if any
- Behavior of cranes, cables and conduits
- Failures of any large pumps and valves, pipe mounted control or valve failure
- Instances of any relay or vibration sensitive components malfunctioning
- Nature of damage to service water and fire-suppression piping - their diameter, material they are made of including their elastic properties, design standards used for the piping design, nature of failure (at support, anchor motion, failure of anchors, subsidence differential movement etc)
- Were there any systems that changed state?
- Impact on physical security, and any vulnerabilities identified
- Were there any impacts on the grid because of the event?
- Please describe the switchyard performance?
- What emergency preparedness concerns have been identified as a result of the event?

3B Transformer Specific Questions – please respond when there is time and other issues have been addressed

- What are the primary and secondary voltages of the transformer?
- What type of transformer - liquid or dry-type (air-cooled)?
- Who was the manufacturer of the transformer?
- What are the physical dimensions of the transformer?
- How are the transformer coils restrained within the cabinet?
- What is the clearance between transformer energized component and cabinet?
- What is the relative displacement for connection between the high voltage leads and the first anchor point (adequate slack?) in the transformer?
- What was the natural frequency of the burned transformer, if known?
- What was the acceleration level (or the response spectrum, if available) at the support location of the burned transformer?
- What seismic requirements exist for the burned transformer? Was the transformer tested or analyzed to a specific acceleration or response spectra, and if so, what are they?
- Are there any of the same type of transformer installed at other locations in the plant?

## Additional Information: Useful Tables

Table of Design Basis Ground Motions for US Plants

Design Basis Earthquake Information					
Nuclear Plant By State/Location	Maximum Observed Or Inferred Intensity (MMI Scale)	Relative Distance Of Seismic Source	Design SSE Peak Acceleration, <i>g</i>	OBE Peak Acceleration, <i>g</i>	Soil Condition
<b>New York</b>					
Fitzpatrick	VI	Near	0.15	0.08	Soil
Ginna 1	VIII/IX	>60 miles	0.2	0.08	Rock
Indian Point 2, 3	VII	Near	0.15	0.1	Rock
Nine Mile Point 1	IX-X	>60 miles	0.11	0.06	Rock
Nine Mile Point 2	VI	Near	0.15	0.075	Rock
<b>New Jersey</b>					
Salem 1,2	VII-VIII	Near	0.2	0.1	Deep Soil
<b>Connecticut</b>					
Millstone 1, 2, 3	VII	Near	0.17	0.07	Rock
<b>Vermont</b>					
Vermont Yankee	VI	Near	0.14	0.07	Rock
<b>Ohio</b>					
Davis Besse 1	VII	Near	0.15	0.08	Rock
Perry 1	VII	Near	0.15	0.08	Rock
<b>Georgia</b>					
Hatch 1, 2	VII	Near	0.15	0.08	Deep Soil
Vogtle 1, 2	VII-VIII	Near	0.2	0.12	Deep Soil
<b>Tennessee</b>					
Sequoyah 1, 2	VIII	Near	0.18	0.09	Rock
Watts Bar 1	VIII	Near	0.18	0.09	Rock
<b>California</b>					
San Onofre 2, 3	IX-X	Near	0.67	0.34	Soil
Diablo Canyon 1, 2	X-XI	Near	0.75	0.20	Rock
<b>Florida</b>					

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Crystal River 3	V	Near	0.10	0.05	Rock
St. Lucie 1, 2	VI	Near	0.10	0.05	Soil
Turkey Point 3, 4	VII	Near	0.15	0.05	Rock

**NOTES:**

MMI=Modified Mercalli Intensity, a measure of observed/reported damage and severity of shaking.  
Relative distance measure used in FSAR to develop SSE acceleration, "Near" indicates distance less than 10 miles.

SSE=Safe Shutdown Earthquake ground motion, for horizontal acceleration, in units of earth's gravity, *g*.  
OBE=Operating Basis Earthquake ground motion, level of horizontal acceleration, which if exceeded requires plant shutdown.

Table of SSE, OBE and Tsunami Water Levels

Nuclear Plant Name By State/ Location	Safe Shutdown Earthquake (SSE) Peak Acceleration (g)	Operating Basis Earthquake (OBE) Peak Acceleration, (g)	Probable Maximum Tsunami OR Maximum Tsunami Water Level
Alabama			
Browns Ferry	0.200	0.100	N/A (Non-Coastal)
Farley	0.100	0.050	N/A (Non-Coastal)
Arkansas			
Arkansas Nuclear	0.200		N/A (Non-Coastal)
Arizona			
Palo Verde	0.200	0.100	N/A (Non-Coastal)
California			
Diablo Canyon	0.400	0.200	The design basis maximum combined wave runup is the greater of that determined for near-shore or distantly-generated tsunamis, and results from near-shore tsunamis. For distantly-generated tsunamis, the combined runup is 30 feet. For near-shore tsunamis, the combined wave runup is 34.6 feet, as determined by hydraulic model testing. The safety-related equipment is installed in watertight compartments to protect it from adverse sea wave events to elevation +48 feet above mean lower low water line (MLLWL).
San Onofre	0.670	0.340	The controlling tsunami occurs during simultaneous high tide and storm surge produces a maximum runup to elevation +15.6 feet mean lower low water line (MLLWL) at the Unit 2 and 3 seawall. When storm waves are superimposed, the predicted maximum runup is to elevation +27 MLLWL. Tsunami protection for the SONGS site is provided by a reinforced concrete seawall constructed to elevation +30.0 MLLWL.
Connecticut			
Millstone	0.170	0.090	18 ft SWL
Florida			
Crystal River	0.050	0.025	N/A (Non-Coastal)

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<b>Nuclear Plant Name By State/ Location</b>	<b>Safe Shutdown Earthquake (SSE) Peak Acceleration (g)</b>	<b>Operating Basis Earthquake (OBE) Peak Acceleration, (g)</b>	<b>Probable Maximum Tsunami OR Maximum Tsunami Water Level</b>
St. Lucie	0.100	0.050	No maximum tsunami level, bounded by PMH surge of +18 MLW wave runup, with plant openings at +19.5 MLW
Turkey Point	0.150	0.050	No maximum tsunami level, bounded by PMH surge of +18.3 MLW water level, site protected to +20 MLW with vital equipment protected to +22 MLW
Georgia			
Hatch	0.150	0.080	N/A (Non-Coastal)
Vogtle	0.200	0.120	N/A (Non-Coastal)
Illinois			
Braidwood	0.200	0.090	N/A (Non-Coastal)
Byron	0.200	0.090	N/A (Non-Coastal)
Clinton	0.250	0.100	N/A (Non-Coastal)
Dresden	0.200	0.100	N/A (Non-Coastal)
LaSalle	0.200	0.100	N/A (Non-Coastal)
Quad Cities	0.240	0.120	N/A (Non-Coastal)
Iowa			
Duane Arnold	0.120	0.060	N/A (Non-Coastal)
Kansas			
Wolf Creek	0.120	0.060	N/A (Non-Coastal)
Louisiana			
River Bend	0.100	0.050	
Waterford	0.100		Floods – 30 feet MSL
Maryland			
Calvert Cliffs	0.150	0.080	14 ft design wave
Massachusetts			
Pilgrim	0.150	0.080	*Storm flooding design basis - 18.3ft
Michigan			
D.C. Cook	0.200	0.100	N/A
Fermi	0.150	0.080	N/A
Palisades	0.200	0.100	N/A

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<b>Nuclear Plant Name By State/ Location</b>	<b>Safe Shutdown Earthquake (SSE) Peak Acceleration (g)</b>	<b>Operating Basis Earthquake (OBE) Peak Acceleration, (g)</b>	<b>Probable Maximum Tsunami OR Maximum Tsunami Water Level</b>
Missouri			
Callaway	0.200		N/A (Non-Coastal)
Mississippi			
Grand Gulf	0.150	0.075	N/A
Minnesota			
Monticello	0.120	0.060	N/A (Non-Coastal)
Prarie Island	0.120	0.060	N/A (Non-Coastal)
Nebraska			
Cooper	0.200	0.100	N/A (Non-Coastal)
Fort Calhoun	0.170	0.080	N/A (Non-Coastal)
New York			
Fitzpatrick	0.150	0.080	N/A (Non-Coastal)
Ginna	0.200	0.080	N/A
Indian Point	0.150	0.100	15 ft msl
Nine Mile Point, Unit 1	0.110	0.060	N/A
Nine Mile Point, Unit 2	0.150	0.075	N/A
New Hampshire			
Seabrook	0.250	0.125	(+) 15.6' MSL Still Water Level (Tsunami Flooding -Such activity is extremely rare on the US Atlantic coast and would result in only minor wave action inside the harbor.)
New Jersey			
Hope Creek	0.200	0.100	35.4 MSL The maximum probable tsunami produces relatively minor water level changes at the site. The maximum runup height reaches an elevation of 18.1 feet MSL with coincident 10 percent exceedance high tide)
Oyster Creek	0.184	0.092	(+) 23.5' MSL Still Water Level (Probable Maximum Tsunami - Tsunami events are not typical of the eastern coast of the United States and have not, therefore, been addressed.)



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<b>Nuclear Plant Name By State/ Location</b>	<b>Safe Shutdown Earthquake (SSE) Peak Acceleration (g)</b>	<b>Operating Basis Earthquake (OBE) Peak Acceleration, (g)</b>	<b>Probable Maximum Tsunami OR Maximum Tsunami Water Level</b>
Salem	0.200	0.100	21.9 MSL (There is no evidence of surface rupture in East Coast earthquakes and no history of significant tsunami activity in the region)
North Carolina			
Brunswick	0.160	0.030	N/A
McGuire	0.150	0.080	N/A (Non-Coastal)
Shearon Harris	0.150		N/A (Non-Coastal)
Ohio			
Davis-Besse	0.150	0.080	N/A
Perry	0.150	0.080	N/A
Pennsylvania			
Beaver Valley	0.130	0.060	N/A (Non-Coastal)
Limerick	0.150	0.075	N/A (Non-Coastal)
Peach Bottom	0.120	0.050	N/A (Non-Coastal)
Three Mile Island	0.120	0.060	N/A (Non-Coastal)
Susquehanna	0.150	0.080	N/A (Non-Coastal)
South Carolina			
Catawba	0.150	0.080	N/A (Non-Coastal)
Oconee	0.150	0.050	N/A (Non-Coastal)
Robinson	0.200	0.100	N/A (Non-Coastal)
V.C. Summer	0.250	0.150	N/A (Non-Coastal)
Tennessee			
Sequoyah	0.180	0.090	N/A (Non-Coastal)
Watts Bar, Unit 1	0.180	0.090	N/A (Non-Coastal)
Texas			
Comanche Peak	0.120	0.060	N/A
South Texas Project	0.100	0.050	N/A
Vermont			

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<b>Nuclear Plant Name By State/ Location</b>	<b>Safe Shutdown Earthquake (SSE) Peak Acceleration (g)</b>	<b>Operating Basis Earthquake (OBE) Peak Acceleration, (g)</b>	<b>Probable Maximum Tsunami OR Maximum Tsunami Water Level</b>
Vermont Yankee	0.140	0.070	N/A
Virginia			
North Anna	0.180		N/A
Surry	0.150	0.080	N/A
Washington			
Columbia	0.250		N/A (Non-Coastal)
Wisconsin			
Kewaunee	0.120	0.060	N/A
Point Beach	0.120		N/A
<b>Definition of Safe Shutdown Earthquake</b>	The safe-shutdown earthquake (SSE) for the site is the ground motion response spectra (GMRS), which also satisfies the minimum requirement of paragraph IV(a)(1)(i) of Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants," to Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities," of the Code of Federal Regulations (10 CFR Part 50).		
<b>Definition of Operating Basis Earthquake:</b>	<p>To satisfy the requirements of paragraph IV(a)(2)(A) of Appendix S to 10 CFR Part 50, the operating-basis earthquake (OBE) ground motion is defined as follows:</p> <ul style="list-style-type: none"> <li>(i) For the certified design portion of the plant, the OBE ground motion is one-third of the CSDRS.</li> <li>(ii) For the safety-related noncertified design portion of the plant, the OBE ground motion is one-third of the design motion response spectra, as stipulated in the design certification conditions specified in design control document (DCD).</li> <li>(iii) The spectrum ordinate criterion to be used in conjunction with Regulatory Guide 1.166, "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-earthquake Actions," issued March 1997, is the lowest of (i) and (ii).</li> </ul>		

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**Table of Plants Near Known Active Faults**

It should be noted that in much of the Central and Eastern US, the seismicity comes from "background" seismicity. Background seismicity is earthquake activity, where the earthquakes cannot be tied to known faults.

Jon Ake and Dogan Seber to complete. High priority to support chairman in response to questions asked by congress.

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Plant (state)	Nearest Active Fault or Fault Zone	Distance to Fault or Range of Distances to Zones	Type of Faulting Mechanism	Range of Maximum Magnitude ( $M_w$ )	OBE (g)	SSE (g)
Columbia						
Diablo Canyon (CA)	Hosgri Fault	5 miles	Predominantly Strike Slip	7.5		
	Shoreline Fault	0.5 miles	Strike Slip	6.25 to 6.75 best estimate by NRC staff in RIL 09-001. Final report on the fault in review by NRC staff		
San Onofre (CA)						
Comanche Peak	Meers					

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**Table From GI-199 Program Containing SSE, SSE Exceedance Frequencies, Review Level Earthquakes, and Seismic Core Damage Frequencies**

Plant	Docket	SSE (g's)	Frequency of Exceeding the SSE (per year)	RLE (HCLPF) (g's)	Seismic Core Damage Frequency (per year)	IPEEE Method	Source
Arkansas 1	05000313	0.2	2.8E-04	0.3	4.1E-06	0.3g full-scope EPRI SMA	GI-199
Arkansas 2	05000368	0.2	9.7E-05	0.3	4.1E-06	0.3g focused-scope EPRI SMA	GI-199
Beaver Valley 1	05000334	0.12	3.3E-04	n/a	4.8E-05	seismic PRA	GI-199
Beaver Valley 2	05000412	0.12	2.7E-04	n/a	2.2E-05	seismic PRA	GI-199
Braidwood 1	05000456	0.2	6.7E-05	0.3	7.3E-06	0.3g focused-scope EPRI SMA	GI-199
Braidwood 2	05000457	0.2	6.7E-05	0.3	7.3E-06	0.3g focused-scope EPRI SMA	GI-199
Browns Ferry 1	05000259	0.2	2.5E-04	0.3	3.7E-06	0.3g focused-scope EPRI SMA	GI-199
Browns Ferry 2	05000260	0.2	2.5E-04	0.26	5.4E-06	0.3g focused-scope EPRI SMA	GI-199
Browns Ferry 3	05000296	0.2	2.5E-04	0.26	5.4E-06	0.3g focused-scope EPRI SMA	GI-199
Brunswick 1	05000325	0.16	7.3E-04	0.3	1.5E-05	0.3g focused-scope EPRI SMA	GI-199
Brunswick 2	05000324	0.16	7.3E-04	0.3	1.5E-05	0.3g focused-scope EPRI SMA	GI-199
Byron 1	05000454	0.2	5.2E-05	0.3	5.8E-06	0.3g focused-scope EPRI SMA	GI-199
Byron 2	05000455	0.2	5.2E-05	0.3	5.8E-06	0.3g focused-scope EPRI SMA	GI-199
Callaway	05000483	0.2	3.8E-05	0.3	2.0E-06	0.3g focused-scope EPRI SMA	GI-199
Calvert Cliffs 1	05000317	0.15	1.9E-04	n/a	1.0E-05	seismic PRA	GI-199
Calvert Cliffs 2	05000318	0.15	1.9E-04	n/a	1.2E-05	seismic PRA	GI-199
Catawba 1	05000413	0.15	1.4E-04	n/a	3.7E-05	seismic PRA	GI-199
Catawba 2	05000414	0.15	1.4E-04	n/a	3.7E-05	seismic PRA	GI-199
Clinton	05000461	0.25	5.8E-05	0.3	2.5E-06	0.3g focused-scope EPRI SMA	GI-199
Columbia	05000397	0.25	1.7E-04	n/a	2.1E-05	seismic PRA	IPEEE
Comanche Peak 1	05000445	0.12	1.6E-05	0.12	4.0E-06	reduced-scope EPRI SMA; SSE = 0.12g	GI-199
Comanche	05000446	0.12	1.6E-05	0.12	4.0E-06	reduced-scope EPRI SMA; SSE =	GI-199

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Plant	Docket	SSE (g's)	Frequency of Exceeding the SSE (per year)	RLE (HCLPF) (g's)	Seismic Core Damage Frequency (per year)	IPEEE Method	Source
Peak 2						0.12g	
Cooper	05000298	0.2	1.5E-04	0.3	7.0E-06	0.3g focused-scope EPRI SMA	GI-199
Crystal River 3	05000302	0.1	8.9E-05	0.1	2.2E-05	reduced-scope EPRI SMA; SSE = 0.1g	GI-199
D.C. Cook 1	05000315	0.2	2.1E-04	n/a	2.2E-05	seismic PRA	GI-199
D.C. Cook 2	05000316	0.2	2.1E-04	n/a	2.2E-05	seismic PRA	GI-199
Davis Besse	05000346	0.15	6.3E-05	0.26	6.7E-06	reduced-scope EPRI SMA	GI-199
Diablo Canyon 1	05000275	0.75	2.0E-04	n/a	4.1E-05	seismic PRA	IPEEE
Diablo Canyon 2	05000323	0.75	2.0E-04	n/a	4.1E-05	seismic PRA	IPEEE
Dresden 2	05000237	0.2	9.7E-05	0.26	1.9E-05	0.3g focused-scope EPRI SMA	GI-199
Dresden 3	05000249	0.2	9.7E-05	0.26	1.9E-05	0.3g focused-scope EPRI SMA	GI-199
Duane Arnold	05000331	0.12	2.3E-04	0.12	3.2E-05	reduced-scope EPRI SMA; SSE = 0.12g	GI-199
Farley 1	05000348	0.1	1.0E-04	0.1	2.8E-05	reduced-scope EPRI SMA; SSE = 0.1g	GI-199
Farley 2	05000364	0.1	1.0E-04	0.1	2.8E-05	reduced-scope EPRI SMA; SSE = 0.1g	GI-199
Fermi 2	05000341	0.15	1.0E-04	0.3	4.2E-06	0.3g focused-scope EPRI SMA	GI-199
Fitzpatrick	05000333	0.15	3.2E-04	0.22	6.1E-06	0.3g focused-scope NRC SMA	GI-199
Fort Calhoun 1	05000285	0.17	3.7E-04	0.25	5.4E-06	0.3g focused-scope NRC SMA	GI-199
Ginna	05000244	0.2	1.0E-04	0.2	1.3E-05	0.3g focused-scope EPRI SMA	GI-199
Grand Gulf	05000416	0.15	1.0E-04	0.15	1.2E-05	reduced-scope EPRI SMA; SSE = 0.15g	GI-199
Hatch 1	05000400	0.148	3.9E-04	0.29	2.3E-06	0.3g focused-scope EPRI SMA	GI-199
Hatch 2	05000321	0.15	2.7E-04	0.3	2.5E-06	0.3g focused-scope EPRI SMA	GI-199

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Plant	Docket	SSE (g's)	Frequency of Exceeding the SSE (per year)	RLE (HCLPF) (g's)	Seismic Core Damage Frequency (per year)	IPEEE Method	Source
Hope Creek	05000366	0.2	9.7E-05	0.3	2.5E-06	0.3g focused-scope EPRI SMA	GI-199
Indian Point 2	05000354	0.15	4.9E-04	n/a	2.8E-06	seismic PRA	GI-199
Indian Point 3	05000247	0.15	4.9E-04	n/a	3.3E-05	seismic PRA	GI-199
Kewaunee	05000286	0.12	2.8E-04	n/a	1.0E-04	seismic PRA	GI-199
LaSalle 1	05000305	0.2	1.7E-04	n/a	5.1E-06	seismic PRA	GI-199
LaSalle 2	05000373	0.2	1.7E-04	n/a	2.8E-06	seismic PRA	GI-199
Limerick 1	05000374	0.15	1.8E-04	n/a	2.8E-06	seismic PRA	GI-199
Limerick 2	05000352	0.15	1.8E-04	0.15	5.3E-05	reduced-scope EPRI SMA	GI-199
McGuire 1	05000353	0.15	9.5E-05	0.15	5.3E-05	reduced-scope EPRI SMA	GI-199
McGuire 2	05000369	0.15	9.5E-05	n/a	3.1E-05	seismic PRA	GI-199
Millstone 1	05000370	0.254	9.3E-05	n/a	3.1E-05	seismic PRA	GI-199
Millstone 2	05000336	0.17	8.3E-05	0.25	1.1E-05	0.3g focused-scope EPRI SMA	GI-199
Millstone 3	05000423	0.17	8.3E-05	n/a	1.5E-05	seismic PRA	GI-199
Monticello	05000263	0.12	9.3E-05	0.12	1.9E-05	modified focused/expended reduced-scope EPRI SMA	GI-199
Nine Mile Point 1	05000220	0.11	1.5E-04	0.27	4.2E-06	0.3g focused-scope EPRI SMA	GI-199
Nine Mile Point 2	05000410	0.15	4.8E-05	0.23	5.6E-06	SPRA and focused-scope EPRI SMA	GI-199
North Anna 1	05000338	0.12	2.1E-04	0.16	4.4E-05	0.3g focused-scope EPRI SMA	GI-199
North Anna 2	05000339	0.12	2.1E-04	0.16	4.4E-05	0.3g focused-scope EPRI SMA	GI-199
Oconee 1	05000269	0.1	9.7E-04	n/a	4.3E-05	seismic PRA	GI-199
Oconee 2	05000270	0.1	9.7E-04	n/a	4.3E-05	seismic PRA	GI-199
Oconee 3	05000287	0.1	9.7E-04	n/a	4.3E-05	seismic PRA	GI-199
Oyster Creek	05000219	0.17	1.5E-04	n/a	1.4E-05	seismic PRA	GI-199
Palisades	05000255	0.2	1.4E-04	n/a	6.4E-06	seismic PRA	GI-199
Palo Verde 1	05000528	0.258	3.5E-05	0.3	3.8E-05	0.3g full-scope EPRI SMA	IPEEE
Palo Verde 2	05000529	0.258	3.5E-05	0.3	3.8E-05	0.3g full-scope EPRI SMA	IPEEE

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Plant	Docket	SSE (g's)	Frequency of Exceeding the SSE (per year)	RLE (HCLPF) (g's)	Seismic Core Damage Frequency (per year)	IPEEE Method	Source
Palo Verde 3	05000530	0.258	3.5E-05	0.3	3.8E-05	0.3g full-scope EPRI SMA	IPEEE
Peach Bottom 2	05000277	0.12	2.0E-04	0.2	2.4E-05	modified focused-scope EPRI SMA	GI-199
Peach Bottom 3	05000278	0.12	2.0E-04	0.2	2.4E-05	modified focused-scope EPRI SMA	GI-199
Perry	05000440	0.15	2.2E-04	0.3	2.1E-05	0.3g focused-scope EPRI SMA	GI-199
Pilgrim 1	05000293	0.15	8.1E-04	n/a	6.9E-05	seismic PRA	GI-199
Point Beach 1	05000266	0.12	2.0E-04	n/a	1.1E-05	seismic PRA	GI-199
Point Beach 2	05000301	0.12	2.0E-04	n/a	1.1E-05	seismic PRA	GI-199
Prairie Island 1	05000282	0.12	2.0E-04	0.28	3.0E-06	0.3g focused-scope EPRI SMA	GI-199
Prairie Island 2	05000306	0.12	2.0E-04	0.28	3.0E-06	0.3g focused-scope EPRI SMA	GI-199
Quad Cities 1	05000254	0.24	8.2E-04	0.09	2.7E-05	0.3g focused-scope EPRI SMA	GI-199
Quad Cities 2	05000265	0.24	8.2E-04	0.09	2.7E-05	0.3g focused-scope EPRI SMA	GI-199
River Bend	05000458	0.1	2.4E-04	0.1	2.5E-05	reduced-scope EPRI SMA; SSE = 0.1g	GI-199
Robinson (HR)	05000261	0.2	1.1E-03	0.28	1.5E-05	0.3g full-scope EPRI SMA	GI-199
Saint Lucie	05000335	0.1	1.4E-04	0.1	4.6E-05	reduced-scope EPRI SMA; SSE = 0.1g	GI-199
Salem 1	05000389	0.2	2.6E-04	0.1	4.6E-05	reduced-scope EPRI SMA; SSE = 0.1g	GI-199
Salem 2	05000272	0.2	2.6E-04	n/a	9.3E-06	seismic PRA	GI-199
San Onofre 2	05000361	0.67	1.2E-04	n/a	1.7E-05	seismic PRA	IPEEE
San Onofre 3	05000362	0.67	1.2E-04	n/a	1.7E-05	seismic PRA	IPEEE
Seabrook	05000311	0.25	1.3E-04	n/a	9.3E-06	seismic PRA	GI-199
Sequoyah 1	05000443	0.18	7.1E-04	n/a	2.2E-05	seismic PRA	GI-199
Sequoyah 2	05000327	0.18	7.1E-04	0.27	5.1E-05	0.3g full-scope EPRI SMA	GI-199
Shearon Harris 1	05000328	0.15	4.6E-05	0.27	5.1E-05	0.3g full-scope EPRI SMA	GI-199
South Texas 1	05000498	0.1	3.0E-05	n/a	6.2E-06	seismic PRA	GI-199

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Plant	Docket	SSE (g's)	Frequency of Exceeding the SSE (per year)	RLE (HCLPF) (g's)	Seismic Core Damage Frequency (per year)	IPEEE Method	Source
South Texas 2	05000499	0.1	3.0E-05	n/a	6.2E-06	seismic PRA	GI-199
Summer	05000395	0.15	3.9E-04	0.22	3.8E-05	0.3g focused-scope EPRI SMA	GI-199
Surry 1	05000280	0.15	2.2E-04	n/a	5.7E-06	seismic PRA	GI-199
Surry 2	05000281	0.15	2.2E-04	n/a	5.7E-06	seismic PRA	GI-199
Susquehanna 1	05000387	0.1	1.9E-04	0.21	1.3E-05	0.3g focused-scope EPRI SMA	GI-199
Susquehanna 2	05000388	0.1	1.9E-04	0.21	1.3E-05	0.3g focused-scope EPRI SMA	GI-199
Three Mile Island 1	05000289	0.12	1.0E-04	n/a	4.0E-05	seismic PRA	GI-199
Turkey Point 3	05000250	0.15	3.8E-05	0.15	1.0E-05	site-specific approach; SSE=0.15g	GI-199
Turkey Point 4	05000251	0.15	3.8E-05	0.15	1.0E-05	site-specific approach; SSE=0.15g	GI-199
Vermont Yankee	05000271	0.14	1.2E-04	0.25	8.1E-06	0.3g focused-scope EPRI SMA	GI-199
Vogtle 1	05000424	0.2	1.5E-04	0.3	1.8E-05	0.3g focused-scope EPRI SMA	GI-199
Vogtle 2	05000425	0.2	1.5E-04	0.3	1.8E-05	0.3g focused-scope EPRI SMA	GI-199
Waterford 3	05000382	0.1	1.1E-04	0.1	2.0E-05	reduced-scope EPRI SMA; SSE = 0.1g	GI-199
Watts Bar	05000390	0.18	2.9E-04	0.3	3.6E-05	0.3g focused-scope EPRI SMA	GI-199
Wolf Creek	05000482	0.12	3.7E-05	0.2	1.8E-05	reduced-scope EPRI SMA	GI-199
25th percentile			9.6E-05		6.0E-06		
min			1.6E-05		2.0E-06		
median			1.7E-04		1.5E-05		
mean			3.1E-04		2.1E-05		
max			3.9E-03		1.0E-04		
75th percentile			2.6E-04		3.2E-05		



**Design Basis Ground Motions and New Review Level Ground Motions Used for Review of Japanese Plants**

Plant sites	Contributing earthquakes	New DBGM $S_1$	Original DBGM $S_2$
Tomari	Earthquakes undefined specifically	550 Gal	370 Gal
Onagawa	Soutei Miyagiken-oki (M8.2)	580	375
Higashidoori	Earthquakes undefined specifically	450	375
Fukushima	Earthquake near the site (M7.1)	600	370
Tokai	Earthquakes undefined specifically	600	380
Hamaoka	Assumed Tokai (M8.0), etc.	800	600
Shika	Sasanami-oki Fault (M7.6)	600	490
Tsuruga	Urazoko-Uchiikemi Fault (M6.9), etc. → Mera-Kareizaki - Kaburagi (M7.8), Shelf edge+B+Nosaka (M7.7)	800	532
Mihama	C, Fo-A Fault (M6.9) → Shelf edge+B+Nosaka (M7.7)	750	405
Ohi	C, Fo-A Fault (M6.9) → Fo-A+Fo-B (M7.4)	700	405
Takahama	Fo-A Fault (M6.9) → Fo-A+Fo-B (M7.4)	550	370
Shimane	Shinji Fault (M7.1)	600	456
Ikata	Central Tectonic Structure (M7.6)	570	473
Genkai	Takekoba F. (M6.9) → Enhanced uncertainty consideration	540	370
Sendai	Gotandagawa F. (M6.9), F-A (M6.9)	540	372
Kashiwazaki-Kariwa	F-B Fault (M7.0), Nagaoka-plain-west Fault (M8.1)	2300 (R1 side) 1209 (R5 side)	450
Monju (Proto Type FBR)	Shiraki-Niu F. (M6.9), C F. (M6.9) → Shelf edge+B+Nosaka (M7.7), Small Damping	760	408
Shimokita Reprocessing F.	Deto-Seiho F. (M6.8), Yokohama F. (M6.8)	450	320

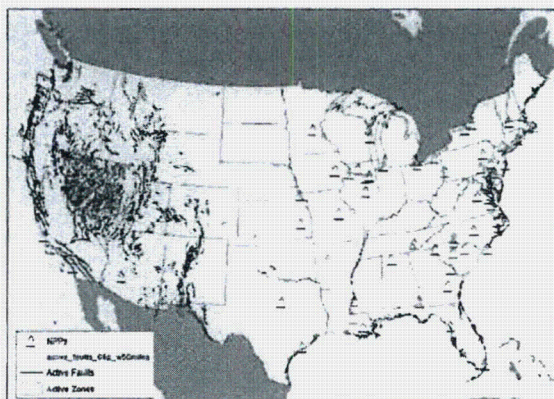
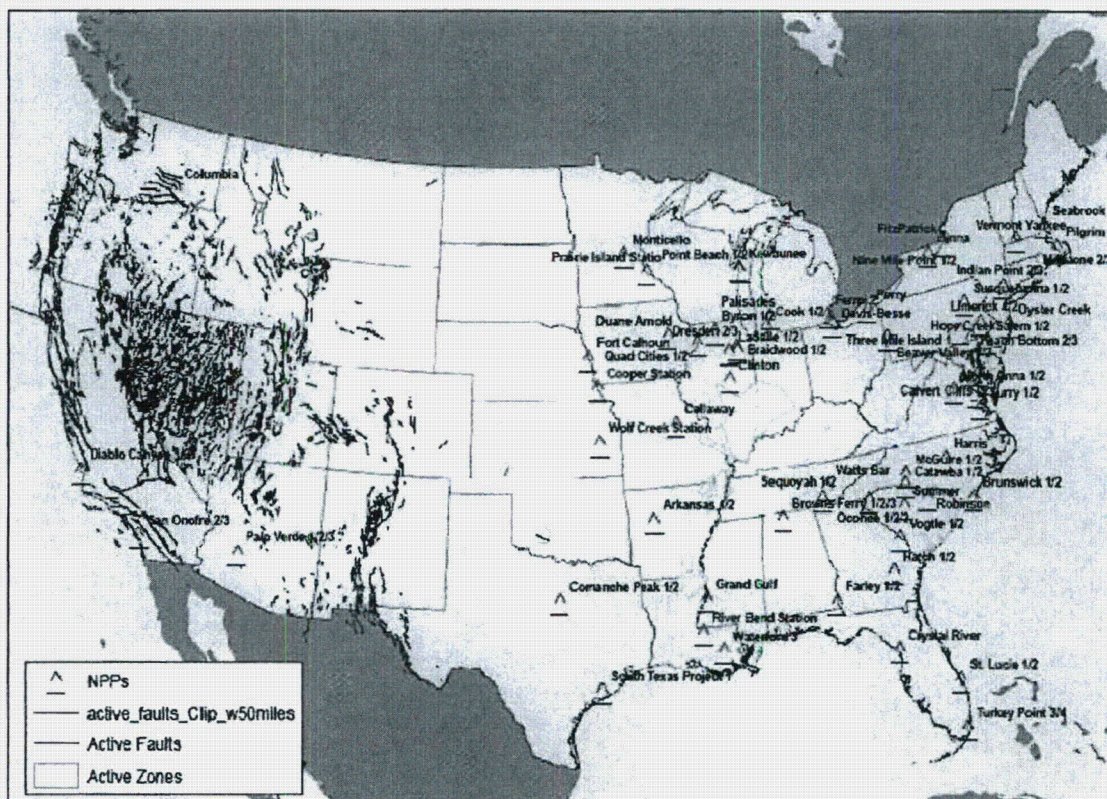
**Status of Review of Japanese NPPs to New Earthquake Levels Based on 2006 Guidance**

Utility	Site (Unit)	Type	Dec.2010
Hokkaido	Tomari	PWR	Δ
Tohoku	Onagawa (Unit1)	BWR	◎
	Higashi-dori	BWR	Δ
Tokyo	Kashiwazaki-Kariwa	BWR	Unit 1,5,6,7 ◎
	Fukushima-No1	BWR	Unit 3 ◇, 5 ◎
	Fukushima-No2	BWR	Unit 4,5 ◎
Chubu	Hamaoka	BWR	Δ
Hokuriku	Shika (Unit 2)	BWR	◎
Kansai	Mihama(Unit 1)	PWR	◎
	Ohi(Unit 3,4)	PWR	◎
	Takahama (Unit 3,4)	PWR	◎
Chugoku	Shimane (Unit 1, 2)	BWR	◎
Shikoku	Ikata (Unit 3)	PWR	◎
Kyushu	Genkai (Unit 3 )	PWR	◎
	Sendai (Unit 1)	PWR	◎
Japan Atomic Power	Tokai-Daini	BWR	○
	Tsuruga	BWR/PWR	Δ
JAEA	Monjyu	Proto Type FBR	◎
Japan Nuc. Fuel	Rokkasyo	Reprocessing	◎
◎: NSC review finished, ○: NISA review finished and in NSC review, Δ: Under review by NISA			

## Additional Information: Useful Plots

### Plot of Mapped Active Quaternary Faults and Nuclear Plants in the US

It is important to note that this plot somewhat misleading as faults in the central and eastern US are not well characterized. For example, the faults responsible for very large historic events, such as the 1811 and 1812 New Madrid Earthquakes, and the 1886 Charleston Earthquakes have not been conclusively located.





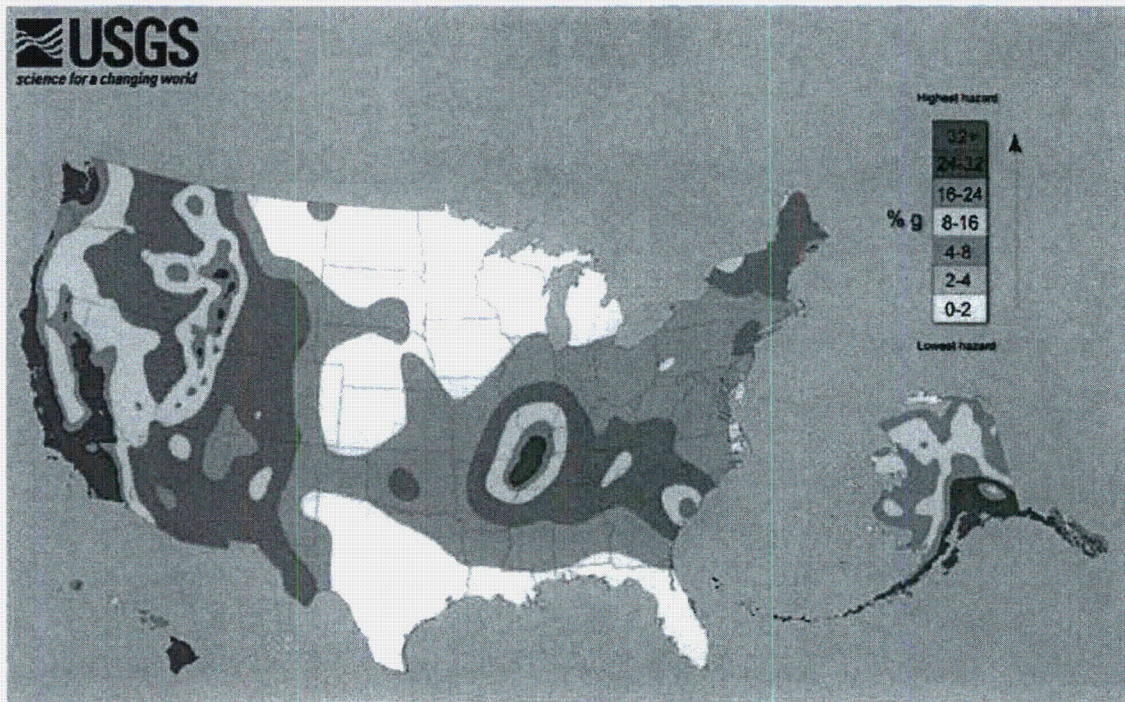
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## Nuclear Plants in the US Compared to the USGS National Seismic Hazard Maps

Dogan to create the map

### USGS US National Seismic Hazard Maps

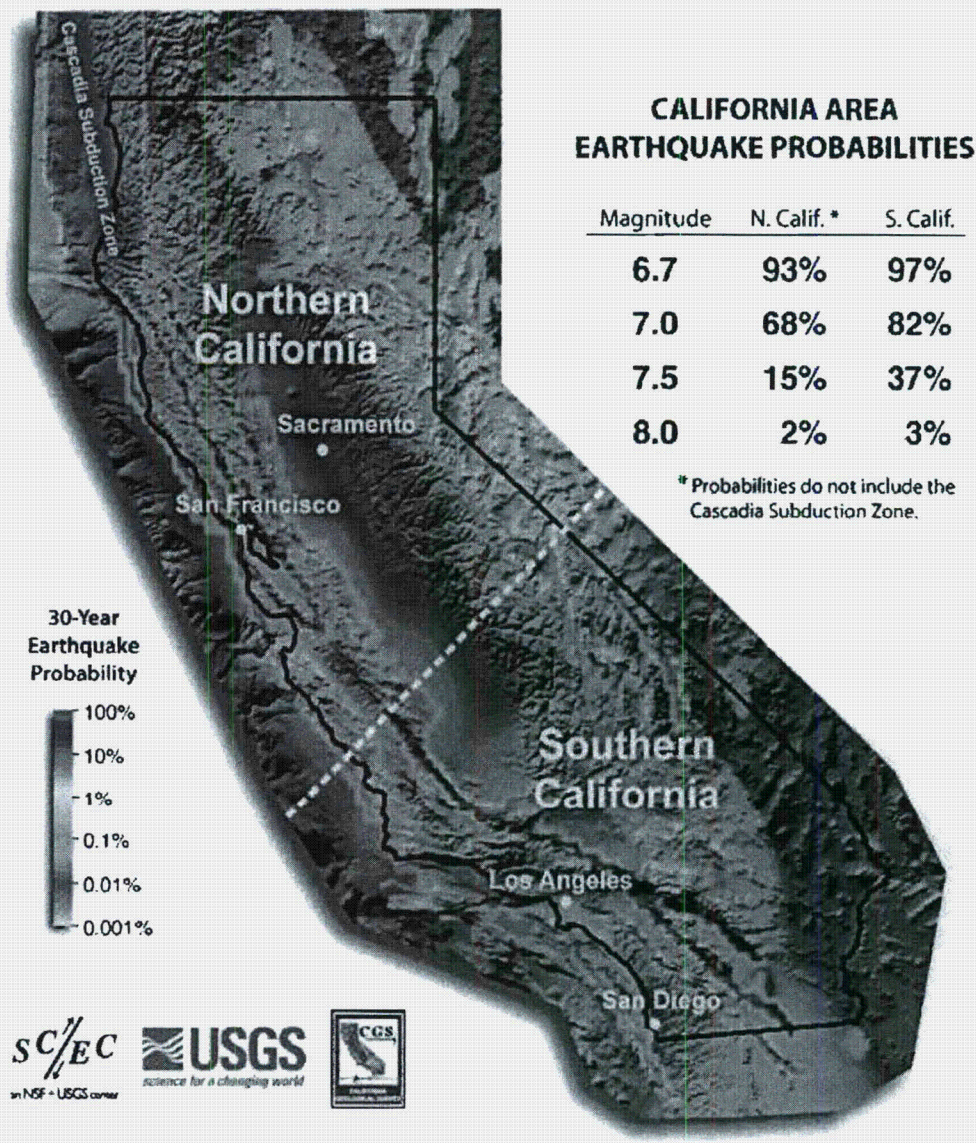
Many version of this map are available at the USGS website at <http://earthquake.usgs.gov/hazards/>





**UCERF Map of California Earthquake Probabilities for Northern versus Southern California**

This is included in this document as Markey (inappropriately) used the below statistics to say that the probability of a magnitude 7 at SONGS was 82%. The dashed line of this California map is the boundary between northern and southern California used in the UCERF study. As shown in the table, the 30-year probability of an earthquake of magnitude 7.5 or larger is higher in the southern half of the state (37%) than in the northern half (15%).

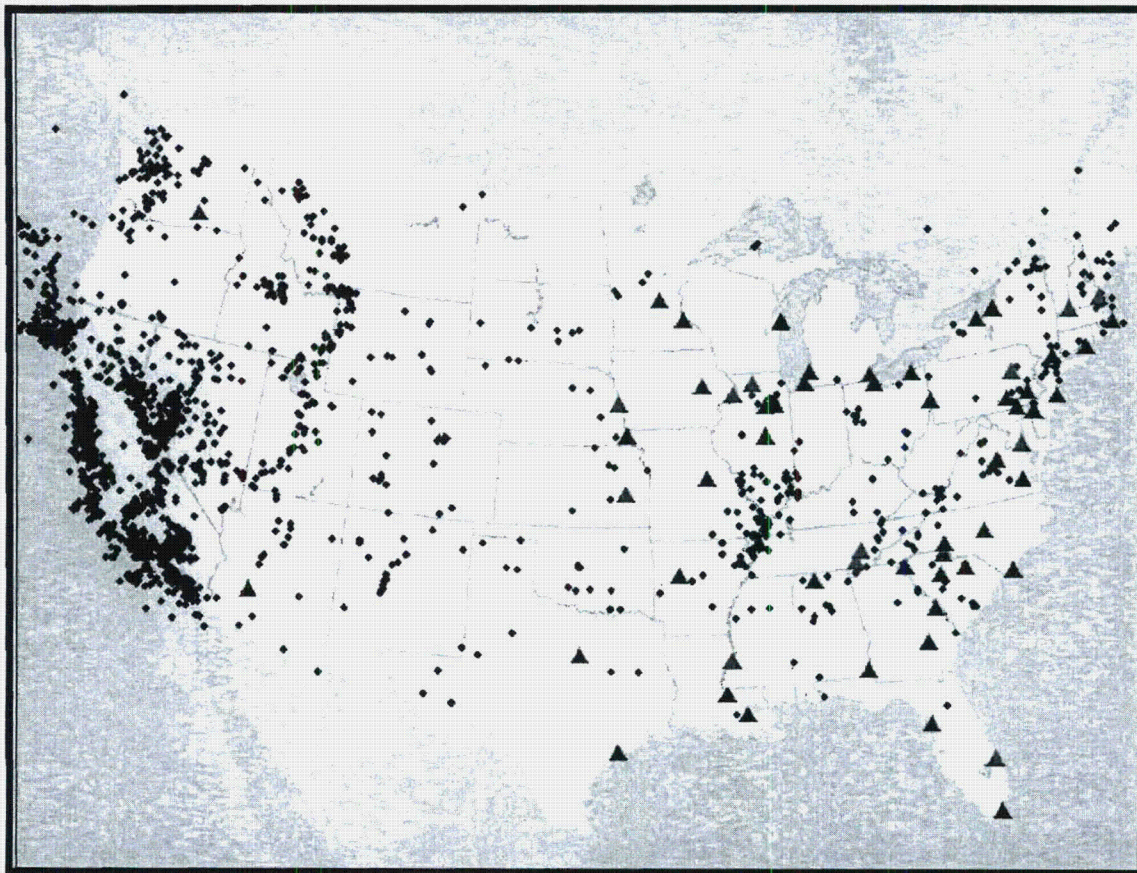




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### Plot of Nuclear Plants in the US Compared to Recent Earthquakes

Not sure of the date on this....It's an awesome plot. can we get this updated with a date? Who made this originally (NRO?RES?)

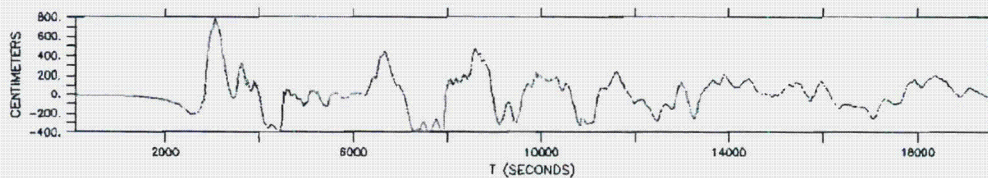
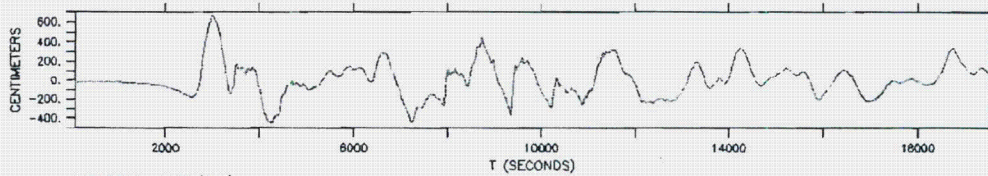
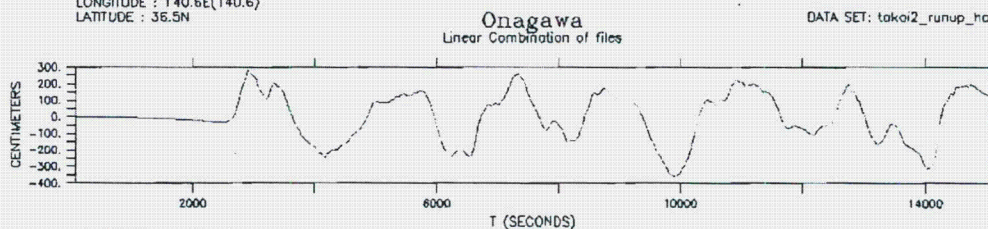
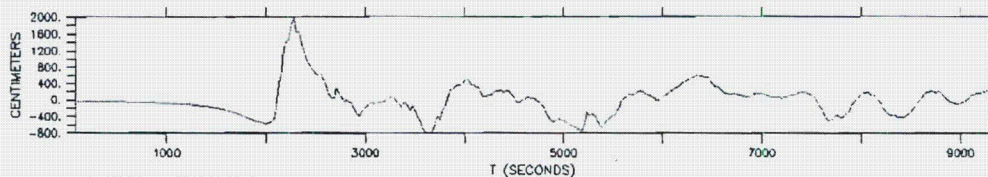




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### Plot of Tsunami Wave Heights at the Japanese Plants (NOAA)

These are results from high-resolution models run by PMEL NOAA staff, who do modeling for the tsunami warning system. While the available bathymetry and topography data used in the model are not of the highest quality at that location, NOAA has confidence in the results, which show good comparisons between model flooding estimates and inundation observations inferred from satellite images. DART measurements are used in the modeling. The images show model time series very close to a shoreline, at about 5m depth. The runup heights (maximum elevation of flooded area) may be different from these amplitudes at shoreline (can be higher or lower, depending on the topographic profile).





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## Additional Information: Fact Sheets

### Fact Sheet: Summarization of the NRC's Regulatory Framework for Seismic Safety (High level overview)

The seismic regulatory basis for licensing of the currently operating nuclear power reactors is contained in the following regulations: 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," including the "General Design Criteria for Nuclear Power Plants," and 10 CFR Part 100 ("Seismic and Geologic Siting Criteria For Nuclear Power Plants") and Appendix A to that Part, which describes the general criteria that guide the evaluation of the suitability of proposed sites for nuclear power plants.

General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena," in Appendix A requires that the structures and components in nuclear power plants be designed to withstand the effects of natural phenomena, including earthquakes and tsunamis, without loss of capability to perform their intended safety functions. GDC 2 also requires that the design bases include sufficient margin to account for the limited accuracy, quantity, and period of time in which the historical data have been accumulated. The earthquake which could cause the maximum vibratory ground motion at the site is designated as the **Safe Shutdown Earthquake (SSE)**. Under SSE ground motions, nuclear power plant structures and components must remain functional and within applicable stress, strain, and deformation limits. Each plant must also have seismic instrumentation to determine if the **Operating Basis Earthquake (OBE)**, typically one-half or one-third the level of the SSE, has been exceeded. If the OBE is exceeded or significant plant damage has occurred, then the nuclear power plant must be shutdown.

Each plant is designed to a ground-shaking level (the SSE) that is appropriate for its location, given the possible earthquake sources that may affect the site and its tectonic environment. Ground shaking is a function of both the magnitude of the earthquake, the distance of the earthquake to the site, and the local geology. The magnitude alone cannot be used to predict ground motions. The existing plants were designed on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquake expected in the area around the plant. This required an assessment of earthquakes that had occurred in the region around each plant site.

Design basis loads for nuclear power plant structures include combined loads for seismic, wind, tornado, normal operating conditions (pressure and thermal), and accident conditions. Codes and standards, such as the American Society of Mechanical Engineers, the American Concrete Institute, and the American Institute of Steel Construction, are used in the design of nuclear power plant structures to ensure a conservative, safe design under design basis loads.

In the mid to late 1990s, NRC staff reviewed the potential consequences of severe earthquakes (earthquakes beyond the safety margin included in each plant's design basis), as part of the Individual Plant Examination of External Events (or IPEEE) program. From this review, the staff determined that seismic designs of operating plants in the United States have adequate safety margins, for withstanding earthquakes, built into the designs. Currently, the NRC staff is reassessing the seismic designs of operating plants through our Generic Issues program. The initial results of this assessment found that: 1) seismic hazard estimates have increased at some operating plants in the central and eastern US; 2) there is no immediate safety concern, plants have significant safety margin and overall seismic risk estimates remain small; and 3) assessment of updated seismic hazards and plant performance should continue.

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## **Fact Sheet: Summarization of the NRC's Regulatory Framework for Seismic Safety (The policy wonk version)**

~~(Jon to clean up upon his return from vaca)~~ NRC's regulatory framework for seismic safety of nuclear reactors and facilities is based on: reactor site suitability with respect to geological, seismological, hydrological and other site specific hazards; classification of structures, systems and components (SSCs) as Seismic Category I, seismic design of Seismic Category I SSCs, seismic and environmental qualification of Category I SSCs; and maintenance and in-service inspection of equipment and structures, including the containment structure. The NRC's regulatory framework with respect to seismic issues has evolved through time.

### **Currently Operating Reactors (licensed prior to 1997):**

The seismic regulatory basis for licensing of the currently operating nuclear power reactors is contained in the following regulations: 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," including the "General Design Criteria for Nuclear Power Plants," and 10 CFR Part 100 ("Seismic and Geologic Siting Criteria For Nuclear Power Plants") and Appendix A to that Part which describes general criteria that guide the evaluation of the suitability of proposed sites for nuclear power plants.

General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena," in Appendix A requires that the SSCs important to safety be designed to withstand the effects of natural phenomena, including earthquakes, tsunamis, and seiches without loss of capability to perform their intended safety functions. GDC 2 requires that the design bases shall include sufficient margin to account for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, and shall consider appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena. The earthquake which could cause the maximum vibratory ground motion at the site is designated the **Safe Shutdown Earthquake (SSE)**.

Each plant is designed to a ground-shaking level (the SSE) that is appropriate for its location, given the possible earthquake sources that may affect the site and its tectonic environment. Ground shaking is a function of both the magnitude of an earthquake and the distance from the fault to the site. The magnitude alone cannot be used to predict ground motions. The existing plants were designed on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquake expected in the area around the plant based on an assessment of earthquakes that had occurred in the region historically. There is no specification of frequency of occurrence in the deterministic approach. There is no requirement for a periodic reassessment of the seismic design basis.

Paragraph VI(a)(3) of Appendix A requires that suitable seismic instrumentation must be provided so that the seismic response of nuclear power plant features important to safety can be determined promptly after an earthquake to permit comparison of such response to that used as the design basis. Such a comparison is needed to decide whether the plant can continue to be operated safely and to permit appropriate action in a timely manner. Appendix A requires that in addition to seismic loads, including aftershocks, applicable concurrent functional and accident induced loads shall be taken into account in the design of safety-related SSCs. Paragraph VI(c) requires that seismically induced flood, water waves from either locally or distantly generated seismic activity and other design conditions shall be taken into account in nuclear power plant design.

### **Proposed New Reactors (submitted after 1997):**

In 1997 new rules governing reactor siting were established. 10 CFR Part 50 Appendix A (GDC 2), 100.23 and Appendix S establish the seismic design basis for plants licensed after January 10, 1997. Similar to

pre-1997, Appendix S defines the SSE as "*the Safe-shutdown earthquake ground motion is the vibratory ground motion for which certain structures, systems, and components must be designed to remain functional.*" 10 CFR Part 100.23 "Geologic and Seismic Siting Criteria" requires that the applicant determine the SSE and its uncertainty, the potential for surface tectonic and nontectonic deformations. Regulatory Guide 1.165 (and subsequently Regulatory Guide 1.208) provides guidance on satisfying 10 CFR Part 100.23, one of which is performing a probabilistic seismic hazard assessment (PSHA).

Appendix S to 10 CFR Part 50 requires for SSE ground motions, SSCs will remain functional and within applicable stress, strain, and deformation limits. The required safety functions of SSCs must be assured during and after the vibratory ground motion through design, testing, or qualification methods. The evaluation must take into account soil-structure interaction effects and the expected duration of the vibratory motions. Appendix S also requires that the horizontal component of the SSE ground motion in the free field at the foundation elevation of structures must be an appropriate response spectrum with a peak ground acceleration (PGA) of at least 0.10g. Design basis loads for nuclear power plant structures, important to safety, include combined loads for seismic, wind, tornado, normal operating conditions (pressure and thermal), and accident conditions. Codes and standards, such as the ASME B&PV Code, the American Institute of Concrete Institute (ACI-359/ASME Section III Division 2, ACI-349) and the American Institute of Steel Construction (AISC N690), are used in the design of nuclear power plant structures to ensure a conservative, safe design under design basis loads.

In contrast to the deterministic approach used prior to 1997, the probabilistic method is used and explicitly accounts for possible earthquakes of various magnitudes that come from all plausible potential sources (including background seismicity) and the likelihood that each particular hypothetical earthquake occurs. The PSHA process provides a complete characterization of the ground motion and comprehensively addresses uncertainties in nuclear power plant seismic demands. The PSHA results are major input to seismic risk evaluation using either SPRA or SMA approaches. As for plants licensed prior to 1997, there is no requirement for a periodic reassessment of the seismic design basis.

In addition to the nominal seismic design, all new generation reactors have to demonstrate a **Seismic margin of 1.67** relative to the site-specific seismic demands. These designs are required to perform a Probabilistic Risk Assessment (PRA) based seismic margins analysis (SMA) to identify the vulnerabilities of their design to seismic events. The minimum high confidence, low probability of failure (HCLPF) for the plant should be at least 1.67 times the ground motion acceleration of the design basis safe-shutdown earthquake (SSE).

The Standard Review Plan (NUREG-0800), Regulatory Guides and Interim Staff Guidance provide the basis for staff reviews of existing reactors and new license applications. Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires that suitable instrumentation must be provided so that the seismic response of nuclear power plant features important to safety can be evaluated promptly after an earthquake. Paragraph 10 CFR 50.54(ff) and Paragraph IV(a)(3) of Appendix S to 10 CFR Part 50 requires shutdown of the nuclear power plant if vibratory ground motion exceeding that of the operating basis earthquake ground motion (OBE) occurs. The OBE is typically one-half or one-third the level of the SSE. If systems, structures, or components necessary for the safe shutdown of the nuclear power plant are not available after occurrence of the OBE, the licensee must consult with the NRC and must propose a plan for the timely, safe shutdown of the nuclear power plant. Paragraph IV(c) requires that seismically induced flood, water waves from either locally or distantly generated seismic activity and other design conditions shall be taken into account in nuclear power plant design so as to prevent undue risk to health and safety of the public.

## Fact Sheet: Summarization of the NRC's Regulatory Framework for Seismic Safety (The cliff notes)

### NRC Regulations and Guidelines for Seismic Safety:

- The seismic regulatory basis for licensing of the currently operating nuclear power reactors is contained in the following regulations:
  - 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," including the "General Design Criteria for Nuclear Power Plants," and
  - 10 CFR Part 100 ("Seismic and Geologic Siting Criteria For Nuclear Power Plants") and Appendix A to that Part, which describes the general criteria that guide the evaluation of the suitability of proposed sites for nuclear power plants.
- In addition, General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena," in Appendix A requires that:
  - The structures and components in nuclear power plants be designed to withstand the effects of natural phenomena, including earthquakes and tsunamis, without loss of capability to perform their intended safety functions.
  - GDC 2 also requires that the design bases include sufficient margin to account for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.
    - The earthquake which could cause the maximum vibratory ground motion at the site is designated as the **Safe Shutdown Earthquake (SSE)**. Under SSE ground motions, nuclear power plant structures and components must remain functional and within applicable stress, strain, and deformation limits.
    - Each plant must also have seismic instrumentation to determine if the **Operating Basis Earthquake (OBE)**, typically one-half or one-third the level of the SSE, has been exceeded. If the OBE is exceeded or significant plant damage has occurred, then the nuclear power plant must be shutdown.

### Plant Design /Design Basis (Seismic):

- Each plant is designed to a ground-shaking level (the SSE) that is appropriate for its location, given the possible earthquake sources that may affect the site and its tectonic environment. Ground shaking is a function of both the magnitude of the earthquake, the distance of the earthquake to the site, and the local geology. The magnitude alone cannot be used to predict ground motions. The existing plants were designed on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquake expected in the area around the plant. This required an assessment of earthquakes that had occurred in the region around each plant site.
- Design basis loads for nuclear power plant structures include combined loads for seismic, wind, tornado, normal operating conditions (pressure and thermal), and accident conditions. Codes and standards, such as the American Society of Mechanical Engineers, the American Concrete Institute, and the American Institute of Steel Construction, are used in the design of nuclear power plant structures to ensure a conservative, safe design under design basis loads.

## **Fact Sheet: Summarization of the NRC's Regulatory Framework for Tsunami**

### **Review Guidance and Guidelines Related to Tsunami:**

1. General Design Criterion 2 (GDC 2), 10CFR50, requires, in part, that structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as floods, tsunami, and seiches without loss of capability to perform their safety functions. Design bases for these SSCs are also required to reflect:
2. 10 CFR 100.23, requires, in part, that the size of seismically induced floods and water waves that could affect a site from either locally or distantly generated seismic activity must be determined.
3. RG 1.102 – Flood Protection for Nuclear Power Plants, describes types of flood protection acceptable to the NRC staff
  - a. Exterior Barriers (e.g.)
    - i. Levee – embankment to protect land from inundation
    - ii. Seawall or floodwall - a structure separating land and water areas, primarily to prevent erosion and other damages due to wave action
    - iii. Bulkhead – similar to seawall, purpose is to restrain the land area
  - b. Incorporated Barriers
    - i. Protection provided by specially designed walls and penetration closures. Walls are usually reinforced concrete designed to resist static and dynamic forces of a Design Basis Flood Level of a Probable Maximum Flood.
4. RG 1.59 – Design Basis Floods for Nuclear Power Plants
  - a. The most severe seismically induced floods reasonably possible should be considered for each site.
  - b. Tsunami requires consideration of seismic events of the severity of the Safe Shutdown Earthquake occurring at the location that would produce the worst such flood at the nuclear power plant site.
5. US NRC, Standard Review Plan, "Probable Maximum Tsunami Flooding," Section 2.4.6, Rev. 2
  - a. Areas of Review
    - i. Probable maximum tsunami postulated for a site should include wave runup and drawdown
    - ii. Hydrologic characteristics of maximum locally and distantly generated tsunami (e.g., volcanoes, landslides)
    - iii. Geological and seismic characteristics of potential tsunami faults (e.g., magnitude, focal depth, source dimensions, fault orientation, and vertical displacement)

### **Questions and Answers for Tsunami Issues**

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

Nuclear plants in both the US and Japan are designed for earthquake shaking. In addition to the design of the plants, significant effort goes into emergency response planning and accident mitigation. This approach is called defense-in-depth.

**135) Are nuclear power plants designed for tsunamis?**

Yes. Plants are built to withstand a variety of environmental hazards and those plants that might face a threat from tsunami are required to withstand large waves and the maximum wave height at the intake structure (which varies by plant.)

**136) What level of tsunami are we designed for?**

Like seismic hazard, the level of tsunami that each plant is designed for is site-specific and is appropriate for what may occur at each location.

**137) Can this happen here (i.e., an earthquake that significantly damages a nuclear powerplant)? Are the Japanese plants similar to US plants?**

All US nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants that are located within areas with low and moderate seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety-significant structures, systems, and components be designed to take into account even rare and extreme seismic and tsunami events.

The Japanese facilities are similar in design to several US facilities

**138) How many reactors are along coastal areas that could be affected by a tsunami (and which ones)?**

Many plants are located in coastal areas that could potentially be affected by tsunami. Two plants, Diablo Canyon and San Onofre, are on the Pacific Coast, which is known to have tsunami hazard. There are also two plants on the Gulf Coast, South Texas and Crystal River. There are many plants on the Atlantic Coast or on rivers that may be affected by a tidal bore resulting from a tsunami. These include St. Lucie, Turkey Point, Brunswick, Oyster Creek, Millstone, Pilgrim, Seabrook, Calvert Cliffs, Salem/Hope Creek, and Surry. Tsunami on the Gulf and Atlantic Coasts occur, but are very rare.

Generally the flooding anticipated from hurricane storm surge exceeds the flooding expected from a tsunami for plants on the Atlantic and Gulf Coast.

## **Fact Sheet: Summarization of the NRC's Regulatory Framework for Flooding**

### **Flooding Issues:**

1. General Design Criterion 2 (GDC 2), 10CFR50, requires, in part, that structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as floods, tsunami, and seiches without loss of capability to perform their safety functions. Design bases for these SSCs are also required to reflect:
  - b. Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding region, with sufficient margin for the limited accuracy and quantity of the historical data and the period of time in which the data have been accumulated.
  - c. Appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena.
  - d. The importance of the safety functions to be performed.
6. Design basis floods for most of the present fleet of operating reactors were calculated using deterministic methods to determine the maximum credible flood levels at the site. These deterministic methods include the site specific calculation of parameters such as the probable maximum precipitation, which is defined as the theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin. Other potential flooding hazards such as flooding due to storm surge, river flooding, coastal flooding including tsunamis, are evaluated at each site using maximum credible levels from each hazard. Over the life of the operating reactor, if new information becomes available that could affect the design basis, licensees are required to evaluate the new information. Based on this review, if needed, licensees are required to take appropriate mitigation measures, update their final safety analysis report and submit it to the NRC for review and approval.
7. In order to impose new requirements on existing plants, the NRC must be able to justify the new requirements in accordance with the "Backfit Rule" (10 CFR 50.109).

### **Questions and Answers for Flooding Issues**

#### **139) Does the NRC consider severe floods in the design of nuclear power plants?**

Yes. NRC regulations require that nuclear power plants are, at all times, capable of safely shutting down and maintaining a safe shutdown condition under severe flooding situations. Safety-related Structures, Systems and Components (SSCs) of Nuclear reactors in the U.S. are required to withstand the design basis flood (DBF). The design basis flood may be caused by the following natural Phenomena:

- 1) Intense rainfall occurring at the site (known as local intense precipitation).
- 2) Intense rainfall (known as the Probable Maximum Precipitation) occurring on other areas of the watershed leading to riverine or coastal flooding (known as Probable Maximum Flood" or "PMF".
- 3) Floods from upstream dam failure or a combination of upstream dam failures.
- 4) Failure of On-site Water Control or Storage Structures (i.e. tanks).
- 5) Storm Surge, Seiche and Tsunami including wave effects.(See Tsunami Q&A Sheet)
- 6) Flooding caused by ice effects (i.e. ice dams both upstream and downstream).
- 7) Floods caused by diversions of stream channels toward the site.



8) Other potential site specific flood hazard(s).

**140) What about droughts and conditions which lead to low water? Are these considered?**

Yes. Impacts to the plant from low water conditions brought about by ice effects, downstream dam breach, tsunamis, hurricanes and channel diversions away from the site are reviewed to ensure the plant remains safe under these scenerios.

**141) Periods of long rainfall can cause the groundwater elevation to rise which can cause structures such as deeply embedded tanks to fail due to buoyancy. Are nuclear power plants designed to withstand this effect?**

Yes. Worst-case groundwater levels are estimated for each site and the impacts of these levels are considered in the design of the plant to ensure the plant remains safe under these conditions. During the safety review, impacts due to groundwater levels and other hydrodynamic effects on the design bases of plant foundations and other safety-related structures systems and components (SSCs) are evaluated. Impacts to a safety-related structure such as a deeply embedded tank or a structure containing a deeply embedded tank are considered in the safety review.

**142) Some of the Reports from the National Weather Service used to estimate the design precipitation are 30-40 years old. Are these estimates still valid?**

The NRC has funded research by the U.S. Bureau of Reclamation to review the information and methods developed by the National Weather Service and the U.S. Army Corps of Engineers (HMR 51), focusing on South and North Carolina. To date, reviews of precipitation records from extreme storm events (e.g., tropical storms, hurricanes) since the publication of HMR 51 does not indicate any exceedance or potential for exceedance of those precipitation (PMP) estimates in this region. We have not seen any information or data that would indicate that HMR precipitation (PMP) estimates for the U.S. have been exceeded. As expected, individual point rainfall gauges have recorded rainfall amounts that have exceeded these areal estimates.

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**Fact Sheet: Summarization of Seismological Information from Regional Instrumentation**

Placeholder: to be developed.

## Fact Sheet: Protection of Nuclear Power Plants against Tsunami Flooding

Nuclear power plants are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The word tsunami literally means harbor wave. Tsunamis can be generated by large offshore earthquakes (usually greater than magnitude 6.5), submarine or on shore land slides or volcanoes. Some large onshore earthquakes close to the shoreline can generate tsunami. The Nuclear Regulatory Commission (NRC) requires all nuclear power plants to be protected against earthquakes, tsunamis and other natural hazards.

### Background

Protection against tsunami effects was required for all operating plants and is required for all new reactors. Following the Indian Ocean tsunami on December 26, 2004, the President moved to protect lives and property by launching an initiative to improve domestic tsunami warning capabilities. This plan was placed under the auspices of the National Science and Technology Council through the President's initiative in July 2005 in the context of a broad national effort of tsunami risk reduction, and United States participated in international efforts to reduce tsunami risk worldwide. In response to the president's initiative, the NRC reviewed its licensing criteria and conducted independent studies and participated in international forums under the auspices of the International Atomic Energy Agency with many participating countries including India and Japan. The final report of the study was published in April 2009 as NUREG/CR 6966, "Tsunami Hazard Assessment at Nuclear Power Plant Sites in the United States of America," ADAMS Accession # ML0915901933. NRC revised its Standard Review Plan for conducting safety reviews of nuclear power plants in 2007. Section 2.4.6 specifically addresses tsunamis. The Office of Nuclear Regulatory Research is conducting tsunami studies in collaboration with the United States Geological Survey and has published a report on tsunami hazard in the Atlantic, Gulf and Pacific coastal areas. Selected nuclear power plants now get tsunami warning notification. The agency requires plant designs to withstand the effects of natural phenomena including effects of tsunamis. The agency's requirements, including General Design Criteria for licensing a plant, are described in Title 10 of the *Code of Federal Regulations* (10 CFR). These license requirements consist of incorporating margins in the initiating hazard and additional margins are due to traditional engineering practices such as "safety factors." Practices such as these add an extra element of safety into design, construction, and operations.

The NRC has always required licensees to design, operate, and maintain safety-significant structures, systems, and components to withstand the effects of natural hazards and to maintain the capability to perform their intended safety functions. The agency ensures these requirements are satisfied through the licensing, reactor oversight, and enforcement processes.

### Tsunami Hazard Evaluation

Tsunami hazard evaluation is one component of the complete hydrological review requirements provided in the Standard Review Plan under Chapter 2.4. The safety determination of reactor sites require consideration of major flood causing events, including consideration of combined flood causing conditions. These conditions include Probable Maximum Flood (PMF) on Streams and Rivers, Potential Dam Failures, Probable Maximum Surge and Seiche Flooding and Probable Maximum Tsunami Hazards, among others. The most significant flooding event is called the design basis flood and flooding protection requirements are correlated to this flood level in 2.4.10.

The Probable Maximum Tsunami (PMT) is defined as that tsunami for which the impact at the site is derived from the use of best available scientific information to arrive at a set of scenarios reasonably expected to affect the nuclear power plant site taking into account (a) appropriate consideration of the most severe of the natural phenomena that have been historically reported or determine from geological and physical data for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (b) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena, and (c) the importance of the safety functions to be performed.

Site-specific tsunami data are collected from historical tsunami records, paleotsunami evidence, regional tsunami assessments, site-specific tsunami mechanisms, site-specific data, such as submarine survey of

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sea bed and approach channel geometry. Effects of tsunami on a nuclear power plant can be flooding due to water run up, hydro-dynamic pressure on exterior walls of structures, impact of floating debris, and foundation scouring. In addition, tsunami can draw down water from the intake source of plant cooling water.

The tsunami database is available for interactive search and downloads on the internet at <http://www.ngdc.noaa.gov/hazard/tsu.shtml>.

### **Tsunami Safety Assessment**

The licensing bases for existing nuclear power plants are based on historical data at each site. This data is used to determine probable maximum tsunami and the tsunami effects are evaluated for each site with potential for tsunami flooding. The potential for tsunami hazard is determined on a hierarchical analysis process that can identify tsunami potential based primarily on distance from tsunami source and site elevation. The NRC also required existing plants to assess their potential vulnerability to external events, as part of the Individual Plant Examination of External Events Program. This process ensured that existing plants are not vulnerable to tsunami hazard, and they continue to provide adequate public health and safety.

Today, the NRC utilizes a risk-informed regulatory approach, including insights from probabilistic assessments and traditional deterministic engineering methods to make regulatory decisions about existing plants (e.g., licensing amendment decisions). Any new nuclear plant the NRC licenses will use a probabilistic, performance-based approach to establish the plant's seismic hazard and the seismic loads for the plant's design basis.

### **Operating Plants**

The NRC is fully engaged in national international tsunami hazard mitigation programs, and is conducting active research to refine the tsunami sources in the Atlantic, Gulf Coast and Pacific Coast areas. Diablo Canyon (DC) and San Onofre (SONGS) are two nuclear plant sites that have potential for tsunami hazard. Both the DC (main plant) and SONGS are located above the flood level associated with tsunami. However, the intake structures and Auxiliary Sea Water System at DC are designed for combination of tsunami-storm wave activity to 45 ft msl. SONGS has a reinforced concrete cantilevered retaining seawall and screen well perimeter wall designed to withstand the design basis earthquake, followed by the maximum predicted tsunami with coincident storm wave action, designed to protect at approximately 27 ft msl. These reactors are adequately protected against tsunami effects. Distant tsunami sources for DC include the Aleutian area, Kuril-Kamchatka region, and the South American coast (for SONGS the Aleutian area). Distant sources for SONGS is limited by the presence of a broad continental shelf. Local or near sources for DC include the Santa Lucia Bank and Santa Maria Basin Faults (for SONGS the Santa Ana wind).

### **Additional Information**

To read more about risk-related NRC policy, see the fact sheets on Probabilistic Risk Assessment (<http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/probabilistic-risk-asses.html>) and Nuclear Reactor Risk (<http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/reactor-risk.html>). Each provides more information on the use of probability in evaluating hazards (including earthquakes) and their potential impact on plant safety margins. Other regulatory framework includes General Design Criterion 2, 10 CFR Part 100.23, Regulatory Guide 1.102 "Flood Protection for Nuclear Power Plants", Rev. 1 1976, Regulatory Guide 1.59 "Design Basis for Nuclear Power Plants" Rev. 2 1977 (update in progress), and USNRC Standard Review Plan "Probable Maximum Tsunami Flooding" Section 2.4.6, Rev. 2.

March 2011

INFORMATION FROM RES STILL NEEDS TO BE ADDED

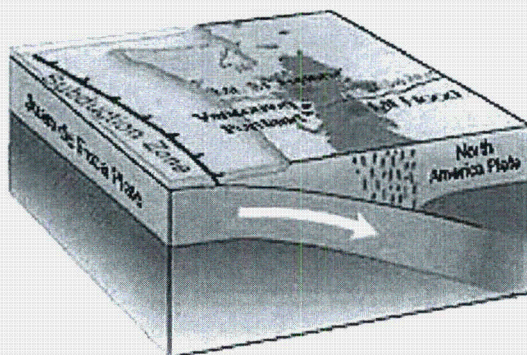
## Fact Sheet: Seismicity of the Central and Eastern US

### Key Points:

- To date, very large earthquakes (Magnitudes greater than 8.25) have only occurred in specific geological settings, in particular the interfaces between tectonic plates in major **subduction zones**. The only subduction zone that potentially impacts the continental US is the Cascadia zone off the coast of northern California, Oregon and Washington.
- Recent analyses of the magnitudes of the largest earthquakes **not associated** with subduction zones indicates magnitudes are less than ~8.25.
- The size (magnitude) of earthquakes is proportional to the fault area that slips in a given earthquake. The prediction of earthquake magnitudes for a specific fault considers the dimensions of the fault. Extremely large earthquakes do not occur on small faults.
- Nuclear power plants are licensed based on vibratory ground shaking, not earthquake magnitude. The ground shaking (accelerations) are used to estimate forces which are used in the seismic design process. In many cases smaller magnitude earthquakes closer to a site produce more severe ground shaking than larger, more distant earthquakes. Hence it is important to consider all potential earthquake sources regardless of magnitude.

**Discussion:** Earthquakes with very large magnitudes such as the March 2011 earthquake off the northeast coast of the Japanese island of Honshu occur within subduction zones, which are locations where one of the earth's tectonic plates is subducting beneath (being thrust under) another. The fault that defines the Japan Trench plate boundary dips to the west, i.e., becomes deeper towards the coast of Honshu. Large offshore earthquakes have historically occurred in the same subduction zone (in 1611, 1896, and 1933) all of which produced significant tsunami waves. The magnitudes of these previous large earthquakes have been estimated to be between 7.6 and 8.6. Prior to March 2011, the Japan Trench subduction zone has produced nine earthquakes with magnitudes greater than 7 just since 1973.

The only subduction zone that is capable of directly impacting the continental US is the Cascadia subduction zone, which lies off of the coast of northern California, Oregon, and Washington. The fault surface defined by this interface dips to the east (becomes deeper) beneath the coast. The Cascadia subduction zone is capable of producing very large earthquakes if all or a large portion of the fault area ruptures in a single event. However, the rate of earthquake occurrence along the Cascadia subduction zone is much less than has been observed along the Japan Trench subduction zone. The only operating nuclear power plant in that area is Columbia, which is far from the coast (~220 miles/350 km) and the Cascadia subduction zone. The occurrence of earthquakes on the Cascadia subduction zone has been considered in the evaluation of the Columbia NPP.



Schematic Illustration of the Cascadia Subduction Zone

The size (magnitude) of earthquakes is proportional to the surface area of a fault that slips in a given earthquake. Large earthquakes are associated with large (long) faults. Hence, the prediction of earthquake magnitudes for a specific fault considers the dimensions of the fault. Identification of fault size is usually based on geologic mapping or the evaluation of spatial patterns of small earthquakes. To provide a point of comparison, the length of the fault that slipped during the March 11, 2011 magnitude 9 Japanese earthquake was >620 km, the length of the fault(s) that slipped during the magnitude 7.3 1992 Landers, CA earthquake was ~90 km and the estimated length of the Hosgi fault near Diablo Canyon NPP is 140 km and a magnitude of 7.5 is assigned to that fault. A number of major crustal faults or fault zones (not associated with the Cascadia subduction zone) have been identified that have produced earthquakes of magnitude 7.5 to 8 in the continental US (including California). ***These fault sources have been identified and characterized in seismic hazard assessments.***

Seismic designs at US nuclear power plants are developed in terms of seismic ground motion spectra, which are called the Safe Shutdown Earthquake ground motion response spectra (SSE). Each nuclear power plant is designed to a ground motion level that is appropriate for the geology and tectonics in the region surrounding the plant location. Currently operating nuclear power plants developed their SSEs based on a "deterministic" or "scenario earthquake" basis that account for the largest earthquake expected in the area around the plant. Seismic activity in the regions surrounding US plants is much lower than that for Japan since most US plants are located in the interior of the stable continental US. The largest earthquakes within the continental US are the 1811-12 New Madrid sequence and the 1886 Charleston, SC, which were estimated to be between about magnitude 6.8 to 7.5. On the west coast of the US, the two nuclear power plants are designed to specific ground motions from earthquakes of about magnitude 7+ on faults located just offshore of the plants. The earthquakes on these faults are mainly strike-slip (horizontal motion on near vertical planes) type earthquakes, not subduction zone earthquakes. This fault geometry does not produce large tsunamigenic waves. Therefore, the likelihood of a significant tsunami from these faults is very remote.



## Fact Sheet: US Portable Array Information

NOTE: This is provided because IRIS participants let us know that here was a discussion about the NRC's involvement in this program during a meeting with congressional staffers. We have been involved in this for the last couple years.



The Incorporated Research Institutions for Seismology is the Consortium of United States Universities with Major Research Programs in Seismology and Related Fields.

### The Transportable Array: A Science Investment that Can Be Leveraged

IRIS is installing the Transportable Array – a set of 400 broadband seismic instruments – in each of more than 1600 sites across the contiguous United States. The instruments operate at each site for two years and then are removed and redeployed further east. Roughly 1100 stations have been installed since 2003, and instruments have been removed from more than 600 of those sites in the western United States.

The National Science Foundation is funding the full cost to “roll” the Transportable Array across the US, more than \$90,000,000 over ten years. Comparatively small incremental investments could add significant data that are relevant to the safety of nuclear power plants. These efforts would be uniquely cost effective, since NSF is already funding installation, and they would feed data into an existing, standardized and widely used data management system that already incorporates the vast majority of seismic data from US networks. But these opportunities are time constrained: the array will be fully installed in the contiguous 48 states by late 2013.

### More Value from Longer Term Regional Observations

A dense, uniform seismic network is necessary for long-term, broad-area seismic monitoring of the central and eastern United States due to low event recurrence rates and the risk of significant earthquakes ( $M > 5$ ) anywhere in the region. Monitoring seismicity in the central and eastern US can be improved by turning selected sites into permanent seismic stations. A total of more than 35 Transportable Array stations have already been “adopted” by several organizations, creating a permanent legacy, but only in the western United States.

A strategic “1-in-4” plan would involve “adoption” of systematically selected stations in the central and eastern United States – every other station in both the east-west and north-south directions, creating a uniform grid of some 250 stations. Long-term regional operation could be combined with two optional enhancements to create a unique observatory for the study of seismicity, source characteristics, attenuation, and local ground acceleration.

#### Enhancement 1: Acquire Higher Frequency Data

Crustal rigidity in the central and eastern US makes it desirable to record high frequency characteristics of local and regional earthquakes. The existing instruments could be reconfigured to record high frequencies but doing so would nearly triple the data flow, necessitating improvements to the communications infrastructure.

#### Enhancement 2: Add Strong Motion Sensors

Acquiring strong motion sensors and reconfiguring field computers that record and telemeter the data would help to measure unique effects of severe shaking. The design anticipated this augmentation, and several stations in California and Washington were operated that way. Upgrade would be more efficient at sites that have not yet been installed.

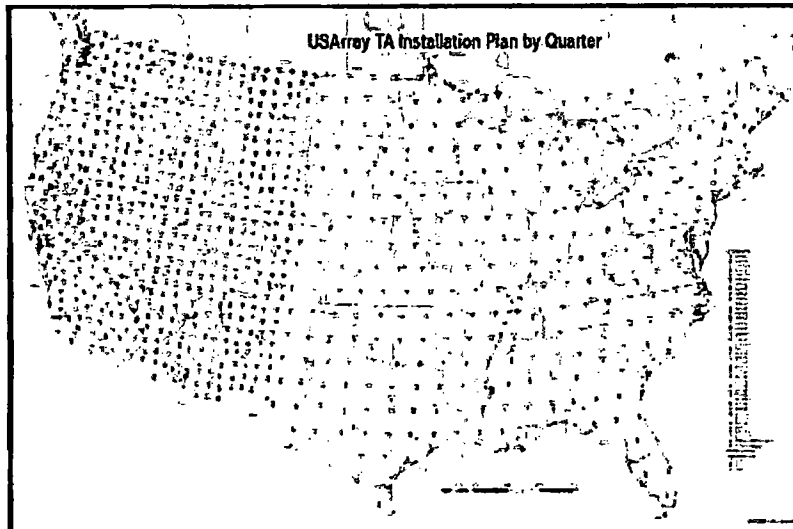
*Estimate of annual acquisition and O&M costs for the 1-in-4, 250-station network in central and eastern US.*

Year	Stations	Acquisition <sup>1</sup>	O&M <sup>2</sup>	Total
2011	50	\$1,800,000	\$ 400,000	\$2,200,000
2012	50	\$1,800,000	\$ 800,000	\$2,600,000
2013	50	\$1,800,000	\$1,200,000	\$3,000,000
2014	50	\$1,800,000	\$1,600,000	\$3,400,000
2015	50	\$1,800,000	\$2,000,000	\$3,800,000
2016	–	–	\$2,000,000	\$2,000,000

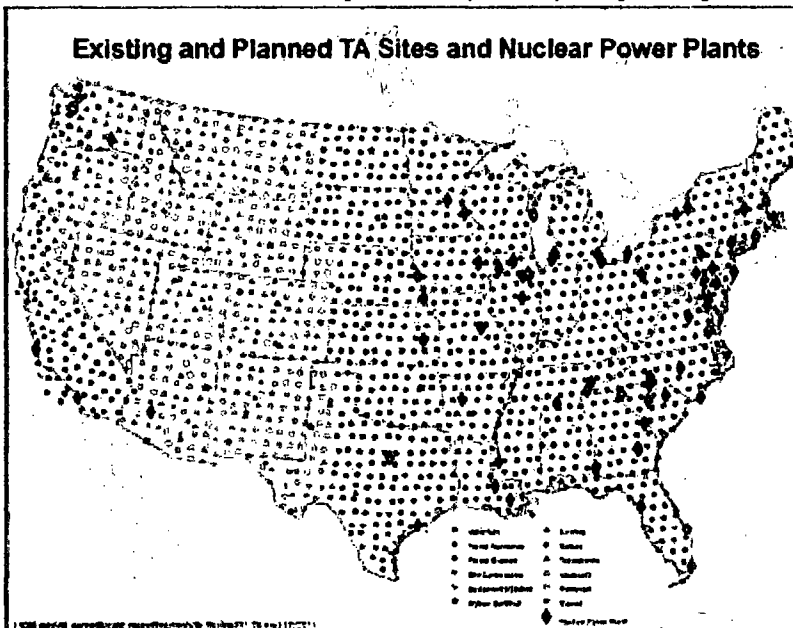
<sup>1</sup> Assumes upgrades to six channel data loggers with strong motion sensors.

<sup>2</sup> Assumes a conservative estimate of \$8,000/station/year.

*The 1-in-4, 250-station network that could be created in the central and eastern US by "leaving behind" one out of every four Transportable Array stations during the years 2011 through 2015.*



*A large majority of nuclear power plants are located in the central and eastern parts of the US, where it is still possible to "leave behind" 1-in-4 Transportable Array stations for long-term regional observations.*





## Additional Information: Terms and Definitions

**Annual exceedance frequency (AEF)** – Number of times per year that a site's ground motion is expected to exceed a specified acceleration.

**Active or seismogenic fault**– need to add definition of active fault from

**Capable Tectonic Source** – A capable tectonic source is a tectonic structure that can generate both vibratory ground motion and tectonic surface deformation such as faulting or folding at or near the earth's surface in the present seismotectonic regime. It is described by at least one of the following characteristics:

- (1) presence of surface or near-surface deformation of landforms or geologic deposits of a recurring nature within the last approximately 500,000 years or at least once in the last approximately 50,000 years
- (2) a reasonable association with one or more moderate to large earthquakes or sustained earthquake activity that are usually accompanied by significant surface deformation
- (3) a structural association with a capable tectonic source that has characteristics of either item a or b (above), such that movement on one could be reasonably expected to be accompanied by movement on the other

In some cases, the geological evidence of past activity at or near the ground surface along a potential capable tectonic source may be obscured at a particular site. This might occur, for example, at a site having a deep overburden. For these cases, evidence may exist elsewhere along the structure from which an evaluation of its characteristics in the vicinity of the site can be reasonably based. Such evidence is to be used in determining whether the structure is a capable tectonic source within this definition. Notwithstanding the foregoing paragraphs, the association of a structure with geological structures that are at least pre-Quaternary, such as many of those found in the central and eastern regions of the United States, in the absence of conflicting evidence, will demonstrate that the structure is not a capable tectonic source within this definition.

**Certified Seismic Design Response Spectra (CSDRS)** – Site-independent seismic design response spectra that have been approved under Subpart B of 10 CFR Part 52 as the seismic design response spectra for an approved certified standard design nuclear power plant. The input or control location for the CSDRS is specified in the certified standard design.

**Combined License** – A combined construction permit and operating license with conditions for a nuclear power facility issued pursuant to Subpart C of 10 CFR Part 52.

**Controlling Earthquakes** – Earthquakes used to determine spectral shapes or to estimate ground motions at the site for some methods of dynamic site response. There may be several controlling earthquakes for a site. As a result of the probabilistic seismic hazard analysis (PSHA), controlling earthquakes are characterized as mean magnitudes and distances derived from a deaggregation analysis of the mean estimate of the PSHA.

**Core damage frequency (CDF)** – Expected number of core damage events per unit of time. *Core damage* refers to the uncovering and heat-up of the reactor core, to the point that prolonged oxidation and severe fuel damage are not only anticipated but also involve enough of the core to result in off-site

public health effects if released. *Seismic core damage frequency* refers to the component of total CDF that is due to seismic events.

**Cumulative Absolute Velocity (CAV)** – For each component of the free-field ground motion, the CAV should be calculated as follows: (1) the absolute acceleration (g units) time-history is divided into 1-second intervals, (2) each 1-second interval that has at least 1 exceedance of 0.025g is integrated over time, and (3) all the integrated values are summed together to arrive at the CAV. The CAV is exceeded if the calculation is greater than 0.16 g-second. The application of the CAV in siting requires the development of a CAV model because the PSHA calculation does not use time histories directly.

**Deaggregation** – The process for determining the fractional contribution of each magnitude-distance pair to the total seismic hazard. To accomplish this, a set of magnitude and distance bins are selected and the annual probability of exceeding selected ground acceleration parameters from each magnitude-distance pair is computed and divided by the total probability for earthquakes.

**Design basis earthquake or safe shutdown earthquake (SSE)** – A *design basis earthquake* is a commonly employed term for the *safe shutdown earthquake (SSE)*; the SSE is the earthquake ground shaking for which certain structures, systems, and components are designed to remain functional. In the past, the SSE has been commonly characterized by a standardized spectral shape associated with a peak *ground acceleration* value.

**Design Factor** – The ratio between the site-specific GMRS and the UHRS. The design factor is aimed at achieving the target annual probability of failure associated with the target performance goals.

**Early Site Permit** – A Commission approval, issued pursuant to Subpart A of 10 CFR Part 52, for a site or sites for one or more nuclear power facilities.

**Earthquake Recurrence** – The frequency of occurrence of earthquakes as a function of magnitude. Recurrence relationships or curves are developed for each seismic source, and they reflect the frequency of occurrence (usually expressed on an annual basis) of magnitudes up to the maximum, including measures of uncertainty.

**Frequency of Onset of Significant Inelastic Deformation (FOSID)** – The annual probability of the onset of significant inelastic deformation (OSID). OSID is just beyond the occurrence of insignificant (or localized) inelastic deformation, and in this way corresponds to “essentially elastic behavior.” As such, OSID of a structure, system, or component (SSC) can be expected to occur well before seismically induced core damage, resulting in much larger frequencies of OSID than seismic core damage frequency (SCDF) values. In fact, OSID occurs before SSC “failure,” where the term failure refers to impaired functionality.

**Ground acceleration** – Acceleration produced at the ground surface by seismic waves, typically expressed in units of *g*, the acceleration of gravity at the earth’s surface.

**Ground Motion Response Spectra (GMRS)** – A site-specific ground motion response spectra characterized by horizontal and vertical response spectra determined as free-field motions on the ground surface or as free-field outcrop motions on the uppermost in-situ competent material using performance-based procedures. When the GMRS are determined as free-field outcrop motions on the uppermost in-situ competent material, only the effects of the materials below this elevation are included in the site response analysis.

**Ground Motion Slope Ratio** – Ratio of the spectral accelerations, frequency by frequency, from a seismic hazard curve corresponding to a 10-fold reduction in hazard exceedance frequency. (See Equation 3 in Regulatory Position 5.1.)

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**High confidence of low probability of failure (HCLPF) capacity** – A measure of *seismic margin*. In seismic risk assessment, *HCLPF capacity* is defined as the earthquake motion level, at which there is high confidence (95%) of a low probability (at most 5%) of failure of a structure, system, or component.

**In-column Motion** – Motion that is within a soil column, as opposed to the motion at the surface or treated as if it is at the surface.

**Intensity** – The intensity of an earthquake is a qualitative description of the effects of the earthquake at a particular location, as evidenced by observed effects on humans, on human-built structures, and on the earth's surface at a particular location. Commonly used scales to specify intensity are the Rossi-Forel, Mercalli, and Modified Mercalli. The Modified Mercalli Intensity (MMI) scale describes intensities with values ranging from I to XII in the order of severity. MMI of I indicates an earthquake that was not felt except by a very few, whereas MMI of XII indicates total damage of all works of construction, either partially or completely.

**Large early release frequency (LERF)** – The expected number of large early releases per unit of time. A *large early release* is the rapid, unmitigated release of airborne fission products from the containment building to the environment, occurring before the effective implementation of off-site emergency response and protective actions, such that there is a potential for early health effects. *Seismic large early release frequency* refers to the component of total LERF that is due to seismic events.

**Magnitude** – An earthquake's magnitude is a measure of the strength of the earthquake as determined from seismographic observations and is an objective, quantitative measure of the size of an earthquake. The magnitude can be expressed in various ways based on seismographic records (e.g., Richter Local Magnitude, Surface Wave Magnitude, Body Wave Magnitude, and Moment Magnitude). Currently, the most commonly used magnitude measurement is the Moment Magnitude,  $M_w$ , which is based on the seismic moment computed as the rupture force along the fault multiplied by the average amount of slip, and thus is a direct measure of the energy released during an earthquake.

**Maximum Magnitude** – The maximum magnitude is the upper bound to earthquake recurrence curves.

**Mean Site Amplification Function** – The mean amplification function is obtained for each controlling earthquake, by dividing the response spectrum from the computed surface motion by the response spectrum from the input hard rock motion, and computing the arithmetic mean of the individual response spectral ratios.

**Nontectonic Deformation** – Nontectonic deformation is distortion of surface or near-surface soils or rocks that is not directly attributable to tectonic activity. Such deformation includes features associated with subsidence, karst terrain, glaciation or deglaciation, and growth faulting.

**Response Spectrum** – A plot of the maximum responses (acceleration, velocity, or displacement) of idealized single-degree-of-freedom oscillators as a function of the natural frequencies of the oscillators for a given damping value. The response spectrum is calculated for a specified vibratory motion input at the oscillators' supports.

**Ring Area** – Annular region bounded by radii associated with the distance rings used in hazard deaggregation (RG 1.208, Appendix D, Table D.1, "Recommended Magnitude and Distance Bins").

**Safe Shutdown Earthquake Ground Motion (SSE)** – The vibratory ground motion for which certain structures, systems, and components are designed, pursuant to Appendix S to 10 CFR Part 50, to remain functional. The SSE for the site is characterized by both horizontal and vertical free-field ground motion response spectra at the free ground surface.

**Seismic hazard** – Any physical phenomenon, such as ground motion or ground failure, that is associated with an earthquake and may produce adverse effects on human activities (such as posing a risk to a nuclear facility).

**Seismic margin** – The difference between a plant's capacity and its seismic design basis (*safe shutdown earthquake, or SSE*).

**Seismic risk** – The risk (frequency of occurrence multiplied by its consequence) of severe earthquake-initiated accidents at a nuclear power plant. A severe accident is an accident that causes core damage, and, possibly, a subsequent release of radioactive materials into the environment. Several risk metrics may be used to express *seismic risk*, such as *seismic core damage frequency* and *seismic large early release frequency*.

**Seismic Wave Transmission (Site Amplification)** – The amplification (increase or decrease) of earthquake ground motion by rock and soil near the earth's surface in the vicinity of the site of interest. Topographic effects, the effect of the water table, and basin edge wave-propagation effects are sometimes included under site response.

**Seismogenic Source** – A portion of the earth that is assumed to have a uniform earthquake potential (same expected maximum earthquake and recurrence frequency), distinct from that of surrounding sources. A seismogenic source will generate vibratory ground motion but is assumed to not cause surface displacement. Seismogenic sources cover a wide range of seismotectonic conditions, from a well-defined tectonic structure to simply a large region of diffuse seismicity.

**Spectral Acceleration** – Peak acceleration response of an oscillator as a function of period or frequency and damping ratio when subjected to an acceleration time history. It is equal to the peak relative displacement of a linear oscillator of frequency,  $f$ , attached to the ground, times the quantity  $(2Bf)^2$ . It is expressed in units of gravity ( $g$ ) or  $\text{cm/second}^2$ .

**Stable Continental Region (SCR)** – An SCR is composed of continental crust, including continental shelves, slopes, and attenuated continental crust, and excludes active plate boundaries and zones of currently active tectonics directly influenced by plate margin processes. It exhibits no significant deformation associated with the major Mesozoic-to-Cenozoic (last 240 million years) orogenic belts. It excludes major zones of Neogene (last 25 million years) rifting, volcanism, or suturing.

**Stationary Poisson Process** – A probabilistic model of the occurrence of an event over time (or space) that has the following characteristics: (1) the occurrence of the event in small intervals is constant over time (or space), (2) the occurrence of two (or more) events in a small interval is negligible, and (3) the occurrence of the event in non-overlapping intervals is independent.

**Target Performance Goal (PF)** – Target annual probability of exceeding the 1 E-05 frequency of onset of significant inelastic deformation (FOSID) limit state.

**Tectonic Structure** – A large-scale dislocation or distortion, usually within the earth's crust. Its extent may be on the order of tens of meters (yards) to hundreds of kilometers (miles).

**Uniform Hazard Response Spectrum (UHRS)** – A plot of a ground response parameter (for example, spectral acceleration or spectral velocity) that has an equal likelihood of exceedance at different frequencies.

**Within Motion** – An earthquake record modified for use in a site response model. Within motions are developed through deconvolution of a surface recording to account for the properties of the overburden material at the level at which the record is to be applied. The within motion can also be called the "bedrock motion" if it occurs at a high-impedance boundary where rock is first encountered.

**What are the definitions of the SSE and OBE?**

CLEAN UP BELOW information – and add above

From RG1.208 Safe Shutdown Earthquake Ground Motion (SSE). The vibratory ground motion for which certain structures, systems, and components are designed, pursuant to Appendix S to 10 CFR Part 50, to remain functional. The SSE for the site is characterized by both horizontal and vertical free-field ground motion response spectra at the free ground surface

Appendix S to 10 CFR Part 50 (3) has the following information: Required Plant Shutdown. If vibratory ground motion exceeding that of the Operating Basis Earthquake Ground Motion or if significant plant damage occurs, the licensee must shut down the nuclear power plant. If systems, structures, or components necessary for the safe shutdown of the nuclear power plant are not available after the occurrence of the Operating Basis Earthquake Ground Motion, the licensee must consult with the Commission and must propose a plan for the timely, safe shutdown of the nuclear power plant. Prior to resuming operations, the licensee must demonstrate to the Commission that no functional damage has occurred to those features necessary for continued operation without undue risk to the health and safety of the public and the licensing basis is maintained.

The ratio is provided in guidance as the ratio that the licensees can chose without additional analysis. The OBE mostly used to be half for existing plants, but now it's a 1/3 unless you do analyses to show why it should be ½.

<b>Definition of Safe Shutdown Earthquake</b>	The safe-shutdown earthquake (SSE) for the site is the ground motion response spectra (GMRS), which also satisfies the minimum requirement of paragraph IV(a)(1)(i) of Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants," to Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities," of the Code of Federal Regulations (10 CFR Part 50).
<b>Definition of Operating Basis Earthquake:</b>	<p>To satisfy the requirements of paragraph IV(a)(2)(A) of Appendix S to 10 CFR Part 50, the operating-basis earthquake (OBE) ground motion is defined as follows:</p> <ul style="list-style-type: none"><li>(iv) For the certified design portion of the plant, the OBE ground motion is one-third of the CSDRS.</li><li>(v) For the safety-related noncertified design portion of the plant, the OBE ground motion is one-third of the design motion response spectra, as stipulated in the design certification conditions specified in design control document (DCD).</li><li>(vi) The spectrum ordinate criterion to be used in conjunction with Regulatory Guide 1.166, "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-earthquake Actions," issued March 1997, is the lowest of (i) and (ii).</li></ul>

## List of Questions

<b>Natural Hazards and Ground Shaking Design Levels .....</b>	<b>1</b>
1) Did the Japanese underestimate the size of the maximum credible earthquake that could affect the plants? .....	1
2) Can a very large earthquake and tsunami happen here? .....	1
3) Has this changed our perception of earthquake risk? .....	2
4) What magnitude earthquake are US plants designed to? .....	2
5) How many US reactors are located in active earthquake zones (and which reactors)? .....	2
6) How many reactors are along coastal areas that could be affected by a tsunami (and which ones)? .....	5
7) If the earthquake in Japan was a larger magnitude than considered by plant design, why can't the same thing happen in the US? .....	3
8) What if an earthquake like the Sendai earthquake occurred near a US plant? .....	1
9) What would be the results of a tsunami generated off the coast of a US plant? (Or why are we confident that large tsunamis will not occur relatively close to US shores?) .....	5
10) Can this happen here (i.e., an earthquake that significantly damages a nuclear power plant)? Are the Japanese plants similar to US plants? .....	3
11) What level of earthquake hazard are the US reactors designed for? .....	3
12) Does the NRC consider earthquakes of magnitude 9? .....	1
13) What is the likelihood of the design basis or "SSE" ground motions being exceeded over the life of the plant? .....	4
14) What is magnitude anyway? What is the Richter Scale? What is intensity? .....	4
15) How do magnitude and ground motion relate to each other? .....	5
16) How are combined seismic and tsunami events treated in risk space? Are they considered together? .....	5
17) How are aftershocks treated in terms of risk assessment? .....	5
<b>Design Against Natural Hazards &amp; Plant Safety in the US .....</b>	<b>6</b>
19) Are nuclear power plants designed for tsunamis? .....	6
20) What level of tsunami are we designed for? .....	6
21) Which plants are close to known active faults? What are the faults and how far away are they from the plants? .....	6
22) How was the seismic design basis for an existing nuclear power plant established? .....	6
23) Is there margin above the design basis? .....	7

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- 24) Are US plants safe? ..... 7
- 25) Was the Japanese plant designed for this type of accident? Are US nuclear plants? ..... 7
- 26) Why do we have confidence that US nuclear power plants are adequately designed for earthquakes and tsunamis? ..... 7
- 27) Can this happen here (i.e., an earthquake that significantly damages a nuclear power plant)? Are the Japanese plants similar to US plants? ..... 7
- 28) Could an accident like the one at Japan's Fukushima Daiichi nuclear plants happen in the US? 8
- 29) Should US nuclear facilities be required to withstand earthquakes and tsunamis of the kind just experienced in Japan? If not, why not? ..... 8
- 30) Can you summarize the plant seismic design basis for the US plants? Are there any special issues associated with seismic design? ..... 9
- 31) How do we know that the equipment in plants is safe in earthquakes? ..... 9
- 32) How do we know equipment will work if the magnitude is bigger than expected, like in Japan? 9
- 33) Are US plants susceptible to the same kind of loss of power as happened in Japan? ..... 9
- 34) How do we know that the emergency diesel generators in Diablo Canyon and SONGS will not fail to operate like in Japan? ..... 10
- 35) Is all equipment at the plant vulnerable to tsunami? ..... 10
- 36) What protection measures do plants have against tsunami? ..... 10
- 37) Is there a risk of loss of water during tsunami drawdown? Is it considered in design? ..... 10
- 38) Are nuclear buildings built to withstand earthquakes? What about tsunami? ..... 10
- 39) Are aftershocks considered in the design of equipment at the plants? Are aftershocks considered in design of the structure? ..... 10
- 40) Are there any special issues associated with seismic design at the plants? For example, Diablo Canyon has special requirements. Are there any others? ..... 10
- 41) Is the NRC planning to require seismic isolators for the next generation of nuclear power plants? How does that differ from current requirements and/or precautions at existing US nuclear power plants? ..... 10
- 42) Are there any US nuclear power plants that incorporate seismic isolators? What precautions are taken in earthquake-prone areas? ..... 11
- 43) Do you think that the recent Japan disaster will cause any rethinking of the planned seismic isolation guidelines, particularly as it regards earthquakes and secondary effects such as tsunamis?

11

About Japanese Hazard, Design and Earthquake Impact..... 14

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44)	Was the damage done to the plants from the earthquake or the tsunami?.....	14
45)	What was the disposition of the plant during the time after the earthquake struck and before the tsunami arrived? Was there indication of damage to the plant solely from the earthquake (if so, what systems) and did emergency procedures function during this time.....	14
46)	What magnitude earthquake was the plant designed to withstand? For example, what magnitude earthquake was the plant expected to sustain with damage but continued operation? And with an expected shutdown but no release of radioactive material? .....	14
47)	Did this reactor sustain damage in the July 16, 2007 earthquake, as the Kashiwazaki power plant did? What damage and how serious was it? .....	14
48)	Was the Fukushima power plant designed to withstand a tsunami of any size? What sort of modeling was done to design the plant to withstand either seismic events or tsunamis? What specific design criteria were applied in both cases? .....	15
49)	What is the design level of the Japanese plants? Was it exceeded? .....	15
50)	What are the Japanese $S_1$ and $S_s$ ground motions and how are they determined? .....	15
51)	Did this earthquake affect the Kashiwazaki-Kariwa nuclear power plant? .....	16
52)	How high was the tsunami at the Fukushima nuclear power plants? .....	16
53)	Wikileaks has a story that quotes US embassy correspondence and some un-named IAEA expert stating that the Japanese were warned about this ... Does the NRC want to comment? .....	16
<b>What Happened to US Nuclear Power Plants During the March 11, 2011, Japan Earthquake?</b>		<b>17</b>
54)	Was there any damage to US reactors from either the earthquake or the resulting tsunami?	17
55)	Have any lessons for US plants been identified? .....	17
<b>Response and Future Licensing Actions</b> .....		<b>18</b>
56)	What is the NRC doing about the emergencies at the nuclear power plants in Japan? Are you sending staff over there? .....	18
57)	With NRC moving to design certification, at what point is seismic capability tested – during design or modified to be site-specific? If in design, what strength seismic event must these be built to withstand? .....	18
<b>Reassessment of US Plants and GI-199</b> .....		<b>19</b>
58)	Can we get the rankings of the plants in terms of safety? (Actually this answer should be considered any time GI-199 data is used to “rank” plants) .....	19
59)	If the plants are designed to withstand the ground shaking why is there so much risk from the design level earthquake.....	19
60)	Does the NRC have a position on the MSNBC article that ranked the safety of US plants? ..	19



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- 61) Overall, how would the NRC characterize the CDF numbers? A quirk of numbers? A serious concern?..... 20
- 62) Describe the study and what it factored in – plant design, soils, previous quakes, etc. .... 20
- 63) Explain "seismic curve" and "plant level fragility curve" ..... 20
- 64) Explain the "weakest link model" ..... 20
- 65) What would constitute fragility at a plant? ..... 21
- 66) The 1-in-18,868 risk for Limerick: What is the risk for? A jostling? A crack? Significant core damage leading to a meltdown? ..... 21
- 67) Can someone put that risk factor into perspective, using something other than MSNBC's chances of winning the lottery?..... 21
- 68) What, if anything, can be done at a site experiencing such a risk? (Or at Limerick in particular.)..... 21
- 69) Has anyone determined that anything SHOULD be done at Limerick or any of the other PA plants?21
- 70) I noted the language on Page 20 of the report: This result confirms NRR's conclusion that currently operating plants are adequately protected against the change in seismic hazard estimates because the guidelines in NRR Office Instruction LIC-504 "Integrated Risk-Informed Decision Making Process for Emergent Issues" are not exceeded. Can someone please explain? ..... 22
- 71) Is the earthquake safety of US plants reviewed once the plants are constructed? ..... 22
- 72) Does the NRC ever review tsunami risk for existing plants? ..... 22
- 73) Does GI-199 consider tsunami? ..... 22
- 74) What is Generic Issue 199 about? ..... 22
- 75) Where can I get current information about Generic Issue 199? ..... 22
- 76) How was the seismic design basis for an existing nuclear power plant established? ..... 23
- 77) Is there margin above the design basis?..... 23
- 78) Are all US plants being evaluated as a part of Generic Issue 199?..... 23
- 79) Are the plants safe? If you are not sure they are safe, why are they not being shut down? If you are sure they are safe, why are you continuing evaluations related to this generic issue?..... 23
- 80) What do you mean by "increased estimates of seismic hazards" at nuclear power plant sites? 24
- 81) Let's say there's an estimate expressed as "2.5E-06." (I'm looking at Table D-2 of the safety/risk assessment of August 2010.) I believe that this expression means the same as  $2.5 \times 10^{-6}$ , or 0.0000025, or 2.5 divided by one million. In layman's terms, that means an expectation, on average, of 2.5 events every million years, or once every 400,000 years. Similarly, "2.5E-05" would

be 2.5 divided by 100,000, or 2.5 events every 100,000 years, on average, or once every 40,000 years. Is this correct? .....	26
82) The GI-199 documents give updated probabilistic seismic hazard estimates for existing nuclear power plants in the central and eastern US What document has the latest seismic hazard estimates (probabilistic or not) for existing nuclear power plants in the western US? .....	26
83) The GI-199 documents refer to newer data on the way. Have NRC, USGS et al. released those? I'm referring to this: "New consensus seismic-hazard estimates will become available in late 2010 or early 2011 (these are a product of a joint NRC, US Department of Energy, US Geological Survey (USGS) and Electric Power Research Institute (EPRI) project). These consensus seismic hazard estimates will supersede the existing EPRI, Lawrence Livermore National Laboratory, and USGS hazard estimates used in the GI-199 Safety/Risk Assessment." .....	27
84) What is the timetable now for consideration of any regulatory changes from the GI-199 research?.....	27
<b>Seismic Probabilistic Risk Assessment (SPRA) .....</b>	<b>29</b>
85) The NRC increasingly uses risk-information in regulatory decisions. Are risk-informed PRAs useful in assessing an event such as this? .....	29
<b>Plant-Specific Questions .....</b>	<b>30</b>
San Onofre Nuclear Generating Station (SONGS) Questions .....	30
86) SONGS received a white finding in 2008 for 125VDC battery issue related to the EDGs that went undetected for 4 years. NRC issued the white finding as there was increased risk that one EDG may not have started due to a low voltage condition on the battery on one Unit (Unit 2). Aren't all plants susceptible to the unknown? Is there any assurance the emergency cooling systems will function as desired in a Japan-like emergency? .....	30
87) Has the earthquake hazard at SONGS been reviewed like Diablo Canyon nuclear power plant (DCNPP) is doing? Are they planning on doing an update before relicensing?.....	30
88) Is possible to have a tsunami at songs that is capable of damaging the plant? .....	30
89) Does SONGS have an emergency plan for tsunami? .....	30
90) Has evacuation planning at SONGS considered tsunami? .....	31
91) Is SONGS designed against tsunami and earthquake? .....	31
92) What is the height of water that SONGS is designed to withstand? .....	31
93) What about drawdown and debris? .....	31
94) Will this be reviewed in light of the Japan earthquake. ....	31
95) Could all onsite and offsite power be disrupted from SONGS in the event of a tsunami, and if that happened, could the plant be safely cooled down if power wasn't restored for days after? ....	31
96) Are there any faults nearby SONGS that could generate a significant tsunami? .....	32

97) What magnitude or shaking level is SONGS designed to withstand? How likely is an earthquake of that magnitude for the SONGS site? .....	32
98) Could SONGS withstand an earthquake of the magnitude of the Japanese earthquake? .....	32
99) What about the evacuation routes at SONGS? How do we know they are reasonable? .....	32
100) Regarding tsunami at DCNPP and SONGS, is the tsunami considered separately from flooding in licensing? And from the design perspective, is the flood still the controlling event for those plants rather than the tsunami? .....	32
101) What is the design level flooding for DNCPP and SONGS? Can a tsunami be larger? .....	33
102) Is there potential linkage between the South Coast Offshore fault near SONGS and the Newport-Inglewood Fault system and/or the Rose Canyon fault? Does this potential linkage impact the maximum magnitude that would be assigned to the South Coast Offshore fault and ultimately to the design basis ground motions for this facility? .....	33
Diablo Canyon Nuclear Power Plant (DCNPP) Questions .....	34
103) Now after the Japan tragedy, will the NRC finally hear us (A4NR) and postpone DC license renewal until seismic studies are complete? How can you be sure that what happened there is not going to happen at Diablo with a worse cast earthquake and tsunami? .....	34
104) The evacuation routes at DCNPP see are not realistic. Highway 101 is small...and can you imagine what it will be like with 40K people on it? Has the evacuation plan been updated w/ all the population growth? .....	34
105) Are there local offshore fault sources capable of producing a tsunami with very short warning times? .....	34
106) Are there other seismically induced failure modes (other than tsunami) that would yield LTSBO? Flooding due to dam failure or widespread liquefaction are examples. ....	34
107) Ramifications of beyond design basis events (seismic and tsunami) and potential LTSBO on spent fuel storage facilities? .....	34
108) Why did the Emergency Warning go out for a 'tsunami' that was only 6 ft (1.8 m) high? Do these guys really know what they're doing? Would they know it if a big one was really coming? Crying wolf all the time doesn't instill a lot of confidence. ....	34
109) How big did the Japanese think an earthquake and tsunami could be before March 11, 2011? Why were they so wrong (assuming this earthquake/tsunami was bigger than what they had designed the plant for)? .....	35
The Japanese were supposed to have one of the best tsunami warning systems around. What went wrong last week (both with the reactors and getting the people out...see #1, evacuation plan above)? .....	35
110) Regarding the tsunami at DCNPP and SONGS, is the tsunami considered separately from flooding in licensing? And from the design perspective, is the flood still the controlling event for those plants rather than the tsunami? .....	35

111) Shouldn't the NRC make licensees consider a Tsunami coincident with a seismic event that triggers the Tsunami? .....	35
112) Given that SSCs get fatigued over time, shouldn't the NRC consider after-shocks in seismic hazard analyses? .....	35
113) Did the Japanese also consider an 8.9 magnitude earthquake and resulting tsunami "way too low a probability for consideration"? .....	35
114) GI-199 shows that the scientific community doesn't know everything about the seismicity of CEUS. And isn't there a prediction that the West coast is likely to get hit with some huge earthquake in the next 30 years or so? Why does the NRC continue to license plants on the west coast? 36	
115) Has industry done anything on tsunami hazards? Also, has anyone done work to look at the effect of numerous cycles of low amplitude acceleration following a larger event. I would expect we would have some information because how do we know a plant would be fit to start back up after an event? We cannot possibly do NDE on everything to determine if flaws have propagated to the point where they need to be replaced.....	36
Indian Point Questions.....	37
116) Why is Indian Point safe if there is a fault line so close to it?.....	37
<b>Outstanding Questions from Congress .....</b>	<b>38</b>
117) Received 3/16/11 from Congresswoman Lowey .....	38
118) From 3/16/11 Press Release from Senators Boxer and Feinstein .....	38
119) From 3/15/11 Press Release from Congresspeople Markey and Capps.....	40
<b>Questions for the Japanese .....</b>	<b>43</b>
<b>Additional Information: Useful Tables .....</b>	<b>45</b>
Table of Design Basis Ground Motions for US Plants .....	45
Table of SSE, OBE and Tsunami Water Levels.....	47
Table of Plants Near Known Active Faults .....	52
Table From GI-199 Program Containing SSE, SSE Exceedance Frequencies, Review Level Earthquakes, and Seismic Core Damage Frequencies .....	53
Design Basis Ground Motions and New Review Level Ground Motions Used for Review of Japanese Plants.....	58
Status of Review of Japanese NPPs to New Earthquake Levels Based on 2006 Guidance.....	59
<b>Additional Information: Useful Plots .....</b>	<b>60</b>
Plot of Mapped Active Quaternary Faults and Nuclear Plants in the US.....	60
Nuclear Plants in the US Compared to the USGS National Seismic Hazard Maps.....	61
USGS US National Seismic Hazard Maps.....	61
UCERF Map of California Earthquake Probabilities for Northern versus Southern California .....	62

~~Official Use Only~~

Plot of Nuclear Plants in the US Compared to Recent Earthquakes.....	63
Plot of Tsunami Wave Heights at the Japanese Plants (unofficial from NOAA) .....	64
<b>Additional Information: Fact Sheets .....</b>	<b>66</b>
Fact Sheet: Summarization of the NRC's Regulatory Framework for Seismic Safety.....	66
Fact Sheet: Summarization of Seismological Information from Regional Instrumentation .....	70
Fact Sheet: Protection of Nuclear Power Plants against Tsunami Flooding .....	76
Fact Sheet: Seismicity of the Central and Eastern US.....	78
Fact Sheet: US Portable Array Information.....	80
<b>Additional Information: Terms and Definitions.....</b>	<b>82</b>
<b>List of Questions.....</b>	<b>87</b>

**From:** Wiggins, Jim  
**To:** Sheron, Brian  
**Subject:** FW: For your reference  
**Date:** Sunday, March 20, 2011 2:53:24 PM  
**Attachments:** 110317 福島第一 原発発生後の時刻表(ENG).xls  
2011\_03\_20\_1230 Conditions of Fukushima-Dai-ichi NPS (Unit1-5)R3.ppt.ppt

---

-----Original Message-----

**From:** Cook, William  
**Sent:** Sunday, March 20, 2011 10:00 AM  
**To:** LIA08 Hoc; LIA06 Hoc; Wiggins, Jim; Miller, Chris  
**Subject:** FW: For your reference

Just received. Don't know if this was passed on to you folks or not.  
Regards,  
Bill Cook

-----Original Message-----

**From:** Foggie, Kirk  
**Sent:** Sunday, March 20, 2011 9:18 AM  
**To:** Liaison Japan  
**Cc:** Dorman, Dan  
**Subject:** Fw: For your reference

All,

I received these presentation on the current status (7pm Sunday) of the plants from JNES. I can't read it on my bb, so I will print it tomorrow when I arrive.

Kirk  
Sent from Blackberry.

----- Original Message -----

**From:** 中川|air <nakagawa@ruby.famille.ne.jp>  
**To:** Foggie, Kirk  
**Sent:** Sun Mar 20 07:55:07 2011  
**Subject:** For your reference

Nakagawa

CH/149

the le Law of	to the provision of Item 1, Article 15 of the Special Law of Emergency Preparedness for Nuclear Disaster had occurred because flow rate of the emergency core cooling system could not be confirmed.	
ng cific if		
tive irmed mal	18:14 ( Approximately ) A radiation monitoring van measured radioactive materials inside and outside power station site (outdoor areas) and confirmed that the levels were normal and no radiological consequence in the external areas at that point.	18:14 ( Approximately ) A radiation monitoring van measured radioactive materials inside and outside power station site (outdoor areas) and confirmed that the levels were normal and no radiological consequence in the external areas at that point.
	22:00 Reactor water level gauge regained its function and the reactor water level was confirmed to be TAF+3400mm.	
m + Fuel	02:50 Confirmed that Reactor Core Isolation Cooling system (hereinafter referred to as RCIC) was in operation. Reactor pressure : 5.6MPa RCIC discharge pressure : 6.0MPa Reactor water level : TAF+3,600mm	
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		07:45 Reactor water level : TAF-3000mm ( Fuel region ) Reactor pressure : 7.31MPa D/W pressure : 460kPa abs S/P pressure : 440kPa abs
ne : mal icle 15 d		08:41 Conducted operation to depressurize reactor containment ve 08:56 Confirmed 882μSv/h ( 08:23) at MP4, and determined that " which abnormal rise of radiation at site boundary" was applicable.
		09:03(Approximately) Conducted rapid depressurization by SR valve 3. Reactor water level : TAF+1800mm ( Fuel region ) Reactor pressure : 0.46MPa D/W pressure : 637kPa S/P pressure : 590kPa 09:20 Confirmed decreasing trend of D/W pressure. Initiated prep: for water injection into reactor by fire protection line.
		11:25 D/D fire protection pump in operation.
ne : mal icle 15 d		14:15 Confirmed 905μSv/h ( 13:50) at MP4, and determined that "abnormal rise of radiation at site boundary" was applicable.
		18:45 Seawater injection into reactor was in progress with tempora seawater injection pump connected to fire protection line. Reactor water level : TAF-1800mm ( Fuel region ) Reactor pressure : 0.25MPa D/W pressure : 420kPa abs

		<p>reactor pressure : 0.101MPa D/W pressure : 425kPa abs</p>
		<p>07:00 Reactor water level : Overscale Reactor pressure : 0.338MPa D/W pressure : 520kPa abs 07:44 Determined that "containment vessel pressure abnormal rise occurred due to D/W pressure of 460kPa. ( Maximum operating pressure 427kPa. ) ( 06:10 )</p>
		<p>08:00 Reactor water level : TAF-1000mm ( Fuel region ) Reactor pressure : 0.31MPa D/W pressure : 500kPa abs</p>
re : mal icle 15 d		<p>09:05 Reactor water level : TAF-1500mm ( Fuel region ) Reactor pressure : 0.304MPa D/W pressure : 490kPa abs</p>
		<p>11:01 Phenomenon seemingly an explosion occurred and white srr was generated. 11:25 Reactor water level : TAF-1800mm ( Fuel region ) Reactor pressure : 0.191MPa D/W pressure : 360kPa abs No internal records of contacting fire department, etc. were cor 11:43 Seemed that one person was injured and six were missing. center requested three ambulances..</p>
		<p>12:15 Four TEPCO employees and two workers were injured. Sev Defense Force members were evacuated.</p>
	<p>13:25 Determined that reactor was in a state of "loss of cooling function," based on the drop of reactor water level, possibly caused by loss of RCIC function. Reactor water level: TAF+3,400mm↓2,400mm (12:00) (13:24 ) 13:34 Conducted reactor depressurization operation and initiated seawater injection. Reactor water level : TAF±0 mm (Fuel region ) Reactor pressure : 6.998MPa D/W pressure:0.42MPa abs</p>	

	gate, and determined that "to which abnormal rise of radiation at site boundary" was applicable. 22:40 Reactor water level : TAF-700mm(Fuel region ) Reactor pressure : 0.428MPa D/W pressure:0.428MPa abs S/C pressure:0.35MPa abs 22:50 D/W pressure (540Pa) exceeded the maximum operating pressure of 427KPa, and determined that "abnormal pressure rise of containment vessel" had occurred.	
	03:00 Reactor water level : Downscale Reactor pressure : 0.653MPa D/W pressure:0.75MPa abs S/C pressure:0.33MPa abs	
	Reactor water level : Downscale Reactor pressure : 0.626MPa D/W pressure:0.75MPa abs S/C pressure:0.30MPa abs	
has ne dness	6:14 Large impact noises occurred. Transferred Fukushima Daiichi Emergency Headquarters to Fukushima Daini, and initiated evacuation. (About fifty members remained in the headquarters.) 6:20 Reactor water level : TAF-2,700mm(Fuel region ) Reactor pressure : 0.612MPa D/W pressure:0.73MPa abs S/C pressure:0MPa abs 6:51 Confirmed 583.7μSv/h ( 6:50) in the vicinity of power station main gate, and determined that "abnormal rise of radiation at site boundary" was applicable.	06:00 ~ 06:10 Confirmed steam was floating above the Unit 3 reactor building.
has ne dness	8:25 TEPCO employees confirmed white smoke (seemingly steam) from the wall in the vicinity of fifth floor of the reactor building.	

[illegible]

**From:** Sheron, Brian  
**To:** Turtill, Richard; LIA08 Hoc; Virgilio, Rosetta; LIA06 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Ryan, Michelle; Leeds, Eric; Wiggins, Jim; Coe, Doug  
**Subject:** RE: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN  
**Date:** Sunday, March 20, 2011 3:06:00 PM

---

RES is working with NRR and will support the meeting. We are not taking the lead to set it up, etc. I am assuming NRR is doing that.

**From:** Turtill, Richard  
**Sent:** Sunday, March 20, 2011 12:40 PM  
**To:** LIA08 Hoc; Virgilio, Rosetta; LIA06 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Ryan, Michelle; Leeds, Eric; Wiggins, Jim; Sheron, Brian  
**Subject:** RE: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN  
**Importance:** High

Jeff (not certain which Jeff):

I'm the Branch Chief of FSME's Intergovernmental Liaison Branch, and some of us, including Rosetta and I, want to be assured that NRR and/or RES are taking the lead in (of course) preparing for the meeting with NY, but also **coordinating logistics for such a meeting**. I was planning to call Eric this afternoon to assure NRR was in fact taking the lead to coordinate meeting with NY, and keeping Chairman's office and RI informed of the meeting.

Shall I call Eric? The meeting is fast approaching... Tuesday. Many will be engaged in the Commission meeting on Mon morning. **I believe we (NRR Administrative support?) should be in touch with NY (their contact in DC - Hilary F. Jochmans, Director New York State Washington Office of the Governor 202-434-7100) first thing Monday morning to plan out meeting logistics for this meeting, including room reservation, etc.**

Can we be assured that NRR (and/or RES) is doing this? At this time, there have been just WAY too many e-mails discussing this meeting. Unless I hear from you shortly, I'll try to contact Eric directly by phone. Please let me know.

Rich Turtill

(b)(6)

**From:** LIA08 Hoc  
**Sent:** Sunday, March 20, 2011 12:00 PM  
**To:** Virgilio, Rosetta; LIA06 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Turtill, Richard; Ryan, Michelle  
**Subject:** RE: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

Hi Rosetta. Just talked to Jim Wiggins. He said to plan on Eric Leeds and Brian Sheron being in the USA next week. Beyond that, not sure what their schedules are now, or what they will look like

CH/150

after Mondays Commission meeting. Jeff

**From:** Virgilio, Rosetta  
**Sent:** Sunday, March 20, 2011 9:59 AM  
**To:** LIA06 Hoc; LIA08 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Turtill, Richard; Ryan, Michelle  
**Subject:** Fw: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

Below is my latest communication to NGA. Have not heard back from Brian Sheron as to his availability. Johnson, Leeds, and Haney are not available. Leeds said he might be available for April 4 - if he doesn't go to Japan.  
What does ET recommend?

Sent from an NRC Blackberry

Rosetta O. Virgilio

(b)(6)

---

**From:** Virgilio, Rosetta  
**To:** gdierkers@nga.org <gdierkers@nga.org>  
**Sent:** Fri Mar 18 15:13:22 2011  
**Subject:** NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

Hello, Greg – Just wanted to touch base and let you know that things are not looking good for NRC participation in next week's NGA webinar; however, I am pursuing the April 4 date, which may be more doable.

As I indicated yesterday, the NRC staff will brief the Commission Monday, March 21, 2011, at 9:00 a.m. regarding NRC's response to recent nuclear events in Japan. The meeting is public and will be held at NRC Headquarters at 11555 Rockville Pike, Commissioners' Conference Room, in Rockville, Maryland.

The meeting can also be viewed via Webcast at: <http://www.nrc.gov/public-involve/public-meetings/webcast-live.html>

Please feel free to share this information with your contacts.

Rosetta O. Virgilio  
Senior Liaison Project Manager  
Intergovernmental Liaison Branch  
U.S. Nuclear Regulatory Commission  
11545 Rockville Pike - T-8F42  
Rockville, MD 20852-2738  
301-415-2367  
[Rosetta.Virgilio@nrc.gov](mailto:Rosetta.Virgilio@nrc.gov)

---

**From:** Virgilio, Rosetta

**To:** 'gdierkers@NGA.ORG' <gdierkers@NGA.ORG>  
**Sent:** Thu Mar 17 17:03:28 2011  
**Subject:** Re: NGA Center NRC expert speaker requests

Thank you, Greg; I will followup and get back to you.

Sent from an NRC Blackberry  
Rosetta O. Virgilio

(b)(6)

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**From:** Dierkers, Gregory <gdierkers@NGA.ORG>  
**To:** Virgilio, Rosetta  
**Cc:** Gander, Sue <sgander@NGA.ORG>; MacLellan, Thomas <TMaclellan@NGA.ORG>; Ferro, Carmen <CFerro@NGA.ORG>  
**Sent:** Thu Mar 17 16:36:04 2011  
**Subject:** NGA Center NRC expert speaker requests

Hi Rosetta,

Thanks for your time today. We appreciate you identifying someone from the NRC to support the NGA Center's outreach to states during this busy time.

As we discussed we would like to invite the NRC to join us for **two upcoming events -- a webinar next week and a conference in early April -- to brief governors' advisors on the Japanese situation and the implications for US plants.** The events are:

1) **A webinar with governors' security and energy advisors.** NGA Center staff is planning to host a conference call next week (Tuesday 3/21 or Wednesday 3/22) to provide senior state officials with an update on the Japan situation and to answer questions as to the operations of US plants, including regulations, plant security/safety, and the emergency preparedness efforts at the US nuclear fleet. We would ask that an NRC expert join the webinar remotely; the webinar would last for 1 hour.

2) **An in-person speaker at a governors' energy advisors meeting.** NGA Center's *Governors' Energy Advisors Policy Institute* on April 4th in Arlington, Virginia. The focus of the April 4th Institute is to provide a 'Technology 101' briefing for governors senior energy advisors. We would invite the NRC to attend in-person on April 4th from 1:45pm to 4:15pm. We would ask for a 10-15 minute presentation on the situation in Japan, the state of nuclear technology and regulations in the US, and the implications for states from the Japanese crisis. Attached is a draft agenda.

Thanks for considering both of these requests.

Sincerely,

Greg Dierkers  
Program Director – Energy and Transportation  
NGA Center for Best Practices

Environment, Energy and Transportation Division

202-624-7789

[gdierkers@nga.org](mailto:gdierkers@nga.org)



**From:** Sheron, Brian  
**To:** Camper, Larry  
**Subject:** FW: Fwd: Re: Radioiodine source  
**Date:** Sunday, March 20, 2011 3:34:00 PM

---

**From:** Aoki, Steven [mailto:Steven.Aoki@nnsa.doe.gov]  
**Sent:** Sunday, March 20, 2011 3:08 PM  
**To:** 'peterson@nuc.berkeley.edu'; SCHU; Adams, Ian; Binkley, Steve; 'RJBudnitz@lbl.gov'; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas; (b)(6); 'rlg2@us.ibm.com'; Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Poneman, Daniel; 'ronaldo.szilard@inl.gov'; (b)(6)  
**Subject:** Re: Fwd: Re: Radioiodine source

Recognizing there will be mixing and multipath effects from the transport across the ocean, if we look at the I-131/Te-32 ratio for each day's take as it arrives in California, would we be able to see in effect a crude history of the event? There's been sporadic venting from the reactors throughout the last week. If we continue to see an iodine age consistent with this source and not from much older fuel, that would suggest the spent fuel has not burned throughout the event.

---

**From:** Per F. Peterson <peterson@nuc.berkeley.edu>  
**To:** Aoki, Steven; SCHU; 'peterson@nuc.berkeley.edu' <peterson@nuc.berkeley.edu>; Adams, Ian; Binkley, Steve; 'RJBudnitz@lbl.gov' <RJBudnitz@lbl.gov>; 'Brian.sheron@nrc.gov' <Brian.sheron@nrc.gov>; Brinkman, Bill; DAgostino, Thomas; (b)(6); (b)(6); 'rlg2@us.ibm.com' <rlg2@us.ibm.com>; Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Poneman, Daniel; 'ronaldo.szilard@inl.gov' <ronaldo.szilard@inl.gov>; (b)(6)  
**Sent:** Sun Mar 20 14:02:41 2011  
**Subject:** Fwd: Re: Radioiodine source

I wanted to let everyone know that the initial measurements suggest that the source of radioiodine measured in rainfall at UC Berkeley was one of the reactors that was operating at the time of the earthquake, not any release from a spent fuel pool. We will be confirming this by measuring iodine isotope ratios. More details are given below. This is also consistent with information from Steve Fetter that Unit for shut down on November 30, in which case there should not be any I-131 left in the discharged fuel.

-Per

Date: Sun, 20 Mar 2011 09:48:46 -0700  
To: Holdren.John, Fetter.Steve  
From: "Per F. Peterson" <peterson@nuc.berkeley.edu>  
Subject: Fwd: Re: Radioiodine source

John and Steve,

CH/151

Here is initial evidence that the source was fuel from a reactor that was shut down in the last 7 days or so. As Rick notes, chemistry effects might be at play (so we'll need to check iodine isotope ratios too), but this is consistent with Steve's belief that the source is venting from the Unit 1, 2, or 3 reactors.

-Per

Date: Sun, 20 Mar 2011 09:28:56 -0700  
Subject: Re: Radioiodine source  
From: Eric Norman <ebnorman@lbl.gov>  
To: "Per F. Peterson" <peterson@nuc.berkeley.edu>, DANIEL CHIVERS <chivers@berkeley.edu>,  
Jasmina Vujic <vujic@nuc.berkeley.edu>, Kai Vetter <kvetter@nuc.berkeley.edu>,  
Alan Smith <arsmith@lbl.gov>, edward morse

(b)(6)

"s.g. prussin" <prussin@berkeley.edu>

Note that the Te-132 that we also see has only a 3.2 day half life, while that for I-131 is 8.0 days. The cumulative yield for I-131 from U-235 fission is 2.89% while that for Te-132 is 4.31%. The activity of Te-32 we see is about 1/4 as much as the I-131. I don't know what kind of chemistry is involved in transporting these two different elements here. If I assume that for some reason the chemistry doesn't matter, then I would conclude that the source of the material we are seeing could not be very old ( more like a week than a month).

Rick

On Sun, Mar 20, 2011 at 8:56 AM, Per F. Peterson <peterson@nuc.berkeley.edu> wrote:  
Dan,

It was just pointed out to me that we should be able to identify whether the source of the radioiodine was one of the operating reactors (isotope ratios for iodine have high I-131) versus the ~30 day off load spent fuel in the unit 4 pool, versus old spent fuel. Could you also check on this?

-Per

--

--

Eric (Rick) Norman

Professor  
Department of Nuclear Engineering  
4109 Etcheverry Hall  
University of California  
Berkeley, CA 94720  
Phone: 510-643-9984  
Fax: 510-643-9685

--  
-----  
Per F. Peterson  
Professor and Chair  
Department of Nuclear Engineering  
University of California  
4153 Etcheverry Hall  
Berkeley, California 94720-1730  
peterson@nuc.berkeley.edu  
Office: (510) 643-7749      Fax: (510) 643-9685  
[http://www.nuc.berkeley.edu/People/Per\\_Peterson](http://www.nuc.berkeley.edu/People/Per_Peterson)  
-----

**From:** Sheron, Brian  
**To:** Virgilio, Rosetta; Leeds, Eric  
**Cc:** Turtill, Richard; Piccone, Josephine; Jackson, Deborah; LIA08 Hoc; LIA04 Hoc  
**Subject:** RE: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN  
**Date:** Sunday, March 20, 2011 4:16:00 PM

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According to my calendar, I should be available April 4<sup>th</sup>.

**From:** Virgilio, Rosetta  
**Sent:** Sunday, March 20, 2011 12:51 PM  
**To:** Leeds, Eric; Sheron, Brian  
**Cc:** Turtill, Richard; Piccone, Josephine; Jackson, Deborah; LIA08 Hoc; LIA04 Hoc  
**Subject:** Fw: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

Gentlemen - See email thread below. I am trying to get more detailed info from NGA, as to date/time for next weeks meeting (Tues 3/22 or Wed 3/23), but would appreciate knowing your availability those days, as well as for April 4.

Sent from an NRC Blackberry  
Rosetta O. Virgilio

(b)(6)

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**From:** LIA08 Hoc  
**To:** Virgilio, Rosetta; LIA06 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Turtill, Richard; Ryan, Michelle  
**Sent:** Sun Mar 20 11:59:33 2011  
**Subject:** RE: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

Hi Rosetta. Just talked to Jim Wiggins. He said to plan on Eric Leeds and Brian Sheron being in the USA next week. Beyond that, not sure what their schedules are now, or what they will look like after Mondays Commission meeting. Jeff

**From:** Virgilio, Rosetta  
**Sent:** Sunday, March 20, 2011 9:59 AM  
**To:** LIA06 Hoc; LIA08 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Turtill, Richard; Ryan, Michelle  
**Subject:** Fw: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

Below is my latest communication to NGA. Have not heard back from Brian Sheron as to his availability. Johnson, Leeds, and Haney are not available. Leeds said he might be available for April 4 - if he doesn't go to Japan.  
What does ET recommend?

Sent from an NRC Blackberry  
Rosetta O. Virgilio

(b)(6)

CH/152

**From:** Virgilio, Rosetta  
**To:** gdierkers@nga.org <gdierkers@nga.org>  
**Sent:** Fri Mar 18 15:13:22 2011  
**Subject:** NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

Hello, Greg – Just wanted to touch base and let you know that things are not looking good for NRC participation in next week's NGA webinar; however, I am pursuing the April 4 date, which may be more doable.

As I indicated yesterday, the NRC staff will brief the Commission Monday, March 21, 2011, at 9:00 a.m. regarding NRC's response to recent nuclear events in Japan. The meeting is public and will be held at NRC Headquarters at 11555 Rockville Pike, Commissioners' Conference Room, in Rockville, Maryland.

The meeting can also be viewed via Webcast at: <http://www.nrc.gov/public-involve/public-meetings/webcast-live.html>

Please feel free to share this information with your contacts.

Rosetta O. Virgilio  
Senior Liaison Project Manager  
Intergovernmental Liaison Branch  
U.S. Nuclear Regulatory Commission  
11545 Rockville Pike - T-8F42  
Rockville, MD 20852-2738  
301-415-2367  
[Rosetta.Virgilio@nrc.gov](mailto:Rosetta.Virgilio@nrc.gov)

---

**From:** Virgilio, Rosetta  
**To:** 'gdierkers@NGA.ORG' <gdierkers@NGA.ORG>  
**Sent:** Thu Mar 17 17:03:28 2011  
**Subject:** Re: NGA Center NRC expert speaker requests

Thank you, Greg; I will followup and get back to you.

Sent from an NRC Blackberry  
Rosetta O. Virgilio

(b)(6)

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**From:** Dierkers, Gregory <gdierkers@NGA.ORG>  
**To:** Virgilio, Rosetta  
**Cc:** Gander, Sue <sgander@NGA.ORG>; MacLellan, Thomas <TMaclellan@NGA.ORG>; Ferro, Carmen <CFerro@NGA.ORG>  
**Sent:** Thu Mar 17 16:36:04 2011  
**Subject:** NGA Center NRC expert speaker requests

Hi Rosetta,

Thanks for your time today. We appreciate you identifying someone from the NRC to support the NGA Center's outreach to states during this busy time.

As we discussed we would like to invite the NRC to join us for **two upcoming events -- a webinar next week and a conference in early April -- to brief governors' advisors on the Japanese situation and the implications for US plants.** The events are:

**1) A webinar with governors' security and energy advisors.** NGA Center staff is planning to host a conference call next week (Tuesday 3/21 or Wednesday 3/22) to provide senior state officials with an update on the Japan situation and to answer questions as to the operations of US plants, including regulations, plant security/safety, and the emergency preparedness efforts at the US nuclear fleet. We would ask that an NRC expert join the webinar remotely; the webinar would last for 1 hour.

**2) An in-person speaker at a governors' energy advisors meeting.** NGA Center's *Governors' Energy Advisors Policy Institute* on April 4th in Arlington, Virginia. The focus of the April 4th Institute is to provide a 'Technology 101' briefing for governors senior energy advisors. We would invite the NRC to attend in-person on April 4th from 1:45pm to 4:15pm. We would ask for a 10-15 minute presentation on the situation in Japan, the state of nuclear technology and regulations in the US, and the implications for states from the Japanese crisis. Attached is a draft agenda.

Thanks for considering both of these requests.

Sincerely,

Greg Dierkers  
Program Director – Energy and Transportation  
NGA Center for Best Practices  
Environment, Energy and Transportation Division  
202-624-7789  
[gdierkers@nga.org](mailto:gdierkers@nga.org)

**From:** Sheron, Brian  
**To:** Camper, Larry  
**Subject:** FW: Re: 5 Liter Rainwater Sample I-131 preliminary results  
**Date:** Sunday, March 20, 2011 5:46:00 PM  
**Attachments:** Sample1Analysis 1.xlsx

---

FYI.

-----Original Message-----

From: Per F. Peterson [mailto:[peterson@nuc.berkeley.edu](mailto:peterson@nuc.berkeley.edu)]  
Sent: Sunday, March 20, 2011 4:33 PM  
To: Aoki, Steven; 'peterson@nuc.berkeley.edu'; SCHU; Adams, Ian; Binkley, Steve; 'RJBudnitz@lbl.gov'; Sheron, Brian; Brinkman, Bill; DAgestino, Thomas; (b)(6) rlg2@us.ibm.com'; Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Poneman, Daniel; 'ronaldo.szilard@inl.gov'; (b)(6)  
Subject: Fwd: Re: 5 Liter Rainwater Sample I-131 preliminary results

(b)(5)

-Per

>Subject: Re: 5 Liter Rainwater Sample I-131 preliminary results  
>From: Dan Chivers <[chivers@berkeley.edu](mailto:chivers@berkeley.edu)>  
>Date: Sun, 20 Mar 2011 12:19:25 -0700  
>Cc: Eric Norman <[ebnorman@lbl.gov](mailto:ebnorman@lbl.gov)>,  
> Kai Vetter <[kvetter@berkeley.edu](mailto:kvetter@berkeley.edu)>,  
> Jasmina Vujic <[vujic@nuc.berkeley.edu](mailto:vujic@nuc.berkeley.edu)>,  
> "s.g. prussin" <[prussin@berkeley.edu](mailto:prussin@berkeley.edu)>,  
> "Per F. Peterson" <[peterson@nuc.berkeley.edu](mailto:peterson@nuc.berkeley.edu)>,  
> Stanley Prussin <[prussin@berkeley.edu](mailto:prussin@berkeley.edu)>  
>To: Dan Chivers <[chivers@berkeley.edu](mailto:chivers@berkeley.edu)>  
>  
>All:  
>  
>Rick and I now have agreement. I estimate this first sample at 115 pCi/L..  
>  
>I have attached the new spreadsheet.  
>  
>Dan  
>  
>  
>  
>On Mar 20, 2011, at 11:04 AM, Dan Chivers wrote:  
>  
>> Rick,  
>>  
>> Sorry. Take that back:  
>>  
>> Mass of KCl: 34.5g  
>> Mass of K: 18.093 g

CH/153

>> Activity: 852 pCi/g  
>>  
>> Total Standard Activity: 570.4 Bq  
>>  
>> Peak Counts: 0.1632 cps  
>>  
>> Peak Efficiency: 2.86E-4 (this is our factor of 10)  
>>  
>> The 364keV Peak Efficiency:  $2.86E-4 * 1460.8 / 364 = 0.0011$   
>>  
>> Dan  
>>  
>>  
>> On Mar 20, 2011, at 10:46 AM, Dan Chivers wrote:  
>>  
>>> Rick,  
>>>  
>>> So, this is what we based yesterdays calculations on. 0.0026 was  
>>>the K40 peak efficiency and we scaled by 1/Egamma to get the 364  
>>>efficiency.  
>>>  
>>> We are preparing another standard this morning with 97.67 g KCl and  
>>>we are sealing the beaker in the process we have developed over the  
>>>last few samples.  
>>>  
>>> Dan.  
>>>  
>>> On Mar 20, 2011, at 10:35 AM, Eric Norman wrote:  
>>>  
>>>> Dan,  
>>>>  
>>>> The KCl source I prepared yesterday emits 60 gammas per second at  
>>>>1461 keV. You can check my calculation from the mass (34.5  
>>>>grams) of KCl I dissolved in the water.  
>>>>  
>>>> So, if you are observing 0.16 counts per second in that peak,  
>>>>then your ABSOLUTE photopeak efficiency at that energy is simply  
>>>> $0.16/60 = 0.0027$ , end of story. To get the efficiency at 364 keV, I  
>>>>would scale this roughly as 1/Egamma as we discussed yesterday.  
>>>>  
>>>> Rick  
>>>>  
>>>>  
>>>>  
>>>> On Sun, Mar 20, 2011 at 10:14 AM, Dan Chivers  
>>>><chivers@berkeley.edu> wrote:  
>>>> Rick,  
>>>>  
>>>> I am running the KCl standard again.  
>>>>  
>>>> 34.5 g KCl in ~1L Marinelli -> I am getting ~0.16 cps  
>>>> In my run yesterday: I got 0.1632 +/- 0.0071 cps  
>>>> The K40 line from a clean Marinelli run shows 0.0173 cps with high  
>>>>statistics.  
>>>>  
>>>> So, my background subtracted counts is 0.1561 cps.  
>>>> You have written on the Marinelli that you got 60cps, this is a  
>>>>factor of 381,..., I'm not sure I understand this.  
> >>> If you had 60 counts per minute rather than seconds then the  
>ratio would be 6.5 which would make more sense.



>>>>  
>>>> - Dan.

>>>>  
>>>>  
>>>>

>>>> On Mar 20, 2011, at 9:42 AM, Eric Norman wrote:

>>>>  
>>>>> Let's compare my results for I-131 with Dan's. From the last  
>>>>>message I saw from Dan, he saw about 0.15 counts per second at  
>>>>>364 keV in one of his water samples. I saw 0.11 counts per second.  
>>>>>His sample was about 5 or 6 liters of rainwater boiled down to 1  
>>>>>liter. My sample was 1 liter unboiled. Dan is using a "10%"  
>>>>>efficient detector while mine is "60%" . To first order, the  
>>>>>difference in sample sizes is cancelled out by the difference in  
>>>>>detector efficiencies. So the activity levels of  
>>>>>I-131 that Dan and I are seeing are within about 30% of each  
>>>>>other. I used my in situ calibration to determine the level in my  
>>>>>sample is 100 pCi/liter. Thus I don't understand where Dan gets  
>>>>>his 1000 pCi/liter value. Can someone explain that to me?

>>>>>  
>>>>> Rick

>>>>>  
>>>>>  
>>>>>  
>>>>>

>>>>> On Sat, Mar 19, 2011 at 1:48 PM, Eric Norman <ebnorman@lbl.gov> wrote:  
>>>>> Overnight, I used a 65% efficient Ge detector to count one  
>>>>>liter of rainwater collected in Berkeley on March 18.

>>>>>  
>>>>> I see:

>>>>>  
>>>>> Egamma (keV)     ID  
>>>>>  
>>>>> 228                Te-132  
>>>>>  
>>>>> 284                I-131  
>>>>> 364                "  
>>>>> 637                "  
>>>>>  
>>>>> 523                I-132  
>>>>> 630                "  
>>>>> 667                "  
>>>>> 773                "  
>>>>>  
>>>>> 605                Cs-134  
>>>>> 796                "  
>>>>>  
>>>>> 662                Cs-137

>>>>>  
>>>>> In this spectrum, the 364-kev line from I-131 is by far the  
>>>>>strongest feature. I measured it's counting rate to be 0.115  
>>>>>counts per second.

>>>>>  
>>>>> Today (Saturday) I dissolved 34.5 grams of KCl in H2O to make a  
>>>>>calibration source that emits 60 gammas per second at 1461 keV. I  
>>>>>put this into a Marinelli beaker and counted it to determine my  
>>>>>detection efficiency at this energy. That turns out to be 1.24%.  
>>>>>Based on my past experience with large extended sources like this,  
>>>>>I estimate that the efficiency at  
>>>>>364 keV is approximately 3 times larger than at 1461 keV, or about

>>>>>3.7%. Using this number and the fact that the branching ratio for  
>>>>>the 364 keV gamma is 0.817, I get that my rainwater sample contains  
>>>>>103 pCi/liter of I-131. I would place an uncertainty of + - 20% on  
>>>>>this number. The other activities are substantially smaller than  
>>>>>this in this sample.

>>>>>

>>>>> I gave the K-40 calibration source to Dan Chivers to calibrate  
>>>>>his system.

>>>>>

>>>>> I am now counting a 1-liter sample of rainwater I collected on  
>>>>>March 18 at my home in the Oakland hills. I'll report on that  
>>>>>tomorrow.

>>>>>

>>>>> If the NE department is going to release information to the  
>>>>>public about what we are observing, it should be done very  
>>>>>carefully. It is crucial to point out that the levels we are  
>>>>>seeing are comparable to or smaller than the natural background.  
>>>>>We just have very sensitive instruments !

>>>>>

>>>>> Rick

>>>>>

>>>>>

>>>>>

>>>>> On Sat, Mar 19, 2011 at 8:08 AM, Dan Chivers

>>>>><chivers@berkeley.edu> wrote:

>>>>> Preliminary:

>>>>>

>>>>> 0.1459 cps I-131 peak counts in 10% HPGe detector

>>>>>

>>>>> The plot efficiency plot below is an absolute efficiency for 1  
>>>>>and 2L Marinelli beakers and I am still researching the size of  
>>>>>detector used for this. But I am assuming we will need the peak to  
>>>>>total ratio to convert absolute to peak efficiency.

>>>>>

>>>>> For 364 keV, the Marinelli efficiency is 0.028. First order peak  
>>>>>to total ratio (by PE/TOTAL attenuation) is 0.088. Thus the peak  
>>>>>efficiency to first order is 0.0025.

>>>>>

>>>>> This estimates the emission rate at 62.84 Bq (Counting Time =  
>>>>>41938 s) or 1698 pCi

>>>>>

>>>>> Since we evaporated 5 liters to 1 liter for this measurement, I  
>>>>>come up with 340 pCi/L.

>>>>>

>>>>> This is conservative since I expect our peak to total ratio will  
>>>>>come up with a better estimate of second order scatter absorption.  
>>>>>We should have this today.

> >>>>>

>>>>> I am working out other peak rates now.

>>>>>

>>>>> Dan.

> >>>>>

--

---

Per F. Peterson  
Professor and Chair  
Department of Nuclear Engineering  
University of California

4153 Etcheverry Hall  
Berkeley, California 94720-1730  
peterson@nuc.berkeley.edu  
Office: (510) 643-7749 Fax: (510) 643-9685  
[http://www.nuc.berkeley.edu/People/Per\\_Peterson](http://www.nuc.berkeley.edu/People/Per_Peterson)

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### Water Sample 1 Analysis

Counting Time      50009 sec  
 Volume              4.425 L  
 Marinelli dmear      0.79 cm  
 K40 Eff              2.60E-03  
 K40 Peak Eff        0.0074  
 K40 muH2O        5.83E-02  
 Marinelli K40 Ef    2.49E-03

Isotope	Peak Energy	Branching	Peak Counts		1/E Scale
Ra-226	186.39	0.0359	158	47	7.84E+00
Te-132	228.71	0.88	1555	76	6.39E+00
Pb-212	239.16	0.433	198	24	6.11E+00
I-131	284.56	0.0614	876	52	5.13E+00
I-131	364.49	0.817	7698	101	4.01E+00
Be-7	477.36	0.1052	196	38	3.06E+00
Tl-208	510.4	0.226	474	43	2.86E+00
Cs-134	569.33	0.1538	52	26	2.57E+00
Tl-208	582.94	0.845	126	27	2.51E+00
Cs-134	604.23	0.9762	273	33	2.42E+00
I-131	636.46	0.0717	355	30	2.30E+00
Cs-137	661.18	0.851	267	31	2.21E+00
I-132	667.24	0.99	602	36	2.19E+00
I-132	772.05	0.756	428	37	1.89E+00
Cs-134	795.23	0.8553	183	26	1.84E+00
I-132	954.02	0.176	83	19	1.53E+00
K-40	1460.83	0.11	863	50	1.00E+00
Tl-208	2614.53	0.99	252	44	5.59E-01

\*Note: Using  
 We have verif

Marinelli Eff*	Activity (pCi)		Activity (pCi/L)	
1.95E-02	122.03	36.30	27.58	8.20
1.59E-02	60.12	2.94	13.59	0.66
1.52E-02	16.27	1.97	3.68	0.45
1.28E-02	603.94	35.85	136.48	8.10
9.97E-03	510.89	6.70	115.45	1.51
7.61E-03	132.30	25.65	29.90	5.80
7.12E-03	159.24	14.45	35.99	3.26
6.38E-03	28.63	14.32	6.47	3.24
6.23E-03	12.93	2.77	2.92	0.63
6.01E-03	25.14	3.04	5.68	0.69
5.71E-03	468.77	39.61	105.94	8.95
5.49E-03	30.86	3.58	6.97	0.81
5.44E-03	60.36	3.61	13.64	0.82
4.71E-03	65.02	5.62	14.69	1.27
4.57E-03	25.31	3.60	5.72	0.81
3.81E-03	66.93	15.32	15.12	3.46
2.49E-03	1704.87	98.78 n/a	n/a	
1.39E-03	99.00	17.29	22.37	3.91

1/E scaling to produce Marinelli beaker efficiency.

Used a 4-4.25 scale from our benchmark standard at 1460keV to the I-131 at 364keV u:

sing Geant4

**From:** Sheron, Brian  
**To:** Camper, Larry  
**Subject:** FW: Fwd: Re: 5 Liter Rainwater Sample I-131 preliminary results  
**Date:** Sunday, March 20, 2011 5:51:00 PM

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-----Original Message-----

**From:** Holdren, John P. (b)(6)  
**Sent:** Sunday, March 20, 2011 5:32 PM  
**To:** Koonin, Steven; 'peterson@nuc.berkeley.edu'; Aoki, Steven; SCHU; Adams, Ian; Binkley, Steve; 'RJBudnitz@lbl.gov'; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas; Garwin, Dick; 'rlg2@us.ibm.com'; 'phillip.finck@inl.gov'; 'john.grossenbacher@inl.gov'; Hurlbut, Brandon; Kelly, John E (NE); Lyons, Peter; 'harold.mcfarlane@inl.gov'; Owens, Missy; Poneman, Daniel; 'ronaldo.szilard@inl.gov'; Fetter, Steve  
**Subject:** RE: Fwd: Re: 5 Liter Rainwater Sample I-131 preliminary results

Colleagues --

(b)(5)

(b)(5)

CH/154

(b)(5)

Best,  
John

JOHN P. HOLDREN

Assistant to the President for Science and Technology  
and Director, Office of Science and Technology Policy  
Executive Office of the President of the United States

email (b)(6)

direct phone (b)(6)

assistant Karrie Pitzer (b)(6)



**From:** Wittick, Brian  
**To:** Leeds, Eric; Grobe, Jack; Sheron, Brian; Coe, Doug  
**Cc:** Turtill, Richard  
**Subject:** NYS visit - prep info  
**Date:** Sunday, March 20, 2011 6:30:10 PM

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Following is a link to an article published Saturday saying the NYS governors office had scheduled a meeting with NRC for Tuesday: <http://polhudson.lohudblogs.com/> Their being a little ahead of us on confirming the meeting explains their angst today.

Please note the article states the purpose of their meeting as: "The purpose of the meeting will be to discuss the risks facing Indian Point in the event of an earthquake, how prepared Indian Point is to handle an earthquake, as well as what risk assessments have been completed regarding Indian Point." This adds a little to their stated purpose to us being: "To better understand the findings of the study, and get an update on the further review at Indian Point that is/may be on going."

VR

Brian Wittick

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**From:** Leeds, Eric  
**Sent:** Sunday, March 20, 2011 4:01 PM  
**To:** Sheron, Brian; Turtill, Richard; LIA08 Hoc; Virgilio, Rosetta; LIA06 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Ryan, Michelle; Wiggins, Jim; Coe, Doug; Grobe, Jack; Wittick, Brian  
**Subject:** RE: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

Yes – NRR is working with the EDOs office to set up the meeting and we appreciate RES's support. Brian Wittick is the POC.

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

**From:** Sheron, Brian  
**Sent:** Sunday, March 20, 2011 3:06 PM  
**To:** Turtill, Richard; LIA08 Hoc; Virgilio, Rosetta; LIA06 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Ryan, Michelle; Leeds, Eric; Wiggins, Jim; Coe, Doug  
**Subject:** RE: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

RES is working with NRR and will support the meeting. We are not taking the lead to set it up, etc. I am assuming NRR is doing that.

**From:** Turtill, Richard  
**Sent:** Sunday, March 20, 2011 12:40 PM  
**To:** LIA08 Hoc; Virgilio, Rosetta; LIA06 Hoc; LIA04 Hoc; OST05 Hoc  
**Cc:** Piccone, Josephine; Jackson, Deborah; Ryan, Michelle; Leeds, Eric; Wiggins, Jim; Sheron, Brian  
**Subject:** RE: NRC PUBLIC MEETING 9:00 AM MONDAY, MARCH 21, 2011: NRC's RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN

CH/155

**Importance:** High

Jeff (not certain which Jeff):

I'm the Branch Chief of FSME's Intergovernmental Liaison Branch, and some of us, including Rosetta and I, want to be assured that NRR and/or RES are taking the lead in (of course) preparing for the meeting with NY, but also **coordinating logistics for such a meeting**. I was planning to call Eric this afternoon to assure NRR was in fact taking the lead to coordinate meeting with NY, and keeping Chairman's office and RI informed of the meeting.

Shall I call Eric? The meeting is fast approaching... Tuesday. Many will be engaged in the Commission meeting on Mon morning. I believe we **(NRR Administrative support?) should be in touch with NY (their contact in DC - Hilary F. Jochmans, Director New York State Washington Office of the Governor 202-434-7100) first thing Monday morning to plan out meeting logistics for this meeting, including room reservation, etc.**

Can we be assured that NRR (and/or RES) is doing this? At this time, there have been just WAY too many e-mails discussing this meeting. Unless I hear from you shortly, I'll try to contact Eric directly by phone. Please let me know.

Rich Turtil

(b)(6)

**From:** Sheron, Brian  
**To:** Camper, Larry  
**Subject:** FW: Fwd: Re: 5 Liter Rainwater Sample I-131 preliminary results  
**Date:** Sunday, March 20, 2011 7:13:00 PM

---

-----Original Message-----

From: Per F. Peterson [mailto:[peterson@nuc.berkeley.edu](mailto:peterson@nuc.berkeley.edu)]  
Sent: Sunday, March 20, 2011 7:08 PM  
To: Holdren, John P.; Koonin, Steven; 'peterson@nuc.berkeley.edu'; Aoki, Steven; SCHU; Adams, Ian; Binkley, Steve; 'RJBudnitz@lbl.gov'; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas; Garwin, Dick; 'rlg2@us.ibm.com'; 'phillip.finck@inl.gov'; 'john.grossenbacher@inl.gov'; Hurlbut, Brandon; Kelly, John E (NE); Lyons, Peter; 'harold.mcfarlane@inl.gov'; Owens, Missy; Poneman, Daniel; 'ronaldo.szilard@inl.gov'; Fetter, Steve  
Subject: RE: Fwd: Re: 5 Liter Rainwater Sample I-131 preliminary results

UC Berkeley rainwater sampling results are now posted online, along with air monitoring results:

<http://www.nuc.berkeley.edu/UCBAirSampling>

To summarize, the first sample collected between 3/17 and 3/18 (Th-F) had 4.27 Bq/L of I-131. To obtain a dose equivalent to a round trip from San Francisco to DC, one would need to drink 630 liters of this water.

The next water sample, collected between 1300 and 2030 on 3/18 (F) had 5.36 Bq/L, and the following sample collected between 2040 on 3/18 and 1000 on 3/19 had 3.68 Bq/L.

Rain is forecast through next Sunday, so we will continue to collect samples and see what the trend looks like.

-Per  
--

---

Per F. Peterson  
Professor and Chair  
Department of Nuclear Engineering  
University of California  
4153 Etcheverry Hall  
Berkeley, California 94720-1730  
[peterson@nuc.berkeley.edu](mailto:peterson@nuc.berkeley.edu)  
Office: (510) 643-7749 Fax: (510) 643-9685  
[http://www.nuc.berkeley.edu/People/Per\\_Peterson](http://www.nuc.berkeley.edu/People/Per_Peterson)

---

CH/156

**From:** Sheron, Brian  
**To:** Johnson, Michael  
**Subject:** FW: Chairman briefings  
**Date:** Sunday, March 20, 2011 8:39:00 PM

---

-----Original Message-----

From: Wiggins, Jim  
Sent: Sunday, March 20, 2011 2:52 PM  
To: Sheron, Brian  
Subject: FW: Chairman briefings

-----Original Message-----

From: ET07 Hoc  
Sent: Sunday, March 20, 2011 2:27 PM  
To: HOO Hoc  
Cc: Wiggins, Jim  
Subject: FW: Chairman briefings

HOOs-

Starting at 1515 EST today, the oncoming ET Director will be providing the Chairman with an update briefing. Call times will be:

1515  
2315  
0715

Thanks, Craig

-----Original Message-----

From: Batkin, Joshua  
Sent: Sunday, March 20, 2011 11:30 AM  
To: Wiggins, Jim; HOO Hoc  
Cc: Virgilio, Martin; Weber, Michael; Borchardt, Bill; ET07 Hoc  
Subject: Re: Chairman briefings

Yes, all three so he can stay tied in and have a feel for who's on duty. How about a high level overview of the status, the priorities for the outgoing shift and the priorities for the incoming one. Then he could jump off and you could do your more detailed shift turnover. Does that sound like a good structure and would those be the right times for something like that?

Joshua C. Batkin  
Chief of Staff  
Chairman Gregory B. Jaczko  
(301) 415-1820

----- Original Message -----

From: Wiggins, Jim  
To: Batkin, Joshua; HOO Hoc  
Cc: Virgilio, Martin; Weber, Michael; Borchardt, Bill; ET07 Hoc  
Sent: Sun Mar 20 11:19:40 2011  
Subject: RE: Chairman briefings

OK. Do you really want the Chairman called at 11:15pm by the oncoming mid-watch? Could do a

CH/157

7:15am and 3:15pm call and disturb him later for noteworthy events/occurrences?

-----Original Message-----

From: Batkin, Joshua

Sent: Sunday, March 20, 2011 10:18 AM

To: Wiggins, Jim; HOO Hoc

Cc: Virgilio, Martin; Weber, Michael; Borchardt, Bill

Subject: Chairman briefings

Can we please put in place short phone briefings for the Chairman around the time of ET shift turnovers? Maybe of the priorities for the next time period? Thank you

Joshua C. Batkin

Chief of Staff

Chairman Gregory B. Jaczko

(301) 415-1820

**From:** Sheron, Brian  
**To:** Cool, Donald; Camper, Larry  
**Subject:** FW: Isotope data from air samples taken in Japan  
**Date:** Sunday, March 20, 2011 10:10:00 PM  
**Attachments:** Air Filter Analyses as of 20 Mar.xlsx

---

FYI.

-----Original Message-----

From: Aoki, Steven [mailto:Steven.Aoki@nnsa.doe.gov]

Sent: Sunday, March 20, 2011 10:04 PM

To: 'peterson@nuc.berkeley.edu'; (b)(6) Koonin, Steven; SCHU; Adams, Ian;  
Binkley, Steve; 'RJBudnitz@lbl.gov'; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas;

(b)(6) 'rlg2@us.ibm.com'; Finck, Phillip; Grossenbacher, John (INL);  
Hurlbut, Brandon; Kelly, John E (NE); Lyons, Peter; McFarlane, Harold; Owens, Missy; Poneman, Daniel;  
'ronaldo.szilard@inl.gov'; (b)(6)

Subject: Isotope data from air samples taken in Japan

Attached is a report on air sampler data taken by our team in Japan. Radioisotopes deposited on filters were counted with an ORTEC HPGe detector at the locations indicated. All of the measurements were very close to background levels.

C4/158

**Summary of Air Samples Analyzed in the Field by CMRT**  
 Partial Results compiled as of 1200 PDT

						Total Activity Measured on Filter by ( $\mu$ Ci)			
Date	Time (JST)	Sample Type	Location Description	Total Flow (SCFM*)	Sampled Volume (ml)	Cs-134	Cs-137	I-131	I-132
3/17/2011	1430	Charcoal	Background (Blank)	N/A		1.78E-04	1.44E-04	2.01E-03	5.73E-04
3/17/2011	1900	Paper	Yokota AFB Bldg 1503 SE Corner	8.90E+02	2.52E+07	1.93E-04	2.18E-04	2.20E-03	6.87E-04
3/16/2011	1355	Paper	US Embassy Tokyo Roof Top SE Corner	4.62E+01	1.31E+06	3.37E-04	1.65E-04	2.78E-03	5.82E-04
3/16/2011	1900	Paper	Yokota AFB Bldg 1503 SE Corner	1.46E+02	4.15E+06	1.75E-04	3.04E-04	2.90E-03	7.34E-04
3/16/2011	1355	Charcoal	US Embassy Tokyo Roof Top SE Corner	4.62E+01	1.31E+06	3.19E-04	1.94E-04	3.24E-03	6.37E-04
3/17/2011	1257	Paper	US Embassy Tokyo Roof Top NE Corner	9.91E+02	2.81E+07	1.37E-04	1.02E-04	2.29E-03	3.28E-04
3/17/2011	1257	Charcoal	US Embassy Tokyo Roof Top NE Corner	9.91E+02	2.81E+07	1.84E-04	1.40E-04	2.40E-03	5.89E-04

\*Standard Cubic Feet Per Minute

HPGe	Air Concentration ( $\mu\text{Ci/ml}$ )					Activity Relative to Blank				
Te-132	Cs-134	Cs-137	I-131	I-132	Te-132	Cs-134	Cs-137	I-131	I-132	Te-132
4.51E-04										
4.75E-04	6.04E-13	2.94E-12	7.38E-12	4.55E-12	9.48E-13	1.09	1.51	1.09	1.20	1.05
4.24E-04	1.22E-10	1.62E-11	5.82E-10	7.37E-12	0.00E+00	1.90	1.15	1.38	1.02	0.94
5.42E-04	0.00E+00	3.86E-11	2.13E-10	3.90E-11	2.20E-11	0.98	2.11	1.44	1.28	1.20
4.19E-04	1.08E-10	3.81E-11	9.34E-10	4.94E-11	Less than background	1.79	1.35	1.61	1.11	0.93
4.25E-04	0.00E+00	0.00E+00	9.82E-12	0.00E+00	0.00E+00	0.77	0.71	1.14	0.57	0.94
4.94E-04	1.98E-13	0.00E+00	1.36E-11	5.91E-13	1.52E-12	1.03	0.97	1.19	1.03	1.09



**From:** Sheron, Brian  
**To:** Gibson, Kathy; Carpenter, Cynthia  
**Subject:** FW: Isotope data from air samples taken in Japan  
**Date:** Sunday, March 20, 2011 10:52:00 PM

---

FYI.

-----Original Message-----

From: Koonin, Steven [mailto:Steven.Koonin@science.doe.gov]  
Sent: Sunday, March 20, 2011 10:33 PM  
To: Aoki, Steven; 'peterson@nuc.berkeley.edu'; (b)(6) SCHU; Adams, Ian;  
Binkley, Steve; 'RJBudnitz@lbl.gov'; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas;  
(b)(6) 'rlg2@us.ibm.com'; 'phillip.finck@inl.gov';  
'john.grossenbacher@inl.gov'; Hurlbut, Brandon; Kelly, John E (NE); Lyons, Peter;  
'harold.mcfarlane@inl.gov'; Owens, Missy; Poneman, Daniel; 'ronaldo.szilard@inl.gov';  
(b)(6)  
Subject: Re: Isotope data from air samples taken in Japan

My Japanese colleague tells me that the nuclear research labs (RIKEN and others) have spectrally resolved, calibrated time series. Earlier this week he told me they were seeking permission from MEXT to release, but I've not heard anything since.

Perhaps propose to MEXT a swap of datasets?

SEK

----- Original Message -----

From: Aoki, Steven  
To: peterson@nuc.berkeley.edu <peterson@nuc.berkeley.edu>; (b)(6)  
(b)(6) Koonin, Steven; SCHU; Adams, Ian; Binkley, Steve;  
RJBudnitz@lbl.gov <RJBudnitz@lbl.gov>; Brian.sheron@nrc.gov <Brian.sheron@nrc.gov>; Brinkman, Bill; DAgostino, Thomas; (b)(6)  
rlg2@us.ibm.com <rlg2@us.ibm.com>; Finck, Phillip <phillip.finck@inl.gov>; Grossenbacher, John (INL) <john.grossenbacher@inl.gov>; Hurlbut, Brandon; Kelly, John E (NE); Lyons, Peter; McFarlane, Harold <harold.mcfarlane@inl.gov>; Owens, Missy; Poneman, Daniel; ronaldo.szilard@inl.gov <ronaldo.szilard@inl.gov>; (b)(6)  
Sent: Sun Mar 20 22:04:26 2011  
Subject: Isotope data from air samples taken in Japan

Attached is a report on air sampler data taken by our team in Japan. Radioisotopes deposited on filters were counted with an ORTEC HPGe detector at the locations indicated. All of the measurements were very close to background levels.

C4/159

**From:** Sheron, Brian  
**To:** Batkin, Joshua  
**Cc:** Virgilio, Martin; Weber, Michael  
**Subject:** RE: Your Question  
**Date:** Sunday, March 20, 2011 10:53:00 PM

---

Will do.

---

**From:** Batkin, Joshua  
**Sent:** Sunday, March 20, 2011 10:39 PM  
**To:** Sheron, Brian  
**Cc:** Virgilio, Martin; Weber, Michael  
**Subject:** Re: Your Question

Got it. Thank you. I'll pass that back to USAID. Please make sure the team knows that the Japanese Ambassador offered to help make sure our team had access to whomever they needed to speak with.  
Thanks Josh

Joshua C. Batkin  
Chief of Staff  
Chairman Gregory B. Jaczko  
(301) 415-1820

---

**From:** Sheron, Brian  
**To:** Batkin, Joshua  
**Cc:** Virgilio, Martin; Weber, Michael  
**Sent:** Sun Mar 20 21:40:24 2011  
**Subject:** Your Question

Josh, you sent an e-mail to Mike Weber and Marty Virgilio asking if we had successfully embedded someone at TEPCO.

We have not embedded anyone in TEPCO. We spoke with the Tokyo team (John Monninger and Dan Dorman) a few minutes ago, and asked their opinion if they felt it would be useful and helpful.

John did not think it was the best use of our resources to embed anyone in TEPCO. He cited two reasons; one was the language barrier. He said that whoever was embedded would need a full-time interpreter, and two was that the lack of authority would be a hindrance. By that, he means that the person would not be able to move about freely within the organization.

John thought that the meetings they were having with TEPCO have been effective and efficient, and better accomplish their objectives than having an embedded NRC person.

CH/160

**From:** Haney, Catherine  
**To:** Weber, Michael  
**Cc:** Sheron, Brian; Uhle, Jennifer; Wiggins, Jim; Kinneman, John; Ordaz, Vonna  
**Subject:** Fw: BRC Briefing  
**Date:** Monday, March 21, 2011 6:06:32 AM  
**Attachments:** BRC 110328.ppt  
BRC 110203.ppt

---

Dan and I discussed this presentation before he left.

One consideration was delaying the meeting until he returns although my preference is to move forward. I'm comfortable doing the presentation if I can get support from RES on the spent fuel pools and NSIR on security- vulnerability assessments. My concern is that RES may not have the time to support this briefing right now.

With that being said, I question if we want to modify these slides given recent events in Japan. I propose RES reviews the slides and makes modifications to reflect current situation. I will engage Brian and Jennifer once I hear from you on moving forward.

Lastly, I don't think it necessary to get permission from the Commission for the presentation since we previously had the ok to brief the BRC. Do you agree?

Cathy

---

**From:** Dorman, Dan  
**To:** Haney, Catherine  
**Cc:** Hill, Brittain  
**Sent:** Fri Mar 18 10:28:56 2011  
**Subject:** BRC Briefing

Cathy,

The first attached file contains a condensed version of the briefing we gave to the BRC last month. The slides I stripped down are included in the background. The second file has the full briefing from February.

You have one hour, including Q/A with Rep Hamilton on the 28<sup>th</sup>.

Dan

CH/161



# **Safety and Security of Spent Nuclear Fuel**

**Presentation to the  
Blue Ribbon Commission  
on America's Nuclear Future  
March 28, 2011**

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# Agenda

- **Background**
- **Spent Fuel Pools**
- **Dry Storage and Transportation**
- **Security Rulemaking**
- **Concluding Remarks**

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# **Security Statement**

- **Discussion of certain security scenarios and associated consequences involves classified information up to Secret (National Security Information)**
- **Details of protective measures involve Safeguards Information**
- **The briefing materials provided are unclassified and include controlled information designated as Official Use Only**

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# Background

- **NRC Mission**
- **Post-9/11 security enhancements**
- **Framework for security regulations**
  - **Threat Assessment**
  - **Security Assessment**
  - **Regulatory Requirements**
- **Evaluation of new information**

## **Spent Fuel Pools**

- **Historical review of low probability natural events (e.g., earthquakes) which may result in draining of the pools water inventory.**
- **Past work has shown that the risk is very low, due to the unlikelihood of such an event damaging the thick reinforced pool walls.**
- **The consequences, however, may be large due to the potential for heatup of all the fuel in the pool.**



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# **Spent Fuel Pools**

- **Following 9/11 terrorist attack, NRC began extensive reexamination of pool safety and security**
  - **Examination of pool vulnerability to attack**
  - **Development of significantly improved analysis of fuel coolability and heatup**
    - **Zirconium cladding fire initiation and propagation**
  - **Development and assessment of mitigation measures which may be taken to improve coolability of fuel in the event of attack**

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# Spent Fuel Pools

- **Focus was on developing measures to improve coolability of fuel stored in pools which would be practical and effective for credible and more realistic threats.**

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# **Spent Fuel Pools**

- **Identified improved fuel configurations with hotter fuel (higher decay heat) dispersed among older, lower decay heat fuel.**
  - **Provides significantly improved (passive) coolability for fuel**
- **Spray capability was then required for each site, the ability to deliver minimum of 200 gpm.**
  - **Provides improved active cooling capability.**
- **Site specific assessments of vulnerabilities and mitigation measures were conducted by each licensee and inspected by NRC.**

# Spent Fuel Pools

- **Subsequent work was done to address validation of spent fuel modeling.**
- **Testing of prototypic BWR assembly was conducted.**
- **Currently experimental work is underway to confirm counterpart PWR modeling**

# **Spent Fuel Pool Conclusions**

- **Spent fuel pools are robust and inherently resistant to security threats**
- **Spent fuel pools at all U.S. reactor sites have been assessed**
- **Additional mitigative measures have been implemented**
  - **Including active and passive measures**
- **These measures were incorporated in the regulations in 2009**
- **Follow-on research using prototypic fuel assemblies and rack cells is addressing the adequacy of phenomenological modeling**

# **Dry Storage**

- **Top-to-bottom review of NRC-licensed activities**
- **“Big picture” review to guide agency response to threats via security orders**
- **Follow-up security orders by rulemaking process**
- **Single security assessment methodology for all licensed activities, excluding nuclear power plants**

## **Historical Perspective**

- **NRC has long considered dry spent fuel storage systems as massive structures that are extremely robust and resistant to a range of both safety-based and security-based events**
- **In a 1995 final rule on emergency planning for independent spent fuel storage installations (ISFSIs), the Commission indicated that potential worst case dose consequences to a member of the public from all events was very low**

## Historical Perspective (cont.)

Scenarios	Low Results*	High Results
Safety and security events	$1 \times 10^{-6}$ rem	$1 \times 10^{-4}$ rem

\* This range of consequences reflects doses to the total body, skin, thyroid, and lung



# **Dry Storage and Transport Security Assessments**

- **Developed scenarios that, prior to 9/11, were considered remote and speculative**
- **Two Step Framework Determination**
  - **Attractiveness**
  - **Consequence**

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# **Dry Storage and Transport Security Assessments**

- **Sandia estimated release fractions**
- **Consequence calculations to estimate early fatalities**
- **All Spent Fuel Framework Findings were Green**

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# Framework Decision Matrix

Attractiveness Category	Consequence				
	V	IV	III	II	I
A (0.0 to 1)	Green - Acceptable	Yellow	Red - Assess Mitigative Strategies		
B (1.0 to 2.0)		Consider			
C (2.0 to 3.0)					
D (3.0 to 4.0)		Mitigative			Strategies
E (4.0 to 5.0)					

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# **Dry Storage and Transport Conclusions**

- **Commission concluded that immediate action was not warranted to change the security level that defines adequate protection**
- **Robust design features ensure spent fuel casks are safe and secure**
- **Post-9/11 security orders remained necessary and sufficient**

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## Next Steps

- **Commission directed NRC staff to proceed to rulemaking to modify the regulatory framework for security of dry storage**
  - **Make generically applicable the security measures in the post-9/11 orders**
  - **Potentially include consideration of security scenarios not previously captured in our historical regulatory perspective.**

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# **Storage Security Rulemaking – Status**

- **Significant comments received from stakeholders opposing key approaches in the draft regulatory basis**
  - Preferred DBT approach over dose calculation approach
  - Preferred use of higher dose limits for security events
- **Commission has directed the staff to engage stakeholders further on –**
  - Threat and vulnerability information
  - Draft adversary characteristics
  - Staff responses to comments on the draft regulatory basis

## **Rulemaking – Status (cont.)**

- **Commission directed the staff to submit a supplemental paper later this year**
  - **Assess stakeholder comments on the draft regulatory basis**
  - **Assess feedback from engagement with stakeholders**
  - **Discuss whether any changes in direction are appropriate and necessary**

# **Spent Fuel Transportation Security Rulemaking**

- **Proposed rule comment period was just extended**
- **The proposed rule will make generically applicable requirements from the post-9/11 SNF transportation security orders**
  - **Increased physical security measures**
  - **Increased personnel security/background check measures**
- **The rule is not adding any significant new measures beyond the existing orders.**



# **NAS Study on Storage**

- **Security for rods not in assemblies**
- **Effectiveness of protective measures**
  - **Force-on-force testing for design basis**
  - **DHS Comprehensive Review for greater threats**
- **Best-estimate analyses of zirc fire events**
- **Measures to reduce consequences**
- **Plant-specific assessments**
- **Information sharing**

# **NAS Study on Transportation**

- **No fundamental technical barriers to safe transport**
  - **Social and institutional challenges**
- **Independent examination of security**
- **Very long duration fires**
- **Strongly endorsed full-scale testing of package performance**
- **State and Tribal outreach**
- **Various recommendations to DOE and DOT**

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**Questions?**

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# **BACKGROUND SLIDES**

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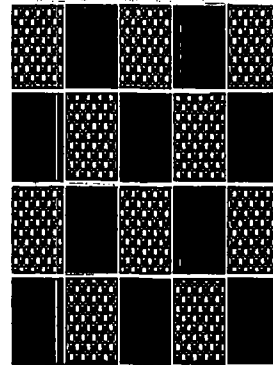
# Fuel Management

High-powered Assembly Surrounded  
by High-powered Assemblies



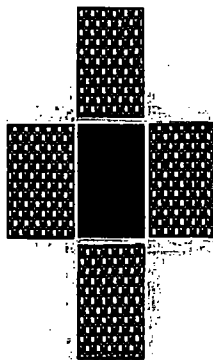
Fuel is Air Coolable After 310  
Days

High-powered Assemblies in Checkerboard  
Pattern with by Low Assemblies



Fuel is Air Coolable After  
120 Days

High-powered Assembly Surrounded by 4  
Low-powered Assemblies (1 x 4)

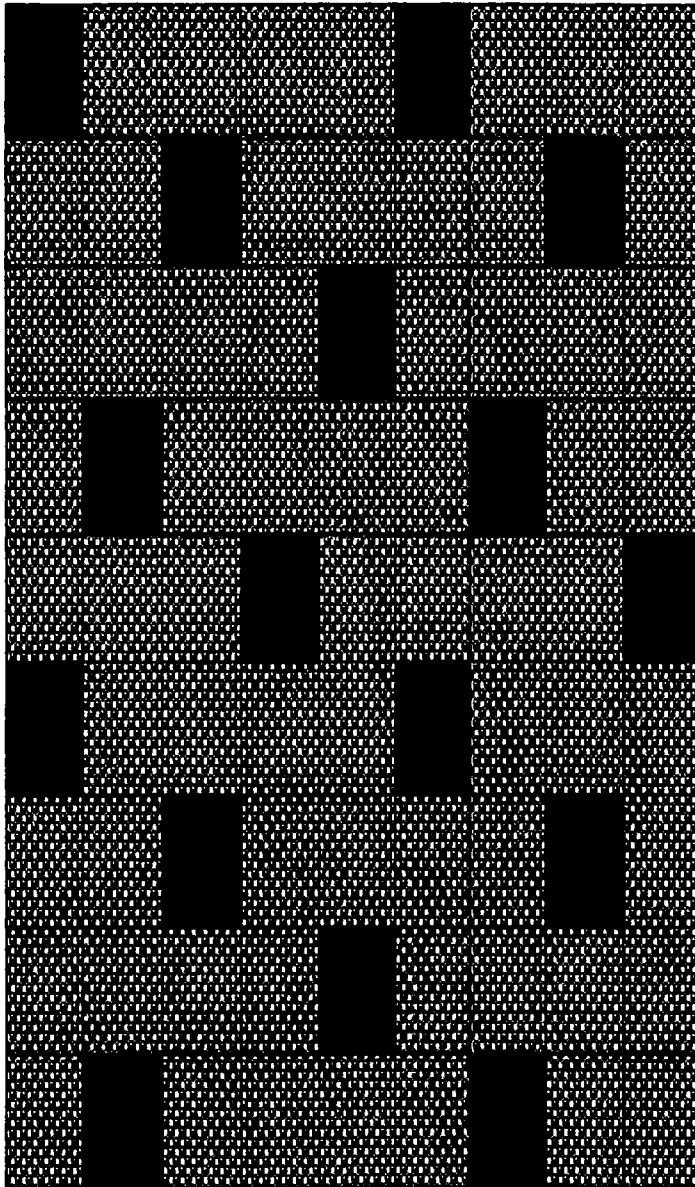


Fuel is Air Coolable After 20  
Days

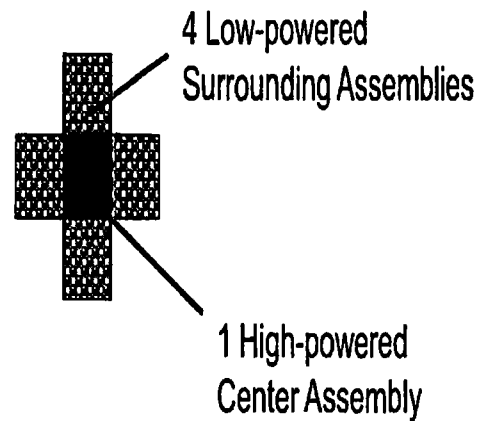
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# Improved Fuel Configuration



1x4 Repeating Pattern



1x4 Spacing

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# **Spent Fuel Pool Safety and Security**

- **Subsequent work was also done at Sandia National Laboratories to address validation of MELCOR spent fuel modeling. Testing of prototypic BWR assembly was conducted.**
  - **Confirmation of modeling of natural circulation, flow resistance and thermal response.**
  - **Confirmation of oxidation kinetics modeling and validation of prediction of zirconium fire initiation and propagation.**

# **Spent Fuel Pool Safety and Security**

- **Currently experimental work is underway to confirm counterpart PWR modeling (Cooperative international program under OECD/CSNI)**
  - **Investigation of natural circulation and flow resistance modeling using full scale prototypic PWR Westinghouse assembly.**
  - **Testing of Zr fire conditions now underway.**



# Attractiveness Ranking Matrix

- **Pre-Event**
  - **Iconic Value**
  - **Complexity of Planning**
- **Event**
  - **Resources Needed**
  - **Execution Risk**
- **Post-Event**
  - **Public Protection Measures**
- **(Icon + CP+ RN + ER + PM) / 5**

Early Fatalities	None	Single Digits	Tens	Hundreds	Thousands
Consequence Category	V	IV	III	II	I

# **Consequence Methodology**

- **Doses delivered over 30 days through**
  - Inhalation**
  - Ingestion**
- **Total Effective Dose Equivalent**
  - 50-year committed dose from particulates inhaled during plume passage**

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## **Consequence Results**

- **Higher consequences to maximally exposed individuals**
- **Highest consequences over 100 m<sup>2</sup> area**
- **Doses dropped off very rapidly**

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# **Consequence Studies**

- **Ongoing - NRC staff is working with a National Lab to evaluate potential impacts from releases from spent fuel dry storage systems (dose vs. distance calculations)**
  - **Not a phenomenological-specific approach**
  - **Will assist in evaluating need for future studies**
- **Intermediate term - further studies under consideration for specific security events with the potential to transport respirable radionuclides offsite**

## **Consequence Studies (cont.)**

- **Long term – additional security consequence studies**
  - **Informed by input from DTRA on potential beyond DBT events (i.e. beyond current ISFSI adversary characteristics)**
  - **Forward-looking approach to address potential step changes to the threat environment**
  - **Not tied to the ongoing ISFSI security rulemaking**

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United States Nuclear Regulatory Commission

*Protecting People and the Environment*

# **Safety and Security of Spent Nuclear Fuel**

**Presentation to the  
Blue Ribbon Commission  
on America's Nuclear Future  
February 3, 2011**

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# **Agenda**

- **Background**
  - **Dan Dorman**
- **Spent Fuel Pool Safety and Security**
  - **Jason Schaperow**
- **Post-9/11 Security Assessments for Dry Storage and Transportation**
  - **Bernard White**
- **ISFSI and Transportation Security Rulemaking and Additional Studies**
  - **Phil Brochman**
- **Concluding Remarks**
  - **Dan Dorman**

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  - **Security Assessment**
  - **Regulatory Requirements**
- **Evaluation of new information**

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United States Nuclear Regulatory Commission

*Protecting People and the Environment*

# **Spent Fuel Pool Safety and Security**

**Jason Schaperow**

**Senior Reactor Systems Engineer**

**Office of Nuclear Regulatory Research**

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# **Spent Fuel Pool Safety and Security**

- **NRC has carefully reviewed the safety of spent fuel stored in pools due primarily to the risk associated with low probability natural events (e.g., earthquakes) which may result in draining of the pools water inventory, thereby leading to fuel uncover, heat-up of the fuel and the release of volatile radionuclides.**

# **Spent Fuel Pool Safety and Security**

- **Past work has shown that the risk is very low, due to the unlikelihood of such an event damaging the thick reinforced pool walls. The consequences, however, may be large due to the potential for heatup of all the fuel in the pool (which may represent 4-5 cores inventory of offloaded fuel).**
  - **Heatup of the fuel in the pool is achieved/assisted by "zirconium fire" initiation and propagation**
  - **Large inventory of Cs-137**

# **Spent Fuel Pool Safety and Security**

- **Following 9/11 terrorist attack, NRC began extensive reexamination of pool safety and security**
  - **Examination of pool vulnerability to attack**
  - **Development of significantly improved analysis of fuel coolability / heatup (Sandia National Laboratories)**
    - **Zirconium cladding fire initiation and propagation**
  - **Development/assessment of mitigation measures which may be taken to improve coolability of fuel in the event of attack**

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# **Spent Fuel Pool Safety and Security**

- **Focus was on developing measures to improve coolability of fuel stored in pools which would be practical and effective for credible and more realistic threats.**

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# **Spent Fuel Pool Safety and Security**

- **Improved analytical methods (MELCOR code) applied to spent fuel pool analysis led to the identification of improved fuel configurations with hotter fuel (higher decay heat) dispersed among older, lower decay heat fuel.**
  - **Provides significantly improved (passive) coolability for fuel**
- **Dispersal of hotter fuel became a requirement for all plants as a result of Commission directive. Other measures such as water makeup were also required.**

# **Spent Fuel Pool Safety and Security**

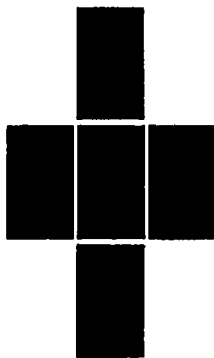
- **Later, additional analyses were performed to address benefits of a spray system for spent fuel cooling. Spray capability was then required for each site, the ability to deliver minimum of 200 gpm.**
  - **Provides improved active cooling capability.**
- **Site specific assessments were required of each licensee and NRC conducted inspections at each site to address vulnerability and mitigation measures.**



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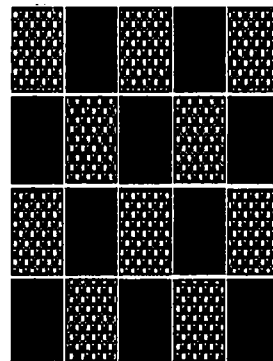
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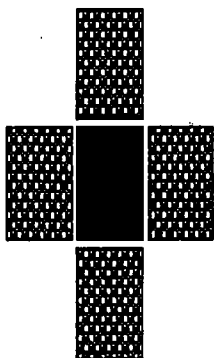
Fuel is Air Coolable After 310  
Days

High-powered Assemblies in Checkerboard  
Pattern with by Low Assemblies



Fuel is Air Coolable After  
120 Days

High-powered Assembly Surrounded by 4  
Low-powered Assemblies (1 x 4)

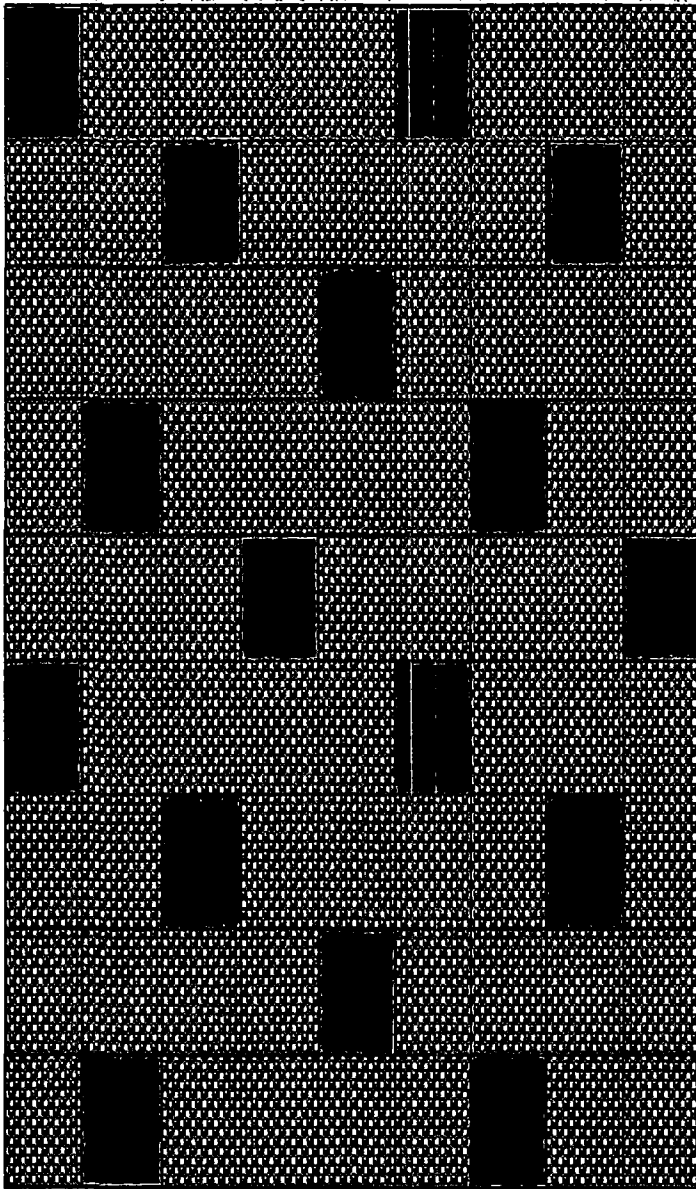


Fuel is Air Coolable After 20  
Days

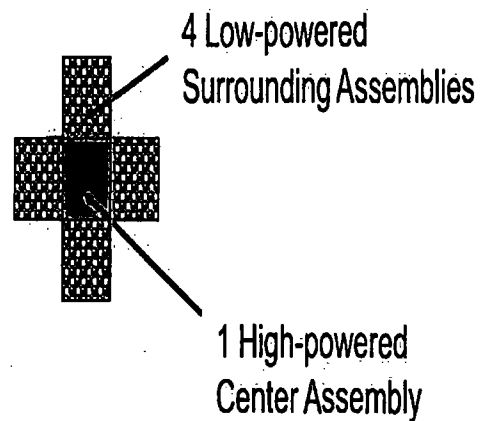
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~~OFFICIAL USE ONLY~~

# Improved Fuel Configuration



1x4 Repeating Pattern



1x4 Spacing

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# **Spent Fuel Pool Safety and Security**

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# Conclusions

- **Spent fuel pools are robust and inherently resistant to security threats**
- **Spent fuel pools at all U.S. reactor sites have been assessed**
- **Additional mitigative measures have been implemented**
  - Including active and passive measures
- **These measures were incorporated in the regulations in 2009**
- **Follow-on research using prototypic fuel assemblies/rack cells is addressing the adequacy of phenomenological modeling**



# **Post-9/11 Security Assessments – Spent Fuel Dry Storage and Transportation**

**Bernard White**  
**Technical Assistant**  
**Office of Nuclear Material Safety and Safeguards**

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# **Background**

- **Top-to-bottom review of NRC-licensed activities**
- **“Big picture” review to guide agency response to threats via security orders**
- **Follow-up security orders by rulemaking process**
- **Single security assessment methodology for all licensed activities, excluding nuclear power plants**

## **Historical Perspective**

- **NRC has long considered dry spent fuel storage systems as massive structures that are extremely robust and resistant to a range of both safety-based and security-based events**
- **In a 1995 final rule on emergency planning for independent spent fuel storage installations (ISFSIs), the Commission indicated that potential worst case dose consequences to a member of the public from all events was very low**



## Historical Perspective (cont.)

Scenarios	Low Results*	High Results
Safety and security events	$1 \times 10^{-6}$ rem	$1 \times 10^{-4}$ rem

\* This range of consequences reflects doses to the total body, skin, thyroid, and lung

# **Spent Fuel Dry Storage and Transport Security Assessments**

- **Developed scenarios that, prior to 9/11, were considered remote and speculative**
- **Two Step Framework Determination**
  - **Attractiveness**
  - **Consequence**

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# **Spent Fuel Dry Storage and Transport Security Assessments**

- **Sandia estimated release fractions**
- **Consequence calculations to estimate early fatalities**
- **All Spent Fuel Framework Findings were Green**

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# Attractiveness Ranking Matrix

- **Pre-Event**
  - **Iconic Value**
  - **Complexity of Planning**
- **Event**
  - **Resources Needed**
  - **Execution Risk**
- **Post-Event**
  - **Public Protection Measures**
- **(Icon + CP+ RN + ER + PM) / 5**

Early Fatalities	None	Single Digits	Tens	Hundreds	Thousands
Consequence Category	V	IV	III	II	I

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# Framework Decision Matrix

Attractiveness Category	Consequence				
	V	IV	III	II	I
A (0.0 to 1)	Green - Acceptable	Yellow	Red - Assess Mitigative Strategies		
B (1.0 to 2.0)		Consider			
C (2.0 to 3.0)				Mitigative	
D (3.0 to 4.0)					Strategies
E (4.0 to 5.0)					

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# **Consequence Methodology**

- **Doses delivered over 30 days through**
  - Inhalation**
  - Ingestion**
  
- **Total Effective Dose Equivalent**
  - 50-year committed dose from particulates inhaled during plume passage**

## **Consequence Results**

- **Higher consequences to maximally exposed individuals**
- **Highest consequences over 100 m<sup>2</sup> area**
- **Doses dropped off very rapidly**

# Conclusions

- **Commission concluded that immediate action was not warranted to change the security level that defines adequate protection**
- **Robust design features ensure spent fuel casks are safe and secure**
- **Post-9/11 security orders remained necessary and sufficient**





# **ISFSI and Transportation Security Rulemaking and Additional Studies**

**Phil Brochman**  
**Senior Program Manager**  
**Office of Nuclear Security and Incident Response**

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## **Next Steps**

- **Commission directed NRC staff to proceed to rulemaking to modify the regulatory framework for security of ISFSIs**
  - **Make generically applicable the security measures in the post-9/11 orders**
  - **Potentially include consideration of security scenarios not previously captured in our historical regulatory perspective.**

# **ISFSI Security Rulemaking – Status**

- **Significant comments received from stakeholders opposing key approaches in the draft regulatory basis**
  - Preferred DBT approach over dose calculation approach
  - Preferred use of higher dose limits for security events
  
- **Commission has directed the staff to engage stakeholders further on –**
  - ISFSI threat and vulnerability information
  - Draft ISFSI adversary characteristics
  - Staff responses to comments on the draft regulatory basis

## **Rulemaking – Status (cont.)**

- **Commission directed the staff to submit a supplemental paper later this year**
  - **Assess stakeholder comments on the draft regulatory basis**
  - **Assess feedback from engagement with stakeholders**
  - **Discuss whether any changes in direction are appropriate and necessary**

# **Spent Fuel Transportation Security Rulemaking**

- **Proposed rule comment period was just extended**
- **The proposed rule will make generically applicable requirements from the post-9/11 SNF transportation security orders**
  - **Increased physical security measures**
  - **Increased personnel security/background check measures**
- **The rule is not adding any significant new measures beyond the existing orders.**

# Consequence Studies

- **Ongoing - NRC staff is working with a National Lab to evaluate potential impacts from releases from spent fuel dry storage systems (dose vs. distance calculations)**
  - **Not a phenomenological-specific approach**
  - **Will assist in evaluating need for future studies**
- **Intermediate term - further studies under consideration for specific security events with the potential to transport respirable radionuclides offsite**

# **Consequence Studies (cont.)**

- **Long term – additional security consequence studies**
  - **Informed by input from DTRA on potential beyond DBT events (i.e. beyond current ISFSI adversary characteristics)**
  - **Forward-looking approach to address potential step changes to the threat environment**
  - **Not tied to the ongoing ISFSI security rulemaking**



# Concluding Remarks

**Dan Dorman**  
**Deputy Director**  
**Office of Nuclear Material Safety and Safeguards**

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# **NAS Study on Storage**

- **Security for rods not in assemblies**
- **Effectiveness of protective measures**
  - **Force-on-force testing for design basis**
  - **DHS Comprehensive Review for greater threats**
- **Best-estimate analyses of zirc fire events**
- **Measures to reduce consequences**
- **Plant-specific assessments**
- **Information sharing**

# **NAS Study on Transportation**

- **No fundamental technical barriers to safe transport**
  - **Social and institutional challenges**
- **Independent examination of security**
- **Very long duration fires**
- **Strongly endorsed full-scale testing of package performance**
- **State and Tribal outreach**
- **Various recommendations to DOE and DOT**

~~OFFICIAL USE ONLY~~

# Questions?

~~OFFICIAL USE ONLY~~

**From:** Sheron, Brian  
**To:** Dion, Jeanne  
**Subject:** FW: Slides for the Commission Meeting this Morning  
**Date:** Monday, March 21, 2011 7:38:00 AM  
**Attachments:** Staff Slides for March 21 Meeting Rev 1.pptx

---

Jeanne, see below. Please make appropriate distribution at Church Street. Thanks.

---

**From:** Andersen, James  
**Sent:** Monday, March 21, 2011 6:15 AM  
**To:** Satorius, Mark; Pederson, Cynthia; Dean, Bill; Lew, David; McCree, Victor; Collins, Elmo; Howell, Art; Wert, Leonard; Sheron, Brian; Uhle, Jennifer  
**Subject:** Slides for the Commission Meeting this Morning

Attached are the Commission Slides for this morning's meeting. Please also forward to your staff so that copies can be made for those individuals watching at the remote locations. Thanks.

Jim A.

CH/162



# **Briefing on NRC Response to Recent Nuclear Events in Japan**

**Bill Borchardt**  
**Executive Director for Operations**  
**March 21, 2011**

# **Agenda**

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

# **Event Overview**

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

# **Immediate NRC Response**

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



# **Continuing NRC Response**

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

# **Health Effects of Radiation**

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

# **Domestic Reactor Safety**

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

## **NRC Activities – Near Term**

- **Inspection Activities**
- **Generic Communications**
- **Immediate regulatory actions**

## **NRC Activities – Longer Term**

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

# **Conclusion**

**From:** Sheron, Brian  
**To:** Case, Michael  
**Cc:** Uhle, Jennifer; Sydnor, Russell; Richards, Stuart  
**Subject:** RE: New OpE Forum COMM Posting - DAVIS-BESSE - Radio Frequency Interference from Walkie Talkie Causes Licensee to Declare a Loss of Emergency Feedwater  
**Date:** Monday, March 21, 2011 7:39:00 AM

---

Thanks.

---

**From:** Case, Michael  
**Sent:** Monday, March 21, 2011 7:22 AM  
**To:** Sheron, Brian  
**Cc:** Uhle, Jennifer; Sydnor, Russell; Richards, Stuart  
**Subject:** FW: New OpE Forum COMM Posting - DAVIS-BESSE - Radio Frequency Interference from Walkie Talkie Causes Licensee to Declare a Loss of Emergency Feedwater

FYI. Followup from the event on walkie-talkie interference at Davis-Besse. We still control these types of events administratively. The link to the OpE comm is below.

---

**From:** Haskell, Russell  
**Sent:** Friday, March 18, 2011 5:08 PM  
**Subject:** New OpE Forum COMM Posting - DAVIS-BESSE - Radio Frequency Interference from Walkie Talkie Causes Licensee to Declare a Loss of Emergency Feedwater

This e-mail is being sent to notify recipients of a new posting on the @Operating Experience Community Forum. Recipients are expected to review the posting for applicability to their areas of regulatory responsibility and consider appropriate actions. However, information contained in the posting is not tasking; therefore, no specific action or written response is required.

**Information Security Reminder:** this link is on NRC's Internal Web site and may contain sensitive information. Please check with the information owner before distributing outside the agency.

The posting may be reviewed at: <http://nrr10.nrc.gov/forum/forumtopic.cfm?selectedForum=03&forumId=SW&topicId=3265&CFID=86342&CFTOKEN=82223744>

It is being provided to the following groups and individuals: ***All Communications, Auxiliary Feedwater, Control Room Habitability, Cyber Security, ECCS, Electrical Power Systems, Emergency Diesel Generators, Fire Protection, Human Performance, HVAC, Instrumentation and Controls, Main Steam & Condensate/Feed Systems, Pump and Valve Performance, Safety Culture, Shutdown Risk, Station Service Water Systems & Ultimate Heat Sink***

To unsubscribe from this distribution list or to subscribe to a different list on the OpE Community, please visit <http://nrr10.nrc.gov/rps/dyn/subscription1.cfm>.

For more information on the Reactor OpE Program, please visit our OpE Gateway at: <http://nrr10.nrc.gov/oep-info-gateway/index.html>

CH7/163

**Russell S. Haskell II**

United States Nuclear Regulatory Commission (NRC)

Reactor Systems Engineer (NRR/DIRS/IOEB)

[Russell.Haskell@nrc.gov](mailto:Russell.Haskell@nrc.gov) | 301.415.1129 | O-7H23



**From:** Sheron, Brian  
**To:** Johns, Nancy  
**Subject:** RE: Cancellation of succession planning meeting for March 23, 2011  
**Date:** Monday, March 21, 2011 7:43:00 AM

---

Nancy, can we also get some relief on the schedule for completing the LPP rankings? I haven't had a chance to focus on them, and since last week I've been spending most of my waking hours either in the IRC or downtown briefing congressional staff on the Japanese event. I would imagine many of the other ERB members are in a similar situation. Thanks.

---

**From:** Johns, Nancy  
**Sent:** Monday, March 21, 2011 7:38 AM  
**To:** Ash, Darren; Borchardt, Bill; Boyce, Thomas (OIS); Buchholz, Jeri; Burns, Stephen; Carpenter, Cynthia; Casto, Chuck; Cohen, Miriam; Collins, Elmo; Dapas, Marc; Dean, Bill; Doane, Margaret; Dorman, Dan; Dyer, Jim; Gallagher, Johanna; Greene, Kathryn; Haney, Catherine; Holahan, Gary; Howell, Art; Johns, Nancy; Johnson, Michael; Kelley, Corenthis; Leeds, Eric; Lew, David; Mamish, Nader; McCree, Victor; Miller, Charles; Moore, Scott; Muessle, Mary; Pederson, Cynthia; Satorius, Mark; Schaeffer, James; Sheron, Brian; Tallarico, Alison; Tracy, Glenn; Uhle, Jennifer; Virgilio, Martin; Weber, Michael; Wert, Leonard; Wiggins, Jim; Armstrong, Janine; Buckley, Patricia; Casby, Marcia; Cianci, Sandra; Cooper, Kiona; Flory, Shirley; Gallagher, Johanna; Garland, Stephanie; Hasan, Nasreen; Higginbotham, Tina; Hudson, Sharon; Johns, Nancy; Kenney, Susan; Kreuter, Jane; Lee, Pamela; Matakas, Gina; Mayberry, Theresa; Miles, Patricia; ODaniell, Cynthia; Owen, Lucy; Pulley, Deborah; Quesenberry, Jeannette; Ronewicz, Lynn; Ross, Robin; Saint, Dian; Salus, Amy; Schumann, Stacy; Schwarz, Sherry; Smith, Courtney; Sprogeris, Patricia; Tannenbaum, Anita; Taylor, Renee; Thomas, Loretta; Tomczak, Tammy; Walker, Dwight  
**Subject:** Cancellation of succession planning meeting for March 23, 2011  
**Importance:** High

Re-sent – I believe I used an old address list the first time.

ERB Members,

This is to confirm that the ERB succession planning meeting scheduled for the morning of March 23, 2011, has been cancelled. We will work on rescheduling at a later date. Meanwhile, Johanna and I appreciate your updates and corrections to the most recent succession planning list regarding readiness and recommended development.

Nancy

CH/164

**From:** Sheron, Brian  
**To:** Flory, Shirley  
**Subject:** Today  
**Date:** Monday, March 21, 2011 8:22:00 AM

---

I should be back up at Church Street shortly after the Commission meeting is over.

CH/165

**From:** Bonaccorso, Amy  
**To:** Sheron, Brian  
**Cc:** Donaldson, Leslie  
**Subject:** RE: RES Seminar: 25th Anniversary of Chernobyl - April 26, 2011  
**Date:** Monday, March 21, 2011 8:46:26 AM

---

Hi Anthony:

Glad to hear you are so interested in the seminar.

We have requested for this seminar to be filmed and intend on making it a NUREG-KM – a new pub type for knowledge management, to keep the DVD and presentation information together. We usually try to have materials available on the RES intranet site sooner rather than later though, so please check the Web site around the time of the seminar.

Thanks,

Amy

---

**From:** Sheron, Brian  
**Sent:** Monday, March 21, 2011 8:44 AM  
**To:** Bonaccorso, Amy  
**Cc:** Donaldson, Leslie  
**Subject:** Fw: RES Seminar: 25th Anniversary of Chernobyl - April 26, 2011

Amy, see below. Please respond. Thx.

---

**From:** Palmer, Anthony  
**To:** Sheron, Brian  
**Sent:** Mon Mar 21 08:40:14 2011  
**Subject:** RES Seminar: 25th Anniversary of Chernobyl - April 26, 2011

Is it possible to either get a copy of the presentations (powerpoints) or a DVD of this seminar for future training purposes?

We at the TTC are always trying to stay abreast of the latest summaries and information so that we may share up to date information with agency personnel in their training.

Thanks you very much;



*Anthony D. Palmer*

Reactor Technology Instructor (PWR)  
USNRC Technical Training Center  
423-855-6699

CH/166

**From:** Hoc, PMT12  
**To:** Jaczko, Gregory  
**Cc:** Carpenter, Cynthia; Lewis, Robert; Ordaz, Vonna; Camper, Larry; Holahan, Patricia; Miller, Charles; Gibson, Kathy; Sullivan, Randy; Jones, Cynthia; Reis, Terrence; Cool, Donald; Holahan, Vincent; Milligan, Patricia; Tappert, John; Lui, Christiana; Lubinski, John; Coe, Doug; Zimmerman, Roy; Wiggins, Jim; Sheron, Brian; Johnson, Michael; Virgilio, Martin; Weber, Michael; Boger, Bruce; Batkin, Joshua; Coggins, Angela; Borchardt, Bill; Weber, Michael; Casto, Chuck; Dorman, Dan; Hoc, PMT12  
**Subject:** FW: PMT Position on Expansion of Protective Actions for US Citizens Beyond the Current 50 Mile Evacuation Recommendation  
**Date:** Monday, March 21, 2011 8:57:44 AM  
**Attachments:** PMT Position on Expansion of Protective Actions for US Citizens Beyond the Current 50 Mile Evacuation Recommendation.docx  
**Importance:** High

---

Mr. Chairman,

(b)(5)

**From:** Hoc, PMT12  
**Sent:** Monday, March 21, 2011 5:42 AM  
**To:** Zimmerman, Roy; Wiggins, Jim; Sheron, Brian; Johnson, Michael; Virgilio, Martin; Weber, Michael; Boger, Bruce  
**Cc:** Carpenter, Cynthia; Lewis, Robert; Ordaz, Vonna; Camper, Larry; Holahan, Patricia; Miller, Charles; Gibson, Kathy; Sullivan, Randy; Jones, Cynthia; Reis, Terrence; Cool, Donald; Holahan, Vincent; Milligan, Patricia; Tappert, John; Lui, Christiana; Lubinski, John; Coe, Doug  
**Subject:** FW: PMT Position on Expansion of Protective Actions for US Citizens Beyond the Current 50 Mile Evacuation Recommendation  
**Importance:** High

(b)(5)

CH/167

**From:** Hoc, PMT12

**Sent:** Monday, March 21, 2011 5:34 AM

**To:** Jaczko, Gregory

**Cc:** Batkin, Joshua; Coggins, Angela; Borchardt, Bill; Weber, Michael; Casto, Chuck; Dorman, Dan

**Subject:** TT Position on Expansion of Protective Actions for US Citizens Beyond the Current 50 Mile Evacuation Recommendation

**Importance:** High

Mr. Chairman,

(b)(5)



(b)(5)

(b)(5)

**Statement: Radiation Monitors Confirm That No Radiation Levels of Concern Have Reached the United States.**

**(<http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/a765bae82e458d3485257857007373a5!OpenDocument>).**

# **JOINT EPA/DOE STATEMENT: Radiation Monitors Confirm That No Radiation Levels of Concern Have Reached the United States**

Release date: 03/18/2011

Contact Information: NEWS MEDIA CONTACT FOR EPA: [press@epa.gov](mailto:press@epa.gov), 202-564-6794 /  
NEWS MEDIA CONTACT FOR DEPARTMENT OF ENERGY: (202) 586-4940

## **UPDATED – (please note differences in what was detected in Washington State and California)**

**WASHINGTON** – The United States Government has an extensive network of radiation monitors around the country and no radiation levels of concern have been detected. The U.S. Environmental Protection Agency RadNet system is designed to protect the public by notifying scientists, in near real time, of elevated levels of radiation so they can determine whether protective action is required. The EPA's system has not detected any radiation levels of concern.

In addition to EPA's RadNet system, the U.S. Department of Energy has radiation monitoring equipment at research facilities around the country, which have also not detected any radiation levels of concern.

As part of the Comprehensive Nuclear Test Ban Treaty Organization's International Monitoring System (IMS), the Department of Energy also maintains the capability to detect tiny quantities of radioisotopes that might indicate an underground nuclear test on the other side of the world. These detectors are extremely sensitive and can detect minute amounts of radioactive materials.

Today, one of the monitoring stations in Sacramento, California that feeds into the IMS detected miniscule quantities of iodine isotopes and other radioactive particles that pose no health concern at the detected levels. Collectively, these levels amount to a level of approximately 0.0002 disintegrations per second per cubic meter of air (0.2 mBq/m<sup>3</sup>). Specifically, the level of Iodine-131 was 0.165 mBq/m<sup>3</sup>, the level of Iodine-132 was measured at 0.03 mBq/m<sup>3</sup>, the level of Tellurium-132 was measured at 0.04 mBq/m<sup>3</sup>, and the level of Cesium-137 was measured at 0.002 mBq/m<sup>3</sup>.

Similarly, between March 16 and 17, a detector at the Department of Energy's Pacific Northwest National Laboratory in Washington State detected trace amounts of Xenon-133, which is a radioactive noble gas produced during nuclear fission that poses no concern at the detected level. The levels detected were approximately 0.1 disintegrations per second per cubic meter of air (100 mBq/m<sup>3</sup>),

The doses received by people per day from natural sources of radiation - such as rocks,



bricks, the sun and other background sources - are 100,000 times the dose rates from the particles and gas detected in California or Washington State.

These types of readings remain consistent with our expectations since the onset of this tragedy, and are to be expected in the coming days.

Following the explosion of the Chernobyl plant in Ukraine in 1986 – the worst nuclear accident in world history – air monitoring in the United States also picked up trace amounts of radioactive particles, less than one thousandth of the estimated annual dose from natural sources for a typical person.

As part of the federal government's continuing effort to make our activities and science transparent and available to the public, the Environmental Protection Agency will continue to keep all RadNet data available in the current online database.

Please see <http://www.epa.gov/japan2011> for more information.

**From:** Evans, Michele  
**To:** Dyer, Jim; Boger, Bruce; Grobe, Jack; Johnson, Michael; Zimmerman, Roy; Ash, Darren; Sheron, Brian  
**Cc:** Wiggins, Jim; Weber, Michael; Taylor, Renee; Salus, Amy; Garland, Stephanie; Cianci, Sandra; Leeds, Eric; Schwarz, Sherry; Flory, Shirley  
**Subject:** ET Directors Schedule 3/21 to 4/10  
**Date:** Monday, March 21, 2011 12:56:43 PM  
**Attachments:** ET Directors Schedule.docx

---

Everyone,

We are trying to establish the ET Director schedule through April 10 per the attached.

**As you will see, we have immediate needs for the back shifts (Thursday and Friday,) and Day shift on Friday.**

In addition, please volunteer for all the other positions through April 10 at this time. Please "reply to all" with your dates.

Thank you!

*Michele Evans*  
**Acting Deputy OD, NSIR**

CH/168

3/21/2011

12:30 pm

## ET Directors Director Schedule

### March 18 – March 25, 2011

Shift	3/18 (Fri)	3/19 (Sat)	3/20 (Sun)	3/21 (Mon)	3/22 (Tues)	3/23 (Wed)	3/24 (Thur)	3/25 (Fri)
7am-3pm	J. Wiggins	J. Wiggins	J. Wiggins	M. Weber	M. Weber	M. Weber	M. Weber	
3pm-11pm	B. Boger	B. Sheron	B. Sheron	J. Wiggins	J. Wiggins	R. Zimmerman	R. Zimmerman	R. Zimmerman
11pm-7am	R. Zimmerman	M. Johnson	M. Johnson	M. Johnson	B. Boger	B. Boger		

### March 26 – April 2, 2011

Shift	3/26 (Sat)	3/27 (Sun)	3/28 (Mon)	3/29 (Tues)	3/30 (Wed)	3/31 (Thur)	4/1 (Fri)	4/2 (Sat)
7am-3pm	J. Dyer	J. Dyer	M. Weber	M. Weber	M. Weber			
3pm-11pm	B. Sheron	B. Sheron				B. Sheron		
11pm-7am								

### April 3 – April 10, 2011

Shift	4/3 (Sun)	4/4 (Mon)	4/5 (Tues)	4/6 (Wed)	4/7 (Thur)	4/8 (Fri)	4/9 (Sat)	4/10 (Sun)
7am-3pm		J. Wiggins	J. Wiggins	J. Wiggins	M. Weber	M. Weber		
3pm-11pm	B. Sheron							
11pm-7am								

**From:** Sheron, Brian  
**To:** Camper, Larry  
**Subject:** RE: Isotope data from air samples taken in Japan  
**Date:** Monday, March 21, 2011 1:02:00 PM

---

Yep.

-----Original Message-----

**From:** Camper, Larry  
**Sent:** Monday, March 21, 2011 10:52 AM  
**To:** Sheron, Brian  
**Subject:** RE: Isotope data from air samples taken in Japan

Great. Thanks. Did you confer with Jennifer U. regarding her E-Mail addressing degradation of cement in the spent fuel pool. Interesting and useful information given our discussion last evening.

-----Original Message-----

**From:** Sheron, Brian  
**Sent:** Sunday, March 20, 2011 10:10 PM  
**To:** Cool, Donald; Camper, Larry  
**Subject:** FW: Isotope data from air samples taken in Japan

FYI.

-----Original Message-----

**From:** Aoki, Steven [<mailto:Steven.Aoki@nnsa.doe.gov>]  
**Sent:** Sunday, March 20, 2011 10:04 PM  
**To:** 'peterson@nuc.berkeley.edu'; (b)(6) Koonin, Steven; SCHU; Adams, Ian; Binklev, Steve; 'RJBudnitz@lbl.gov'; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas; (b)(6) rig2@us.ibm.com'; Findk, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; Kelly, John E (NE); Lyons, Peter; McFarlane, Harold; Owens, Missy; Poneman, Daniel; 'ronaldo.szilard@inl.gov'; (b)(6)  
**Subject:** Isotope data from air samples taken in Japan

Attached is a report on air sampler data taken by our team in Japan. Radioisotopes deposited on filters were counted with an ORTEC HPGe detector at the locations indicated. All of the measurements were very close to background levels.

CH/169

**From:** Sheron, Brian  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; kpitzer@ostp.eop.gov; Gonzalez, Raquel  
**Subject:** RE: Nuclear science group conference call this afternoon  
**Date:** Monday, March 21, 2011 1:16:00 PM

---

Ian, I am not available this afternoon so go without me. I am scheduled to give congressional staff briefings.

---

**From:** Adams, Ian [mailto:Ian.Adams@Hq.Doe.Gov]  
**Sent:** Monday, March 21, 2011 1:11 PM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; kpitzer@ostp.eop.gov; Gonzalez, Raquel  
**Subject:** Nuclear science group conference call this afternoon

Good afternoon,

We're going to do a conference call this afternoon with the nuclear science group to check in. Please let me if 2:30pm EDT or 4:00pm EDT would be more convenient for you.

Thanks,  
Ian

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

CH/170

**From:** Richards, Stuart  
**To:** Sheron, Brian  
**Cc:** Case, Michael  
**Subject:** California Tsunami Info  
**Date:** Monday, March 21, 2011 2:56:07 PM

---

Brian

From the LA Times;

"Edison [San Onofre] has said that its facility, which houses two reactors, could withstand the equivalent of a magnitude 7 quake and is protected by a 30-foot seawall that is higher than the calculated maximum tsunami for the area.

PG&E, for its part, said that Diablo Canyon's two reactors could survive a magnitude 7.5 temblor, noting that it's built on a cliff 85 feet above sea level [ Note: Intake structure is at ocean level, but may be designed to prevent flooding in the event of a tsunami]. "

Fyi  
Stu

CH/171

**From:** Rini, Brett  
**To:** Case, Michael; Richards, Stuart; Coe, Doug; Coyne, Kevin; Scott, Michael; Gibson, Kathy; Elkins, Scott  
**Cc:** Sheron, Brian; Uhle, Jennifer; Valentin, Andrea; Grancorvitz, Teresa; Rivera-Lugo, Richard; Armstrong, Kenneth; Ibarra, Jose; Hudson, Daniel; RidsResPmdaMail Resource  
**Subject:** QUERY: Funding Needs for Japan Follow-up  
**Date:** Monday, March 21, 2011 4:43:46 PM  
**Attachments:** Japan Lessons Learned.docx  
**Importance:** High

---

Division Directors,

(b)(5)

Thanks,

Brett

**From:** Kasputys, Clare  
**Sent:** Monday, March 21, 2011 4:18 PM  
**To:** RidsNroOd Resource; RidsNrrOd Resource; RidsNsirOd Resource; RidsResOd Resource; RidsFsmeOd Resource; RidsNmssOd Resource; RidsOgcMailCenter Resource; RidsCsoMailCenter Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource; RidsOipMailCenter Resource  
**Cc:** RidsNrrPmda Resource; RidsNroPmda Resource; RidsNsirPmda Resource; RidsResPmdaMail Resource; RidsFsmePbpaFmb Resource; RidsNmssTa Resource; Golder, Jennifer; Smolik, George; Muessle, Mary; Andersen, James; Jacobs-Baynard, Elizabeth; Allwein, Russell; Peterson, Gordon; Peterson, Gordon; Virgilio, Martin; Virgilio, Martin; Weber, Michael; Weber, Michael; Ash, Darren; Ash, Darren  
**Subject:** Funding Needs for Japan Follow-up - Resent to provide Attachment

Resent to provide the Attachment

(b)(5)

CH/172

(b)(5)

If you have any questions, please let me know.

Thank you for your support.



Japan Lessons Learned

(b)(5)



**From:** Weber, Michael  
**To:** Bowman, Gregory; Brock, Kathryn; Campbell, Andy; Carpenter, Cynthia; Dorman, Dan; Frazier, Alan; Haney, Catherine; Krupnick, David; McCrary, Cheryl; Miller, Charles; Moore, Scott; Sheron, Brian; Uhle, Jennifer; Zimmerman, Roy  
**Subject:** HEADS UP - Agenda Planning Meeting  
**Date:** Monday, March 21, 2011 5:00:26 PM

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Adjustments to the Commission agenda from this morning's agenda planning session after the Commission meeting on the Japanese nuclear emergency.

**From:** Andersen, James  
**Sent:** Monday, March 21, 2011 1:35 PM  
**To:** EDO\_TBPM Distribution  
**Cc:** Muesle, Mary; Weber, Michael; Virgilio, Martin; Ash, Darren; Landau, Mindy  
**Subject:** Agenda Planning Meeting

ETAs,

The Commission held an Agenda Planning Meeting this morning. SECY will provide the formal summary, but I wanted to let you know a couple things as quickly as possible:

- The 10CFR50.46(a) Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Bill Ruland was informed)
- The SMR Commission meeting on 3/29 is still on (Mike Mayfield was informed)
- The Source Security Commission meeting on 4/19 is still on (Josie Piccone was informed)
- The ITAAC Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Mike Mayfield was informed)
- The EEO/Human Capital Commission meeting was moved to June 2 (**Kris – please advise HR and SBCR**)
- The Cumulative Effectives of Regulation Commission meeting was postponed to a later unspecified date (Tom Blount was informed)
- The AARM Commission meeting on 5/27 is still on (**Brian please advice NRR**)
- The Emergency Planning Final Rule Commission meeting was moved up to May 12 (left Bob Kahler a message)
- The ACRS meeting on 6/6 is still on
- The International Commission meeting was postponed to a later unspecified date

Several new meetings were added:

- 30, 60, and 90 day status meetings regarding the Near-Term NRC Review Effort (task group?); probably around 5/3, 6/16, 7/18 (**Jim A lead for scheduling note**)

CH/173

- Status meeting on the Japanese event with additional focus on radiological consequence / health effects; probably around 4/14 (**Brian lead for scheduling note**)
- Status meeting on the Japanese event with additional focus on station blackout; probably around 4/28 (**Brian lead for scheduling note**)
- Stakeholder meeting on the staff's 90 day status report; probably around 7/25 (**Jim A lead for scheduling note**)

**From:** Sheron, Brian  
**To:** Haney, Catherine; Uhle, Jennifer; Wiggins, Jim  
**Subject:** RE: RESPONSE - BRC Briefing  
**Date:** Monday, March 21, 2011 5:43:00 PM

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What time?

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**From:** Haney, Catherine  
**Sent:** Monday, March 21, 2011 4:26 PM  
**To:** Uhle, Jennifer; Sheron, Brian; Wiggins, Jim  
**Subject:** Fw: RESPONSE - BRC Briefing

I'd like someone from RES and NSIR to join me in briefing Rep Hamilton on the 28th. Can you help.

Also can you look at the slides that Dan had planned to use. They were attached to my earlier message. I would suggest changes in light of Japan event but this is more your area than mine.

D

---

**From:** Weber, Michael  
**To:** Haney, Catherine  
**Cc:** Sheron, Brian; Uhle, Jennifer; Wiggins, Jim; Kinneman, John; Ordaz, Vonna; Frazier, Alan; Andersen, James; Muessle, Mary; Evans, Michele  
**Sent:** Mon Mar 21 16:01:16 2011  
**Subject:** RESPONSE - BRC Briefing

(b)(5)

**From:** Haney, Catherine  
**Sent:** Monday, March 21, 2011 6:06 AM  
**To:** Weber, Michael  
**Cc:** Sheron, Brian; Uhle, Jennifer; Wiggins, Jim; Kinneman, John; Ordaz, Vonna  
**Subject:** Fw: BRC Briefing

(b)(5)

Cathy

CH/174

**From:** Dorman, Dan  
**To:** Haney, Catherine  
**Cc:** Hill, Brittain  
**Sent:** Fri Mar 18 10:28:56 2011  
**Subject:** BRC Briefing

Cathy,

The first attached file contains a condensed version of the briefing we gave to the BRC last month. The slides I stripped down are included in the background. The second file has the full briefing from February.

You have one hour, including Q/A with Rep Hamilton on the 28<sup>th</sup>.

Dan

**From:** Sheron, Brian  
**To:** RidsResOd Resource; Uhle, Jennifer; RidsResPmdaMail Resource  
**Cc:** Rini, Brett  
**Subject:** RE: FOR TICKETING/DUE NOON TUESDAY: FW: Funding Needs for Japan Follow-up  
**Date:** Monday, March 21, 2011 5:44:00 PM

---

We got a reprieve until COB tomorrow.

---

**From:** Flory, Shirley **On Behalf Of** RidsResOd Resource  
**Sent:** Monday, March 21, 2011 3:28 PM  
**To:** Sheron, Brian; Uhle, Jennifer; RidsResPmdaMail Resource  
**Subject:** FOR TICKETING/DUE NOON TUESDAY: FW: Funding Needs for Japan Follow-up  
**Importance:** High

FOR TICKETING. DUE NOON TUESDAY.

Thanks - Shirley

---

**From:** Kasputys, Clare  
**Sent:** Monday, March 21, 2011 3:07 PM  
**To:** RidsNroOd Resource; RidsNrrOd Resource; RidsNsirOd Resource; RidsResOd Resource; RidsFsmeOd Resource; RidsNmssOd Resource; RidsOgcMailCenter Resource; RidsCsoMailCenter Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource; RidsOipMailCenter Resource  
**Cc:** RidsNrrPmda Resource; RidsNroPmda Resource; RidsNsirPmda Resource; RidsResPmdaMail Resource; RidsFsmePbpaFmb Resource; RidsNmssTa Resource; Golder, Jennifer; Smolik, George; Muessle, Mary; Andersen, James; Jacobs-Baynard, Elizabeth; Allwein, Russell; Peterson, Gordon; Peterson, Gordon; Virgilio, Martin; Virgilio, Martin; Weber, Michael; Weber, Michael; Ash, Darren; Ash, Darren  
**Subject:** Funding Needs for Japan Follow-up

All,

The Chairman has requested for the NRC to conduct a Near-term (90 day effort) and a longer-term review (as discussed by Bill B at the Commission meeting today) of regulatory issues affecting U.S. operating reactors based on the events in Japan. The Chairman is interested in seeking supplemental funding to support our efforts for the above effort, in addition to NRC's costs associated with emergency response and technical experts sent to Japan. OCFO is preparing cost data associated with emergency response and technical support to Japan.

On Friday, the OCFO requested some initial estimates to support the reviews (see attached). At this time, we are requesting the offices to review these initial estimates and include some information concerning the work that is envisioned to support these reviews. Listed below are some initial thoughts about the scope of the near-term and long-term reviews. Also, consider what on-going efforts related to the development of our regulatory program could benefit with supplemental funding. For example, it was mentioned in the Commission meeting that NRC is currently working on GSI-199. Should funding be accelerated for this effort and others of this nature.

Near Term Review (90 day effort):

- Evaluate currently available technical and operational information from the Japan event to identify near-term (or immediate) operational or regulatory

CH/175

issues affecting U.S. operating reactors of all designs in areas such as protection against earthquakes, tsunamis, flooding, hurricanes, station blackout and a degraded ability to restore power; severe accident mitigation and emergency preparedness

- Develop recommendations for generic communications, orders, changes to inspection procedures and licensing review guidance, etc.
- Possibly prepare a 30 day quick look report

Longer-Term Review (Following obtaining sufficient technical information from the Japan event)

- Evaluate all technical and policy issues related to the event to identify additional research, generic issues, changes to the reactor oversight process, rulemakings and adjustments to the regulatory framework that should be conducted by the NRC.
- Evaluate interagency issues such as emergency preparedness.
- Applicability of the lessons learned to non-operating reactor and non-reactor facilities.

It is recognized that the full scope of the reviews has yet to be determined or the size of the group that will be conducting the analysis. Therefore, we are looking only for rough cost estimates. You are requested to send the level of funding (dollars and FTE) that is anticipated that could be obligated in FY 2011 for both the near-term and long-term efforts. We are asking the business line leads to coordinate with supporting offices and submit a response by business line and by office. Please send your responses to me and Liz Jacobs-Baynard and copy Jennifer Golder and George Smolik, OCFO NLT than Noon on Tuesday.

If you have any questions, please let me know.

Thank you for your support.

**From:** Sheron, Brian  
**To:** Droggitis, Spiros  
**Subject:** Answers to Congressional Staff Questions  
**Date:** Monday, March 21, 2011 5:54:00 PM

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1.) Request for doses in millirem.

Don Cool responded and explained that we could not give doses in millirem because it requires additional assumptions on uptake, etc. However, he said doses would be small fractions of PAGs

2.) What was the basis for concluding that the core debris in the unit 4 SFP would not ablate the concrete floor?

Basis was preliminary calculations run with the MELCOR code that showed temperatures did not reach levels that would cause ablation. However, further calculations are being performed.

3.) What is the half-life of Xenon-133?

Don Cool provided the response that it is 2.2 days.

4.) Workers were evacuated at unit #3 due to high radiation. Is this true?

At 3:50 pm Japan time yesterday, a puff of smoke or steam was released from unit #3. We do not know if it contained increased radiation, and we believe the workers were evacuated as a precautionary measure.

5.) Can you provide the Sacramento radiation readings in millirem?

Don Cool responded and explained that we could not give doses in millirem because it requires additional assumptions on uptake, etc. However, he said doses would be small fractions of PAGs

6.) Smoke was seen from units 2 & 3. Do we know what that was?

We believe these events were not simultaneous but separated by several days. The smoke or steam from unit #3 is discussed in item #4 above. We believe the smoke or steam seen at unit #2 was released when TEPCO cut a hole in the unit #2 reactor building siding.

CH/176



**From:** Weber, Michael  
**To:** Sheron, Brian; Leeds, Eric; Boger, Bruce; Wiggins, Jim; Evans, Michele  
**Cc:** Muessle, Mary; Andersen, James; Jacobs-Baynard, Elizabeth; Kasputys, Clare  
**Subject:** HEADS UP - Supplemental Funding Request for Japan Event Support  
**Date:** Monday, March 21, 2011 5:54:59 PM

---

(b)(5)

**From:** Dyer, Jim  
**Sent:** Monday, March 21, 2011 5:35 PM  
**To:** Borchardt, Bill; Virgilio, Martin; Ash, Darren; Weber, Michael; Muessle, Mary; Jacobs-Baynard, Elizabeth; Kasputys, Clare  
**Cc:** Brown, Milton; Golder, Jennifer; Peterson, Gordon  
**Subject:** Supplemental Funding Request for Japan Event Support

(b)(5)

CH/177

(b)(5)

**From:** Sheron, Brian  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
**Subject:** RE: Nuclear science group conference call - Tuesday  
**Date:** Monday, March 21, 2011 5:56:00 PM

---

Works for me.

---

**From:** Adams, Ian [mailto:Ian.Adams@Hq.Doe.Gov]  
**Sent:** Monday, March 21, 2011 5:30 PM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
**Subject:** Nuclear science group conference call - Tuesday

Good afternoon,

For Tuesday's call, please let me know whether or not 5:00pm-6:00pm will work for you.

Thanks,  
Ian

---

**From:** Adams, Ian  
**Sent:** Monday, March 21, 2011 2:02 PM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
**Subject:** RE: Nuclear science group conference call this afternoon - 4:00pm

Thank you for your responses. Consensus has it that 4:00pm will work best for this call.

**Conference call information:**  
**Monday, 3/21/2011, 4:00pm**  
**Please dial into (202) 586-2535**  
**No PIN is needed.**

Thanks,  
Ian

---

**From:** Adams, Ian  
**Sent:** Monday, March 21, 2011 1:11 PM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; (b)(6) Gonzalez, Raquel

CH/178

**Subject:** Nuclear science group conference call this afternoon

Good afternoon,

We're going to do a conference call this afternoon with the nuclear science group to check in. Please let me if 2:30pm EDT or 4:00pm EDT would be more convenient for you.

Thanks,  
Ian

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

**From:** Sheron, Brian  
**To:** Rini, Brett  
**Cc:** Uhle, Jennifer; RidsResPmdaMail Resource  
**Subject:** RE: FOR TICKETING/DUE NOON TUESDAY: FW: Funding Needs for Japan Follow-up  
**Date:** Monday, March 21, 2011 6:01:00 PM

---

That will work. Commissioner Svinicki just canceled her periodic with me, which was at 3:15pm Tuesday, so it freed up a good part of my afternoon.

---

**From:** Rini, Brett  
**Sent:** Monday, March 21, 2011 5:53 PM  
**To:** Sheron, Brian  
**Cc:** Uhle, Jennifer; RidsResPmdaMail Resource  
**Subject:** RE: FOR TICKETING/DUE NOON TUESDAY: FW: Funding Needs for Japan Follow-up

I asked for division input by noon, so COB will give us enough time to compile the inputs and run them past you.

Thanks for the update.

---

**From:** Sheron, Brian  
**Sent:** Monday, March 21, 2011 5:44 PM  
**To:** RidsResOd Resource; Uhle, Jennifer; RidsResPmdaMail Resource  
**Cc:** Rini, Brett  
**Subject:** RE: FOR TICKETING/DUE NOON TUESDAY: FW: Funding Needs for Japan Follow-up

We got a reprieve until COB tomorrow.

---

**From:** Flory, Shirley **On Behalf Of** RidsResOd Resource  
**Sent:** Monday, March 21, 2011 3:28 PM  
**To:** Sheron, Brian; Uhle, Jennifer; RidsResPmdaMail Resource  
**Subject:** FOR TICKETING/DUE NOON TUESDAY: FW: Funding Needs for Japan Follow-up  
**Importance:** High

FOR TICKETING. DUE NOON TUESDAY.

Thanks - Shirley

---

**From:** Kasputys, Clare  
**Sent:** Monday, March 21, 2011 3:07 PM  
**To:** RidsNroOd Resource; RidsNrrOd Resource; RidsNsirOd Resource; RidsResOd Resource; RidsFsmeOd Resource; RidsNmssOd Resource; RidsOgcMailCenter Resource; RidsCsoMailCenter Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource; RidsOipMailCenter Resource  
**Cc:** RidsNrrPmda Resource; RidsNroPmda Resource; RidsNsirPmda Resource; RidsResPmdaMail Resource; RidsFsmePbpaFmb Resource; RidsNmssTa Resource; Golder, Jennifer; Smolik, George; Muessle, Mary; Andersen, James; Jacobs-Baynard, Elizabeth; Allwein, Russell; Peterson, Gordon; Peterson, Gordon; Virgilio, Martin; Virgilio, Martin; Weber, Michael; Weber, Michael; Ash, Darren; Ash, Darren  
**Subject:** Funding Needs for Japan Follow-up

All,  
The Chairman has requested for the NRC to conduct a Near-term (90 day effort)

CH/179

and a longer-term review (as discussed by Bill B at the Commission meeting today) of regulatory issues affecting U.S. operating reactors based on the events in Japan. The Chairman is interested in seeking supplemental funding to support our efforts for the above effort, in addition to NRC's costs associated with emergency response and technical experts sent to Japan. OCFO is preparing cost data associated with emergency response and technical support to Japan.

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If you have any questions, please let me know.

Thank you for your support.

**From:** Adams, Ian  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
**Subject:** RE: Nuclear science group conference call - Tuesday, 3:30pm  
**Date:** Monday, March 21, 2011 7:37:47 PM

---

Thanks for your input.

Barring any changes, we are confirmed for 3:30pm EDT on Tuesday and 12:30pm EDT on Wednesday.

**Nuclear science group conference call schedule:**

**Tuesday: 3:30-4:30pm EDT**

**Wednesday: 12:30-1:30pm EDT**

**Conference call information:**

**Please dial into (202) 586-2535**

**No PIN is needed.**

Thanks,  
Ian

---

**From:** Adams, Ian  
**Sent:** Monday, March 21, 2011 6:06 PM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
**Subject:** RE: Nuclear science group conference call - Tuesday

I'm sorry, it doesn't look like 5pm will work for everyone. Please let me know if you have conflicts with a call from 3:30pm-4:30pm EDT Tuesday.

Additionally, I am proposing the call on Wednesday for 12:30pm-1:30pm EDT. Please let me know if both of these times work for you.

**Nuclear science group conference call – proposed schedule:**

**Tuesday: 3:30-4:30pm EDT**

**Wednesday: 12:30-1:30pm EDT**

**Conference call information:**

**Please dial into (202) 586-2535**

**No PIN is needed.**

CH/180

Thanks,  
Ian

---

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**Sent:** Monday, March 21, 2011 5:30 PM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
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**Cc:** Narendra, Blake; Fitzgerald, Paige; (b)(6) Gonzalez, Raquel  
**Subject:** Nuclear science group conference call this afternoon

Good afternoon,



We're going to do a conference call this afternoon with the nuclear science group to check in. Please let me if 2:30pm EDT or 4:00pm EDT would be more convenient for you.

Thanks,  
Ian

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

**From:** Uhle, Jennifer  
**To:** Sheron, Brian  
**Subject:** Fw: RESPONSE - BRC Briefing  
**Date:** Monday, March 21, 2011 8:22:42 PM

---

What is the briefing focusing on. Jason did the BRC. J

---

**From:** Haney, Catherine  
**To:** Uhle, Jennifer; Sheron, Brian; Wiggins, Jim  
**Sent:** Mon Mar 21 16:26:18 2011  
**Subject:** Fw: RESPONSE - BRC Briefing

I'd like someone from RES and NSIR to join me in briefing Rep Hamilton on the 28th. Can you help.

Also can you look at the slides that Dan had planned to use. They were attached to my earlier message. I would suggest changes in light of Japan event but this is more your area than mine.

D

---

**From:** Weber, Michael  
**To:** Haney, Catherine  
**Cc:** Sheron, Brian; Uhle, Jennifer; Wiggins, Jim; Kinneman, John; Ordaz, Vonna; Frazier, Alan; Andersen, James; Muessle, Mary; Evans, Michele  
**Sent:** Mon Mar 21 16:01:16 2011  
**Subject:** RESPONSE - BRC Briefing

(b)(5)

**From:** Haney, Catherine  
**Sent:** Monday, March 21, 2011 6:06 AM  
**To:** Weber, Michael  
**Cc:** Sheron, Brian; Uhle, Jennifer; Wiggins, Jim; Kinneman, John; Ordaz, Vonna  
**Subject:** Fw: BRC Briefing

(b)(5)

Cathy

CH/181

**From:** Dorman, Dan  
**To:** Haney, Catherine  
**Cc:** Hill, Brittain  
**Sent:** Fri Mar 18 10:28:56 2011  
**Subject:** BRC Briefing

Cathy,

The first attached file contains a condensed version of the briefing we gave to the BRC last month. The slides I stripped down are included in the background. The second file has the full briefing from February.

You have one hour, including Q/A with Rep Hamilton on the 28<sup>th</sup>.

Dan

**From:** Sheron, Brian  
**To:** Weber, Michael  
**Subject:** FW: Embedded DOE staff in IRC  
**Date:** Monday, March 21, 2011 9:14:15 PM

---

Mike, my guess is that a DOE person on the LT won't focus on the technical issues being worked by the RST and PMT. I suggest we make an offer to DOE to embed someone in the RST/PMT.

---

**From:** LIA06 Hoc  
**Sent:** Monday, March 21, 2011 7:41 PM  
**To:** Weber, Michael; Sheron, Brian  
**Cc:** RST01 Hoc; LIA06 Hoc  
**Subject:** RE: Embedded DOE staff in IRC

We've had a DOE person in the LT for the past few days.

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

**From:** Weber, Michael  
**Sent:** Monday, March 21, 2011 7:19 PM  
**To:** Sheron, Brian  
**Cc:** RST01 Hoc; LIA06 Hoc  
**Subject:** Response - Embedded DOE staff in IRC

Check with the RST. We had embedded DOE (other than NR) last week.

---

**From:** Sheron, Brian  
**To:** Weber, Michael  
**Sent:** Mon Mar 21 18:46:02 2011  
**Subject:** Embedded DOE staff in IRC

Mike, I checked with Jim Wiggins. There is no embedded DOE staff in the IRC that he is aware of. I spoke with John Kelly (deputy Assistant Secretary for nuclear) and he is very amenable to having a DOE person embedded with the RST/PMT. Jim Wiggins had no problem with someone from DOE embedding themselves in the IRC. If it is OK with you/Marty/Bill, I will call John and offer for DOE to have someone embed themselves in the IRC, like NR has done. Please let me know.

I will be participating on a conference call with Secretary Chu and his 'swat team' tomorrow afternoon, and I imagine this issue might come up.

CH/182

**From:** RST08 Hoc  
**To:** Uhle, Jennifer  
**Subject:** FW: Questions from TEPCO Meeting  
**Date:** Tuesday, March 22, 2011 3:40:37 AM  
**Attachments:** [20110321Agenda.doc](#)  
[NRCExecutiveBriefingR1.ppt](#)  
[1FDoseRate20110320r1.ppt](#)

---

**From:** RST08 Hoc  
**Sent:** Tuesday, March 22, 2011 2:20 AM  
**To:** 'Herman, David R CIV NAVSEA, 08'  
**Subject:** FW: Questions from TEPCO Meeting

**From:** RST08 Hoc  
**Sent:** Tuesday, March 22, 2011 2:18 AM  
**To:** 'inpoercassistance@inpo.org'; 'ge.hitachinuclearresponseteam@ge.com'  
**Cc:** RST01 Hoc  
**Subject:** Questions from TEPCO Meeting

Gentleman,

Today we had a good conversation with TEPCO Engineers.

They had 5 questions that they asked for our assistance on:

1. They would like us to validate their salt accumulation calculation from the attached powerpoint (NRCExecutiveBriefingR1.ppt).
  - a. Do we agree that they could lose core cooling by March 31<sup>st</sup>?
2. Are there other methods of core cooling or potential ways to inject water into the core? - What do we feel is the preferred method of long term core cooling?
3. What are potential methods of flushing the salt solution out of the vessel?
4. Do we have any criticality concerns with inadvertent criticality in the reactor vessel?
5. Is there anything that they can do to reduce the risk of another potential hydrogen explosion in the drywell and reactor building?

If you could take a look at these issues and email me back with a time that you think you could have some initial (preliminary) thoughts on the matter, I would appreciate it.

We are trying to get them (TEPCO) some initial thoughts later today (before 9pm EDT). I would like to have a bridge call setup sometime later today to discuss the issue among ourselves prior to giving TEPCO our initial recommendations.

I realize that this is a rapid turnaround and I appreciate your assistance.

Feel free to email me at [RST01.hoc@nrc.gov](mailto:RST01.hoc@nrc.gov) or call me at 301-816-5100 and ask for the RST Team

CH/183

if you have any questions.

Thanks,

Mike

Mike Brown  
Reactor Safety Team

Here is a brief summary of the meeting, FYI:

Summary of 9pm meeting between NRC and TEPCO Engineers

A meeting was held at 9pm on 3/21/11 between TEPCO engineers and the NRC to discuss a number of issues

#1 - Was a concern raised by TEPCO about salt accumulation in the Reactor Vessels - see attached for PPT for risks of sea water

TEPCO informed us that currently the cooling flow paths for the cores are as follows:

Unit 1:

Ocean -> Core Spray Line - Reactor -> SRV -> Suppression Pool

Units 2 and 3

Ocean -> Recirc Line -> Jet Pumps -> Reactor -> SRV -> Suppression Pool

Based on their calculations and current salt accumulation they expect that they may have issues with core cooling as early as March 31st.

They are attempting to obtain a fresh water source to use for core cooling. They have 2 potential sources:

- \* Pure water from a Dam
- \* Desalination Equipment and use Ocean water.

They stated their preferred method at this time was pure water from the Dam and they specifically mentioned that they are not requesting desalination equipment from us at this time.

They did ask 4 questions of us:

1. Are there other potential methods of core cooling (i.e. other potential ways to inject water into the core)

2. What are options/ methods to flush the salt solution out of the core

3. Do we have any potential criticality concerns.

4. Any ideas on ways to prevent a hydrogen explosion in their containment/ reactor building.

I've also included a copy of the Agenda for the meeting and a recent Dose Map of the area for your information.

Agenda on the meeting @ the Embassy of the U.S.A. 2011.03.22

1. Salt Issue
  - TEPCO: preliminary analysis result on salt development
  - NRC: analysis result
  - discussion on salt issue solutions
2. Additional questions on core cooling, criticality and hydrogen explosion
  - how to implement core cooling, except ongoing TEPCO ideas (recovery of CS, CRD and SLC)
  - how to avoid recurrence of criticality
  - how to avoid hydrogen explosion
3. Progress in water cannon, robot and radiation detector/protection
  - NRC: answers on water cannon questions from TEPCO
  - NRC: specific proposals on robots from NRC
  - NRC: specific proposals on radiation detector/protection from NRC
  - TEPCO: radiation level map of 1F site
4. Schedule on water cannon
  - when to arrive at Yokota
  - how to make the first contact with Bechtel experts



# Risks of Salt Accumulation

- Loss of Cooling of Fuel
- Loss of Function of SRV
  - Degradation of Efficiency of Heat Exchanger (if we are able to go into mid or long term heat removal)
    - SCC (significant increase of Crack Growth Rate)

# Loss of Cooling of Fuel

- Injection of Sea Water Starts
  - Unit 1: March 12 20:20
  - Unit 2: March 14 16:30
  - Unit 3: March 13 13:10
- Regulator's Concerns on March 16
- I was told to examine the same Concern by Superintendent's on March 16
- Efforts to accelerate the preparation on Fresh Water

# Rough Estimation of Time Limit (1)

Total Sea Water Injected as of March 20 15:00

- Unit 1(1,380 MWth): 3,530 ton
- Unit 2(2,381 MWth): 5,880 ton
- Unit 3(2,381 MWth): 4,389 ton

Scenario

- Saturated (Already saturated)
- Starts of Accumulation Salt (Already progressed)
- Level of Accumulated Salt Reaches to the Lower End of Fuels = Loss of Cooling

## Rough Estimation of Time Limit (2)

Injected Flow Rate of Sea Water after 24:00

March 20 Assumed in the Following Way

- Unit 1: 115 l/min (Its Latent heat is equal to then decay heat (=0.3% of Thermal Power )
- Unit 2 and 3: 190 l/min

Salt Production and accumulated Rate

- All Salt of Injected Sea Water Remains and Accumulates in RPV

# Discussion (1)

Adequacy of Criteria of Loss of Cooling-

What is Appropriate Criteria ?

Adequacy of Density of Accumulated Salt (I intentionally assume 1 gram/cm<sup>3</sup> instead of theoretical density 2.16 because 2.16 is neither conceivable nor conservative

Further Insights of Chemistry Specialists –

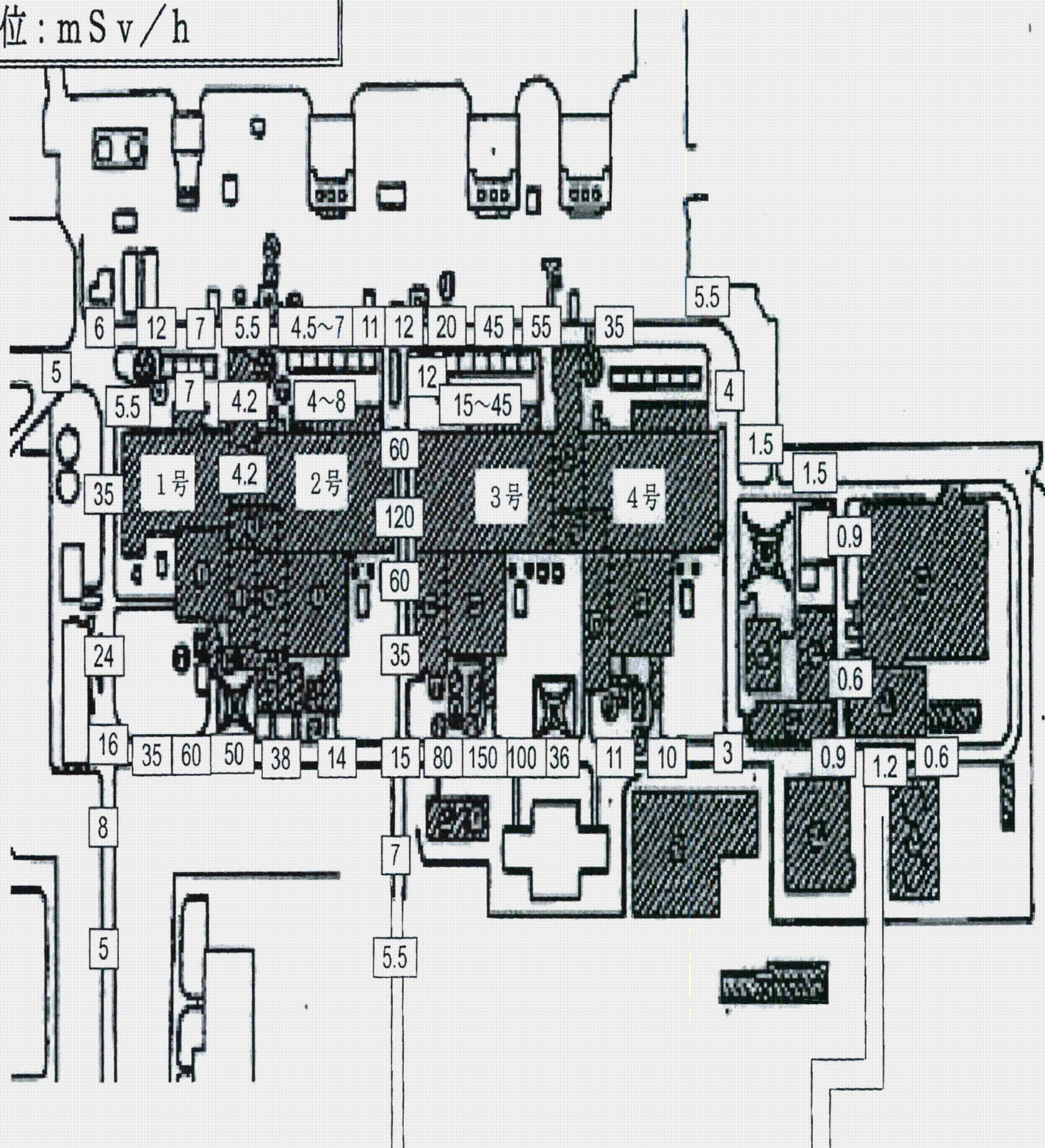
Any Potential Risks

測定日時：

3月20日 15時～17時30分

単位：mSv/h

海側



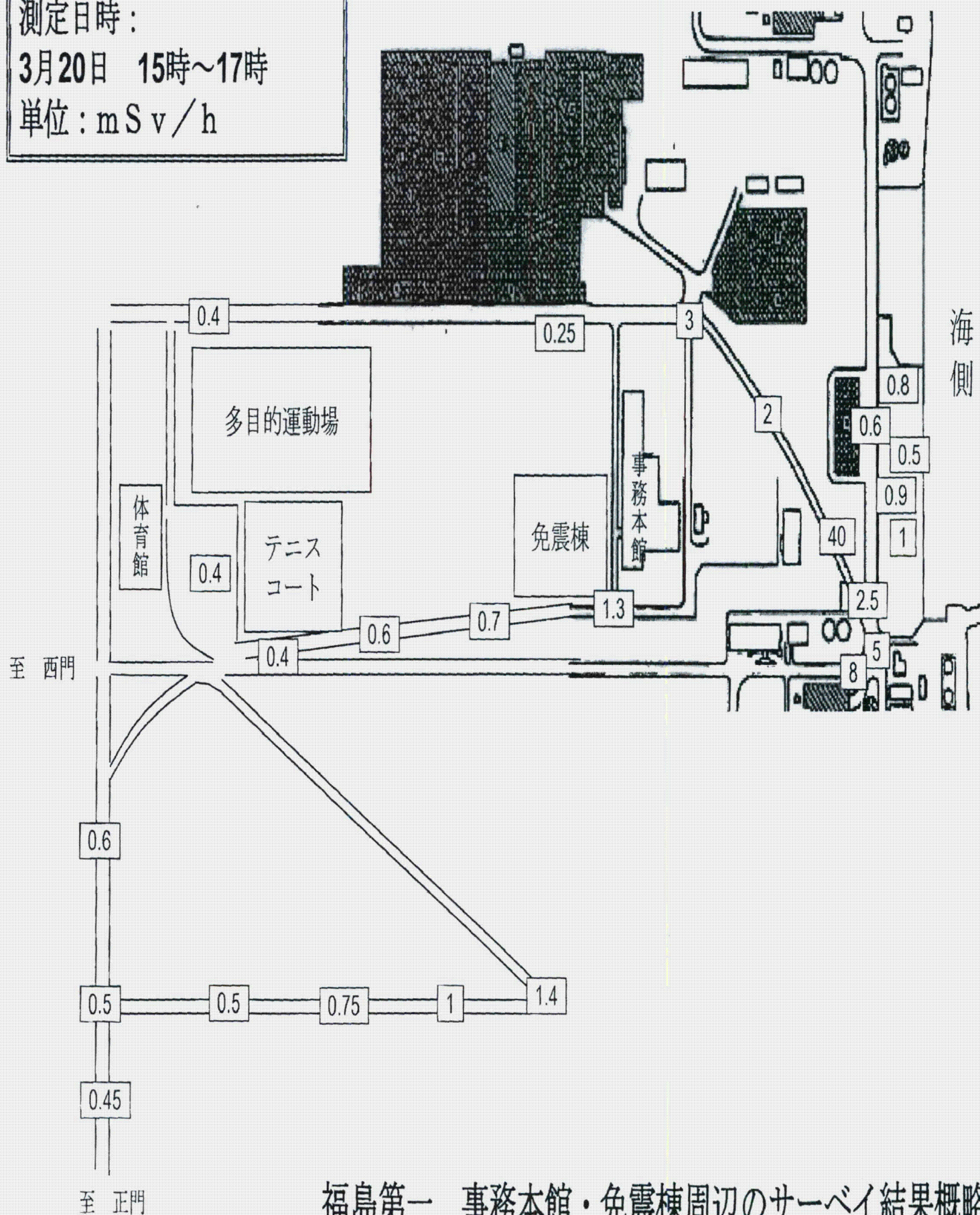
福島第一・1～4号機周辺のサーベイ結果概略



測定日時:

3月20日 15時~17時

単位: mSv/h



福島第一 事務本館・免震棟周辺のサーベイ結果概略図

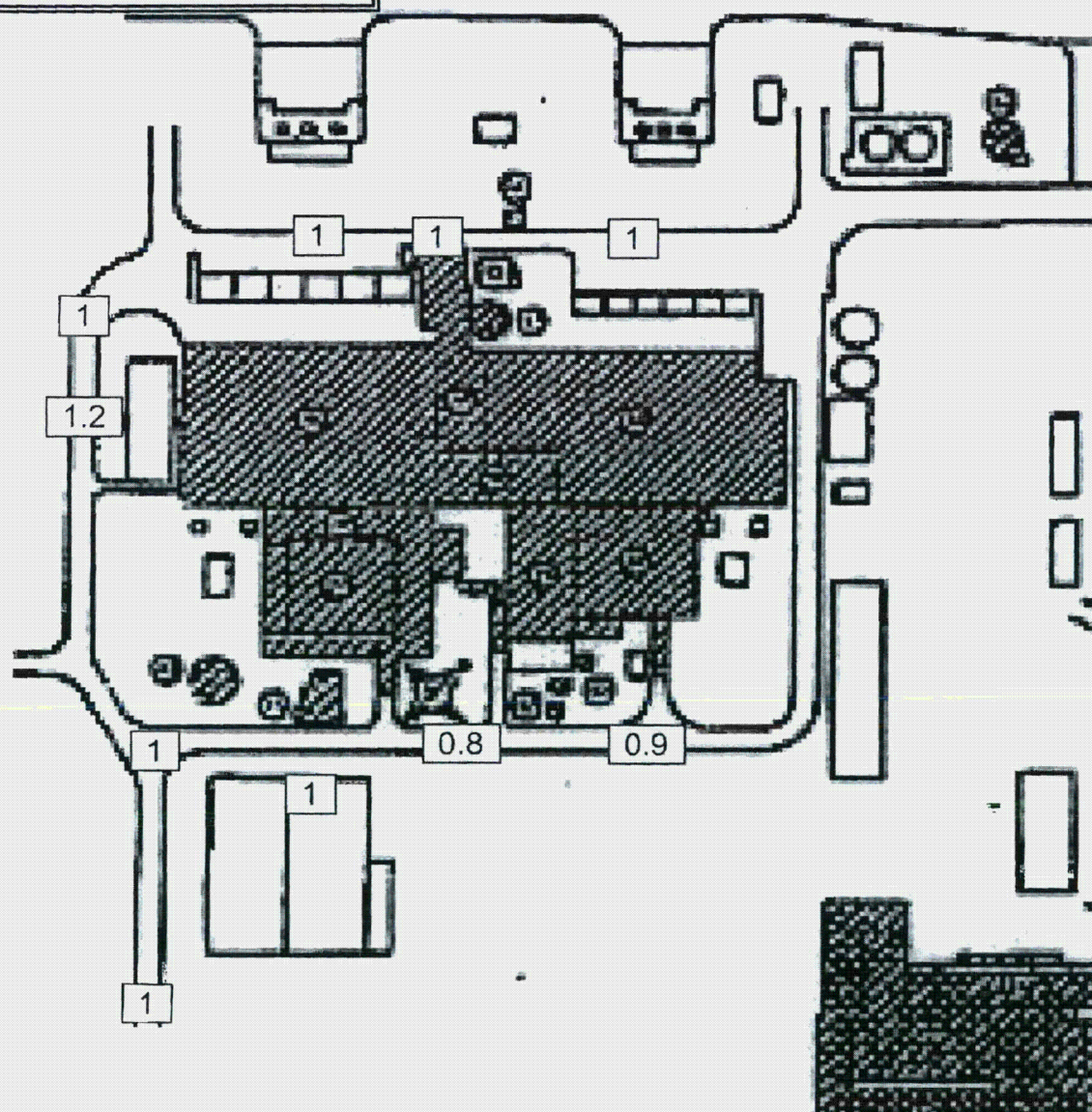


測定日時：

3月18日 18時15分～18時30分

単位：mSv/h

海側



5・6号機周辺のサーベイ結果概略



**From:** [Horak, William C](#)  
**To:** [David Diamond](#); [Robert Bari](#); [Sharon, Brian](#)  
**Subject:** Fwd: IAEA Technical Briefing Summary, Monday, March 21, 2011  
**Date:** Tuesday, March 22, 2011 5:36:50 AM  
**Attachments:** [IAEA Technical Briefing 03212011.docx](#)  
[ATT00001.htm](#)

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William C Horak  
Chair  
Nuclear Science and Technology Department  
Brookhaven National Laboratory  
+1-631-344-2627  
[Horak@bnl.gov](mailto:Horak@bnl.gov)

Begin forwarded message:

**From:** "Queirolo, Al" <[queiroloa@state.gov](mailto:queiroloa@state.gov)>  
**Date:** March 22, 2011 4:54:29 AM EDT  
**To:** "Kessler, Carol" <[ckessler@bnl.gov](mailto:ckessler@bnl.gov)>, "Disser, James" <[jdisser@bnl.gov](mailto:jdisser@bnl.gov)>, "Horak, William C" <[horak@bnl.gov](mailto:horak@bnl.gov)>, "Pepper, Susan E" <[pepper@bnl.gov](mailto:pepper@bnl.gov)>  
**Subject:** IAEA Technical Briefing Summary, Monday, March 21, 2011

This article is similar to another email I previously sent you. If you read this (better version) then you don't need to read the other.

**IAEA Technical Briefing on March 21, 2011**

(b)(4)

CH / 184

(b)(4)

(b)(4)

This email is UNCLASSIFIED.

(b)(4)

(b)(4)

**From:** Leeds, Eric  
**To:** Virgilio, Martin; Wittick, Brian; Borchardt, Bill; Weber, Michael  
**Cc:** Muessle, Mary; Andersen, James; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim; Nelson, Robert; Markley, Michael; Brenner, Eliot; Hayden, Elizabeth; Evans, Michele; Milligan, Patricia; McDermott, Brian  
**Subject:** RE: REPLY: Status update on NYS LtGov visit  
**Date:** Tuesday, March 22, 2011 7:41:05 AM

---

Try this:

There are two EPZs; a 10 mile EPZ for plume exposure and a 50 mile EPZ for food exposure. The 10 mile EPZ is the area established as a basis for planning because the projected doses from most accident sequences would not exceed the EPA protective action dose guidelines (1-5 rem) at 10 miles. However, the 10 mile EPZ was always considered a basis for emergency planning that could be expanded if the situation warranted. The situation in Japan, with three reactors and two fuel pools experiencing exceptional difficulties simultaneously, along with a dearth of radiological monitoring information surrounding the plant, led to the decision to expand the evacuation beyond the 10 mile radius.

Comments/suggestions/improvements are welcome. Please provide to Bob Nelson.

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

-----Original Message-----

From: Virgilio, Martin  
Sent: Monday, March 21, 2011 9:52 PM  
To: Wittick, Brian; Borchardt, Bill; Weber, Michael  
Cc: Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim  
Subject: REPLY: Status update on NYS LtGov visit

Thanks, Brian

Do we have a prepared response(s) to a question(s) related to the implications for Indian Point associated with the 50 mile evacuation recommendation in Japan.

Marty

-----Original Message-----

From: Wittick, Brian  
Sent: Monday, March 21, 2011 6:46 PM  
To: Borchardt, Bill; Weber, Michael; Virgilio, Martin  
Cc: Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim  
Subject: Status update on NYS LtGov visit

Bill/Mike/Marty,

Following is an update to the NYS LtGov delegation visiting tomorrow:

The NYS delegation includes:

Lieutenant Governor Robert Duffy  
Howard Glaser, Director of State Operations and Senior Policy Advisor  
Thomas Congdon, Assistant Secretary for Energy and Environment  
Andrew Feeney, Director - New York State Office of Emergency Management  
Joan Matthews, Assistant Commissioner - Department of Environmental Conservation  
Paul Eddy, Utilities Supervisor - Department of Public Service  
Brian Quiara, Senior Policy Advisor to Lieutenant Governor Duffy

CH/185

David Doyle, Press Officer from the Governor's office

Stated topics of interest include:

- The governor's office desires to establish a foundation for communications with the NRC at a high level;
- They desire to obtain a better understand the September 2010 report on seismicity, especially with respect to Indian Point; they are also interested in any follow-up reviews or plans for review;
- They want to understand how the findings of the seismic report relate to relicensing;
- Andrew Feeney, Director of Emergency Management is coming as a result of our recommendation to evacuate out to 50 miles in Japan, to understand how this fits into their perceived plans; Tom Congdon indicated they had always only focused on a 10 mile evacuation capability.

It would appear they are bringing a press officer as they want to be able to make a statement after the meeting that they have reached agreement with NRC on certain issues.

The meeting is being held from 1030 - 1200 in O13B4, with HOC tour following.

VR/

Brian Wittick

Executive Technical Assistant for Reactors

Office of the Executive Director for Operations

U.S. Nuclear Regulatory Commission

301-415-2496 (w); (b)(6) (c)

**From:** Sheron, Brian  
**To:** Valentin, Andrea  
**Cc:** Donaldson, Leslie  
**Subject:** RE: request for assistance  
**Date:** Tuesday, March 22, 2011 7:46:00 AM

---

OK. Can you sit down with Amy and find out what her workload is. My suggestion is that she be allowed to defer low priority work, and that she be allowed to work for OPA using the time she gains.

-----Original Message-----

From: Valentin, Andrea  
Sent: Tuesday, March 22, 2011 6:07 AM  
To: Sheron, Brian  
Cc: Donaldson, Leslie  
Subject: Re: request for assistance

I agree. Home base is RES, no binding commitment.

Sent from my NRC Blackberry

Andrea Valentin

(b)(6)

----- Original Message -----

From: Sheron, Brian  
To: Brenner, Eliot  
Cc: Valentin, Andrea; Kardaras, Tom; Donaldson, Leslie  
Sent: Mon Mar 21 21:19:25 2011  
Subject: RE: request for assistance

I will check with Andrea tomorrow. If Amy has any time that we can spare her, I will gladly make her available to you. I just don't want to make a binding commitment at this time.

---

From: Brenner, Eliot  
Sent: Monday, March 21, 2011 6:54 PM  
To: Sheron, Brian  
Subject: RE: request for assistance

Ok. Never hurts to ask. Thanks muchly for even considering it.

Eliot

From: Sheron, Brian  
Sent: Monday, March 21, 2011 6:38 PM  
To: Brenner, Eliot  
Subject: RE: request for assistance

Eliot, I hate saying no, but we are getting overwhelmed and drained of staff.

I haven't seen my deputy or two of my division directors for several days, because they are all on graveyard shift IRC duty. I don't have a 3rd division director because Commissioner Apostolakis took Chris Lui and Rich Correia won't start here until 3/28. One of my deputy division directors and an SL just got sent to Japan to be part of Casto's team. I have several staff working in the IRC, and I'm running around doing weekend duty as the IRC ET Director, briefing congressional staff, and interacting with DOE Secretary Chu and his SWAT team.

From: Brenner, Eliot  
Sent: Monday, March 21, 2011 6:17 PM

CH/186



To: Sheron, Brian  
Subject: request for assistance

Brian: we are more than a little snowed under with media and public inquiry because of the Japan quake. That doesn't make us too much different than the rest of the agency, but ...

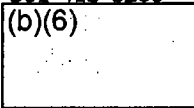
The focus is beginning to shift to the agency and our regulatory regime will be under a real spotlight going forward, not to mention that the task force Jaczko is going to have assembled will require a fair amount of OPA support.

I wonder if you could lend me Amy Bonoccorso for a month with the proviso that when she is not helping me she gets the most important parts of her RES work accomplished. Given my druthers, I'd really like to ask for 90 days, but I don't want to seem overly greedy. I can always plead poverty again later!

Any chance I can steal her for a bit? I promise no banjo jokes as long as I have her services.

Eliot

Eliot Brenner  
Director, Office of Public Affairs  
Nuclear Regulatory Commission  
Rockville, Md.  
O: 301-415-8200  
C: (b)(6)



**From:** Bowman, Gregory  
**To:** Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael  
**Cc:** Bush-Goddard, Stephanie; Rini, Brett; Dion, Jeanne; Armstrong, Kenneth  
**Subject:** Commission Meeting on Japanese Events  
**Date:** Tuesday, March 22, 2011 7:51:02 AM  
**Attachments:** 1104xx Japan Rad Consequence Scheduling Note.doc  
**Importance:** High

---

I just learned that we're working towards scheduling a near-term meeting on the events in Japan, with a focus on radiological consequences and potential health effects. The current thinking is that RES would have the lead for this meeting, which will most likely take place on April 14.

The meeting would involve discussion of (1) status of the event (maybe led by NRR), (2) radiological impacts, and (3) radiological significance. The external panel might involve other Federal agencies (e.g., EPA, DOE), HPS, industry, and/or a representative from one of the labs, although it could end up being a challenge to get participation given the timeframe. We would just need to give SECY suggestions and let them take care of the invitations.

Alan Frazier put together the attached draft scheduling note, but it will need to be revised. My understanding is the SECY will likely need a revised scheduling note back today to get to the Commission. Please let me know as soon as you can if you think the lead for this meeting should be assigned to a different office (if that's the case, we'll need to circle back with Mike).

Greg

---

**From:** Frazier, Alan  
**Sent:** Monday, March 21, 2011 4:47 PM  
**To:** Bowman, Gregory  
**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Merzke, Daniel  
**Subject:** RE: ACTION: Draft Scheduling Note for New Commission Meeting

Greg,

FSME tells me that last week RES agreed to take the lead in any discussion of rad consequences or health affects if those topics had come up during today's Commission meeting. The Commission would now like to have a Commission meeting in April focused on rad consequences and health effects.

Could you please confirm with RES tomorrow that they should have the lead for the April Commission meeting? Note that it was Jeanne Dion that agreed RES should have the lead last week (see attached email) but I am not aware of any front office interaction on this.

Alan

---

**From:** Deegan, George

CH/187

**Sent:** Monday, March 21, 2011 4:29 PM

**To:** Frazier, Alan

**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel

**Subject:** RE: ACTION: Draft Scheduling Note for New Commission Meeting

Alan- Thanks for forwarding Jim Andersen's email.

When Allen Howe's Working Group was assembled last week to construct an outline for today's Commission briefing, the rad consequences/health effects issue was identified as originally marked as an FSME potential topic, but we later determined that RES would be better to take lead (with SOARCA etc.). I'd think they'd be the best ones to lead any new Commission briefing in April on this topic. I'll forward you that email chain separately.

---

**From:** Frazier, Alan

**Sent:** Monday, March 21, 2011 3:42 PM

**To:** Deegan, George

**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel

**Subject:** ACTION: Draft Scheduling Note for New Commission Meeting

George,

Please take a look at Jim's note below from today's agenda planning meeting which was held immediately after the Commission meeting.

Note in particular the highlighted **new Commission meeting in April on the Japan event with additional focus on radiological consequence / health effects** (probably around 4/14). FSME will have the lead for this new Commission meeting. Additionally, I got some feedback from Jim that you should consider having the following elements in the scheduling note.

- Status of event
- Radiological Impacts
- Radiological significance
- External panel

**ACTION: In cooperation with NRR and NSIR (and any other offices you feel should be involved) please take the lead for developing a scheduling note. I have attached a initial draft to help get you started.**

I do not know when this action will be due but I wanted to give you a head-start. We are still waiting for SECY's official summary of the meeting, which usually contains due dates for the draft scheduling notes.

Please let me know if you have any questions.

Regards,

Alan L. Frazier  
Executive Technical Assistant

Office of the Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
301-415-1763

---

**From:** Andersen, James  
**Sent:** Monday, March 21, 2011 1:35 PM  
**To:** EDO\_TBPM Distribution  
**Cc:** Muessle, Mary; Weber, Michael; Virgilio, Martin; Ash, Darren; Landau, Mindy  
**Subject:** Agenda Planning Meeting

ETAs,

The Commission held an Agenda Planning Meeting this morning. SECY will provide the formal summary, but I wanted to let you know a couple things as quickly as possible:

- The 10CFR50.46(a) Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Bill Ruland was informed)
- The SMR Commission meeting on 3/29 is still on (Mike Mayfield was informed)
- The Source Security Commission meeting on 4/19 is still on (Josie Piccone was informed)
- The ITAAC Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Mike Mayfield was informed)
- The EEO/Human Capital Commission meeting was moved to June 2 (Kris – please advise HR and SBCR)
- The Cumulative Effectives of Regulation Commission meeting was postponed to a later unspecified date (Tom Blount was informed)
- The AARM Commission meeting on 5/27 is still on (Brian please advise NRR)
- The Emergency Planning Final Rule Commission meeting was moved up to May 12 (left Bob Kahler a message)
- The ACRS meeting on 6/6 is still on
- The International Commission meeting was postponed to a later unspecified date

Several new meetings were added:

- 30, 60, and 90 day status meetings regarding the Near-Term NRC Review Effort (task group?); probably around 5/3, 6/16, 7/18 (Jim A lead for scheduling note)
- Status meeting on the Japanese event with additional focus on radiological consequence / health effects; probably around 4/14 (Brian lead for scheduling)

**note)**

- Status meeting on the Japanese event with additional focus on station blackout; probably around 4/28 (**Brian lead for scheduling note**)
- Stakeholder meeting on the staff's 90 day status report; probably around 7/25 (**Jim A lead for scheduling note**)

Draft 3/21/11

## SCHEDULING NOTE

**Title:** BRIEFING ON THE JAPAN NUCLEAR EVENT: RADIOLOGICAL CONSEQUENCES AND POTENTIAL HEALTH EFFECTS (Public)

**Purpose:** Provide the Commission an update of the Japan nuclear event with additional focus on radiological consequences and potential health effects and an opportunity to hear a representative sample of external stakeholder viewpoints.

**Scheduled:** April TBD  
9:00am

**Duration:** Approx. 3 hours

**Location:** Commissioner's Hearing Room, 1<sup>st</sup> fl. OWFN

<b>Participants:</b>	<b>Presentation</b>
<b><u>NRC Staff</u></b>	<b>50 mins.*</b>
<b>Bill Borchardt</b> , Executive Director for Operations <u>Topic:</u> Opening Remarks and Event Status	10 mins.*
<b>TBD</b> , Director of RES (or Division of ____, RES) <u>Topic:</u> Radiological Significance and Impacts	20 mins.*
<b>TBD</b> , Director of NSIR (or Division of ____, NSIR) <u>Topic:</u> TBD	10 mins.*
<b>TBD</b> , Director of FSME (or Division of ____, FSME) <u>Topic:</u> TBD	10 mins.*
<b>Commission Q &amp; A</b>	<b>50 mins.</b>
<b>BREAK</b>	<b>5 mins.</b>
<b><u>Stakeholder Panel</u></b>	<b>40 mins.*</b>
<b><u>Other Federal Agencies (???)</u></b>	
<b>TBD</b> , Title <u>Topic:</u> TBD	20 mins.*
<b><u>Industry (???)</u></b>	
<b>TBD</b> , Title	20 mins.*

Topic: TBD

**Commission Q & A**

**30 mins.**

**Discussion – Wrap-up**

**5 mins.**

\*For presentation only and does not include time for Commission Q & A's

Documents:

- TBD
- TBD

Staff background material due to SECY: Ten business days prior to the briefing.

Slides due to SECY: Five business days prior to the briefing.

**From:** Lew, David  
**To:** Virgilio, Martin; Wittick, Brian; Borchardt, Bill; Weber, Michael  
**Cc:** Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Wiggins, Jim  
**Subject:** RE: REPLY: Status update on NYS LtGov visit  
**Date:** Tuesday, March 22, 2011 7:51:30 AM

---

Marty,

There has been a number of interactions with NYS, including the counties since NY is a home rule state. Bob Kahler and others have been on conference calls and have discussed key messages, some of them paraphrased below. That said, NYS's underlying interest does not seem to be focused on challenging the 10 mile planning bases, as much as trying to effectively respond to its constituents (in particular, the media) regarding the adequacy of their emergency planning in light of the NRC recommendation in Japan. What we have been hearing is a strong desire for the NRC to get more information out publicly, such as on its website, so that they can point to the information or use it to respond to their constituents. To that extent, if we can commit to getting this information on our website, it go far in meeting their interests.

- The NRC's recommendation associated with the Fukushima event was consistent with the emergency planning bases developed in the US. That said, the NRC will be reviewing all aspects of the Fukushima events in a systematic and methodical way for lesson learned.
- The 10 mile emergency planning zone is the area that was established as a basis for planning because the projected doses from most accident sequences would not exceed the Environmental Protection Agency protective action dose guidelines (1-5 rem) at 10 miles.
- However, the 10 mile EPZ was always considered a basis for emergency planning that could be expanded if the situation warranted. NUREG-0654/FEMA-REP-1 the basis for the 10 mile EPZ that states the 10 mile EPZ provides a substantial basis for expansion of the 10 mile EPZ as is necessary.
- The situation in Japan involved three reactors and two spent fuel pools experiencing exceptional difficulties simultaneously. Furthermore, given the lack of information at the time coming from the Japanese, the lack of any apparent cohesive plan to address the problems, and the projected doses if things continued to get worse, the NRC decided it was prudent to recommend evacuation beyond the 10 mile radius.

Dave

-----Original Message-----

**From:** Virgilio, Martin  
**Sent:** Monday, March 21, 2011 9:52 PM  
**To:** Wittick, Brian; Borchardt, Bill; Weber, Michael  
**Cc:** Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim  
**Subject:** REPLY: Status update on NYS LtGov visit

Thanks, Brian

Do we have a prepared response(s) to a question(s) related to the implications for Indian Point associated with the 50 mile evacuation recommendation in Japan.

Marty

-----Original Message-----

**From:** Wittick, Brian  
**Sent:** Monday, March 21, 2011 6:46 PM  
**To:** Borchardt, Bill; Weber, Michael; Virgilio, Martin  
**Cc:** Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim  
**Subject:** Status update on NYS LtGov visit

Bill/Mike/Marty,

CH/AB



Following is an update to the NYS LtGov delegation visiting tomorrow:

The NYS delegation includes:

Lieutenant Governor Robert Duffy  
Howard Glaser, Director of State Operations and Senior Policy Advisor  
Thomas Congdon, Assistant Secretary for Energy and Environment  
Andrew Feeney, Director - New York State Office of Emergency Management  
Joan Matthews, Assistant Commissioner - Department of Environmental Conservation  
Paul Eddy, Utilities Supervisor - Department of Public Service  
Brian Quiara, Senior Policy Advisor to Lieutenant Governor Duffy  
David Doyle, Press Officer from the Governor's office

Stated topics of interest include:

- The governor's office desires to establish a foundation for communications with the NRC at a high level;
- They desire to obtain a better understand the September 2010 report on seismicity, especially with respect to Indian Point; they are also interested in any follow-up reviews or plans for review;
- They want to understand how the findings of the seismic report relate to relicensing;
- Andrew Feeney, Director of Emergency Management is coming as a result of our recommendation to evacuate out to 50 miles in Japan, to understand how this fits into their perceived plans; Tom Congdon indicated they had always only focused on a 10 mile evacuation capability.

It would appear they are bringing a press officer as they want to be able to make a statement after the meeting that they have reached agreement with NRC on certain issues.

The meeting is being held from 1030 - 1200 in O13B4, with HOC tour following.

VR/

Brian Wittick  
Executive Technical Assistant for Reactors  
Office of the Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
301-415-2496 (w); (b)(6) c)

**From:** Sheron, Brian  
**To:** Leeds, Eric  
**Subject:** RE: REPLY: Status update on NYS LtGov visit  
**Date:** Tuesday, March 22, 2011 7:54:00 AM

---

The obvious question then is: There are 2 operating units at Indian Point. If a seismic event occurred, it would likely affect both units. Does our emergency planning consider an accident happening at both units simultaneously? If not, why not?

-----Original Message-----

**From:** Leeds, Eric  
**Sent:** Tuesday, March 22, 2011 7:41 AM  
**To:** Virgilio, Martin; Wittick, Brian; Borchardt, Bill; Weber, Michael  
**Cc:** Muessle, Mary; Andersen, James; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim; Nelson, Robert; Markley, Michael; Brenner, Eliot; Hayden, Elizabeth; Evans, Michele; Milligan, Patricia; McDermott, Brian  
**Subject:** RE: REPLY: Status update on NYS LtGov visit

Try this:

There are two EPZs; a 10 mile EPZ for plume exposure and a 50 mile EPZ for food exposure. The 10 mile EPZ is the area established as a basis for planning because the projected doses from most accident sequences would not exceed the EPA protective action dose guidelines (1-5 rem) at 10 miles. However, the 10 mile EPZ was always considered a basis for emergency planning that could be expanded if the situation warranted. The situation in Japan, with three reactors and two fuel pools experiencing exceptional difficulties simultaneously, along with a dearth of radiological monitoring information surrounding the plant, led to the decision to expand the evacuation beyond the 10 mile radius.

Comments/suggestions/improvements are welcome. Please provide to Bob Nelson.

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

-----Original Message-----

**From:** Virgilio, Martin  
**Sent:** Monday, March 21, 2011 9:52 PM  
**To:** Wittick, Brian; Borchardt, Bill; Weber, Michael  
**Cc:** Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim  
**Subject:** REPLY: Status update on NYS LtGov visit

Thanks, Brian

Do we have a prepared response(s) to a question(s) related to the implications for Indian Point associated with the 50 mile evacuation recommendation in Japan.

Marty

-----Original Message-----

**From:** Wittick, Brian  
**Sent:** Monday, March 21, 2011 6:46 PM  
**To:** Borchardt, Bill; Weber, Michael; Virgilio, Martin  
**Cc:** Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim  
**Subject:** Status update on NYS LtGov visit

Bill/Mike/Marty,

CH/189

Following is an update to the NYS LtGov delegation visiting tomorrow:

The NYS delegation includes:

Lieutenant Governor Robert Duffy  
Howard Glaser, Director of State Operations and Senior Policy Advisor  
Thomas Congdon, Assistant Secretary for Energy and Environment  
Andrew Feeney, Director - New York State Office of Emergency Management  
Joan Matthews, Assistant Commissioner - Department of Environmental Conservation  
Paul Eddy, Utilities Supervisor - Department of Public Service  
Brian Quiara, Senior Policy Advisor to Lieutenant Governor Duffy  
David Doyle, Press Officer from the Governor's office

Stated topics of interest include:

- The governor's office desires to establish a foundation for communications with the NRC at a high level;
- They desire to obtain a better understand the September 2010 report on seismicity, especially with respect to Indian Point; they are also interested in any follow-up reviews or plans for review;
- They want to understand how the findings of the seismic report relate to relicensing;
- Andrew Feeney, Director of Emergency Management is coming as a result of our recommendation to evacuate out to 50 miles in Japan, to understand how this fits into their perceived plans; Tom Congdon indicated they had always only focused on a 10 mile evacuation capability.

It would appear they are bringing a press officer as they want to be able to make a statement after the meeting that they have reached agreement with NRC on certain issues.

The meeting is being held from 1030 - 1200 in O13B4, with HOC tour following.

VR/

Brian Wittick  
Executive Technical Assistant for Reactors  
Office of the Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
301-415-2496 (w); (b)(6) (c)

**From:** Gibson, Kathy  
**To:** Sheron, Brian; Elkins, Scott  
**Cc:** Tinkler, Charles; Uhle, Jennifer  
**Subject:** Re: SOARCA data requested for briefing to Secretary of Energy  
**Date:** Tuesday, March 22, 2011 8:08:03 AM

---

We are looking at them. Will have an answer shortly.

---

**From:** Sheron, Brian  
**To:** Elkins, Scott  
**Cc:** Tinkler, Charles; Uhle, Jennifer; Gibson, Kathy  
**Sent:** Tue Mar 22 07:33:17 2011  
**Subject:** FW: SOARCA data requested for briefing to Secretary of Energy

You're acting. Any problem with SNL giving this to DOE?

**From:** Burns, Shawn [mailto:spburns@sandia.gov]  
**Sent:** Tuesday, March 22, 2011 3:58 AM  
**To:** Sheron, Brian; 'kathy.wagner@nrc.gov'  
**Cc:** Santiago, Patricia; Chang, Richard; Gauntt, Randall O; Pickering, Susan Y; Tinkler, Charles  
**Subject:** SOARCA data requested for briefing to Secretary of Energy

Brian and Kathy,

I prepared the attached to fulfill a request for information for a briefing to be given to the Secretary of Energy on Tuesday, March 22, 2011 regarding the Fukushima event. The slides reflect data taken directly from the Peach Bottom long term station blackout analysis that Sandia prepared for the SOARCA project and are intended to show various levels of core damage progression in this type of event as well as potential environmental releases. John Kelly (DOE/NE-7) sent Brian an e-mail regarding this request at approximately 11:00 EDT on March 21.

I am requesting NRC approval to forward this information to Idaho National Laboratories so that it can be included in the briefing they are preparing for the Secretary. At this time I do not know what the scheduled time for the briefing is on the 22<sup>nd</sup>.

Best regards,

Shawn

---

Shawn P. Burns, Ph.D., P.E.  
Manager, Risk and Reliability Analysis  
Department 6761

Sandia National Laboratories  
P.O. Box 5800  
Albuquerque, NM 87185-0748

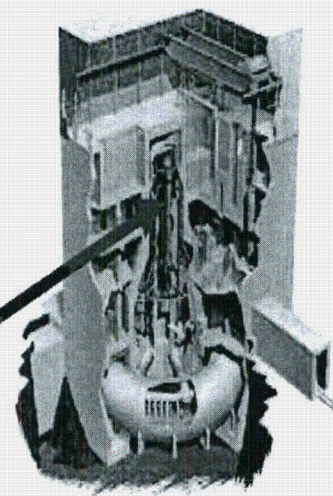
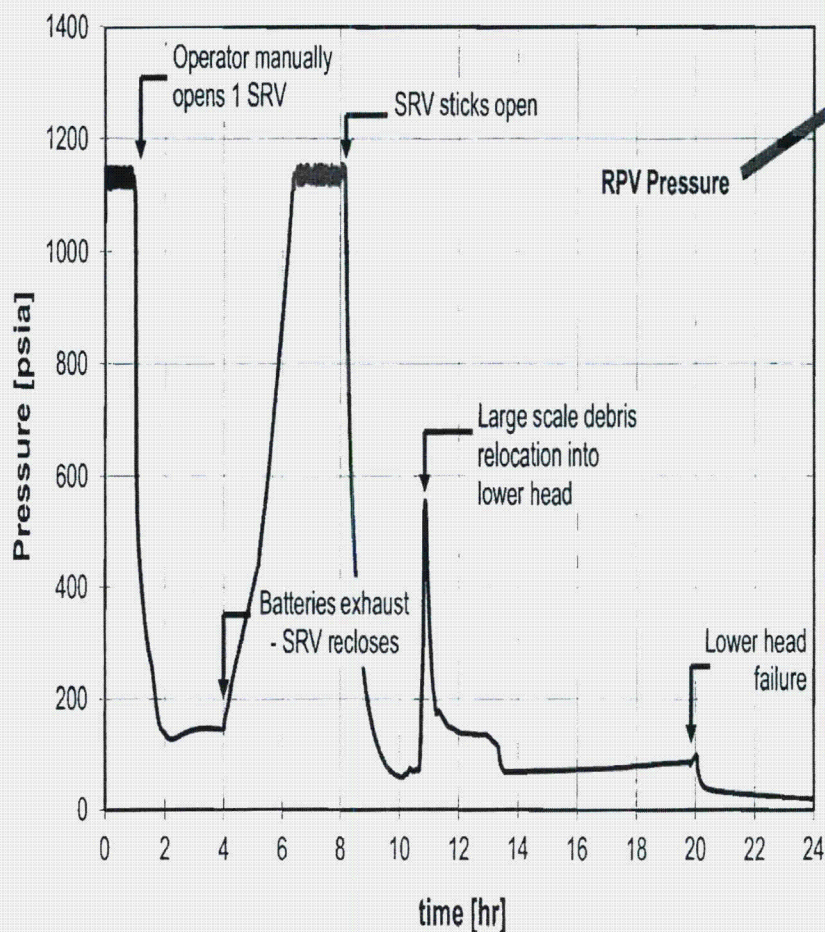
Phone: (505)844-6200  
Mobile: (b)(6)  
Fax: (505)844-2829

CH/190

e-mail: [spburns@sandia.gov](mailto:spburns@sandia.gov)

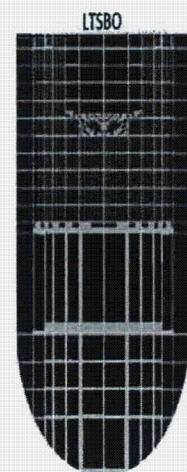
Web: <http://www.sandia.gov/ERN/nuclear-energy/index.html>

# General Electric Boiling Water Reactor Mark 1 Containment Reactor Vessel Pressure for Long Term Station Blackout Scenario

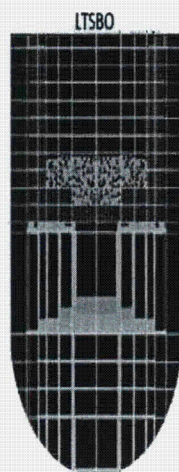




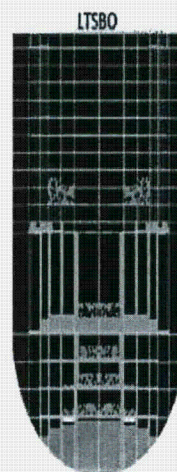
# Core Damage Progression for GE BWR Mark 1 Long Term Station Blackout Scenario



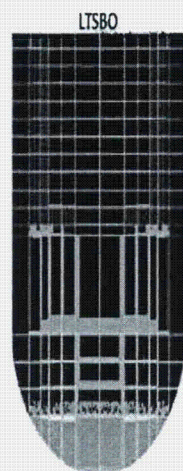
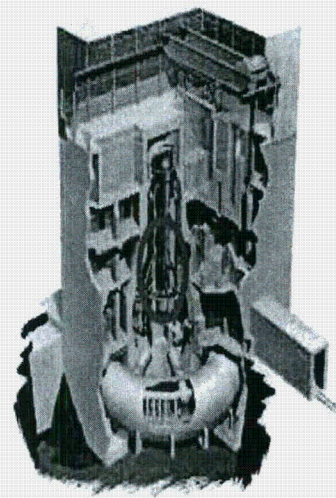
10 hours



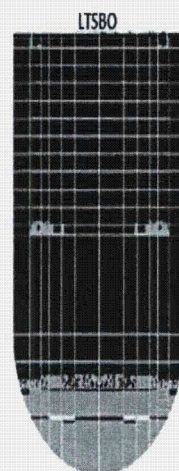
10.6 hours  
Core plate yield  
(10.5 hr)



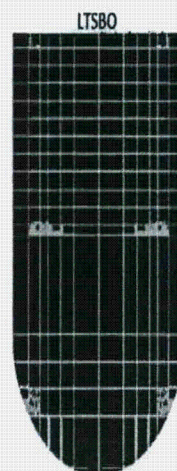
11 hours  
Large scale debris relocation  
to lower head



13.3 hours  
Lower head dry-out



19.6 hours



19.9 hours  
Lower head failure  
(19.7 hr)

Intact Fuel



Core Debris



Support Structure



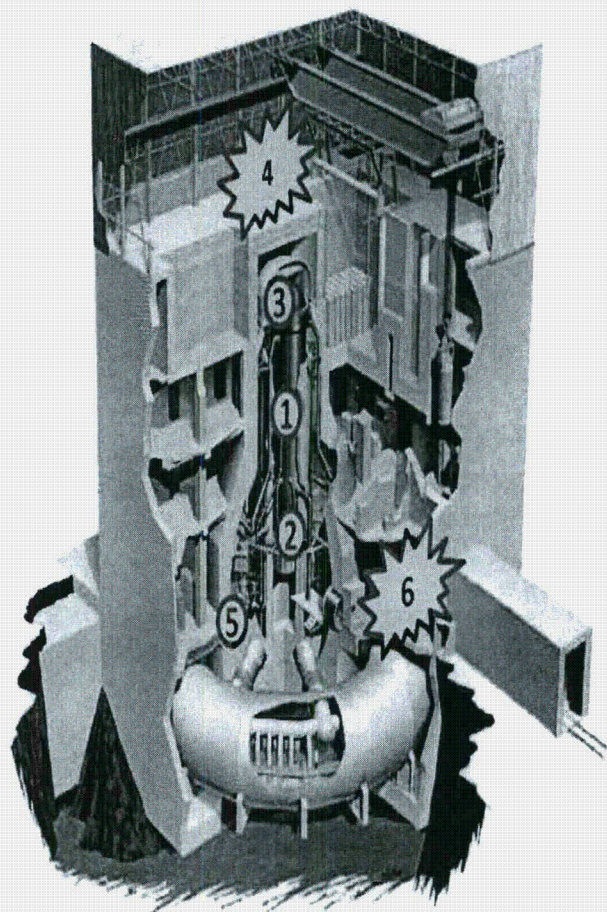
Water





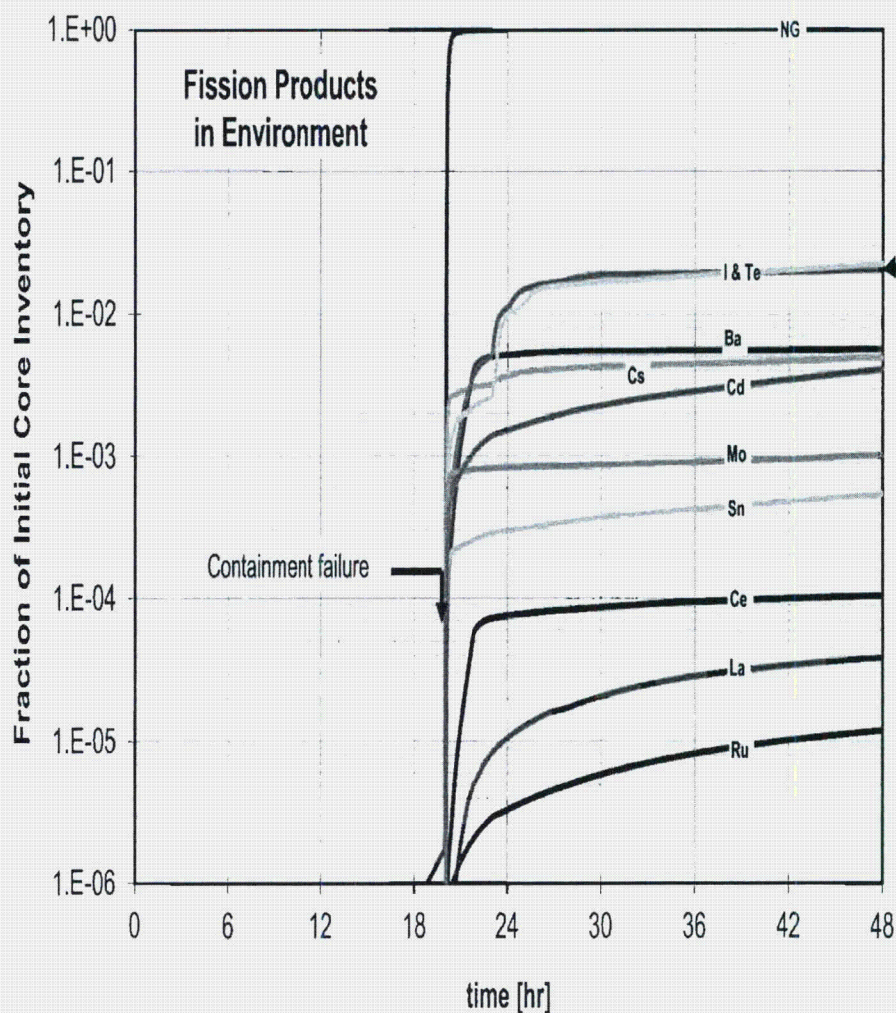
# GE BWR Mark 1 Long Term Station Blackout Hydrogen Combustion

#	Event	Time
0	Station blackout loss of all onsite and offsite ac power	0.0 hr
1	Hydrogen generation in vessel from zircalloy oxidation	8.9 – 19.7 hr
2	Lower head failure	19.7 hr
3	Hydrogen release to secondary containment through head flange	19.9 hr
4	Hydrogen burns in refueling bay	20.0 hr
5	Drywell liner melt through	20.0 hr
6	Hydrogen burns in lower reactor building	20.1 hr





# Radionuclide release to the environment from GE BWR Mark 1 long term station blackout analysis



Note 2% core inventory of iodine release predicted for a full core melt with containment failure

**From:** Dion, Jeanne  
**To:** Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael  
**Cc:** Bush-Goddard, Stephanie; Rini, Brett; Armstrong, Kenneth; Bowman, Gregory  
**Subject:** RE: Commission Meeting on Japanese Events  
**Date:** Tuesday, March 22, 2011 8:10:53 AM

---

Brian,  
RES involvement with the commission meeting (monday 3/21) was as a pass-thru for information from the PMT in the Op center. I provided talking points and Q&A on potential consequences (all information coming from the Op center).

Jeanne

---

**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 7:51 AM  
**To:** Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael  
**Cc:** Bush-Goddard, Stephanie; Rini, Brett; Dion, Jeanne; Armstrong, Kenneth  
**Subject:** Commission Meeting on Japanese Events

I just learned that we're working towards scheduling a near-term meeting on the events in Japan, with a focus on radiological consequences and potential health effects. The current thinking is that RES would have the lead for this meeting, which will most likely take place on April 14.

The meeting would involve discussion of (1) status of the event (maybe led by NRR), (2) radiological impacts, and (3) radiological significance. The external panel might involve other Federal agencies (e.g., EPA, DOE), HPS, industry, and/or a representative from one of the labs, although it could end up being a challenge to get participation given the timeframe. We would just need to give SECY suggestions and let them take care of the invitations.

Alan Frazier put together the attached draft scheduling note, but it will need to be revised. My understanding is the SECY will likely need a revised scheduling note back today to get to the Commission. Please let me know as soon as you can if you think the lead for this meeting should be assigned to a different office (if that's the case, we'll need to circle back with Mike).

Greg

**From:** Frazier, Alan  
**Sent:** Monday, March 21, 2011 4:47 PM  
**To:** Bowman, Gregory  
**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Merzke, Daniel  
**Subject:** RE: ACTION: Draft Scheduling Note for New Commission Meeting

Greg,

FSME tells me that last week RES agreed to take the lead in any discussion of rad consequences or health affects if those topics had come up during today's Commission meeting. The Commission would now like to have a Commission meeting in April focused on rad consequences and health effects.

Could you please confirm with RES tomorrow that they should have the lead for the April Commission meeting? Note that it was Jeanne Dion that agreed RES should have the lead last week (see attached email) but I am not aware of any front office interaction on this.

Alan

CH/191

From: Deegan, George  
Sent: Monday, March 21, 2011 4:29 PM  
To: Frazier, Alan  
Cc: Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel  
Subject: RE: ACTION: Draft Scheduling Note for New Commission Meeting

Alan- Thanks for forwarding Jim Andersen's email.

When Allen Howe's Working Group was assembled last week to construct an outline for today's Commission briefing, the rad consequences/health effects issue was identified as originally marked as an FSME potential topic, but we later determined that RES would be better to take lead (with SOARCA etc.). I'd think they'd be the best ones to lead any new Commission briefing in April on this topic. I'll forward you that email chain separately.

From: Frazier, Alan  
Sent: Monday, March 21, 2011 3:42 PM  
To: Deegan, George  
Cc: Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel  
Subject: ACTION: Draft Scheduling Note for New Commission Meeting

George,

Please take a look at Jim's note below from today's agenda planning meeting which was held immediately after the Commission meeting.

Note in particular the highlighted new Commission meeting in April on the Japan event with additional focus on radiological consequence / health effects (probably around 4/14). FSME will have the lead for this new Commission meeting. Additionally, I got some feedback from Jim that you should consider having the following elements in the scheduling note.

- Status of event
- Radiological Impacts
- Radiological significance
- External panel

ACTION: In cooperation with NRR and NSIR (and any other offices you feel should be involved) please take the lead for developing a scheduling note. I have attached a initial draft to help get you started.

I do not know when this action will be due but I wanted to give you a head-start. We are still waiting for SECY's official summary of the meeting, which usually contains due dates for the draft scheduling notes.

Please let me know if you have any questions.

Regards,

Alan L. Frazier  
Executive Technical Assistant  
Office of the Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
301-415-1763

From: Andersen, James  
Sent: Monday, March 21, 2011 1:35 PM  
To: EDO\_TBPM Distribution  
Cc: Muesse, Mary; Weber, Michael; Virgilio, Martin; Ash, Darren; Landau, Mindy  
Subject: Agenda Planning Meeting

ETAs,

The Commission held an Agenda Planning Meeting this morning. SECY will provide the formal summary, but I wanted to let you know a couple things as quickly as possible:

- The 10CFR50.46(a) Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Bill Ruland was informed)
- The SMR Commission meeting on 3/29 is still on (Mike Mayfield was informed)
- The Source Security Commission meeting on 4/19 is still on (Josie Piccone was informed)
- The ITAAC Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Mike Mayfield was informed)
- The EEO/Human Capital Commission meeting was moved to June 2 (Kris – please advise HR and SBCR)
- The Cumulative Effectives of Regulation Commission meeting was postponed to a later unspecified date (Tom Blount was informed)
- The AARM Commission meeting on 5/27 is still on (Brian please advise NRR)
- The Emergency Planning Final Rule Commission meeting was moved up to May 12 (left Bob Kahler a message)
- The ACRS meeting on 6/6 is still on
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Several new meetings were added:

- 30, 60, and 90 day status meetings regarding the Near-Term NRC Review Effort (task group?); probably around 5/3, 6/16, 7/18 (Jim A lead for scheduling note)

- Status meeting on the Japanese event with additional focus on radiological consequence / health effects; probably around 4/14 (Brian lead for scheduling note)

- Status meeting on the Japanese event with additional focus on station blackout; probably around 4/28 (Brian lead for scheduling note)

- Stakeholder meeting on the staff's 90 day status report; probably around 7/25 (Jim A lead for scheduling note)

**From:** Sheron, Brian  
**To:** Bowman, Gregory  
**Subject:** FW: Commission Meeting on Japanese Events  
**Date:** Tuesday, March 22, 2011 8:11:00 AM

---

Greg, see below. I need to know ASAP if this is a go and that RES has the lead.

---

**From:** Gibson, Kathy  
**Sent:** Tuesday, March 22, 2011 8:07 AM  
**To:** Sheron, Brian; Uhle, Jennifer; Scott, Michael; Bush-Goddard, Stephanie  
**Cc:** Elkins, Scott  
**Subject:** Re: Commission Meeting on Japanese Events

| Yes we should lead (with NSIR/Ops Center support) and we can be ready. As soon as you tell me to launch, I will put a team together to work it.

---

**From:** Sheron, Brian  
**To:** Uhle, Jennifer; Gibson, Kathy; Scott, Michael; Bush-Goddard, Stephanie  
**Sent:** Tue Mar 22 07:56:32 2011  
**Subject:** FW: Commission Meeting on Japanese Events

See below. Can we be ready to do this by 4/14? Should we be the lead? /

---

**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 7:51 AM  
**To:** Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael  
**Cc:** Bush-Goddard, Stephanie; Rini, Brett; Dion, Jeanne; Armstrong, Kenneth  
**Subject:** Commission Meeting on Japanese Events  
**Importance:** High

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CH/192

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**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Merzke, Daniel  
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Regards,

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Office of the Executive Director for Operations  
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**Sent:** Monday, March 21, 2011 1:35 PM  
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**From:** Elkins, Scott  
**To:** Sheron, Brian  
**Cc:** Tinkler, Charles; Uhle, Jennifer; Gibson, Kathy; Lee, Richard; Santiago, Patricia  
**Subject:** RE: SOARCA data requested for briefing to Secretary of Energy  
**Date:** Tuesday, March 22, 2011 8:14:16 AM

---

Brian, DSA has no problem with this being released as long as the slides are marked OOU.

---

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 7:33 AM  
**To:** Elkins, Scott  
**Cc:** Tinkler, Charles; Uhle, Jennifer; Gibson, Kathy  
**Subject:** FW: SOARCA data requested for briefing to Secretary of Energy

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---

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Best regards,

Shawn

---

Shawn P. Burns, Ph.D., P.E.  
Manager, Risk and Reliability Analysis  
Department 6761

Sandia National Laboratories  
P.O. Box 5800  
Albuquerque, NM 87185-0748

Phone: (505)844-6200

Mobile: (b)(6)

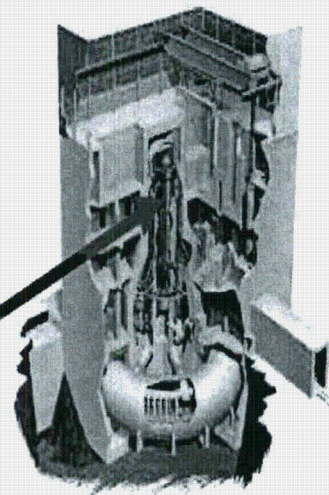
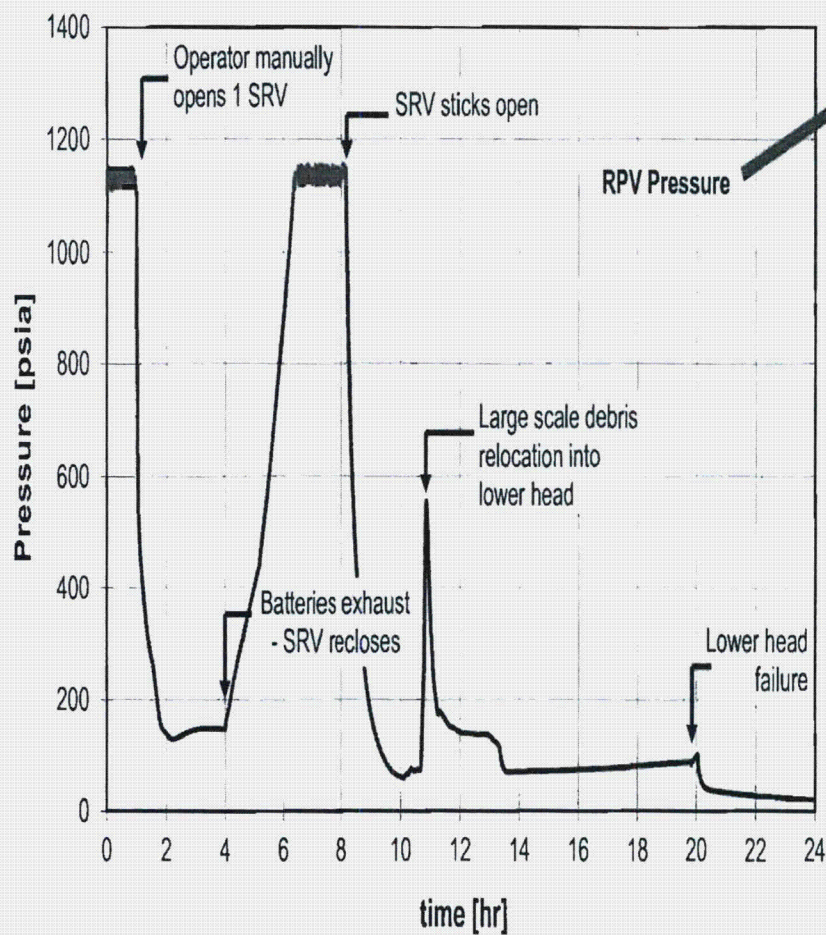
Fax: (505)844-2829

CH/193

e-mail: [spburns@sandia.gov](mailto:spburns@sandia.gov)

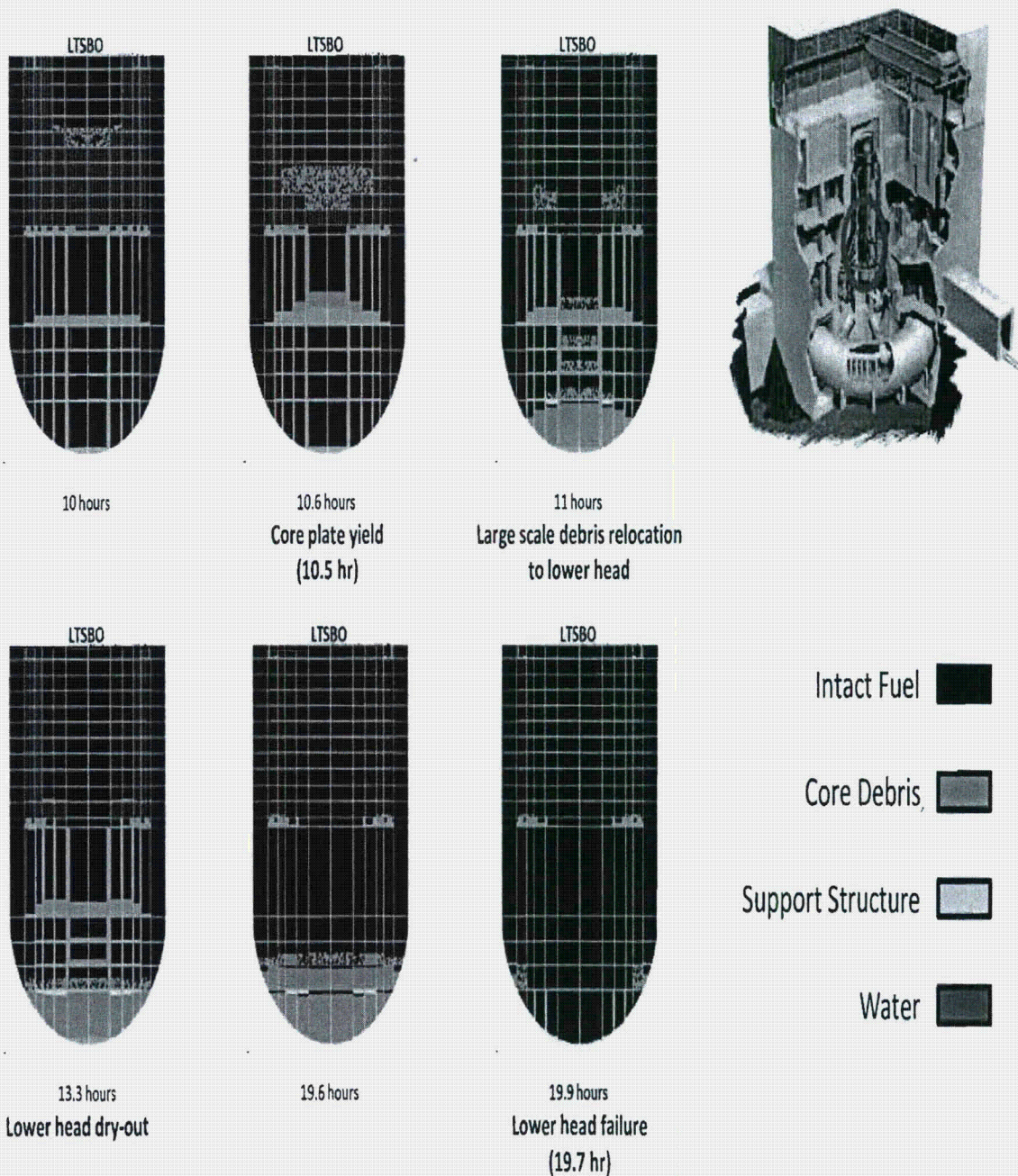
Web: <http://www.sandia.gov/ERN/nuclear-energy/index.html>

# General Electric Boiling Water Reactor Mark 1 Containment Reactor Vessel Pressure for Long Term Station Blackout Scenario





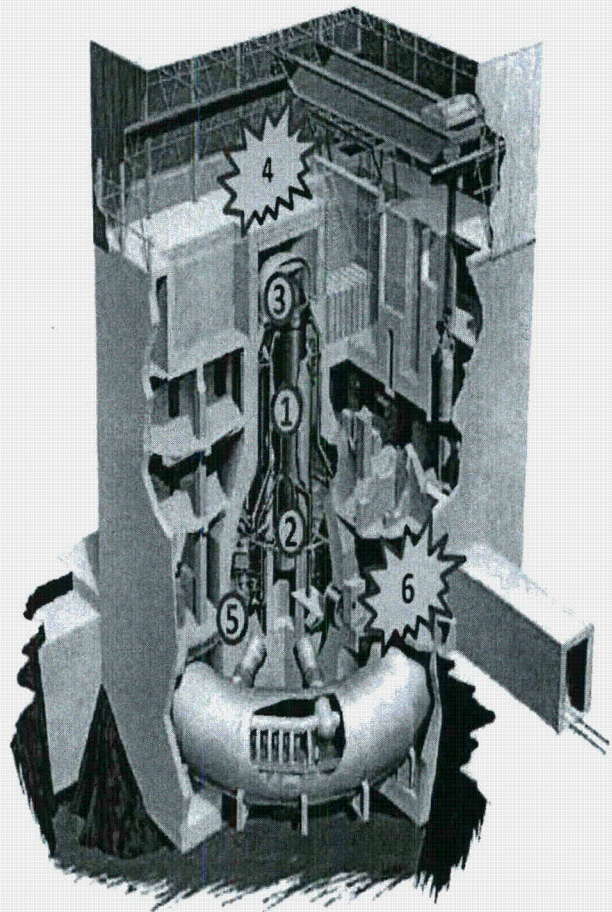
# Core Damage Progression for GE BWR Mark 1 Long Term Station Blackout Scenario



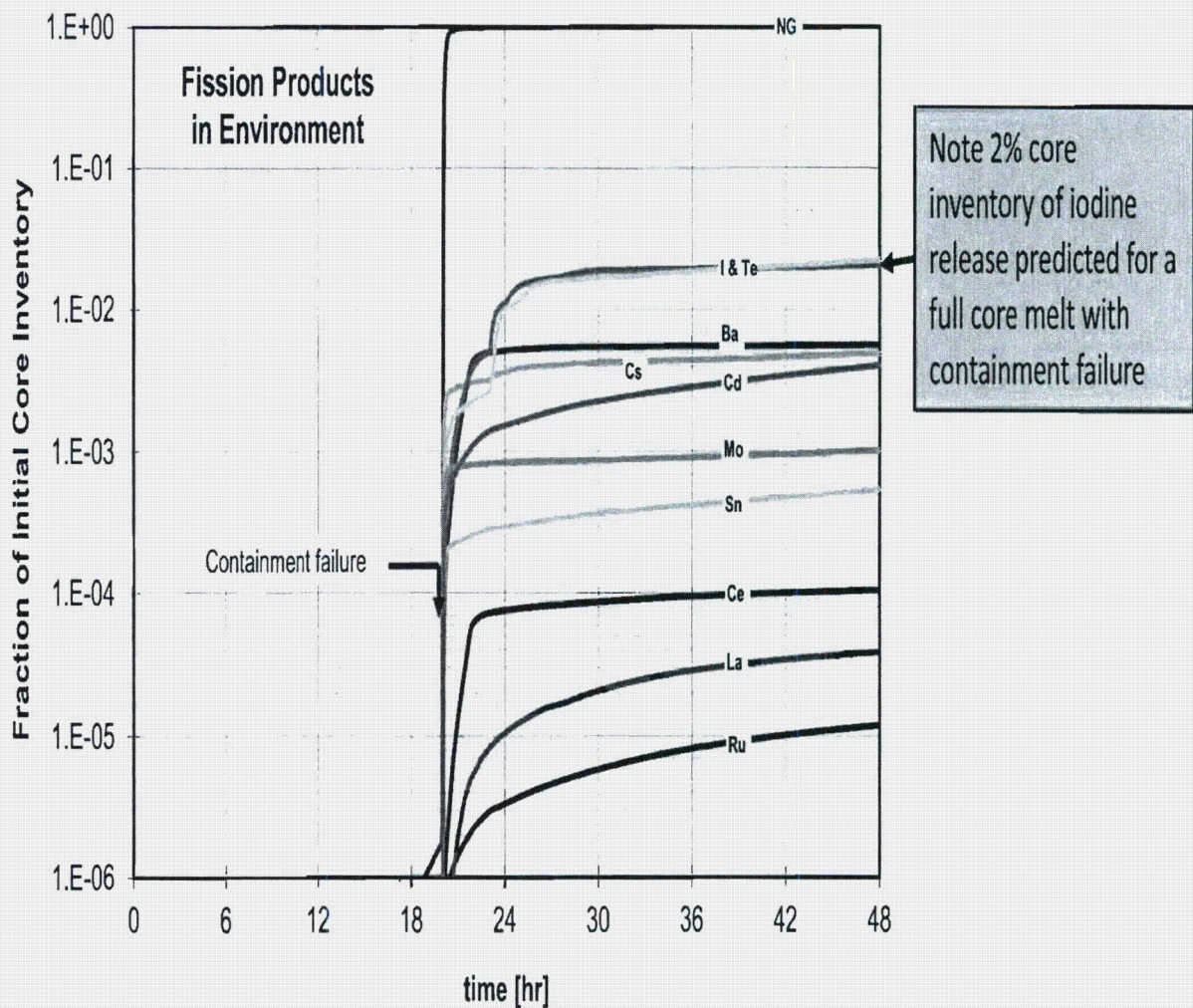


## GE BWR Mark 1 Long Term Station Blackout Hydrogen Combustion

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6	Hydrogen burns in lower reactor building	20.1 hr



# Radionuclide release to the environment from GE BWR Mark 1 long term station blackout analysis



**From:** Sheron, Brian  
**To:** Bari, Robert A  
**Subject:** RE: NRC 30 day and 90 day studies  
**Date:** Tuesday, March 22, 2011 8:23:00 AM

---

We don't have any tasking memo yet, and funding is still an issue.

---

**From:** Bari, Robert A [mailto:[bari@bnl.gov](mailto:bari@bnl.gov)]  
**Sent:** Monday, March 21, 2011 3:30 PM  
**To:** Sheron, Brian  
**Subject:** NRC 30 day and 90 day studies

Hi Brian

My call to you on Friday was about NRC's next steps in response to the events in Japan. I know that NRC's focus is now starting to firm up, so let me know if BNL can fit into the equation in some way.

DOE lab folks have been interacting on how they can provide useful input to DOE/NE. Some of what I have seen and heard could arguably be part of what NRC might end up doing.

Best,

Bob

CH/194



**From:** Sheron, Brian  
**To:** Johnson, Michael  
**Subject:** FW: Answers to Congressional Staff Questions  
**Date:** Tuesday, March 22, 2011 8:39:00 AM

---

Mike, I think you are taking the call today. Here are the Q's I got during yesterday's call that I did not have an immediate answer to. Don Cool joined the conference part-way through.

---

**From:** Sheron, Brian  
**Sent:** Monday, March 21, 2011 5:54 PM  
**To:** Droggitis, Spiros  
**Subject:** Answers to Congressional Staff Questions

1.) Request for doses in millirem.

Don Cool responded and explained that we could not give doses in millirem because it requires additional assumptions on uptake, etc. However, he said doses would be small fractions of PAGs

2.) What was the basis for concluding that the core debris in the unit 4 SFP would not ablate the concrete floor?

Basis was preliminary calculations run with the MELCOR code that showed temperatures did not reach levels that would cause ablation. However, further calculations are being performed.

3.) What is the half-life of Xenon-133?

Don Cool provided the response that it is 2.2 days.

4.) Workers were evacuated at unit #3 due to high radiation. Is this true?

At 3:50 pm Japan time yesterday, a puff of smoke or steam was released from unit #3. We do not know if it contained increased radiation, and we believe the workers were evacuated as a precautionary measure.

5.) Can you provide the Sacramento radiation readings in millirem?

Don Cool responded and explained that we could not give doses in millirem because it requires additional assumptions on uptake, etc. However, he said doses would be small fractions of PAGs

6.) Smoke was seen from units 2 & 3. Do we know what that was?

We believe these events were not simultaneous but separated by several days. The smoke or steam from unit #3 is discussed in item #4 above. We believe the smoke or steam seen at unit #2 was released when TEPCO cut a hole in the unit #2 reactor building siding.

CH/195

**From:** Lew, David  
**To:** Sheron, Brian; Virgilio, Martin; Wittick, Brian; Borchardt, Bill; Weber, Michael  
**Cc:** Muessle, Mary; Andersen, James; Leeds, Eric; Dean, Bill; Wiggins, Jim  
**Subject:** RE: REPLY: Status update on NYS LtGov visit  
**Date:** Tuesday, March 22, 2011 8:45:48 AM

---

Brian,

I agree that such a speculative question will likely come up. It would be good to have some alignment on what the response would be. While no expert, I would offer some thoughts for consideration:

- do we need to qualify what we mean by a similar event? i.e., there are dissimilarities due to the number of reactors, the lack of information coming from Japan, the lack of structured communications with our citizens in Japan, and the population in the areas recommended for evacuation. All these factor (and others) cause a conservative modeling and decision making.
- a recommendation needs to factor in a number of issues, including population, meteorological information, etc. The 10 EPZ planning bases provide a foundation for expanding beyond ten miles, but it is with the consideration of these other factors. For example, small areas beyond 10 mi in combination with sheltering recommendation would be feasible.

Dave

-----Original Message-----

From: Sheron, Brian  
Sent: Tuesday, March 22, 2011 8:03 AM  
To: Lew, David; Virgilio, Martin; Wittick, Brian; Borchardt, Bill; Weber, Michael  
Cc: Muessle, Mary; Andersen, James; Leeds, Eric; Dean, Bill; Wiggins, Jim  
Subject: RE: REPLY: Status update on NYS LtGov visit

I think the question we need to be prepared to answer is: There are two reactors at the IP site. NRC said that if a similar event happened at a U.S. site, we would also recommend a 50 mile evacuation. If both IP reactors were damaged by a seismic event (a la Japan), would we still recommend a 50 mile evacuation, since it is impractical to evacuate NYC?

-----Original Message-----

From: Lew, David  
Sent: Tuesday, March 22, 2011 7:51 AM  
To: Virgilio, Martin; Wittick, Brian; Borchardt, Bill; Weber, Michael  
Cc: Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Wiggins, Jim  
Subject: RE: REPLY: Status update on NYS LtGov visit

Marty,

There has been a number of interactions with NYS, including the counties since NY is a home rule state. Bob Kahler and others have been on conference calls and have discussed key messages, some of them paraphrased below. That said, NYS's underlying interest does not seem to be focused on challenging the 10 mile planning bases, as much as trying to effectively respond to its constituents (in particular, the media) regarding the adequacy of their emergency planning in light of the NRC recommendation in Japan. What we have been hearing is a strong desire for the NRC to get more information out publically, such as on its website, so that they can point to the information or use it to respond to their constituents. To that extent, if we can commit to getting this information on our website, it go far in meeting their interests.

- The NRC's recommendation associated with the Fukushima event was consistent with the emergency planning bases developed in the US. That said, the NRC will be reviewing all aspects of the Fukushima events in a systematic and methodical way for lesson learned.
- The 10 mile emergency planning zone is the area that was established as a basis for planning because the projected doses from most accident sequences would not exceed the Environmental Protection Agency protective action dose guidelines (1-5 rem) at 10 miles.

CH/196

- However, the 10 mile EPZ was always considered a basis for emergency planning that could be expanded if the situation warranted. NUREG-0654/FEMA-REP-1 the basis for the 10 mile EPZ that states the 10 mile EPZ provides a substantial basis for expansion of the 10 mile EPZ as is necessary.

- The situation in Japan involved three reactors and two spent fuel pools experiencing exceptional difficulties simultaneously. Furthermore, given the lack of information at the time coming from the Japanese, the lack of any apparent cohesive plan to address the problems, and the projected doses if things continued to get worse, the NRC decided it was prudent to recommend evacuation beyond the 10 mile radius.

Dave

-----Original Message-----

From: Virgilio, Martin

Sent: Monday, March 21, 2011 9:52 PM

To: Wittick, Brian; Borchardt, Bill; Weber, Michael

Cc: Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim

Subject: REPLY: Status update on NYS LtGov visit

Thanks, Brian

Do we have a prepared response(s) to a question(s) related to the implications for Indian Point associated with the 50 mile evacuation recommendation in Japan.

Marty

-----Original Message-----

From: Wittick, Brian

Sent: Monday, March 21, 2011 6:46 PM

To: Borchardt, Bill; Weber, Michael; Virgilio, Martin

Cc: Muessle, Mary; Andersen, James; Leeds, Eric; Sheron, Brian; Dean, Bill; Lew, David; Wiggins, Jim

Subject: Status update on NYS LtGov visit

Bill/Mike/Marty,

Following is an update to the NYS LtGov delegation visiting tomorrow:

The NYS delegation includes:

Lieutenant Governor Robert Duffy

Howard Glaser, Director of State Operations and Senior Policy Advisor

Thomas Congdon, Assistant Secretary for Energy and Environment

Andrew Feeney, Director - New York State Office of Emergency Management

Joan Matthews, Assistant Commissioner - Department of Environmental Conservation

Paul Eddy, Utilities Supervisor - Department of Public Service

Brian Quiara, Senior Policy Advisor to Lieutenant Governor Duffy

David Doyle, Press Officer from the Governor's office

Stated topics of interest include:

- The governor's office desires to establish a foundation for communications with the NRC at a high level;

- They desire to obtain a better understand the September 2010 report on seismicity, especially with respect to Indian Point; they are also interested in any follow-up reviews or plans for review;

- They want to understand how the findings of the seismic report relate to relicensing;

- Andrew Feeney, Director of Emergency Management is coming as a result of our recommendation to evacuate out to 50 miles in Japan, to understand how this fits into their perceived plans; Tom Congdon indicated they had always only focused on a 10 mile evacuation capability.

It would appear they are bringing a press officer as they want to be able to make a statement after the meeting that they have reached agreement with NRC on certain issues.

The meeting is being held from 1030 - 1200 in O13B4, with HOC tour following.

VR/

Brian Wittick

Executive Technical Assistant for Reactors

Office of the Executive Director for Operations

U.S. Nuclear Regulatory Commission

301-415-2496 (w); (b)(6) (c)

**From:** Bowman, Gregory  
**To:** Sheron, Brian; Gibson, Kathy; Elkins, Scott  
**Cc:** Uhle, Jennifer  
**Subject:** RE: Commission Meeting on Japanese Events  
**Date:** Tuesday, March 22, 2011 8:48:08 AM

---

That's right, although we're thinking that Bill may actually cover the event status in addition to introductions. Jim told me he'd check on that and let me know. Event status may end up going to NRR, but we can update that later. Staff would cover the other two topics.

---

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 8:38 AM  
**To:** Gibson, Kathy; Elkins, Scott; Bowman, Gregory  
**Cc:** Uhle, Jennifer  
**Subject:** RE: Commission Meeting on Japanese Events

I would imagine EDO would introduce staff, and then appropriate staff would do the bulk of the briefing.

When will you be in the office so we can discuss?

---

**From:** Gibson, Kathy  
**Sent:** Tuesday, March 22, 2011 8:35 AM  
**To:** Sheron, Brian; Elkins, Scott; Bowman, Gregory  
**Cc:** Uhle, Jennifer  
**Subject:** Re: Commission Meeting on Japanese Events

Ok - do we know who is doing the briefing? Will it be EDO - just trying to determine level of detail.

Also, Greg, please pass on contacts in other offices if and as you get them. Thanks!

---

**From:** Sheron, Brian  
**To:** Gibson, Kathy; Elkins, Scott  
**Cc:** Uhle, Jennifer  
**Sent:** Tue Mar 22 08:19:55 2011  
**Subject:** FW: Commission Meeting on Japanese Events

See below, you got it.

---

**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 8:17 AM  
**To:** Sheron, Brian  
**Subject:** RE: Commission Meeting on Japanese Events

It's on the schedule, and if you don't object to taking the lead, you've got it (for what it's worth, I saw an e-mail from Mike over the weekend indicating that he thought it belonged with RES, with coordination from the other offices).

---

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 8:11 AM  
**To:** Bowman, Gregory  
**Subject:** FW: Commission Meeting on Japanese Events

CH/197

Greg, see below. I need to know ASAP if this is a go and that RES has the lead.

---

**From:** Gibson, Kathy  
**Sent:** Tuesday, March 22, 2011 8:07 AM  
**To:** Sheron, Brian; Uhle, Jennifer; Scott, Michael; Bush-Goddard, Stephanie  
**Cc:** Elkins, Scott  
**Subject:** Re: Commission Meeting on Japanese Events

Yes we should lead (with NSIR/Ops Center support) and we can be ready. As soon as you tell me to launch, I will put a team together to work it.

---

**From:** Sheron, Brian  
**To:** Uhle, Jennifer; Gibson, Kathy; Scott, Michael; Bush-Goddard, Stephanie  
**Sent:** Tue Mar 22 07:56:32 2011  
**Subject:** FW: Commission Meeting on Japanese Events

See below. Can we be ready to do this by 4/14? Should we be the lead?

---

**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 7:51 AM  
**To:** Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael  
**Cc:** Bush-Goddard, Stephanie; Rini, Brett; Dion, Jeanne; Armstrong, Kenneth  
**Subject:** Commission Meeting on Japanese Events  
**Importance:** High

I just learned that we're working towards scheduling a near-term meeting on the events in Japan, with a focus on radiological consequences and potential health effects. The current thinking is that RES would have the lead for this meeting, which will most likely take place on April 14.

The meeting would involve discussion of (1) status of the event (maybe led by NRR), (2) radiological impacts, and (3) radiological significance. The external panel might involve other Federal agencies (e.g., EPA, DOE), HPS, industry, and/or a representative from one of the labs, although it could end up being a challenge to get participation given the timeframe. We would just need to give SECY suggestions and let them take care of the invitations.

Alan Frazier put together the attached draft scheduling note, but it will need to be revised. My understanding is the SECY will likely need a revised scheduling note back today to get to the Commission. Please let me know as soon as you can if you think the lead for this meeting should be assigned to a different office (if that's the case, we'll need to circle back with Mike).

Greg

---

**From:** Frazier, Alan  
**Sent:** Monday, March 21, 2011 4:47 PM  
**To:** Bowman, Gregory  
**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Merzke, Daniel  
**Subject:** RE: ACTION: Draft Scheduling Note for New Commission Meeting

Greg,

FSME tells me that last week RES agreed to take the lead in any discussion of rad consequences or health affects if those topics had come up during today's Commission meeting. The Commission would now like to have a Commission meeting in April focused on rad consequences and health effects.

Could you please confirm with RES tomorrow that they should have the lead for the April Commission meeting? Note that it was Jeanne Dion that agreed RES should have the lead last week (see attached email) but I am not aware of any front office interaction on this.

Alan

---

**From:** Deegan, George  
**Sent:** Monday, March 21, 2011 4:29 PM  
**To:** Frazier, Alan  
**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel  
**Subject:** RE: ACTION: Draft Scheduling Note for New Commission Meeting

Alan- Thanks for forwarding Jim Andersen's email.

When Allen Howe's Working Group was assembled last week to construct an outline for today's Commission briefing, the rad consequences/health effects issue was identified as originally marked as an FSME potential topic, but we later determined that RES would be better to take lead (with SOARCA etc.). I'd think they'd be the best ones to lead any new Commission briefing in April on this topic. I'll forward you that email chain separately.

---

**From:** Frazier, Alan  
**Sent:** Monday, March 21, 2011 3:42 PM  
**To:** Deegan, George  
**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel  
**Subject:** ACTION: Draft Scheduling Note for New Commission Meeting

George,

Please take a look at Jim's note below from today's agenda planning meeting which was held immediately after the Commission meeting.

Note in particular the highlighted **new Commission meeting in April on the Japan event with additional focus on radiological consequence / health effects** (probably around 4/14). FSME will have the lead for this new Commission meeting. Additionally, I got some feedback from Jim that you should consider having the following elements in the scheduling note.

- Status of event
- Radiological Impacts

**Radiological significance**  
**External panel**

**ACTION:** In cooperation with NRR and NSIR (and any other offices you feel should be involved) please take the lead for developing a scheduling note. I have attached a initial draft to help get you started.

I do not know when this action will be due but I wanted to give you a head-start. We are still waiting for SECY's official summary of the meeting, which usually contains due dates for the draft scheduling notes.

Please let me know if you have any questions.

Regards,

Alan L. Frazier  
Executive Technical Assistant  
Office of the Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
301-415-1763

---

**From:** Andersen, James  
**Sent:** Monday, March 21, 2011 1:35 PM  
**To:** EDO\_TBPM Distribution  
**Cc:** Muesle, Mary; Weber, Michael; Virgilio, Martin; Ash, Darren; Landau, Mindy  
**Subject:** Agenda Planning Meeting

ETAs,

The Commission held an Agenda Planning Meeting this morning. SECY will provide the formal summary, but I wanted to let you know a couple things as quickly as possible:

- The 10CFR50.46(a) Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Bill Ruland was informed)
- The SMR Commission meeting on 3/29 is still on (Mike Mayfield was informed)
- The Source Security Commission meeting on 4/19 is still on (Josie Piccone was informed)
- The ITAAC Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Mike Mayfield was informed)
- The EEO/Human Capital Commission meeting was moved to June 2 (**Kris – please advise HR and SBCR**)
- The Cumulative Effectives of Regulation Commission meeting was postponed to a



later unspecified date (Tom Blount was informed)

- The AARM Commission meeting on 5/27 is still on (**Brian please advise NRR**)
- The Emergency Planning Final Rule Commission meeting was moved up to May 12 (left Bob Kahler a message)
- The ACRS meeting on 6/6 is still on
- The International Commission meeting was postponed to a later unspecified date

Several new meetings were added:

- 30, 60, and 90 day status meetings regarding the Near-Term NRC Review Effort (task group?); probably around 5/3, 6/16, 7/18 (**Jim A lead for scheduling note**)
- Status meeting on the Japanese event with additional focus on radiological consequence / health effects; probably around 4/14 (**Brian lead for scheduling note**)
- Status meeting on the Japanese event with additional focus on station blackout; probably around 4/28 (**Brian lead for scheduling note**)
- Stakeholder meeting on the staff's 90 day status report; probably around 7/25 (**Jim A lead for scheduling note**)

**From:** Adams, Jan  
**To:** Adams, Jan; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Brinkman, Bill; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; Kelly, John E. (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Per Peterson; Rolando Szilard; Steve Fetter  
**Subject:** Japanese Earthquake 22 March 2011 0600 EDT Situation Report  
**Date:** Tuesday, March 22, 2011 9:01:43 AM  
**Attachments:** Japan Earthquake Response 03222011 0600.ppt  
SITREP MAR22 0600 final.docx  
**Importance:** High

---

Attached please find this morning's Japan sit rep.

This information should not be shared or further distributed.

-----Original Message-----

**From:** NITOPS

**Sent:** Tuesday, March 22, 2011 6:02 AM

**To:** (b)(6)

(b)(6)

**Subject:** Japanese Earthquake 22 March 2011 0600 EDT Situation Report

**Importance:** High

Please find attached the latest DOE SITREP regarding the ongoing earthquake and tsunami response in Japan.

This information is provided for your internal use and should be shared only with those who have a need to know.

CH/198

The SITREP will be updated every 12 hours.

Nuclear Incident Team (NIT)

Office of Emergency Response (NA-42)

National Nuclear Security Administration U.S. Department of Energy nitops@nnsa.doe.gov

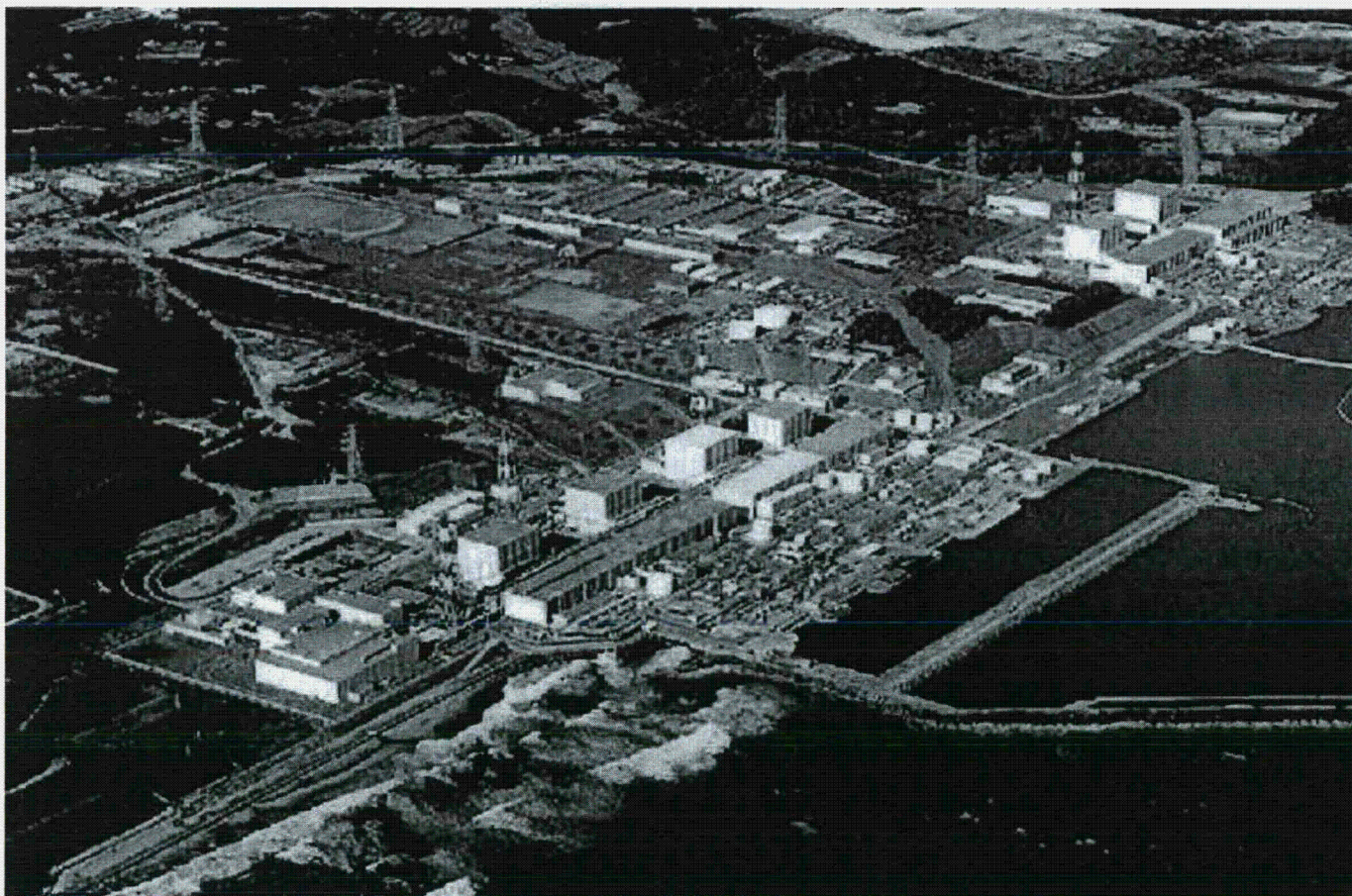
nit@doe.gov 202-586-8100



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# Japan Earthquake Response

## March 22, 2011 // 0600 EDT



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**This information is for limited  
distribution to those with a  
NEED TO KNOW  
and should not be forwarded outside  
your agency or organization without  
prior clearance from U.S. DOE**

**Contact: DOE/NNSA Nuclear Incident  
Team: NITOPS@nnsa.doe.gov**

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# Current Status

- No major changes in radiation levels at the Fukushima Daiichi Nuclear Power Plant
  - **Unit 1:** Reactor water level stable, core damage est. 70%. Seawater injection continues. Electrical power line connected. Spraying continues on spent fuel pool.
  - **Unit 2:** Reactor water level stable, core damage est. 33%. Seawater injection continues. Power restored and electric water pump systems being tested.
  - **Unit 3:** Reactor water level stable and pressure stabilized. Spraying on spent fuel pool continues. Power connection efforts underway.
  - **Unit 4:** Concrete pumpers expected to pour water on reactor building to fill spent fuel pool. Power connection efforts underway.
  - **Units 5 & 6:** Diesel generators supplying power to cooling system. Reactors appear stable.

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# DOE/NNSA Response

## ◇ Command, Control, Coordination:

- **Nuclear Incident Team (NIT):** Coordinating overall emergency response
- **Policy Working Group (PWG):** Coordinating overall policy
- **Senior Energy Official:** Primary Manager of deployed field teams
- **Liaisons:** DART, USPACOM, USAID, NRC

## ◇ Modeling

- **National Atmospheric Release Advisory Center (NARAC):** conducting predictive radioactive atmospheric dispersion modeling

## ◇ Monitoring and Sampling

- **Consequence Management Response Team (CMRT):** Conducting ground monitoring, air sampling and initial results analysis
- **Aerial Monitoring System (AMS):** Conducts aerial detection for mapping radiological ground material deposits

## ◇ Assessment

- **Consequence Management Home Team (CMHT):** Scientific assessment of data updated daily from ground measurements and AMS flights

## ◇ Medical Consultation

- **Radiation Emergency Assistance Center/Training Site (REAC/TS):** Providing medical advice about radiological exposure

## Deployed (41)

### Yokota AB

- (1) SEO
- (28) CMRT
- (5) AMS

### US Embassy Tokyo

- (2) Foreign Service Nationals
- (2) Permanent Staff
- (1) DART LNO
- (1) Nuclear Energy Representative

### USPACOM HQ

- (1) LNO

\* Additional DOE personnel departing 22 MAR2011

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# Operations Over Past 24 Hrs.

## ♦ Modeling

- NARAC: Produced predictive plume models for next 24 hours including two bounding cases for Tokyo and completion of west coast impacts table

## ♦ Field Monitoring

- AMS: Operations with rotary wing aircraft only due to inclement weather. Conducted aerial monitoring along Tokyo Bay to Yokosuka and back. Readings in area of previous anomalous Navy air sample were not above background.
- CMRT: Teams conducted monitoring missions south of incident site along Tohoku Expressway, at US Embassy (Tokyo), and to Yokosuka area

## ♦ Assessment

- CMRT and CMHT compiled DOE, Interagency, and Japan inputs to produce field measurement summary for last 24 hours

## ♦ Medical Consult

- Responded to 10 medical consult RFIs in past 48 hours

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# External Data Providers

## ◇ Japan

- Ministry of Foreign Affairs (MOFA)
- Ministry of Education, Culture, Sports, Science, and Technology (MEXT)
- Tokyo Electric Power Company (TEPCO)
- Nuclear Safety Technology Center (NUSTEC)

## ◇ United States

- Japan Emergency Command Center, US Embassy, Tokyo
- USAF, BSC Commander
- Futenma Marine Corps Air Station
- Nuclear Regulatory Commission

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# Guide to Interpretation

## Derived Response Levels (DRL)

### ◇ Early Phase DRL

- If a person is in danger of receiving an external radiation dose of 1 Rem over 4 days, the EPA recommends evacuation until radiation levels decrease. This area is indicated in red.

### ◇ First Year DRL

- If a person is in danger of receiving an external radiation dose greater than 2 Rem during the first year, the EPA recommends relocation until radiation levels decrease. This is not an urgent action because the dose is received over a full year. This area is indicated in orange.

### ◇ Fifty Year DRL

- If a person is in danger of receiving an external radiation dose greater than 5 Rem over 50 years, the EPA recommends relocation until radiation levels decrease. This is not an urgent action because the dose is received over fifty years. This area is indicated in yellow.

### ◇ Second Year DRL

- If a person is in danger of receiving an external radiation dose of greater than 0.5 Rem in a the second year (or any subsequent year), the EPA recommends relocation until radiation levels decrease. This area is indicated in green.

These calculations account for multiple variables. For instance, radiation is most intense in the first days following its release therefore dose reduction may be met by evacuating early in the response.

Protective actions are frequently expressed in dose rates. The dose rate is an indicator that residents would accumulate the threshold dose if they stayed in the area the entire time expressed (e.g. 1 year, 2 years, 50 years)

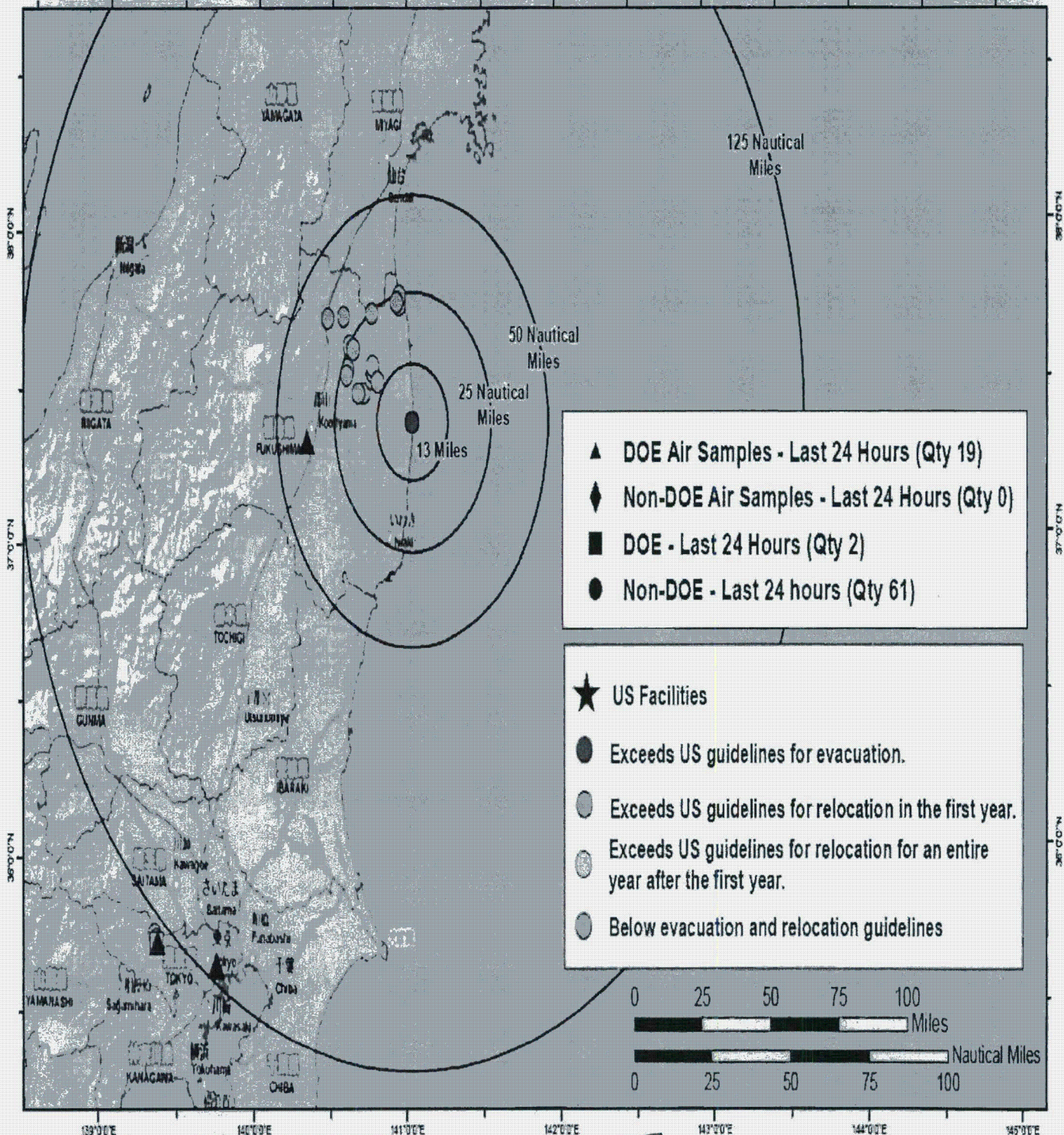
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# Field Monitoring Results Last 24 Hours

## FUKUSHIMA DAIICHI JAPAN



Map created on 03222011 1720 JST  
Name: NIT Last24HrsMonitoringResults 22Mar2011 v5

Official Use Only

Nuclear Incident Team DOE NIT  
Contact (202) 586 - 8100

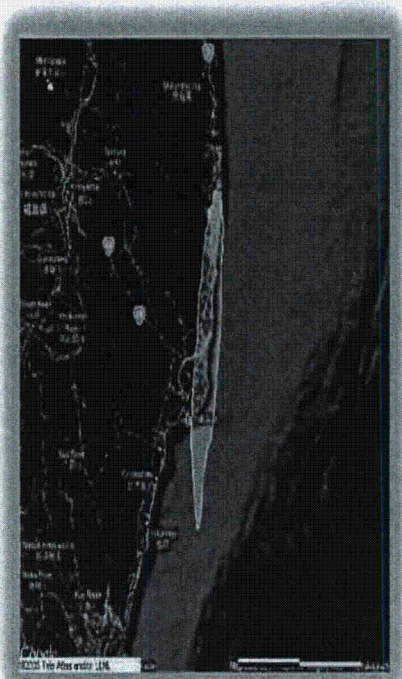




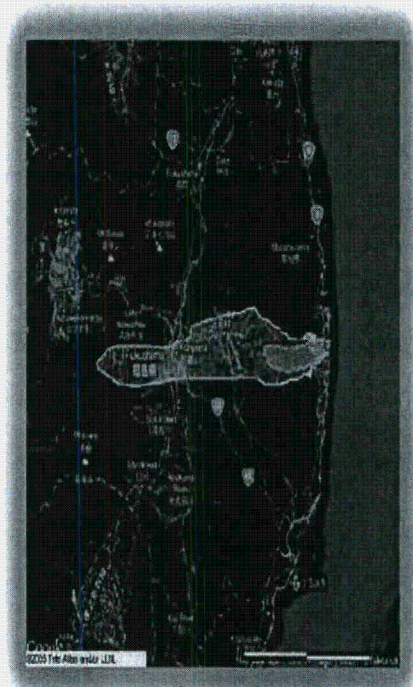
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# Forecasted Weather March 22-23

- ♦ Wind is predicted to be from East from 1000-1500 UTC with intermittent precipitation forecasted



0300 UTC 23 MAR



1000 UTC 22 MAR

- ♦ Wind is predicted to shift to a North-South trajectory from 1600 UTC 22 Mar to 0300 UTC 23 Mar with cloudcover

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# Planned Operations: Next 24 Hrs

## ♦ Field Monitoring

- AMS: Operations planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas
- CMRT: Ground monitoring along Joban Expressway north to Ibaraki Prefecture (Mito), Potential joint operations with USMC monitoring team

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## **DEPARTMENT OF ENERGY SITUATION REPORT**

### **Earthquake & Tsunami in Japan**

22 March 2011

0600 (EDT) UPDATE

#### **POWER PLANT UPDATE AND OTHER NUCLEAR ISSUES**

**Summary:** Summary of information received as of 0600 (EDT) 22 March from the NRC, Embassy-Tokyo, IAEA Incident and Emergency Center, TEPCO, METI, NISA, Japan Atomic Industrial Forum, Nuclear Energy Institute, and media outlets. (NOTE: JST = EDT + 13 hours; EDT = GMT/UTC - 4 hours).

According to the NRC SITREP 1800 (EDT) 20 March, the Japanese Ministry of Defense (MOD) has assumed the lead role in Japanese response activities. TEPCO is now in an advisory role to MOD.

MOD announced that the Self-Defense Force helicopter measured the surface temperatures of Fukushima Dai-ichi from the air and found that, as of the afternoon of 20 March (EDT), the temperature of each unit's are below 100 degrees Celsius. The temperatures are as follows: Unit 1: 58 °C; Unit 2: 35 °C; Unit 3: 62 °C; Unit 4: 42 °C; Unit 5: 24 °C; Unit 6: 25 °C.

**Smoke from Units 2 and 3:** Reported by Kyodo News, 21 March 2011. Work to connect power cables to the No. 3 and No. 4 reactors was halted Monday at the Fukushima Daiichi nuclear power plant, after smoke rose from the buildings housing the No. 2 and No. 3 reactors, the plant operator said.

TEPCO said it had briefly evacuated its workers after grayish and blackish smoke was spotted at the southeast of the No. 3 reactor building around 3:55 p.m. (0255 EDT, 21 March 2011) above a pool storing spent nuclear fuel, though a blast was not heard. The smoke stopped after 6 p.m. (0500 EDT), but TEPCO subsequently found that white smoke was rising through a crack in the roof of the building that houses the No. 2 reactor at around 6:20 p.m. (0520 EDT). The utility said later the smoke is believed to be steam, not from the reactor's fuel pool.

The Tokyo Fire Department stopped spraying water for the day after the smoke rose from the No. 3 reactor building. It will suspend the operation until safety at the site is confirmed, it said, adding whether it will resume on Tuesday remains undecided at present. As Unit 3 remains without power, smoke was not apparently triggered by an electrical fault.

At 3:28PM (JST) March 22, firefighters resumed spraying water at the building housing Unit 3 according to Japanese public broadcaster NHK. Concrete pumpers expected to pour water on building housing unit 4 to fill spent fuel pool.

According to a Reuters news report at 2151 (EDT) 21 March, TEPCO said it has resumed work on Tuesday restoring power to units, 1,2, 3, and 4 after checking that the smoke seen earlier from the reactors had turned to steam.

**Updates for cooling efforts at Dai-ichi spent fuel pools:** Pumping equipment which utilizes a 50 meter articulating boom and associated pumps are being delivered to the site to assist with water distribution. Use of such equipment will greatly improve the amount of water delivered to critical locations within the pool.

The IAEA confirmed on 20 March (EDT) that the temperature in pools 5 and 6 had decreased significantly.

Per NRC Emergency Operations Center (EOC) status of 1800 21 Mar, NRC continues to work with other Federal agencies to deliver temporary cooling equipment to the Daiichi site. An initial shipment of equipment arrived in Japan at 1600 EDT on March 21. A second shipment is scheduled to arrive in Japan at 0400 EDT on March 22.

**Updates on electrical power restoration efforts:** According to an ABC news report at 0430 (EDT) 21 March, TEPCO reports that power has been restored in some capacity to all reactors. NHK Press confirms this report for Units 1, 2, 5 and 6. Further distribution of power into the units will be made following equipment inspections. According to TEPCO, two diesel generators at unit 6 are running, and that there is now enough power available to units 5 and 6 to operate the residual heat removal system pumps. Per IAEA, Power supply for unit 5 was switched from diesel generator to external power supply. Per IAEA update, work for laying electricity cable to power center for both Unit 3 and Unit 4 completed March 21, 2011

**Plant Design Standards:** NHK broadcasting network reported that Tokyo Electric Power Co. confirmed that the March 11 earthquake and tsunami were beyond the Fukushima Daiichi plant's design standards. TEPCO believes the tsunami that inundated the Fukushima Daiichi site was 14 meters high. The design basis tsunami for the site was 5.7 meters, and the reactors and backup power sources were located 10 to 13 meters above sea level. The company reported that the maximum earthquake for which the Fukushima Daiichi plants were designed was magnitude 8. The quake that struck March 11 was magnitude 9.

**Update on DOE efforts on Aerial Measurements:** One helicopter mission occurred on 22 Mar. The fixed wing aircraft was grounded due to local cloud cover. Within the next 24 hours with weather permitting, operations are planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas. The team will begin planning for three aircraft missions per day in an anticipation of additional capability. In total, AMS has flown 13 flights, 7 rotary wing and 6 fixed wing.

**NISA Updates on Temporary Ratings on the International Nuclear and Radiological Event Scale (INES):** The scale ranges from Level 0 (no safety significance, normal operations) to Level 7 (major accident). (Three Mile Island was a Level 5 event.) As of 19 March (EDT), NISA's revised rating for Fukushima Units 1, 2, and 3 was Level 5. NISA's revised rating for Fukushima Unit 4 was Level 3. Units 5 and 6 are at Level 0.

**Radiation Levels:** On 20 March (EDT), the Nuclear Energy Institute (NEI) reported that dose rate near Unit 3 and 4 are declining (was 40-rem/hr, now 15-rem/hr). Dose rate near Unit 5 and 6 are 0.1-rem/hr. Dose rates near the power block range from 1 to 5-rem/hr. The site access gate, which is about 1220 meters (4000 feet) from the plant, was 0.060-rem/hr. A dose rate of 0.012-rem/hr was recorded at a point 20-km (12.4 miles) inland from the plant. All other dose rates at 20 to 40 km (12.4 – 24.8 miles) from the plant are marginally above background. NARAC conducting continuous predictive plume modeling including two bounding cases for Tokyo and completion of west coast impacts table. There have been no major changes in the radiation levels at the site.

Japan's government has halted shipment of raw milk from the Fukushima prefecture and told a total of four prefectures near the stricken plant to hold shipments of spinach and other leafy green plants. Monitoring results of a few dairy and agricultural products such as milk in Fukushima and spinach in Ibaraki prefectures exceeded the national regulatory standard. The World Health Organization (WHO) issued information on food safety, after reports that some food in Japan has been contaminated with radiation.

TEPCO has reported elevated levels of radioactivity in sea water samples taken near the Fukushima Daiichi nuclear power plant. materials. Iodine 131 was 126.7 times higher than the legal level, cesium 134 was 24.8 higher, and cesium 137 was 16.5 times higher.

**Fukushima Dai-ichi Unit 1 reactor (NRC priority 4):** Per the NRC (quoting various sources), as of 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, periodic water spraying of the spent fuel pool continues. Japan's Self Defense Forces (SDF) sprayed 80 tons of water to cool the storage pool for spent nuclear fuel at the unit 4. The water level remains stable, core damage is undermined, and no cooling water has leaked to the reactor containment vessel.

Per NRC EOC status of 1800 on March 21, the Reactor Cooling System (RCS) pressure is 2.97 atmospheres; seawater injected to cool core; Primary containment is functional; drywell pressure is 1.6 ATM; secondary containment lost; spent fuel (292 bundles) water level unknown. Offsite power line connected to local substation, power restoration ongoing.

Per JAIF, 1700 (HST) 21 March: Reactor parameters appear stable (pressure - 0.176-MPa gauge (depressurized), water level - 1.75 meters below the top of the fuel rods, containment vessel - 0.16-MPa (abs). Previous estimate of fuel rod damage was at 70%.



**Fukushima Dai-ichi Unit 2 reactor (NRC priority 3):** Per NRC (quoting various sources), 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, injection of 40 tons of seawater into the spent fuel pool commenced. The water level remains stable and no cooling water has leaked to the reactor containment vessel. TEPCO reports power has been restored and electric water pump injection systems are being tested for damage.

Per NRC EOC status of 1800 on March 21, RCS pressure is 0.8 ATM; seawater injected to cool core; Primary containment has possible Torus damage; the drywell pressure is 1.25 atmospheres according to the IAEA on 20 March. Secondary containment has hole cut in side of fuel floor metal to reduce hydrogen buildup, steam is coming from hole; spent fuel (587 bundles). 40 tons of water sprayed into SFP. Offsite power restored to load-side power panel; condition of pump motors and instrumentation is unknown due to equipment environment. TEPCO has outside power to Auxiliary Transformer.

Per JAIF, 1700 (JST) 21 March: Reactor parameters appear stable (pressure – 0.024-MPa (gauge) (depressurized), water level - 1.35 meters below the top of the fuel rods, containment vessel – 0.12-MPa (abs). Previous estimate of fuel rod damage was at 33%.

**Fukushima Dai-ichi Unit 3 reactor (NRC priority 1):** Per the NRC (quoting various sources), as of 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, periodic water spraying of the spent fuel pool continues. The water level remains stable and no cooling water has leaked to the reactor containment vessel. Pressure has stabilized and venting measures are not necessary. Within two hours, TEPCO reported that Unit 3 pressure had stabilized and the venting was not necessary. Key print media outlets (NYT & WAPO) picked up the venting announcement, but not the updated decision. Had venting proceeded, gases would have been vented into the suppression pool inside the primary containment to prevent any radioactive material from being released. TEPCO reports local substation power connection efforts are underway.

Per Nuclear and Industrial Safety Agency report on Seismic Damage Information as of 1030 21 March 2011, water spray over the spent fuel pool by Hyper Rescue Unit of Tokyo Fire Department was started at 2139 JST, 20 March 2011 (0839 EDT, 20 March 2011) and finished at 0358 JST, 21 March 2011 (1458 EDT, 20 March 2011).

Per NRC EOC status of 1800 (EDT) on March 21, the RCS pressure is 0.4 ATM; radiation has been released, seawater is still being injected to cool the core. Primary containment status is 1.2 atmospheres (std), the secondary containment has been lost, and visible “white smoke” has been interpreted by NRC as steam. SFP has 514 bundles in the pool; water sprayed from ground several times. Cumulative water sprayed into the pool is 3,742 tons (IAEA).

Per JAIF, 1700 (JST) 21 March: Reactor parameters appear stable (pressure - 0.088-MPa (gauge) (depressurized), water level - 1.8 meters below the top of the fuel rods, containment vessel - 0.11-MPa (abs). (0.340-MPa (abs) at 1530 (EDT) March 19 (0430 JST March 20).

**Fukushima Dai-ichi Unit 4 reactor (NRC priority 2):** Per NRC (quoting various sources), as of 1800 (EDT) 21 March: Core offloaded; RCS - Not applicable; Primary containment - Not applicable; Secondary containment - lost, visible "white smoke" interpreted by NRC as steam; Spent fuel (1201 to 1331 bundles). Concrete pumpers expected to pour water on reactor building to fill spent fuel pool. Previous updates reported pool may be dry, damage to fuel rods suspected. Cumulative water sprayed into the pool is 255 tons (IAEA).

Per the 21 March DHS and IAEA reports, Periodic spraying of the SFP continues. The water level remains stable and no cooling water has leaked to the reactor containment vessel. TEPCO reports finished laying cables to transmit electricity to unit 4, as a step toward resuscitating the power systems at unit 3 and 4. Per NRC update, work for laying electricity cable to power center completed at ~0200 EDT March 21, 2011 (source: NISA).

Per Nuclear and Industrial Safety Agency report on Seismic Damage Information as of 1030 21 March 2011, water spray over the spent fuel pool by Self-Defence Force (13 fire engines was started around 0637 JST, 21 March 2011 (1737 EDT, 20 March 2011), and finished at 0841 JST, 21 March 2011 (1941 EDT, 20 March 2011)

An earlier report suggested that an explosion had damaged the Unit 4 reactor building, exposing used fuel. The SFP may have been damaged during the explosion, and the ability of the pond to retain water for a significant period is in doubt.

According to NEI, water spraying activities were concluded just before 0700 (EDT) 20 March. Japan's defense ministry reported that most of the 100 tons of water that the Self Defense Force discharged reached inside the reactor building. No information on water level is available for Unit 4 SFP.

**Fukushima Dai-ichi Unit 5 reactor (NRC priority 5):** As 0130 (EDT) 20 March (1430 (JST) 20 March), Unit 5 declared in cold shutdown (reactor temperature less than 100 °C). Per NRC quoting various sources), 1800 (EDT) 21 March: Shutdown since 3 January 2011. Core in RPV; spent fuel (950 bundles). Unit 5 was in a refueling outage at the time of the earthquake.

Per the 21 March DHS and IAEA reports, reactor achieved cold shutdown conditions. The Residual Heat Removal (RHR) system was restarted and is providing cooling water to the reactor. Pumps are operating intermittently and result in some fluctuations in temperature and pressure. Power is supplied from Unit 6 diesel generators. Reactor parameters appear stable.

Per NRC EOC status of 1800 on March 21, core in RPV, 4.32 ATM, level plus 164 cm above top of active fuel. SFP: 950 bundles, temperature 42C (from IAEA update). Unit 6 emergency diesel generator is available and supplying power to units 5 and 6. Ventilated the rooftop of reactors to release hydrogen and prevent explosions; pump for residual heat removal started up and cooling of spent fuel storage pool has started using power supply from diesel generator of unit 6, switched to external power supply 2236 EDT March 20.

As a result of restarting the Residual Heat Removal (RHR) pump (C), cooling to the SFP has resulted in lowering its temperature from 68.7-C at 0600 (EDT) 19 March 19 to 42.3°C at 1700 (JST) 21 March. Pumps are operating intermittently resulting in fluctuations in temperature and pressure. Power is supplied from Unit 6 EDG.

**Fukushima Dai-ichi Unit 6 reactor (NRC priority 6):** As of 0627 (EDT) 20 March (1927 (JST) 20 March), Unit 6 declared in cold shutdown (reactor temperature less than 100 °C). Per NRC quoting various sources), 1800 (EDT) 20 March: Shutdown since 14 August 2010 for refueling. Core in RPV at 7.94 atmospheres (according to the IAEA on March 20); spent fuel (876 bundles), temperature 66-C, two emergency diesels generator are available to supply power.

Per the 21 March DHS and AIEA reports, Reactor achieved cold shutdown conditions. Two diesel generators are running and powering the pumps. Cooling of the reactor cores continues. Reactor parameters appear stable.

Per NISA, 1700 (JST) March 21: Reactor parameters appear stable (pressure – 0.716-MPa (depressurized), water level is 1.56 meters above the top of the fuel. The reactor temperature is 67°C. Pumps are operating intermittently resulting in some fluctuations in temperature and pressure.

Cooling function of the Unit 6 SFP was restored at 2200 (EDT) 19 March. The pool temperature at restart was 67°C and lowered to 36.5°C at 1700 (JST) on 21 March.

Holes have been made in the roof to provide a vent path to reduce the potential for a hydrogen explosion. No new update from NRC EOC status of 1800 on March 21.

**Common Spent Fuel Pool:** 6,000 bundles (Source: GEH) maintained at 57 C located on land side of Unit 4. Water spray started 2137 EDT March 20 (Source: NISA).

**Fukushima Dai-ichi Units 1-4:** TEPCO confirmed cold shutdown and continued cooling of reactor cores.

#### **Summary of Conditions at Fukushima Daiichi Nuclear Power Plant – 1700 (EDT) 20 March**

From the IAEA website:

<http://www.iaea.org/newscenter/news/tsunamiupdate01.html>



LEGEND    No Immediate Concern    Concern    Severe Condition

Unit	1	2	3	4	5	
Power (MWe/th)	460/1380	784/2381	784/2381	784/2381	784/2381	11
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BW
Status at Time of Event	In service – auto shutdown following earthquake			Shut down for outage before earthqu		
Core and Fuel	Damaged			No fuel rods	Cold shutdown	
Containment Integrity	No damage reported	Damage suspected	No information	Outage configuration	No damage expected	
Off-site Power	Substation connected	Power center (in line) connected	Not available		Not available	
Diesel Generators	Not available				Two emergency die generators powerin and 6	
Building	Severe damage	Slight damage	Severe damage		No damage reported	
Water Level in Reactor Pressure	About half of fuel assembly (stable)			Outage	Above fuel	

#### Aerial Measurements Update:

- ♦ DOE Team AMS Operations 22 March 2011 (JST)
  - Helicopter mission down the west side of Tokyo Bay to Yokosuka, of the east side of the bay then serpentine north up over Chiba to around Mito
  - C-12 mission grounded due to local cloud cover
  - Within the next 24 hours with weather permitting, operations planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas.
  - Begin planning for three aircraft missions per day in an anticipation of additional capability.
  - In total, AMS has flown 13 flights
    - 7 Rotary wing
    - 6 Fixed wing
  - Dosimeter readings for the deployed teams averaged 2 mR for a total of 4 personnel; maximum reading was 3.3 mR.

#### News Reports

Secretary Chu appeared on several morning news programs on 20 March 2011, including Fox News Sunday and CNN's "State of the Union":

<http://www.businessweek.com/news/2011-03-20/japan-atomic-crisis-eases-as-u-s-says-worst-may-be-over.html>

Japan Atomic Crisis Eases as Spent-Fuel Pools Cool Below 100 Degrees Celsius:

<http://www.bloomberg.com/news/2011-03-21/japan-s-nuclear-crisis-eases-as-spent-fuel-pools-cool-below-boiling-point.html>



**IAEA Board of Governors Meeting:** From IAEA.org. On Monday, 21 March 2011 at 10:00 UTC (0500 EDT) the 35-state IAEA Board of Governors convened a special meeting to discuss the report of Director General (DG) Yukiya Amano's recent visit to Japan.

Amano reported that the Incident and Emergency Center (IEC) was immediately activated following the earthquake and tsunami, and added that the Agency has provided daily briefings for member states and the press since March 14 to report on developments in Japan. The DG met with the Japanese Prime Minister, Foreign Minister, and senior reps from METI, TEPCO and NISA, and offered support from the IAEA as well as over a dozen member states. The DG also noted that he encouraged increased information sharing between the Government of Japan and the IAEA. The DG reported that the Agency has also dispatched a radiation monitoring team, dispatched a senior officer to Japan to coordinate assistance, appointed two liaison officers to work with NISA 24/7, and plans to dispatch additional staff to assist with radiation monitoring.

#### **OTHER NUCLEAR ISSUES**

No new information in this report.

#### **DOE ASSESSMENT**

[Factored into reactor summaries]

#### **REQUESTS FOR US ASSISTANCE**

No new information in this report.

#### **ENERGY INFRASTRUCTURE:**

No new information in this report.

#### **CONTACTS WITH JAPANESE OFFICIALS**

No new information in this report.

#### **QUESTIONS BEING WORKED:**

A concise timeline of events at Fukushima reactors 1-6 is being developed.

The following request came in from DOS asking for assistance. We are working a response.

The Permanent Mission of Japan, through the IAEA Incident and Emergency Centre, is seeking information about the following capabilities in your countries:

1. Unmanned remotely controlled aerial vehicle for the aerial radiological survey
2. Robots for the work in the high dose rate areas
3. Unmanned remotely controlled ground vehicles for carrying equipment in the high dose rate areas
4. We would appreciate if you could provide the following information is required for three above mentioned categories:
  - Technical details of the above mentioned equipment (including specifications)
  - What is the possible availability of this equipment, and
  - When it would be possible to dispatch this equipment, if requested

**CONTACT INFORMATION:**

**Debra Wilbur will depart for Japan on March 22 to interface with the US DOE and Japanese response organizations to improve coordination.**

**Nuclear Incident Team in the Emergency Operations Center  
([NITOPS@NNSA.DOE.GOV](mailto:NITOPS@NNSA.DOE.GOV)) - 202-586-8100**

**Office of the Deputy Secretary 202-586-5500**

**Watch Schedule:**

Mark Whitney            0800/22 Mar – 1600/22 Mar  
Thomas Robinson  
Rich Reister

Dave Huizenga            1600/22 Mar – 2400/22 Mar  
Heather Looney  
Craig Welling

Lew Steinhoff            0000/23 Mar – 0800/23 Mar  
Karyn Durbin

Jim McConnell,            0800/23 Mar – 1600/23 Mar  
Mike Marthaler

Doug Fremont,            0800/23 Mar – 1600/23 Mar  
Maegan Barlow

**From:** Sheron, Brian  
**To:** HOO Hoc  
**Subject:** FW: Japanese Earthquake 22 March 2011 0600 EDT Situation Report  
**Date:** Tuesday, March 22, 2011 9:05:00 AM  
**Attachments:** Japan Earthquake Response 03222011 0600.ppt  
SITREP MAR22 0600 final.docx  
**Importance:** High

---

Please forward to ET Director. I'm not sure if we get these updates from DOE.

-----Original Message-----

**From:** Adams, Ian [<mailto:Ian.Adams@Hq.Doe.Gov>]  
**Sent:** Tuesday, March 22, 2011 9:02 AM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Brinkman, Bill; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Per Peterson; Rolando Szilard; Steve Fetter  
**Subject:** Japanese Earthquake 22 March 2011 0600 EDT Situation Report  
**Importance:** High

Attached please find this morning's Japan sit rep.

This information should not be shared or further distributed.

-----Original Message-----

**From:** NITOPS  
**Sent:** Tuesday, March 22, 2011 6:02 AM  
**To:** (b)(6)

(b)(6)

CH/199

Whitney, Mark; Wright, Rasheem

Subject: Japanese Earthquake 22 March 2011 0600 EDT Situation Report

Importance: High

Please find attached the latest DOE SITREP regarding the ongoing earthquake and tsunami response in Japan.

This information is provided for your internal use and should be shared only with those who have a need to know.

The SITREP will be updated every 12 hours.

Nuclear Incident Team (NIT)

Office of Emergency Response (NA-42)

National Nuclear Security Administration U.S. Department of Energy nitops@nnsa.doe.gov

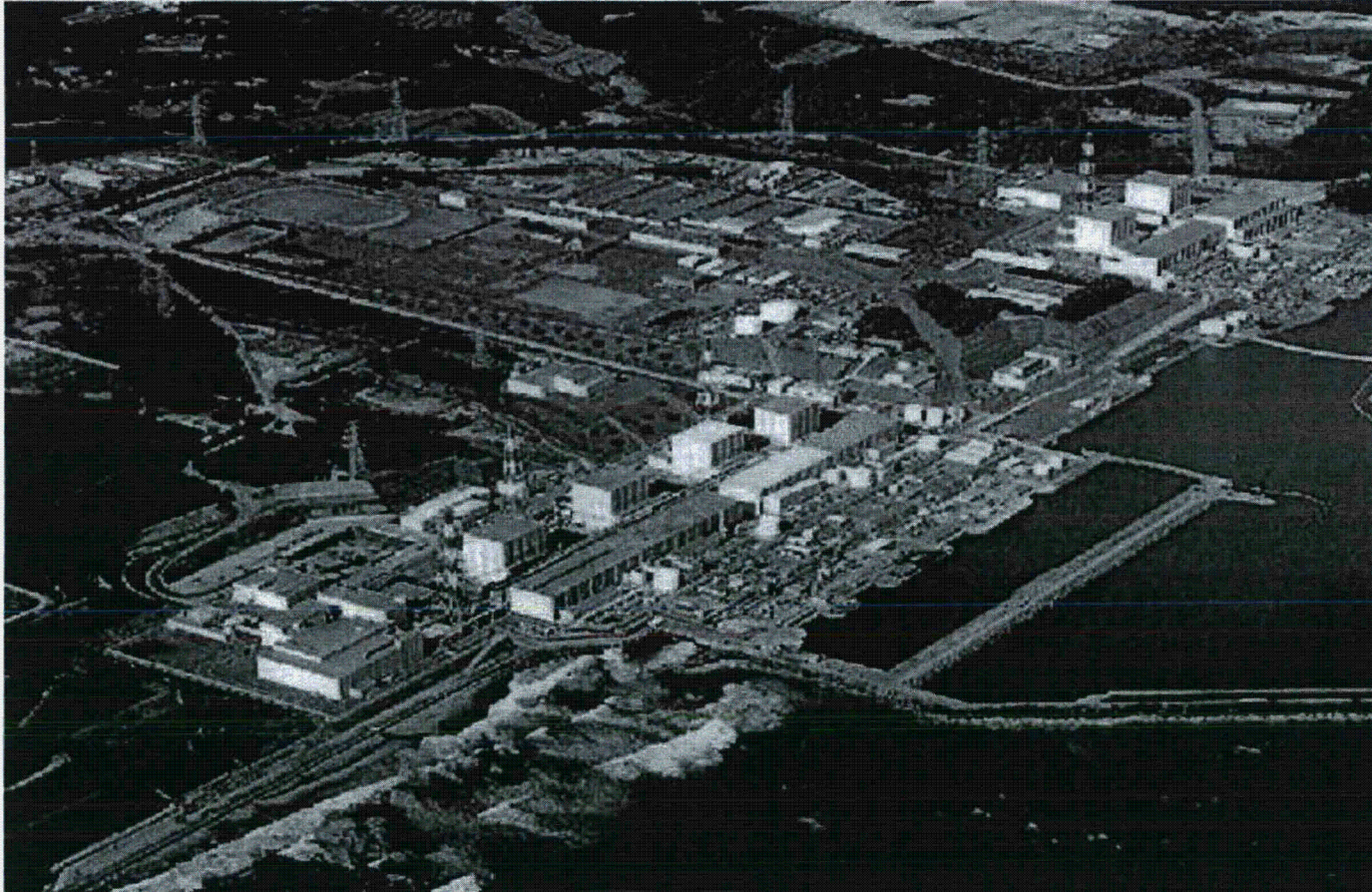
nit@doe.gov 202-586-8100





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# Japan Earthquake Response March 22, 2011 // 0600 EDT



Official Use Only



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**This information is for limited  
distribution to those with a  
NEED TO KNOW  
and should not be forwarded outside  
your agency or organization without  
prior clearance from U.S. DOE**

**Contact: DOE/NNSA Nuclear Incident  
Team: NITOPS@nnsa.doe.gov**

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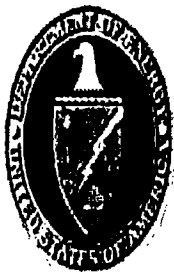


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# Current Status

- ◆ No major changes in radiation levels at the Fukushima Daiichi Nuclear Power Plant
  - **Unit 1:** Reactor water level stable, core damage est. 70%. Seawater injection continues. Electrical power line connected. Spraying continues on spent fuel pool.
  - **Unit 2:** Reactor water level stable, core damage est. 33%. Seawater injection continues. Power restored and electric water pump systems being tested.
  - **Unit 3:** Reactor water level stable and pressure stabilized. Spraying on spent fuel pool continues. Power connection efforts underway.
  - **Unit 4:** Concrete pumpers expected to pour water on reactor building to fill spent fuel pool. Power connection efforts underway.
  - **Units 5 & 6:** Diesel generators supplying power to cooling system. Reactors appear stable.

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# DOE/NNSA Response

## ◇ **Command, Control, Coordination:**

- **Nuclear Incident Team (NIT):** Coordinating overall emergency response
- **Policy Working Group (PWG):** Coordinating overall policy
- **Senior Energy Official:** Primary Manager of deployed field teams
- **Liaisons:** DART, USPACOM, USAID, NRC

## ◇ **Modeling**

- **National Atmospheric Release Advisory Center (NARAC):** conducting predictive radioactive atmospheric dispersion modeling

## ◇ **Monitoring and Sampling**

- **Consequence Management Response Team (CMRT):** Conducting ground monitoring, air sampling and initial results analysis
- **Aerial Monitoring System (AMS):** Conducts aerial detection for mapping radiological ground material deposits

## ◇ **Assessment**

- **Consequence Management Home Team (CMHT):** Scientific assessment of data updated daily from ground measurements and AMS flights

## ◇ **Medical Consultation**

- **Radiation Emergency Assistance Center/Training Site (REAC/TS):** Providing medical advice about radiological exposure

### **Deployed (41)**

#### **Yokota AB**

- (1) SEO
- (28) CMRT
- (5) AMS

#### **US Embassy Tokyo**

- (2) Foreign Service Nationals
- (2) Permanent Staff
- (1) DART LNO
- (1) Nuclear Energy Representative

#### **USPACOM HQ**

- (1) LNO

\* Additional DOE personnel departing 22 MAR2011

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# Operations Over Past 24 Hrs.

## ◇ Modeling

- NARAC: Produced predictive plume models for next 24 hours including two bounding cases for Tokyo and completion of west coast impacts table

## ◇ Field Monitoring

- AMS: Operations with rotary wing aircraft only due to inclement weather. Conducted aerial monitoring along Tokyo Bay to Yokosuka and back. Readings in area of previous anomalous Navy air sample were not above background.
- CMRT: Teams conducted monitoring missions south of incident site along Tohoku Expressway, at US Embassy (Tokyo), and to Yokosuka area

## ◇ Assessment

- CMRT and CMHT compiled DOE, Interagency, and Japan inputs to produce field measurement summary for last 24 hours

## ◇ Medical Consult

- Responded to 10 medical consult RFIs in past 48 hours

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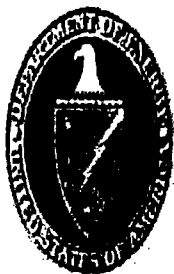
# External Data Providers

## ♦ Japan

- Ministry of Foreign Affairs (MOFA)
- Ministry of Education, Culture, Sports, Science, and Technology (MEXT)
- Tokyo Electric Power Company (TEPCO)
- Nuclear Safety Technology Center (NUSTEC)

## ♦ United States

- Japan Emergency Command Center, US Embassy, Tokyo
- USAF, BSC Commander
- Futenma Marine Corps Air Station
- Nuclear Regulatory Commission



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# Guide to Interpretation

## Derived Response Levels (DRL)

### ◇ Early Phase DRL

- If a person is in danger of receiving an external radiation dose of 1 Rem over 4 days, the EPA recommends evacuation until radiation levels decrease. This area is indicated in red.

### ◇ First Year DRL

- If a person is in danger of receiving an external radiation dose greater than 2 Rem during the first year, the EPA recommends relocation until radiation levels decrease. This is not an urgent action because the dose is received over a full year. This area is indicated in orange.

### ◇ Fifty Year DRL

- If a person is in danger of receiving an external radiation dose greater than 5 Rem over 50 years, the EPA recommends relocation until radiation levels decrease. This is not an urgent action because the dose is received over fifty years. This area is indicated in yellow.

### ◇ Second Year DRL

- If a person is in danger of receiving an external radiation dose of greater than 0.5 Rem in a the second year (or any subsequent year), the EPA recommends relocation until radiation levels decrease. This area is indicated in green.

These calculations account for multiple variables. For instance, radiation is most intense in the first days following its release therefore dose reduction may be met by evacuating early in the response.

Protective actions are frequently expressed in dose rates. The dose rate is an indicator that residents would accumulate the threshold dose if they stayed in the area the entire time expressed (e.g. 1 year, 2 years, 50 years)

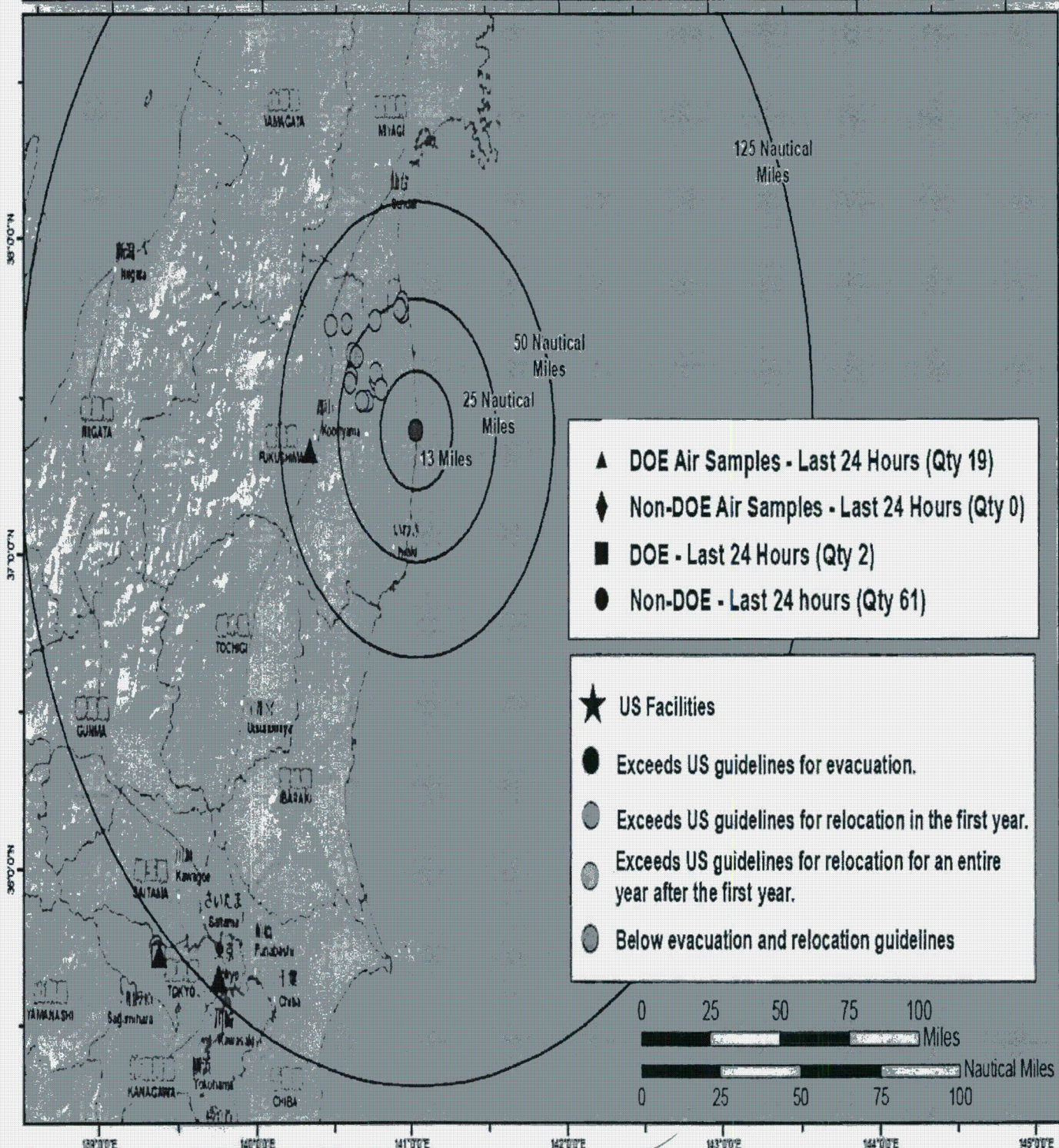
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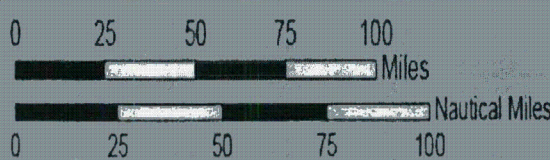
# Field Monitoring Results Last 24 Hours

## FUKUSHIMA DAICHI JAPAN



- ▲ DOE Air Samples - Last 24 Hours (Qty 19)
- ◆ Non-DOE Air Samples - Last 24 Hours (Qty 0)
- DOE - Last 24 Hours (Qty 2)
- Non-DOE - Last 24 hours (Qty 61)

- ★ US Facilities
- Exceeds US guidelines for evacuation.
- Exceeds US guidelines for relocation in the first year.
- Exceeds US guidelines for relocation for an entire year after the first year.
- Below evacuation and relocation guidelines



Map created on 03222011 1720 JST  
Name: NIT Last24HrsMonitoringResults 22Mar2011 v5

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Nuclear Incident Team DOE NIT  
Contact (202) 586 - 8100

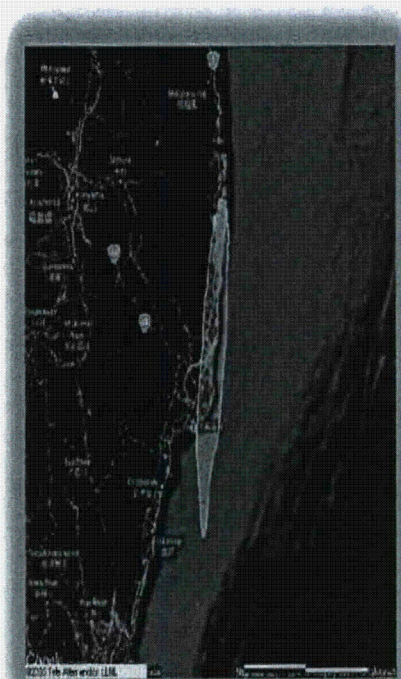




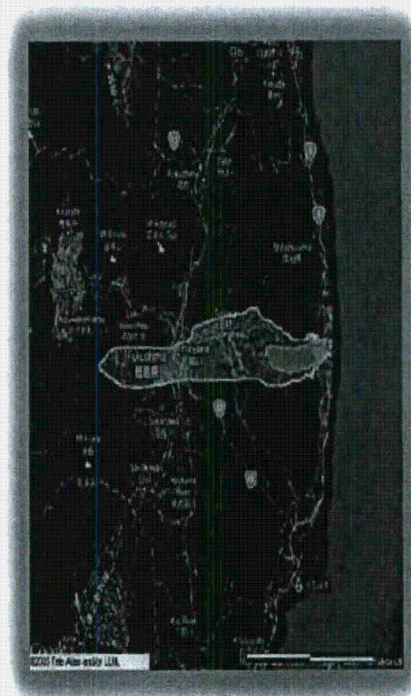
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# Forecasted Weather March 22-23

- ♦ Wind is predicted to be from East from 1000-1500 UTC with intermittent precipitation forecasted



0300 UTC 23 MAR



1000 UTC 22MAR

- ♦ Wind is predicted to shift to a North-South trajectory from 1600 UTC 22 Mar to 0300 UTC 23 Mar with cloudcover

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# Planned Operations: Next 24 Hrs

## ♦ Field Monitoring

- AMS: Operations planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas
- CMRT: Ground monitoring along Joban Expressway north to Ibaraki Prefecture (Mito), Potential joint operations with USMC monitoring team

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## **DEPARTMENT OF ENERGY SITUATION REPORT**

### **Earthquake & Tsunami in Japan**

22 March 2011

0600 (EDT) UPDATE

#### **POWER PLANT UPDATE AND OTHER NUCLEAR ISSUES**

**Summary:** Summary of information received as of 0600 (EDT) 22 March from the NRC, Embassy-Tokyo, IAEA Incident and Emergency Center, TEPCO, METI, NISA, Japan Atomic Industrial Forum, Nuclear Energy Institute, and media outlets. (NOTE: JST = EDT + 13 hours; EDT = GMT/UTC – 4 hours).

According to the NRC SITREP 1800 (EDT) 20 March, the Japanese Ministry of Defense (MOD) has assumed the lead role in Japanese response activities. TEPCO is now in an advisory role to MOD.

MOD announced that the Self-Defense Force helicopter measured the surface temperatures of Fukushima Dai-ichi from the air and found that, as of the afternoon of 20 March (EDT), the temperature of each unit's are below 100 degrees Celsius. The temperatures are as follows: Unit 1: 58 °C; Unit 2: 35 °C; Unit 3: 62 °C; Unit 4: 42 °C; Unit 5: 24 °C; Unit 6: 25 °C.

**Smoke from Units 2 and 3:** Reported by Kyodo News, 21 March 2011. Work to connect power cables to the No. 3 and No. 4 reactors was halted Monday at the Fukushima Daiichi nuclear power plant, after smoke rose from the buildings housing the No. 2 and No. 3 reactors, the plant operator said.

TEPCO said it had briefly evacuated its workers after grayish and blackish smoke was spotted at the southeast of the No. 3 reactor building around 3:55 p.m. (0255 EDT, 21 March 2011) above a pool storing spent nuclear fuel, though a blast was not heard. The smoke stopped after 6 p.m. (0500 EDT), but TEPCO subsequently found that white smoke was rising through a crack in the roof of the building that houses the No. 2 reactor at around 6:20 p.m. (0520 EDT). The utility said later the smoke is believed to be steam, not from the reactor's fuel pool.

The Tokyo Fire Department stopped spraying water for the day after the smoke rose from the No. 3 reactor building. It will suspend the operation until safety at the site is confirmed, it said, adding whether it will resume on Tuesday remains undecided at present. As Unit 3 remains without power, smoke was not apparently triggered by an electrical fault.

At 3:28PM (JST) March 22, firefighters resumed spraying water at the building housing Unit 3 according to Japanese public broadcaster NHK. Concrete pumps expected to pour water on building housing unit 4 to fill spent fuel pool.

According to a Reuters news report at 2151 (EDT) 21 March, TEPCO said it has resumed work on Tuesday restoring power to units, 1, 2, 3, and 4 after checking that the smoke seen earlier from the reactors had turned to steam.

**Updates for cooling efforts at Dai-ichi spent fuel pools:** Pumping equipment which utilizes a 50 meter articulating boom and associated pumps are being delivered to the site to assist with water distribution. Use of such equipment will greatly improve the amount of water delivered to critical locations within the pool.

The IAEA confirmed on 20 March (EDT) that the temperature in pools 5 and 6 had decreased significantly.

Per NRC Emergency Operations Center (EOC) status of 1800 21 Mar, NRC continues to work with other Federal agencies to deliver temporary cooling equipment to the Daiichi site. An initial shipment of equipment arrived in Japan at 1600 EDT on March 21. A second shipment is scheduled to arrive in Japan at 0400 EDT on March 22.

**Updates on electrical power restoration efforts:** According to an ABC news report at 0430 (EDT) 21 March, TEPCO reports that power has been restored in some capacity to all reactors. NHK Press confirms this report for Units 1, 2, 5 and 6. Further distribution of power into the units will be made following equipment inspections. According to TEPCO, two diesel generators at unit 6 are running, and that there is now enough power available to units 5 and 6 to operate the residual heat removal system pumps. Per IAEA, Power supply for unit 5 was switched from diesel generator to external power supply. Per IAEA update, work for laying electricity cable to power center for both Unit 3 and Unit 4 completed March 21, 2011

**Plant Design Standards:** NHK broadcasting network reported that Tokyo Electric Power Co. confirmed that the March 11 earthquake and tsunami were beyond the Fukushima Daiichi plant's design standards. TEPCO believes the tsunami that inundated the Fukushima Daiichi site was 14 meters high. The design basis tsunami for the site was 5.7 meters, and the reactors and backup power sources were located 10 to 13 meters above sea level. The company reported that the maximum earthquake for which the Fukushima Daiichi plants were designed was magnitude 8. The quake that struck March 11 was magnitude 9.

**Update on DOE efforts on Aerial Measurements:** One helicopter mission occurred on 22 Mar. The fixed wing aircraft was grounded due to local cloud cover. Within the next 24 hours with weather permitting, operations are planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas. The team will begin planning for three aircraft missions per day in an anticipation of additional capability. In total, AMS has flown 13 flights, 7 rotary wing and 6 fixed wing.

**NISA Updates on Temporary Ratings on the International Nuclear and Radiological Event Scale (INES):** The scale ranges from Level 0 (no safety significance, normal operations) to Level 7 (major accident). (Three Mile Island was a Level 5 event.) As of 19 March (EDT), NISA's revised rating for Fukushima Units 1, 2, and 3 was Level 5. NISA's revised rating for Fukushima Unit 4 was Level 3. Units 5 and 6 are at Level 0.

**Radiation Levels:** On 20 March (EDT), the Nuclear Energy Institute (NEI) reported that dose rate near Unit 3 and 4 are declining (was 40-rem/hr, now 15-rem/hr). Dose rate near Unit 5 and 6 are 0.1-rem/hr. Dose rates near the power block range from 1 to 5-rem/hr. The site access gate, which is about 1220 meters (4000 feet) from the plant, was 0.060-rem/hr. A dose rate of 0.012-rem/hr was recorded at a point 20-km (12.4 miles) inland from the plant. All other dose rates at 20 to 40 km (12.4 – 24.8 miles) from the plant are marginally above background. NARAC conducting continuous predictive plume modeling including two bounding cases for Tokyo and completion of west coast impacts table. There have been no major changes in the radiation levels at the site.

Japan's government has halted shipment of raw milk from the Fukushima prefecture and told a total of four prefectures near the stricken plant to hold shipments of spinach and other leafy green plants. Monitoring results of a few dairy and agricultural products such as milk in Fukushima and spinach in Ibaraki prefectures exceeded the national regulatory standard. The World Health Organization (WHO) issued information on food safety, after reports that some food in Japan has been contaminated with radiation.

TEPCO has reported elevated levels of radioactivity in sea water samples taken near the Fukushima Daiichi nuclear power plant. materials. Iodine 131 was 126.7 times higher than the legal level, cesium 134 was 24.8 higher, and cesium 137 was 16.5 times higher.

**Fukushima Dai-ichi Unit 1 reactor (NRC priority 4):** Per the NRC (quoting various sources), as of 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, periodic water spraying of the spent fuel pool continues. Japan's Self Defense Forces (SDF) sprayed 80 tons of water to cool the storage pool for spent nuclear fuel at the unit 4. The water level remains stable, core damage is undermined, and no cooling water has leaked to the reactor containment vessel.

Per NRC EOC status of 1800 on March 21, the Reactor Cooling System (RCS) pressure is 2.97 atmospheres; seawater injected to cool core; Primary containment is functional; drywell pressure is 1.6 ATM; secondary containment lost; spent fuel (292 bundles) water level unknown. Offsite power line connected to local substation, power restoration ongoing.

Per JAIF, 1700 (HST) 21 March: Reactor parameters appear stable (pressure - 0.176-MPa gauge (depressurized), water level - 1.75 meters below the top of the fuel rods, containment vessel - 0.16-MPa (abs). Previous estimate of fuel rod damage was at 70%.

**Fukushima Dai-ichi Unit 2 reactor (NRC priority 3):** Per NRC (quoting various sources), 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, injection of 40 tons of seawater into the spent fuel pool commenced. The water level remains stable and no cooling water has leaked to the reactor containment vessel. TEPCO reports power has been restored and electric water pump injection systems are being tested for damage.

Per NRC EOC status of 1800 on March 21, RCS pressure is 0.8 ATM; seawater injected to cool core; Primary containment has possible Torus damage; the drywell pressure is 1.25 atmospheres according to the IAEA on 20 March. Secondary containment has hole cut in side of fuel floor metal to reduce hydrogen buildup, steam is coming from hole; spent fuel (587 bundles). 40 tons of water sprayed into SFP. Offsite power restored to load-side power panel; condition of pump motors and instrumentation is unknown due to equipment environment. TEPCO has outside power to Auxiliary Transformer.

Per JAIF, 1700 (JST) 21 March: Reactor parameters appear stable (pressure – 0.024-MPa (gauge) (depressurized), water level - 1.35 meters below the top of the fuel rods, containment vessel – 0.12-MPa (abs). Previous estimate of fuel rod damage was at 33%.

**Fukushima Dai-ichi Unit 3 reactor (NRC priority 1):** Per the NRC (quoting various sources), as of 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, periodic water spraying of the spent fuel pool continues. The water level remains stable and no cooling water has leaked to the reactor containment vessel. Pressure has stabilized and venting measures are not necessary. Within two hours, TEPCO reported that Unit 3 pressure had stabilized and the venting was not necessary. Key print media outlets (NYT & WAPO) picked up the venting announcement, but not the updated decision. Had venting proceeded, gases would have been vented into the suppression pool inside the primary containment to prevent any radioactive material from being released. TEPCO reports local substation power connection efforts are underway.

Per Nuclear and Industrial Safety Agency report on Seismic Damage Information as of 1030 21 March 2011, water spray over the spent fuel pool by Hyper Rescue Unit of Tokyo Fire Department was started at 2139 JST, 20 March 2011 (0839 EDT, 20 March 2011) and finished at 0358 JST, 21 March 2011 (1458 EDT, 20 March 2011).

Per NRC EOC status of 1800 (EDT) on March 21, the RCS pressure is 0.4 ATM; radiation has been released, seawater is still being injected to cool the core. Primary containment status is 1.2 atmospheres (std), the secondary containment has been lost, and visible “white smoke” has been interpreted by NRC as steam. SFP has 514 bundles in the pool; water sprayed from ground several times. Cumulative water sprayed into the pool is 3,742 tons (IAEA).



Per JAIF, 1700 (JST) 21 March: Reactor parameters appear stable (pressure - 0.088-MPa (gauge) (depressurized), water level - 1.8 meters below the top of the fuel rods, containment vessel - 0.11-MPa (abs). (0.340-MPa (abs) at 1530 (EDT) March 19 (0430 JST March 20).

**Fukushima Dai-ichi Unit 4 reactor (NRC priority 2):** Per NRC (quoting various sources), as of 1800 (EDT) 21 March: Core offloaded; RCS – Not applicable; Primary containment – Not applicable; Secondary containment - lost, visible “white smoke” interpreted by NRC as steam; Spent fuel (1201 to 1331 bundles). Concrete pumpers expected to pour water on reactor building to fill spent fuel pool. Previous updates reported pool may be dry, damage to fuel rods suspected. Cumulative water sprayed into the pool is 255 tons (IAEA).

Per the 21 March DHS and IAEA reports, Periodic spraying of the SFP continues. The water level remains stable and no cooling water has leaked to the reactor containment vessel. TEPCO reports finished laying cables to transmit electricity to unit 4, as a step toward resuscitating the power systems at unit 3 and 4. Per NRC update, work for laying electricity cable to power center completed at ~0200 EDT March 21, 2011 (source: NISA).

Per Nuclear and Industrial Safety Agency report on Seismic Damage Information as of 1030 21 March 2011, water spray over the spent fuel pool by Self-Defence Force (13 fire engines was started around 0637 JST, 21 March 2011 (1737 EDT, 20 March 2011), and finished at 0841 JST, 21 March 2011 (1941 EDT, 20 March 2011)

An earlier report suggested that an explosion had damaged the Unit 4 reactor building, exposing used fuel. The SFP may have been damaged during the explosion, and the ability of the pond to retain water for a significant period is in doubt.

According to NEI, water spraying activities were concluded just before 0700 (EDT) 20 March. Japan’s defense ministry reported that most of the 100 tons of water that the Self Defense Force discharged reached inside the reactor building. No information on water level is available for Unit 4 SFP.

**Fukushima Dai-ichi Unit 5 reactor (NRC priority 5):** As 0130 (EDT) 20 March (1430 (JST) 20 March), Unit 5 declared in cold shutdown (reactor temperature less than 100 °C). Per NRC quoting various sources), 1800 (EDT) 21 March: Shutdown since 3 January 2011. Core in RPV; spent fuel (950 bundles). Unit 5 was in a refueling outage at the time of the earthquake.

Per the 21 March DHS and IAEA reports, reactor achieved cold shutdown conditions. The Residual Heat Removal (RHR) system was restarted and is providing cooling water to the reactor. Pumps are operating intermittently and result in some fluctuations in temperature and pressure. Power is supplied from Unit 6 diesel generators. Reactor parameters appear stable.

Per NRC EOC status of 1800 on March 21, core in RPV, 4.32 ATM, level plus 164 cm above top of active fuel. SFP: 950 bundles, temperature 42C (from IAEA update). Unit 6 emergency diesel generator is available and supplying power to units 5 and 6. Ventilated the rooftop of reactors to release hydrogen and prevent explosions; pump for residual heat removal started up and cooling of spent fuel storage pool has started using power supply from diesel generator of unit 6, switched to external power supply 2236 EDT March 20.

As a result of restarting the Residual Heat Removal (RHR) pump (C), cooling to the SFP has resulted in lowering its temperature from 68.7-C at 0600 (EDT) 19 March 19 to 42.3°C at 1700 (JST) 21 March. Pumps are operating intermittently resulting in fluctuations in temperature and pressure. Power is supplied from Unit 6 EDG.

**Fukushima Dai-ichi Unit 6 reactor (NRC priority 6):** As of 0627 (EDT) 20 March (1927 (JST) 20 March), Unit 6 declared in cold shutdown (reactor temperature less than 100 °C). Per NRC quoting various sources), 1800 (EDT) 20 March: Shutdown since 14 August 2010 for refueling. Core in RPV at 7.94 atmospheres (according to the IAEA on March 20); spent fuel (876 bundles), temperature 66-C, two emergency diesels generator are available to supply power.

Per the 21 March DHS and AIEA reports, Reactor achieved cold shutdown conditions. Two diesel generators are running and powering the pumps. Cooling of the reactor cores continues. Reactor parameters appear stable.

Per NISA, 1700 (JST) March 21: Reactor parameters appear stable (pressure – 0.716-MPa (depressurized), water level is 1.56 meters above the top of the fuel. The reactor temperature is 67°C. Pumps are operating intermittently resulting in some fluctuations in temperature and pressure.

Cooling function of the Unit 6 SFP was restored at 2200 (EDT) 19 March. The pool temperature at restart was 67°C and lowered to 36.5°C at 1700 (JST) on 21 March.

Holes have been made in the roof to provide a vent path to reduce the potential for a hydrogen explosion. No new update from NRC EOC status of 1800 on March 21.

**Common Spent Fuel Pool:** 6,000 bundles (Source: GEH) maintained at 57 C located on land side of Unit 4. Water spray started 2137 EDT March 20 (Source: NISA).

**Fukushima Dai-ichi Units 1-4:** TEPCO confirmed cold shutdown and continued cooling of reactor cores.

#### **Summary of Conditions at Fukushima Daiichi Nuclear Power Plant – 1700 (EDT) 20 March**

From the IAEA website:

<http://www.iaea.org/newscenter/news/tsunamiupdate01.html>



LEGEND	No Immediate Concern	Concern	Severe Condition
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Unit	1	2	3	4	5	
Power (MWe/th)	460/1380	784/2381	784/2381	784/2381	784/2381	11
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	8W
Status at Time of Event	In service – auto shutdown following earthquake			Shut down for outage before earthquake		
Core and Fuel	Damaged			No fuel rods	Cold shutdown	
Containment Integrity	No damage reported	Damage suspected	No information	Outage configuration	No damage expected	
Off-site Power	Substation connected	Power Center (in Unit) connected	Not available			Not available
Diesel Generators	Not available				Two emergency diesel generators powering and 6	
Building	Severe damage	Slight damage	Severe damage			No damage reported
Water Level in Reactor Pressure Vessel	About half of fuel assembly (stable)			Outage configuration	Above fuel	

#### Aerial Measurements Update:

- ♦ DOE Team AMS Operations 22 March 2011 (JST)
  - Helicopter mission down the west side of Tokyo Bay to Yokosuka, of the east side of the bay then serpentine north up over Chiba to around Mito
  - C-12 mission grounded due to local cloud cover
  - Within the next 24 hours with weather permitting, operations planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas.
  - Begin planning for three aircraft missions per day in an anticipation of additional capability.
  - In total, AMS has flown 13 flights
    - 7 Rotary wing
    - 6 Fixed wing
  - Dosimeter readings for the deployed teams averaged 2 mR for a total of 4 personnel; maximum reading was 3.3 mR.

#### News Reports

Secretary Chu appeared on several morning news programs on 20 March 2011, including Fox News Sunday and CNN's "State of the Union":

<http://www.businessweek.com/news/2011-03-20/japan-atomic-crisis-eases-as-u-s-says-worst-may-be-over.html>

Japan Atomic Crisis Eases as Spent-Fuel Pools Cool Below 100 Degrees Celsius:

<http://www.bloomberg.com/news/2011-03-21/japan-s-nuclear-crisis-eases-as-spent-fuel-pools-cool-below-boiling-point.html>



**IAEA Board of Governors Meeting:** From IAEA.org. On Monday, 21 March 2011 at 10:00 UTC (0500 EDT) the 35-state IAEA Board of Governors convened a special meeting to discuss the report of Director General (DG) Yukiya Amano's recent visit to Japan.

Amano reported that the Incident and Emergency Center (IEC) was immediately activated following the earthquake and tsunami, and added that the Agency has provided daily briefings for member states and the press since March 14 to report on developments in Japan. The DG met with the Japanese Prime Minister, Foreign Minister, and senior reps from METI, TEPCO and NISA, and offered support from the IAEA as well as over a dozen member states. The DG also noted that he encouraged increased information sharing between the Government of Japan and the IAEA. The DG reported that the Agency has also dispatched a radiation monitoring team, dispatched a senior officer to Japan to coordinate assistance, appointed two liaison officers to work with NISA 24/7, and plans to dispatch additional staff to assist with radiation monitoring.

#### **OTHER NUCLEAR ISSUES**

No new information in this report.

#### **DOE ASSESSMENT**

[Factored into reactor summaries]

#### **REQUESTS FOR US ASSISTANCE**

No new information in this report.

#### **ENERGY INFRASTRUCTURE:**

No new information in this report.

#### **CONTACTS WITH JAPANESE OFFICIALS**

No new information in this report.

#### **QUESTIONS BEING WORKED:**

A concise timeline of events at Fukushima reactors 1-6 is being developed.

The following request came in from DOS asking for assistance. We are working a response.

The Permanent Mission of Japan, through the IAEA Incident and Emergency Centre, is seeking information about the following capabilities in your countries:

1. Unmanned remotely controlled aerial vehicle for the aerial radiological survey
2. Robots for the work in the high dose rate areas
3. Unmanned remotely controlled ground vehicles for carrying equipment in the high dose rate areas
4. We would appreciate if you could provide the following information is required for three above mentioned categories:
  - Technical details of the above mentioned equipment (including specifications)
  - What is the possible availability of this equipment, and
  - When it would be possible to dispatch this equipment, if requested

**CONTACT INFORMATION:**

**Debra Wilbur will depart for Japan on March 22 to interface with the US DOE and Japanese response organizations to improve coordination.**

**Nuclear Incident Team in the Emergency Operations Center  
([NITOPS@NNSA.DOE.GOV](mailto:NITOPS@NNSA.DOE.GOV)) - 202-586-8100**

**Office of the Deputy Secretary 202-586-5500**

**Watch Schedule:**

Mark Whitney            0800/22 Mar – 1600/22 Mar  
Thomas Robinson  
Rich Reister

Dave Huizenga            1600/22 Mar – 2400/22 Mar  
Heather Looney  
Craig Welling

Lew Steinhoff            0000/23 Mar – 0800/23 Mar  
Karyn Durbin

Jim McConnell,            0800/23 Mar – 1600/23 Mar  
Mike Marthaler

Doug Fremont,            0800/23 Mar – 1600/23 Mar  
Maegan Barlow

**From:** Sheron, Brian  
**To:** Weber, Michael; Virgilio, Martin  
**Subject:** FW: Japanese Earthquake 22 March 2011 0600 EDT Situation Report  
**Date:** Tuesday, March 22, 2011 9:07:00 AM  
**Attachments:** Japan Earthquake Response 03222011 0600.ppt  
SITREP MAR22 0600 final.docx  
**Importance:** High

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FYI.

-----Original Message-----

**From:** Adams, Ian [<mailto:Ian.Adams@Hq.Doe.Gov>]  
**Sent:** Tuesday, March 22, 2011 9:02 AM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Brinkman, Bill; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Per Peterson; Rolando Szilard; Steve Fetter  
**Subject:** Japanese Earthquake 22 March 2011 0600 EDT Situation Report  
**Importance:** High

Attached please find this morning's Japan sit rep.

This information should not be shared or further distributed.

-----Original Message-----

**From:** NITOPS  
**Sent:** Tuesday, March 22, 2011 6:02 AM  
**To:** (b)(6)

(b)(6)

CH/200

(b)(6)

Subject: Japanese Earthquake 22 March 2011 0600 EDT Situation Report  
Importance: High

Please find attached the latest DOE SITREP regarding the ongoing earthquake and tsunami response in Japan.

This information is provided for your internal use and should be shared only with those who have a need to know.

The SITREP will be updated every 12 hours.

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.gov 202-586-8100

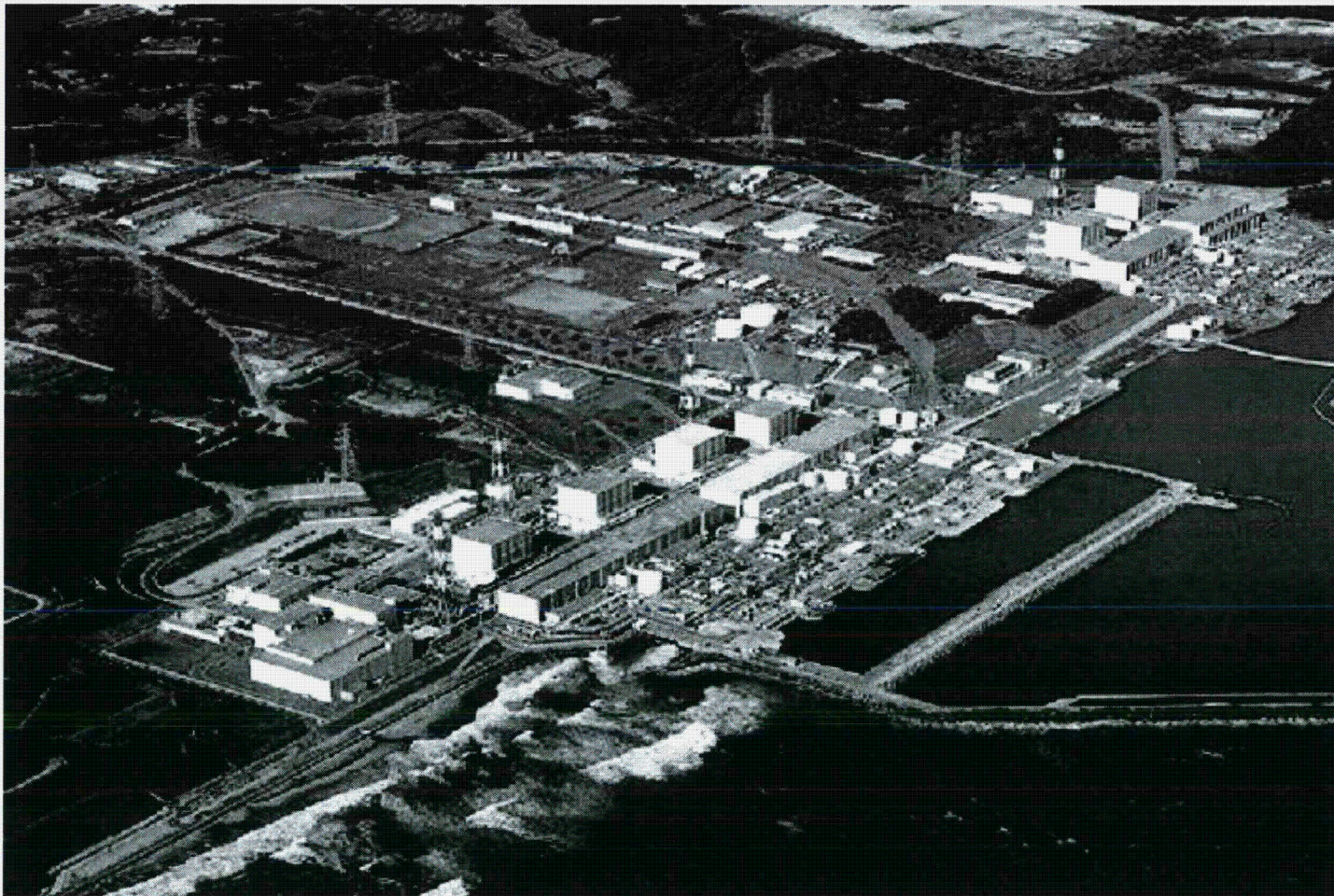




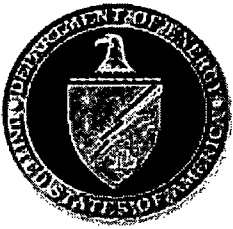
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# Japan Earthquake Response

## March 22, 2011 // 0600 EDT



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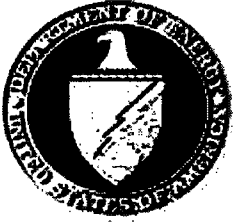


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and should not be forwarded outside  
your agency or organization without  
prior clearance from U.S. DOE**

**Contact: DOE/NNSA Nuclear Incident  
Team: NITOPS@nnsa.doe.gov**

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# Current Status

## No major changes in radiation levels at the Fukushima Daiichi Nuclear Power Plant

- **Unit 1:** Reactor water level stable, core damage est. 70%. Seawater injection continues. Electrical power line connected. Spraying continues on spent fuel pool.
- **Unit 2:** Reactor water level stable, core damage est. 33%. Seawater injection continues. Power restored and electric water pump systems being tested.
- **Unit 3:** Reactor water level stable and pressure stabilized. Spraying on spent fuel pool continues. Power connection efforts underway.
- **Unit 4:** Concrete pumpers expected to pour water on reactor building to fill spent fuel pool. Power connection efforts underway.
- **Units 5 & 6:** Diesel generators supplying power to cooling system. Reactors appear stable.





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# DOE/NNSA Response

## ◇ **Command, Control, Coordination:**

- **Nuclear Incident Team (NIT):** Coordinating overall emergency response
- **Policy Working Group (PWG):** Coordinating overall policy
- **Senior Energy Official:** Primary Manager of deployed field teams
- **Liaisons:** DART, USPACOM, USAID, NRC

## ◇ **Modeling**

- **National Atmospheric Release Advisory Center (NARAC):** conducting predictive radioactive atmospheric dispersion modeling

## ◇ **Monitoring and Sampling**

- **Consequence Management Response Team (CMRT):** Conducting ground monitoring, air sampling and initial results analysis
- **Aerial Monitoring System (AMS):** Conducts aerial detection for mapping radiological ground material deposits

## ◇ **Assessment**

- **Consequence Management Home Team (CMHT):** Scientific assessment of data updated daily from ground measurements and AMS flights

## ◇ **Medical Consultation**

- **Radiation Emergency Assistance Center/Training Site (REAC/TS):** Providing medical advice about radiological exposure

## Deployed (41)

### Yokota AB

- (1) SEO
- (28) CMRT
- (5) AMS

### US Embassy Tokyo

- (2) Foreign Service Nationals
- (2) Permanent Staff
- (1) DART LNO
- (1) Nuclear Energy Representative

### USPACOM HQ

- (1) LNO

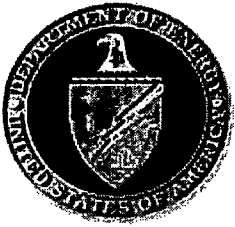
\* Additional DOE personnel departing 22 MAR2011

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# Operations Over Past 24 Hrs.

- ◆ Modeling
  - NARAC: Produced predictive plume models for next 24 hours including two bounding cases for Tokyo and completion of west coast impacts table
- ◆ Field Monitoring
  - AMS: Operations with rotary wing aircraft only due to inclement weather. Conducted aerial monitoring along Tokyo Bay to Yokosuka and back. Readings in area of previous anomalous Navy air sample were not above background.
  - CMRT: Teams conducted monitoring missions south of incident site along Tohoku Expressway, at US Embassy (Tokyo), and to Yokosuka area
- ◆ Assessment
  - CMRT and CMHT compiled DOE, Interagency, and Japan inputs to produce field measurement summary for last 24 hours
- ◆ Medical Consult
  - Responded to 10 medical consult RFIs in past 48 hours



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# External Data Providers

## ◆ Japan

- Ministry of Foreign Affairs (MOFA)
- Ministry of Education, Culture, Sports, Science, and Technology (MEXT)
- Tokyo Electric Power Company (TEPCO)
- Nuclear Safety Technology Center (NUSTEC)

## ◆ United States

- Japan Emergency Command Center, US Embassy, Tokyo
- USAF, BSC Commander
- Futenma Marine Corps Air Station
- Nuclear Regulatory Commission

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# Guide to Interpretation

## Derived Response Levels (DRL)

### ◇ Early Phase DRL

- If a person is in danger of receiving an external radiation dose of 1 Rem over 4 days, the EPA recommends evacuation until radiation levels decrease. This area is indicated in red.

### ◇ First Year DRL

- If a person is in danger of receiving an external radiation dose greater than 2 Rem during the first year, the EPA recommends relocation until radiation levels decrease. This is not an urgent action because the dose is received over a full year. This area is indicated in orange.

### ◇ Fifty Year DRL

- If a person is in danger of receiving an external radiation dose greater than 5 Rem over 50 years, the EPA recommends relocation until radiation levels decrease. This is not an urgent action because the dose is received over fifty years. This area is indicated in yellow.

### ◇ Second Year DRL

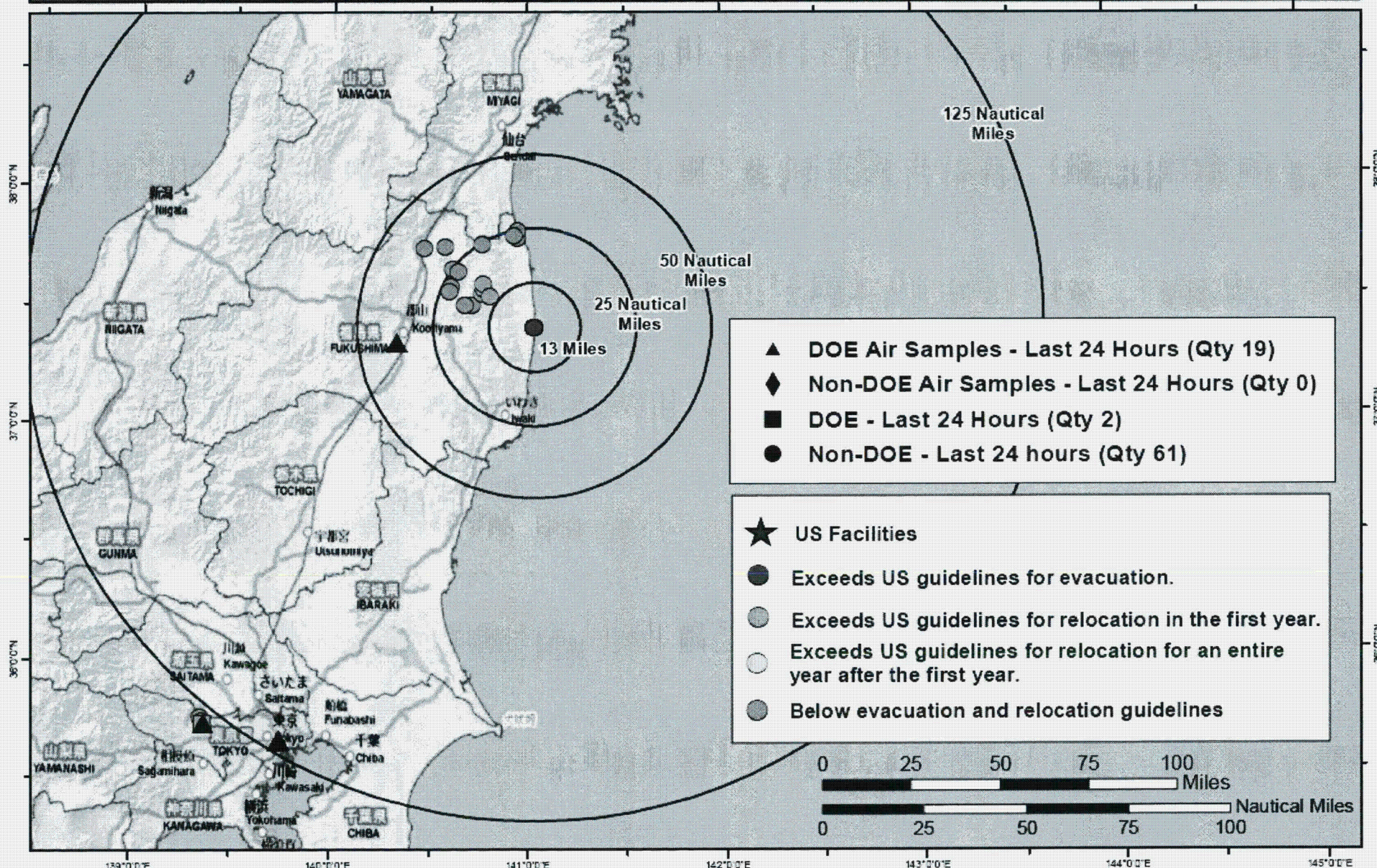
- If a person is in danger of receiving an external radiation dose of greater than 0.5 Rem in a the second year (or any subsequent year), the EPA recommends relocation until radiation levels decrease. This area is indicated in green.

These calculations account for multiple variables. For instance, radiation is most intense in the first days following its release therefore dose reduction may be met by evacuating early in the response.

Protective actions are frequently expressed in dose rates. The dose rate is an indicator that residents would accumulate the threshold dose if they stayed in the area the entire time expressed (e.g. 1 year, 2 years, 50 years)

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Map created on 03222011 1720 JST

Name: NIT Last24HrsMonitoringResults 22Mar2011 v5

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Nuclear Incident Team DOE NIT

Contact (202) 586 - 8100





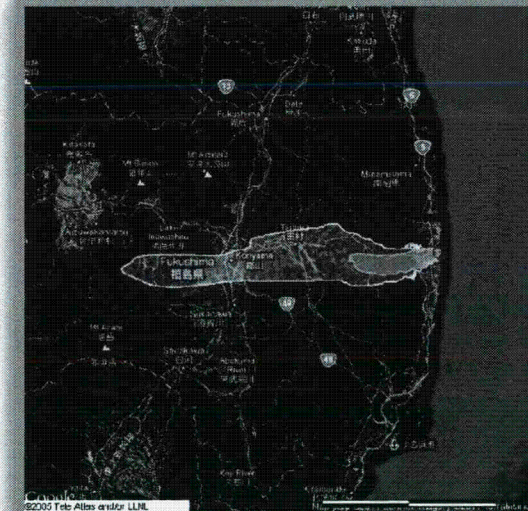
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# Forecasted Weather March 22-23

- ◆ Wind is predicted to be from East from 1000-1500 UTC with intermittent precipitation forecasted



0300 UTC 23 MAR



1000 UTC 22MAR

- ◆ Wind is predicted to shift to a North-South trajectory from 1600 UTC 22 Mar to 0300 UTC 23 Mar with cloudcover

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# Planned Operations: Next 24 Hrs

## ◆ Field Monitoring

- AMS: Operations planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas
- CMRT: Ground monitoring along Joban Expressway north to Ibaraki Prefecture (Mito), Potential joint operations with USMC monitoring team

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## **DEPARTMENT OF ENERGY SITUATION REPORT**

### **Earthquake & Tsunami in Japan**

22 March 2011

0600 (EDT) UPDATE

#### **POWER PLANT UPDATE AND OTHER NUCLEAR ISSUES**

**Summary:** Summary of information received as of 0600 (EDT) 22 March from the NRC, Embassy-Tokyo, IAEA Incident and Emergency Center, TEPCO, METI, NISA, Japan Atomic Industrial Forum, Nuclear Energy Institute, and media outlets. (NOTE: JST = EDT + 13 hours; EDT = GMT/UTC - 4 hours).

According to the NRC SITREP 1800 (EDT) 20 March, the Japanese Ministry of Defense (MOD) has assumed the lead role in Japanese response activities. TEPCO is now in an advisory role to MOD.

MOD announced that the Self-Defense Force helicopter measured the surface temperatures of Fukushima Dai-ichi from the air and found that, as of the afternoon of 20 March (EDT), the temperature of each unit's are below 100 degrees Celsius. The temperatures are as follows: Unit 1: 58 °C; Unit 2: 35 °C; Unit 3: 62 °C; Unit 4: 42 °C; Unit 5: 24 °C; Unit 6: 25 °C.

**Smoke from Units 2 and 3:** Reported by Kyodo News, 21 March 2011. Work to connect power cables to the No. 3 and No. 4 reactors was halted Monday at the Fukushima Daiichi nuclear power plant, after smoke rose from the buildings housing the No. 2 and No. 3 reactors, the plant operator said.

TEPCO said it had briefly evacuated its workers after grayish and blackish smoke was spotted at the southeast of the No. 3 reactor building around 3:55 p.m. (0255 EDT, 21 March 2011) above a pool storing spent nuclear fuel, though a blast was not heard. The smoke stopped after 6 p.m. (0500 EDT), but TEPCO subsequently found that white smoke was rising through a crack in the roof of the building that houses the No. 2 reactor at around 6:20 p.m. (0520 EDT). The utility said later the smoke is believed to be steam, not from the reactor's fuel pool.

The Tokyo Fire Department stopped spraying water for the day after the smoke rose from the No. 3 reactor building. It will suspend the operation until safety at the site is confirmed, it said, adding whether it will resume on Tuesday remains undecided at present. As Unit 3 remains without power, smoke was not apparently triggered by an electrical fault.

At 3:28PM (JST) March 22, firefighters resumed spraying water at the building housing Unit 3 according to Japanese public broadcaster NHK. Concrete pumpers expected to pour water on building housing unit 4 to fill spent fuel pool.



According to a Reuters news report at 2151 (EDT) 21 March, TEPCO said it has resumed work on Tuesday restoring power to units, 1, 2, 3, and 4 after checking that the smoke seen earlier from the reactors had turned to steam.

**Updates for cooling efforts at Dai-ichi spent fuel pools:** Pumping equipment which utilizes a 50 meter articulating boom and associated pumps are being delivered to the site to assist with water distribution. Use of such equipment will greatly improve the amount of water delivered to critical locations within the pool.

The IAEA confirmed on 20 March (EDT) that the temperature in pools 5 and 6 had decreased significantly.

Per NRC Emergency Operations Center (EOC) status of 1800 21 Mar, NRC continues to work with other Federal agencies to deliver temporary cooling equipment to the Daiichi site. An initial shipment of equipment arrived in Japan at 1600 EDT on March 21. A second shipment is scheduled to arrive in Japan at 0400 EDT on March 22.

**Updates on electrical power restoration efforts:** According to an ABC news report at 0430 (EDT) 21 March, TEPCO reports that power has been restored in some capacity to all reactors. NHK Press confirms this report for Units 1, 2, 5 and 6. Further distribution of power into the units will be made following equipment inspections. According to TEPCO, two diesel generators at unit 6 are running, and that there is now enough power available to units 5 and 6 to operate the residual heat removal system pumps. Per IAEA, Power supply for unit 5 was switched from diesel generator to external power supply. Per IAEA update, work for laying electricity cable to power center for both Unit 3 and Unit 4 completed March 21, 2011

**Plant Design Standards:** NHK broadcasting network reported that Tokyo Electric Power Co. confirmed that the March 11 earthquake and tsunami were beyond the Fukushima Daiichi plant's design standards. TEPCO believes the tsunami that inundated the Fukushima Daiichi site was 14 meters high. The design basis tsunami for the site was 5.7 meters, and the reactors and backup power sources were located 10 to 13 meters above sea level. The company reported that the maximum earthquake for which the Fukushima Daiichi plants were designed was magnitude 8. The quake that struck March 11 was magnitude 9.

**Update on DOE efforts on Aerial Measurements:** One helicopter mission occurred on 22 Mar. The fixed wing aircraft was grounded due to local cloud cover. Within the next 24 hours with weather permitting, operations are planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas. The team will begin planning for three aircraft missions per day in an anticipation of additional capability. In total, AMS has flown 13 flights, 7 rotary wing and 6 fixed wing.

**NISA Updates on Temporary Ratings on the International Nuclear and Radiological Event Scale (INES):** The scale ranges from Level 0 (no safety significance, normal operations) to Level 7 (major accident). (Three Mile Island was a Level 5 event.) As of 19 March (EDT), NISA's revised rating for Fukushima Units 1, 2, and 3 was Level 5. NISA's revised rating for Fukushima Unit 4 was Level 3. Units 5 and 6 are at Level 0.

**Radiation Levels:** On 20 March (EDT), the Nuclear Energy Institute (NEI) reported that dose rate near Unit 3 and 4 are declining (was 40-rem/hr, now 15-rem/hr). Dose rate near Unit 5 and 6 are 0.1-rem/hr. Dose rates near the power block range from 1 to 5-rem/hr. The site access gate, which is about 1220 meters (4000 feet) from the plant, was 0.060-rem/hr. A dose rate of 0.012-rem/hr was recorded at a point 20-km (12.4 miles) inland from the plant. All other dose rates at 20 to 40 km (12.4 – 24.8 miles) from the plant are marginally above background. NARAC conducting continuous predictive plume modeling including two bounding cases for Tokyo and completion of west coast impacts table. There have been no major changes in the radiation levels at the site.

Japan's government has halted shipment of raw milk from the Fukushima prefecture and told a total of four prefectures near the stricken plant to hold shipments of spinach and other leafy green plants. Monitoring results of a few dairy and agricultural products such as milk in Fukushima and spinach in Ibaraki prefectures exceeded the national regulatory standard. The World Health Organization (WHO) issued information on food safety, after reports that some food in Japan has been contaminated with radiation.

TEPCO has reported elevated levels of radioactivity in sea water samples taken near the Fukushima Daiichi nuclear power plant. materials. Iodine 131 was 126.7 times higher than the legal level, cesium 134 was 24.8 higher, and cesium 137 was 16.5 times higher.

**Fukushima Dai-ichi Unit 1 reactor (NRC priority 4):** Per the NRC (quoting various sources), as of 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, periodic water spraying of the spent fuel pool continues. Japan's Self Defense Forces (SDF) sprayed 80 tons of water to cool the storage pool for spent nuclear fuel at the unit 4. The water level remains stable, core damage is undermined, and no cooling water has leaked to the reactor containment vessel.

Per NRC EOC status of 1800 on March 21, the Reactor Cooling System (RCS) pressure is 2.97 atmospheres; seawater injected to cool core; Primary containment is functional; drywell pressure is 1.6 ATM; secondary containment lost; spent fuel (292 bundles) water level unknown. Offsite power line connected to local substation, power restoration ongoing.

Per JAIF, 1700 (HST) 21 March: Reactor parameters appear stable (pressure - 0.176-MPa gauge (depressurized), water level - 1.75 meters below the top of the fuel rods, containment vessel – 0.16-MPa (abs). Previous estimate of fuel rod damage was at 70%.

**Fukushima Dai-ichi Unit 2 reactor (NRC priority 3):** Per NRC (quoting various sources), 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, injection of 40 tons of seawater into the spent fuel pool commenced. The water level remains stable and no cooling water has leaked to the reactor containment vessel. TEPCO reports power has been restored and electric water pump injection systems are being tested for damage.

Per NRC EOC status of 1800 on March 21, RCS pressure is 0.8 ATM; seawater injected to cool core; Primary containment has possible Torus damage; the drywell pressure is 1.25 atmospheres according to the IAEA on 20 March. Secondary containment has hole cut in side of fuel floor metal to reduce hydrogen buildup, steam is coming from hole; spent fuel (587 bundles). 40 tons of water sprayed into SFP. Offsite power restored to load-side power panel; condition of pump motors and instrumentation is unknown due to equipment environment. TEPCO has outside power to Auxiliary Transformer.

Per JAIF, 1700 (JST) 21 March: Reactor parameters appear stable (pressure – 0.024-MPa (gauge) (depressurized), water level - 1.35 meters below the top of the fuel rods, containment vessel – 0.12-MPa (abs). Previous estimate of fuel rod damage was at 33%.

**Fukushima Dai-ichi Unit 3 reactor (NRC priority 1):** Per the NRC (quoting various sources), as of 1800 (EDT) 20 March: Core damaged to undetermined extent.

Per the 21 March DHS and IAEA reports, periodic water spraying of the spent fuel pool continues. The water level remains stable and no cooling water has leaked to the reactor containment vessel. Pressure has stabilized and venting measures are not necessary. Within two hours, TEPCO reported that Unit 3 pressure had stabilized and the venting was not necessary. Key print media outlets (NYT & WAPO) picked up the venting announcement, but not the updated decision. Had venting proceeded, gases would have been vented into the suppression pool inside the primary containment to prevent any radioactive material from being released. TEPCO reports local substation power connection efforts are underway.

Per Nuclear and Industrial Safety Agency report on Seismic Damage Information as of 1030 21 March 2011, water spray over the spent fuel pool by Hyper Rescue Unit of Tokyo Fire Department was started at 2139 JST, 20 March 2011 (0839 EDT, 20 March 2011) and finished at 0358 JST, 21 March 2011 (1458 EDT, 20 March 2011).

Per NRC EOC status of 1800 (EDT) on March 21, the RCS pressure is 0.4 ATM; radiation has been released, seawater is still being injected to cool the core. Primary containment status is 1.2 atmospheres (std), the secondary containment has been lost, and visible “white smoke” has been interpreted by NRC as steam. SFP has 514 bundles in the pool; water sprayed from ground several times. Cumulative water sprayed into the pool is 3,742 tons (IAEA).

Per JAIF, 1700 (JST) 21 March: Reactor parameters appear stable (pressure - 0.088-MPa (gauge) (depressurized), water level - 1.8 meters below the top of the fuel rods, containment vessel - 0.11-MPa (abs). (0.340-MPa (abs) at 1530 (EDT) March 19 (0430 JST March 20).

**Fukushima Dai-ichi Unit 4 reactor (NRC priority 2):** Per NRC (quoting various sources), as of 1800 (EDT) 21 March: Core offloaded; RCS - Not applicable; Primary containment - Not applicable; Secondary containment - lost, visible "white smoke" interpreted by NRC as steam; Spent fuel (1201 to 1331 bundles). Concrete pumps expected to pour water on reactor building to fill spent fuel pool. Previous updates reported pool may be dry, damage to fuel rods suspected. Cumulative water sprayed into the pool is 255 tons (IAEA).

Per the 21 March DHS and IAEA reports, Periodic spraying of the SFP continues. The water level remains stable and no cooling water has leaked to the reactor containment vessel. TEPCO reports finished laying cables to transmit electricity to unit 4, as a step toward resuscitating the power systems at unit 3 and 4. Per NRC update, work for laying electricity cable to power center completed at ~0200 EDT March 21, 2011 (source: NISA).

Per Nuclear and Industrial Safety Agency report on Seismic Damage Information as of 1030 21 March 2011, water spray over the spent fuel pool by Self-Defence Force (13 fire engines was started around 0637 JST, 21 March 2011 (1737 EDT, 20 March 2011), and finished at 0841 JST, 21 March 2011 (1941 EDT, 20 March 2011)

An earlier report suggested that an explosion had damaged the Unit 4 reactor building, exposing used fuel. The SFP may have been damaged during the explosion, and the ability of the pond to retain water for a significant period is in doubt.

According to NEI, water spraying activities were concluded just before 0700 (EDT) 20 March. Japan's defense ministry reported that most of the 100 tons of water that the Self Defense Force discharged reached inside the reactor building. No information on water level is available for Unit 4 SFP.

**Fukushima Dai-ichi Unit 5 reactor (NRC priority 5):** As 0130 (EDT) 20 March (1430 (JST) 20 March), Unit 5 declared in cold shutdown (reactor temperature less than 100 °C). Per NRC quoting various sources), 1800 (EDT) 21 March: Shutdown since 3 January 2011. Core in RPV; spent fuel (950 bundles). Unit 5 was in a refueling outage at the time of the earthquake.

Per the 21 March DHS and IAEA reports, reactor achieved cold shutdown conditions. The Residual Heat Removal (RHR) system was restarted and is providing cooling water to the reactor. Pumps are operating intermittently and result in some fluctuations in temperature and pressure. Power is supplied from Unit 6 diesel generators. Reactor parameters appear stable.

Per NRC EOC status of 1800 on March 21, core in RPV, 4.32 ATM, level plus 164 cm above top of active fuel. SFP: 950 bundles, temperature 42C (from IAEA update). Unit 6 emergency diesel generator is available and supplying power to units 5 and 6. Ventilated the rooftop of reactors to release hydrogen and prevent explosions; pump for residual heat removal started up and cooling of spent fuel storage pool has started using power supply from diesel generator of unit 6, switched to external power supply 2236 EDT March 20.

As a result of restarting the Residual Heat Removal (RHR) pump (C), cooling to the SFP has resulted in lowering its temperature from 68.7-C at 0600 (EDT) 19 March 19 to 42.3°C at 1700 (JST) 21 March. Pumps are operating intermittently resulting in fluctuations in temperature and pressure. Power is supplied from Unit 6 EDG.

**Fukushima Dai-ichi Unit 6 reactor (NRC priority 6):** As of 0627 (EDT) 20 March (1927 (JST) 20 March), Unit 6 declared in cold shutdown (reactor temperature less than 100 °C). Per NRC quoting various sources), 1800 (EDT) 20 March: Shutdown since 14 August 2010 for refueling. Core in RPV at 7.94 atmospheres (according to the IAEA on March 20); spent fuel (876 bundles), temperature 66-C, two emergency diesels generator are available to supply power.

Per the 21 March DHS and AIEA reports, Reactor achieved cold shutdown conditions. Two diesel generators are running and powering the pumps. Cooling of the reactor cores continues. Reactor parameters appear stable.

Per NISA, 1700 (JST) March 21: Reactor parameters appear stable (pressure – 0.716-MPa (depressurized), water level is 1.56 meters above the top of the fuel. The reactor temperature is 67°C. Pumps are operating intermittently resulting in some fluctuations in temperature and pressure.

Cooling function of the Unit 6 SFP was restored at 2200 (EDT) 19 March. The pool temperature at restart was 67°C and lowered to 36.5°C at 1700 (JST) on 21 March.

Holes have been made in the roof to provide a vent path to reduce the potential for a hydrogen explosion. No new update from NRC EOC status of 1800 on March 21.

**Common Spent Fuel Pool:** 6,000 bundles (Source: GEH) maintained at 57 C located on land side of Unit 4. Water spray started 2137 EDT March 20 (Source: NISA).

**Fukushima Dai-ichi Units 1-4:** TEPCO confirmed cold shutdown and continued cooling of reactor cores.

#### **Summary of Conditions at Fukushima Daiichi Nuclear Power Plant – 1700 (EDT) 20 March**

**From the IAEA website:**

**<http://www.iaea.org/newscenter/news/tsunamiupdate01.html>**



LEGEND	No Immediate Concern	Concern	Severe Condition
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Unit	1	2	3	4	5	
Power (MWe/th)	460/1380	784/2381	784/2381	784/2381	784/2381	11
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BW
Status at Time of Event	In service – auto shutdown following earthquake			Shut down for outage before earthqu		
Core and Fuel	Damaged			No fuel rods	Cold shutdown	
Containment Integrity	No damage reported	Damage suspected	No information	Outage configuration	No damage expecte	
Off-site Power	Substation connected	Power center (in Unit) connected	Not available			Not available
Diesel Generators	Not available				Two emergency die generators powerin and 6	
Building	Severe damage	Slight damage	Severe damage			No damage reporte
Water Level in Reactor Pressure Vessel	About half of fuel assembly (stable)			Outage configuration	Above fuel	

### Aerial Measurements Update:

- ♦ DOE Team AMS Operations 22 March 2011 (JST)
  - Helicopter mission down the west side of Tokyo Bay to Yokosuka, of the east side of the bay then serpentine north up over Chiba to around Mito
  - C-12 mission grounded due to local cloud cover
  - Within the next 24 hours with weather permitting, operations planned for north, northwest and west of incident site to include re-flights to validate older readings and new coverage of agricultural areas.
  - Begin planning for three aircraft missions per day in an anticipation of additional capability.
  - In total, AMS has flown 13 flights
    - 7 Rotary wing
    - 6 Fixed wing
  - Dosimeter readings for the deployed teams averaged 2 mR for a total of 4 personnel; maximum reading was 3.3 mR.

### News Reports

Secretary Chu appeared on several morning news programs on 20 March 2011, including Fox News Sunday and CNN's "State of the Union":

<http://www.businessweek.com/news/2011-03-20/japan-atomic-crisis-eases-as-u-s-says-worst-may-be-over.html>

Japan Atomic Crisis Eases as Spent-Fuel Pools Cool Below 100 Degrees Celsius:

<http://www.bloomberg.com/news/2011-03-21/japan-s-nuclear-crisis-eases-as-spent-fuel-pools-cool-below-boiling-point.html>



**IAEA Board of Governors Meeting:** From IAEA.org. On Monday, 21 March 2011 at 10:00 UTC (0500 EDT) the 35-state IAEA Board of Governors convened a special meeting to discuss the report of Director General (DG) Yukiya Amano's recent visit to Japan.

Amano reported that the Incident and Emergency Center (IEC) was immediately activated following the earthquake and tsunami, and added that the Agency has provided daily briefings for member states and the press since March 14 to report on developments in Japan. The DG met with the Japanese Prime Minister, Foreign Minister, and senior reps from METI, TEPCO and NISA, and offered support from the IAEA as well as over a dozen member states. The DG also noted that he encouraged increased information sharing between the Government of Japan and the IAEA. The DG reported that the Agency has also dispatched a radiation monitoring team, dispatched a senior officer to Japan to coordinate assistance, appointed two liaison officers to work with NISA 24/7, and plans to dispatch additional staff to assist with radiation monitoring.

## **OTHER NUCLEAR ISSUES**

No new information in this report.

## **DOE ASSESSMENT**

[Factored into reactor summaries]

## **REQUESTS FOR US ASSISTANCE**

No new information in this report.

## **ENERGY INFRASTRUCTURE:**

No new information in this report.

## **CONTACTS WITH JAPANESE OFFICIALS**

No new information in this report.

## **QUESTIONS BEING WORKED:**

A concise timeline of events at Fukushima reactors 1-6 is being developed.

The following request came in from DOS asking for assistance. We are working a response.

The Permanent Mission of Japan, through the IAEA Incident and Emergency Centre, is seeking information about the following capabilities in your countries:

1. Unmanned remotely controlled aerial vehicle for the aerial radiological survey
2. Robots for the work in the high dose rate areas
3. Unmanned remotely controlled ground vehicles for carrying equipment in the high dose rate areas
4. We would appreciate if you could provide the following information is required for three above mentioned categories:
  - Technical details of the above mentioned equipment (including specifications)
  - What is the possible availability of this equipment, and
  - When it would be possible to dispatch this equipment, if requested

**CONTACT INFORMATION:**

**Debra Wilbur will depart for Japan on March 22 to interface with the US DOE and Japanese response organizations to improve coordination.**

**Nuclear Incident Team in the Emergency Operations Center  
([NITOPS@NNSA.DOE.GOV](mailto:NITOPS@NNSA.DOE.GOV)) - 202-586-8100**

**Office of the Deputy Secretary 202-586-5500**

**Watch Schedule:**

Mark Whitney            0800/22 Mar – 1600/22 Mar  
Thomas Robinson  
Rich Reister

Dave Huizenga            1600/22 Mar – 2400/22 Mar  
Heather Looney  
Craig Welling

Lew Steinhoff            0000/23 Mar – 0800/23 Mar  
Karyn Durbin

Jim McConnell,            0800/23 Mar – 1600/23 Mar  
Mike Marthaler

Doug Fremont,            0800/23 Mar – 1600/23 Mar  
Maegan Barlow



**From:** Haney, Catherine  
**To:** Sheron, Brian  
**Subject:** Re: RESPONSE - BRC Briefing  
**Date:** Tuesday, March 22, 2011 9:20:56 AM

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10 am at navy yard.

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**From:** Sheron, Brian  
**To:** Haney, Catherine; Uhle, Jennifer; Wiggins, Jim  
**Sent:** Mon Mar 21 17:43:25 2011  
**Subject:** RE: RESPONSE - BRC Briefing

What time?

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**From:** Haney, Catherine  
**Sent:** Monday, March 21, 2011 4:26 PM  
**To:** Uhle, Jennifer; Sheron, Brian; Wiggins, Jim  
**Subject:** Fw: RESPONSE - BRC Briefing

I'd like someone from RES and NSIR to join me in briefing Rep Hamilton on the 28th. Can you help.

Also can you look at the slides that Dan had planned to use. They were attached to my earlier message. I would suggest changes in light of Japan event but this is more your area than mine.

D

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**From:** Weber, Michael  
**To:** Haney, Catherine  
**Cc:** Sheron, Brian; Uhle, Jennifer; Wiggins, Jim; Kinneman, John; Ordaz, Vonna; Frazier, Alan; Andersen, James; Muessle, Mary; Evans, Michele  
**Sent:** Mon Mar 21 16:01:16 2011  
**Subject:** RESPONSE - BRC Briefing

I concur with your proposal. We need to notify the Commission (One Week Look Ahead) about the plan for you to brief Congressman Hamilton on 28 March (next Monday), but not seek permission given the same information is being briefed.

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**From:** Haney, Catherine  
**Sent:** Monday, March 21, 2011 6:06 AM  
**To:** Weber, Michael  
**Cc:** Sheron, Brian; Uhle, Jennifer; Wiggins, Jim; Kinneman, John; Ordaz, Vonna  
**Subject:** Fw: BRC Briefing

Dan and I discussed this presentation before he left.

One consideration was delaying the meeting until he returns although my preference is to move forward. I'm comfortable doing the presentation if I can get support from RES on the spent fuel pools and NSIR on security- vulnerability assessments. My concern is that RES may not have the time to support this briefing right now.

With that being said, I question if we want to modify these slides given recent events in Japan. I propose RES reviews the slides and makes modifications to reflect current situation. I will engage Brian

CH/201

and Jennifer once I hear from you on moving forward.

Lastly, I don't think it necessary to get permission from the Commission for the presentation since we previously had the ok to brief the BRC. Do you agree?

Cathy

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**From:** Dorman, Dan  
**To:** Haney, Catherine  
**Cc:** Hill, Brittain  
**Sent:** Fri Mar 18 10:28:56 2011  
**Subject:** BRC Briefing

Cathy,

The first attached file contains a condensed version of the briefing we gave to the BRC last month. The slides I stripped down are included in the background. The second file has the full briefing from February.

You have one hour, including Q/A with Rep Hamilton on the 28<sup>th</sup>.

Dan

**From:** Bowman, Gregory  
**To:** Sheron, Brian; Uhle, Jennifer; Coe, Doug; Coyne, Kevin  
**Cc:** Gibson, Kathy; Scott, Michael  
**Subject:** Agenda Planning Meeting - Level 3 PRA Paper  
**Date:** Tuesday, March 22, 2011 10:04:55 AM  
**Attachments:** Possible Chairman Proposal.docx  
**Importance:** High

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I'm not sure if you saw this on the Chairman's agenda that Mike sent out over the weekend, but the Chairman is looking to move the Level 3 PRA meeting up to early July. That would mean the paper would need to come to the Commission in mid-June (several weeks earlier than currently scheduled).

Can you let me know if that's even doable? I know there was some coordination between the Level 3 paper and SOARCA (if I remember right, you were trying to publish the draft SOARCA paper for public comment before the Commission meeting, but I might have that wrong), and that might add some additional complications.

If either you can't move up the Level 3 paper or moving it up is going to cause significant consequences (e.g., you won't be able to discuss SOARCA), please let me know as soon as possible. If that's the case, we'll need to communicate those concerns to the Chairman's office. I'll take care of that, but I'll need some help in coming up with language.

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**From:** Weber, Michael  
**Sent:** Sunday, March 20, 2011 6:52 PM  
**To:** Sheron, Brian; Uhle, Jennifer; Haney, Catherine; Kinneman, John; Miller, Charles; Moore, Scott; Zimmerman, Roy; McCrary, Cheryl  
**Cc:** Brock, Kathryn; Frazier, Alan; Bowman, Gregory  
**Subject:** FYI - Agenda Planning Meeting

Early awareness of potential proposed changes to the Commission calendar...stay tuned

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**From:** Andersen, James  
**To:** Borchardt, Bill; Virgilio, Martin; Weber, Michael; Ash, Darren; Muessle, Mary; Landau, Mindy; Leeds, Eric  
**Cc:** Baval, Rochelle; Laufer, Richard; Vietti-Cook, Annette  
**Sent:** Sun Mar 20 18:18:07 2011  
**Subject:** Agenda Planning Meeting

Over the weekend, I have been called into a number of Agenda Planning discussions with the Chairman's office and finally today with the Chairman. I believe the attached is close to what the Chairman plans to propose during the 11:00am meeting. The Chairman understands this is aggressive and may push the staff to far. A point I tried to make a couple times in a nice manner. I can discuss more during the 8:00am meeting if needed. Since I created this document, I don't know how close this will be to the actual document the Chairman's office creates for the Chairman's use.

I have copied SECY to give them a heads up.

Jim A.

CH/202

### Possible Chairman Proposal for Commission Meetings

3/21	Japanese Earthquake Status
3/24	50.46(a) – CANCEL, discuss whether to withdraw paper
3/29	SMR – CANCEL, keep paper for review
3/29	Possible Commission Meeting on Status Update on Japan Event plus Radiation Consequences with External Stakeholders
3/30	Senate Congressional Hearing
3/31	House Congressional Hearing
3/31	McGaffigan Award
Week 4/4	EPW Hearing
	Chairman to CNS ?
Week 4/11	Possible Commission Meeting on Status Update on Japan Event plus Design Basis and Beyond Design Basis (No External Panel)
Week 4/18	Source Security (4/19)
Week 4/25	Possible Commission Meeting on Status Update on Japan Event plus Natural Hazards (No External Panel)
	ITAAC Commission Meeting – CANCEL
Week 5/2	30 Day Quick Look Report Commission Meeting (No paper)
	Cumulative Effects Commission Meeting – CANCEL
Week 5/9	Emergency Planning Commission Meeting (Final Rule plus how EP works)
Week 5/16	Exercise
Week 5/23	AARM Commission Meeting (5/27)
Week 5/30	Human Capital and EEO (moved from 5/3)
Week 6/6	ACRS (topics may need to change)
Week 6/13	International Commission Meeting – POSTPONE
	60 Day Quick Look Report Commission Meeting (No paper)
Week 6/20	??
Week 6/27	??
Week 7/4	PRA Level 3 (would need to move up paper)

Week 7/11

IRRS Action Plan Commission Meeting

Week 7/18

90 Day Quick Look Report Commission Meeting (paper)

Week 7/25

Stakeholder Commission Meeting on 90 Day Quick Look Report

**From:** Kammerer, Annie  
**To:** Sheron, Brian; Case, Michael; Richards, Stuart; Hogan, Rosemary  
**Subject:** RE: tsunami hazard studies from TEPCO experts (2 of 2)  
**Date:** Tuesday, March 22, 2011 11:44:58 AM

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IAEA ISSC contacts. Turns out they were sitting in my personal email too...Several of the staff over there are either no-cost experts from Japan and some are hires on temporary leave from their home institutions. I've been trying to get more info on Onagawa through that route as well. I can't understand how they survived a 20m tsunami! Trying to get the elevation of the plant.

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**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 9:33 AM  
**To:** Kammerer, Annie; Case, Michael; Richards, Stuart; Hogan, Rosemary  
**Subject:** RE: tsunami hazard studies from TEPCO experts (2 of 2)

Thank Bob Budnitz. Somehow he managed to get them.

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**From:** Kammerer, Annie  
**Sent:** Tuesday, March 22, 2011 9:26 AM  
**To:** Sheron, Brian; Case, Michael; Richards, Stuart; Hogan, Rosemary  
**Subject:** RE: tsunami hazard studies from TEPCO experts (2 of 2)

Thanks. I had the first presentation, and wasn't sure it was the design basis information or not. I didn't have the second one, which is extremely useful!

Annie

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**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 9:08 AM  
**To:** Case, Michael; Richards, Stuart; Hogan, Rosemary; Kammerer, Annie  
**Subject:** FW: tsunami hazard studies from TEPCO experts (2 of 2)

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**From:** Adams, Ian [mailto:Ian.Adams@Hq.Doe.Gov]  
**Sent:** Tuesday, March 22, 2011 9:03 AM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Brinkman, Bill; DAgostino, Thomas; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Hurlbut, Brandon; John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Owens, Missy; Per Peterson; Poneman, Daniel; Rolando Szilard; Steve Fetter  
**Subject:** FW: tsunami hazard studies from TEPCO experts (2 of 2)

Attached is the 2nd of 2 files sent to the nuclear group via Bob Budnitz.

Thanks,  
Ian

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**From:** Bob Budnitz [mailto:rjbudnitz@lbl.gov]  
**Sent:** Tuesday, March 22, 2011 6:17 AM  
**To:** Adams, Ian

CH/203

**Subject:** tsunami hazard studies from TEPCO experts (2 of 2)

TO: Ian Adams  
FROM: Robert Budnitz (LBNL)

**TSUNAMI HAZARD STUDIES FOR JAPAN AND SPECIFICALLY FOR  
FUKUSHIMA**

[Ian, can you please distribute this to the science group? Thanks. Bob]

**SENDING THE MAIN FILE NEXT. SEPARATE EMAIL NEEDED DUE TO FILE  
SIZE**

Dear Colleagues,

Dr. Antonio Godoy, a long-standing colleague and friend of mine, retired a few months ago from a post at the IAEA in Vienna where he was responsible for the program in seismic and tsunami hazards. In an email that I just received, and responding to my inquiry, Godoy explained to me that in May 2010 he sponsored an IAEA "Experts Meeting regarding the Site Selection and Evaluation for Philippines NPP" in Vienna. Two presentations at that meeting are directly relevant to the tsunami hazard at Fukushima, and the view graphs from both are attached here. Both are from experts at TEPCO, Drs. Takao and Sakai.

One of these presentations gives a general methodology overview, while the other is "Appendix A" and uses Fukushima as a case study.

There is a lot of jargon in these viewgraphs, which I am intimately familiar with but which some of our group may not be familiar with. Oh well .....

I will try to see if any original papers exist to back up these slides, and if so whether they are available.

By the way, since his retirement Godoy has been rehired by the IAEA part-time, but has also set up a consulting practice in Vienna and in fact has done a small piece of consulting work for me at LBNL recently. He is also very close professionally to Annie Kammerer of the NRC staff, one of NRC's top seismic experts.

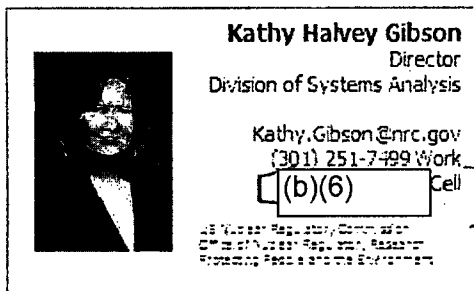
Bob Budnitz

**From:** Gibson, Kathy  
**To:** Bowman, Gregory; Elkins, Scott  
**Cc:** Shaffer, Vered; Rini, Brett; Sheron, Brian; Uhle, Jennifer  
**Subject:** RE: Commission Meeting on Japanese Events  
**Date:** Tuesday, March 22, 2011 12:38:44 PM  
**Attachments:** Kathy Halvey Gibson2.vcf

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I discussed with Brian and we were thinking along the lines of an SL panel, probably 3 – one to cover how we develop the source terms (RES – Charlie Tinkler), one to cover the tools and processes for dose projections (in the Ops Center)(NSIR – Cindy Jones), one to cover health effects and protective actions (NSIR – Trish Milligan). It will take coordination with a number of offices to develop slides and talking points.) (Haven't discussed with NSIR yet)

As to external panel, we were thinking DOE (multiple assets – AMS, NARAC, labs), EPA (PAGs), FDA (food interdiction), NR or DOD (military assets and response).



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**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 12:23 PM  
**To:** Gibson, Kathy; Elkins, Scott  
**Cc:** Shaffer, Vered; Rini, Brett  
**Subject:** RE: Commission Meeting on Japanese Events

Here you go.

I would recommend keeping the internal panel to Bill (introductions and overview of the event) and a couple people to discuss radiological aspects. The attached draft includes NSIR and FSME, but I think they can be removed. Like I said in my e-mail below, the external panel is a little more up in the air. Between the Chairman's office and the EDO's office, I've heard the following suggestions: other Federal agencies (e.g., EPA, DOE); HPS; industry; and/or a representative from one of the labs. We'd need to make a proposal and SECY would take care of the invitations. Don't worry about polishing it too much – I think they have an agenda planning meeting on Thursday and we'll get more direction then, I'm sure.

Brett just called me about this a little while ago, and he might have already started working on the scheduling note.

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**From:** Gibson, Kathy  
**Sent:** Tuesday, March 22, 2011 12:15 PM  
**To:** Bowman, Gregory; Elkins, Scott

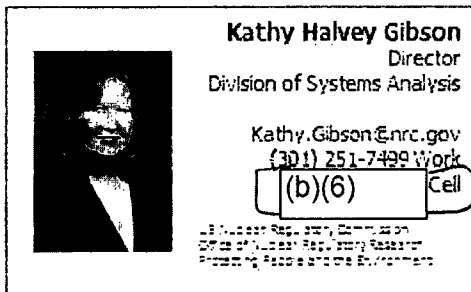
CH/204



**Cc:** Shaffer, Vered  
**Subject:** RE: Commission Meeting on Japanese Events  
**Importance:** High

Thanks Greg. Could you please send us the draft scheduling note again. We will work on a proposed final version this afternoon.

Scott Elkins is our lead for the Commission meeting with staff support from Vered Shaffer.



---

**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 9:45 AM  
**To:** Gibson, Kathy; Elkins, Scott  
**Subject:** RE: Commission Meeting on Japanese Events

I think you can just use the office TAs as the POCs for now:

NRR: Sean Meighan and Quynh Nguyen  
FSME: George Deegan  
NSIR: Mike Dudek  
NRO: Donna Williams

Allen Howe, one of the DORL deputy directors in NRR, led the coordination of yesterday's Commission meeting. If I get any better contact names from the other EDO TAs, I'll pass them along.

Are you going to be able to get me an updated draft scheduling note today? If you need any help with that, please let me know.

---

**From:** Gibson, Kathy  
**Sent:** Tuesday, March 22, 2011 8:35 AM  
**To:** Sheron, Brian; Elkins, Scott; Bowman, Gregory  
**Cc:** Uhle, Jennifer  
**Subject:** Re: Commission Meeting on Japanese Events

Ok - do we know who is doing the briefing? Will it be EDO - just trying to determine level of detail.

Also, Greg, please pass on contacts in other offices if and as you get them. Thanks!

---

**From:** Sheron, Brian  
**To:** Gibson, Kathy; Elkins, Scott

**Cc:** Uhle, Jennifer  
**Sent:** Tue Mar 22 08:19:55 2011  
**Subject:** FW: Commission Meeting on Japanese Events

See below, you got it.

---

**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 8:17 AM  
**To:** Sheron, Brian  
**Subject:** RE: Commission Meeting on Japanese Events

It's on the schedule, and if you don't object to taking the lead, you've got it (for what it's worth, I saw an e-mail from Mike over the weekend indicating that he thought it belonged with RES, with coordination from the other offices).

---

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 8:11 AM  
**To:** Bowman, Gregory  
**Subject:** FW: Commission Meeting on Japanese Events

Greg, see below. I need to know ASAP if this is a go and that RES has the lead.

---

**From:** Gibson, Kathy  
**Sent:** Tuesday, March 22, 2011 8:07 AM  
**To:** Sheron, Brian; Uhle, Jennifer; Scott, Michael; Bush-Goddard, Stephanie  
**Cc:** Elkins, Scott  
**Subject:** Re: Commission Meeting on Japanese Events

Yes we should lead (with NSIR/Ops Center support) and we can be ready. As soon as you tell me to launch, I will put a team together to work it.

---

**From:** Sheron, Brian  
**To:** Uhle, Jennifer; Gibson, Kathy; Scott, Michael; Bush-Goddard, Stephanie  
**Sent:** Tue Mar 22 07:56:32 2011  
**Subject:** FW: Commission Meeting on Japanese Events

See below. Can we be ready to do this by 4/14? Should we be the lead?

---

**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 7:51 AM  
**To:** Sheron, Brian; Uhle, Jennifer; Gibson, Kathy; Scott, Michael  
**Cc:** Bush-Goddard, Stephanie; Rini, Brett; Dion, Jeanne; Armstrong, Kenneth  
**Subject:** Commission Meeting on Japanese Events  
**Importance:** High

I just learned that we're working towards scheduling a near-term meeting on the events in Japan, with a focus on radiological consequences and potential health effects. The current thinking is that RES would have the lead for this meeting, which will most likely take place on April 14.

The meeting would involve discussion of (1) status of the event (maybe led by NRR), (2) radiological impacts, and (3) radiological significance. The external panel might involve

other Federal agencies (e.g., EPA, DOE), HPS, industry, and/or a representative from one of the labs, although it could end up being a challenge to get participation given the timeframe. We would just need to give SECY suggestions and let them take care of the invitations.

Alan Frazier put together the attached draft scheduling note, but it will need to be revised. My understanding is the SECY will likely need a revised scheduling note back today to get to the Commission. Please let me know as soon as you can if you think the lead for this meeting should be assigned to a different office (if that's the case, we'll need to circle back with Mike).

Greg

---

**From:** Frazier, Alan  
**Sent:** Monday, March 21, 2011 4:47 PM  
**To:** Bowman, Gregory  
**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Merzke, Daniel  
**Subject:** RE: ACTION: Draft Scheduling Note for New Commission Meeting

Greg,

FSME tells me that last week RES agreed to take the lead in any discussion of rad consequences or health effects if those topics had come up during today's Commission meeting. The Commission would now like to have a Commission meeting in April focused on rad consequences and health effects.

Could you please confirm with RES tomorrow that they should have the lead for the April Commission meeting? Note that it was Jeanne Dion that agreed RES should have the lead last week (see attached email) but I am not aware of any front office interaction on this.

Alan

---

**From:** Deegan, George  
**Sent:** Monday, March 21, 2011 4:29 PM  
**To:** Frazier, Alan  
**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel  
**Subject:** RE: ACTION: Draft Scheduling Note for New Commission Meeting

Alan- Thanks for forwarding Jim Andersen's email.

When Allen Howe's Working Group was assembled last week to construct an outline for today's Commission briefing, the rad consequences/health effects issue was identified as originally marked as an FSME potential topic, but we later determined that RES would be better to take lead (with SOARCA etc.). I'd think they'd be the best ones to lead any new Commission briefing in April on this topic. I'll forward you that email chain separately.

---

**From:** Frazier, Alan

**Sent:** Monday, March 21, 2011 3:42 PM

**To:** Deegan, George

**Cc:** Brock, Kathryn; Andersen, James; Wittick, Brian; Weber, Michael; Miller, Charles; Moore, Scott; Merzke, Daniel

**Subject:** ACTION: Draft Scheduling Note for New Commission Meeting

George,

Please take a look at Jim's note below from today's agenda planning meeting which was held immediately after the Commission meeting.

Note in particular the highlighted **new Commission meeting in April on the Japan event with additional focus on radiological consequence / health effects** (probably around 4/14). FSME will have the lead for this new Commission meeting. Additionally, I got some feedback from Jim that you should consider having the following elements in the scheduling note.

- Status of event
- Radiological Impacts
- Radiological significance
- External panel

**ACTION:** In cooperation with NRR and NSIR (and any other offices you feel should be involved) please take the lead for developing a scheduling note. I have attached a initial draft to help get you started.

I do not know when this action will be due but I wanted to give you a head-start. We are still waiting for SECY's official summary of the meeting, which usually contains due dates for the draft scheduling notes.

Please let me know if you have any questions.

Regards,

Alan L. Frazier  
Executive Technical Assistant  
Office of the Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
301-415-1763

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**From:** Andersen, James

**Sent:** Monday, March 21, 2011 1:35 PM

**To:** EDO\_TBPM Distribution

**Cc:** Muesle, Mary; Weber, Michael; Virgilio, Martin; Ash, Darren; Landau, Mindy

**Subject:** Agenda Planning Meeting

ETAs,

The Commission held an Agenda Planning Meeting this morning. SECY will provide the formal summary, but I wanted to let you know a couple things as quickly as possible:

- The 10CFR50.46(a) Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Bill Ruland was informed)
- The SMR Commission meeting on 3/29 is still on (Mike Mayfield was informed)
- The Source Security Commission meeting on 4/19 is still on (Josie Piccone was informed)
- The ITAAC Commission meeting was postponed to a later unspecified date, the Commission will continue to review the paper (Mike Mayfield was informed)
- The EEO/Human Capital Commission meeting was moved to June 2 (**Kris – please advise HR and SBCR**)
- The Cumulative Effectives of Regulation Commission meeting was postponed to a later unspecified date (Tom Blount was informed)
- The AARM Commission meeting on 5/27 is still on (**Brian please advise NRR**)
- The Emergency Planning Final Rule Commission meeting was moved up to May 12 (left Bob Kahler a message)
- The ACRS meeting on 6/6 is still on
- The International Commission meeting was postponed to a later unspecified date

Several new meetings were added:

- 30, 60, and 90 day status meetings regarding the Near-Term NRC Review Effort (task group?); probably around 5/3, 6/16, 7/18 (**Jim A lead for scheduling note**)
- Status meeting on the Japanese event with additional focus on radiological consequence / health effects; probably around 4/14 (**Brian lead for scheduling note**)
- Status meeting on the Japanese event with additional focus on station blackout; probably around 4/28 (**Brian lead for scheduling note**)
- Stakeholder meeting on the staff's 90 day status report; probably around 7/25 (**Jim A lead for scheduling note**)

**From:** Versluis, Rob  
**To:** Kelly, John E (NE); Lyons, Peter; DL-NERT-All; NITSolutions; DL-NITSolutions  
**Cc:** Finck, Phillip; McFarlane, Harold; "Elizabeth A Connell"; Sheron, Brian  
**Subject:** RE: have any good graphics on bwr damage and melt progression... it would help with a briefing for tomorrow (to Chu) i tended to focuss on tmi-2 stuff over the years...  
**Date:** Tuesday, March 22, 2011 1:20:28 PM

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I am now established in the NRC Incident Response Center (IRC) Reactor Safety Team on behalf of the DOE Office of Nuclear Energy and have access to both my DOE email and the IRC email. I am monitoring email traffic and am getting up to speed on current activities. I am ready to respond to specific requests.

Rob Versluis at 301-816-5189 (IRC) or (b)(6) (m)

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**From:** Kelly, John E (NE)  
**Sent:** Tuesday, March 22, 2011 1:00 PM  
**To:** Lyons, Peter; DL-NERT-All; NITSolutions; DL-NITSolutions  
**Cc:** Finck, Phillip; McFarlane, Harold; 'Elizabeth A Connell'  
**Subject:** FW: have any good graphics on bwr damage and melt progression... it would help with a briefing for tomorrow (to Chu) i tended to focuss on tmi-2 stuff over the years...

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**From:** Sheron, Brian [mailto:Brian.Sheron@nrc.gov]  
**Sent:** Tuesday, March 22, 2011 7:28 AM  
**To:** Kelly, John E (NE); Burns, Shawn; Gauntt, Randall O  
**Cc:** Tinkler, Charles; Pickering, Susan Y; 'Joy.Rempe@inl.gov'  
**Subject:** RE: have any good graphics on bwr damage and melt progression... it would help with a briefing for tomorrow (to Chu) i tended to focuss on tmi-2 stuff over the years...

John, yes, I agree. I spoke with Mike Weber, and, per our discussion last night, we suggest that DOE embed a reactor engineer in our Incident response Center working with both our reactor Safety and Protective Measures teams. I was told DOE has an employee here, but they are part of the Liaison Team, which normally does not get involved with the technical team work.

I think that if you had an employee here working with the teams, it would facilitate quick communication and coordination of technical information (i.e., like the issue below).

If you give me the name of the person you want to send here, I'll alert the IRC and make the arrangements for him to participate.

---

**From:** Kelly, John E (NE) [mailto:JohnE.Kelly@Nuclear.Energy.Gov]  
**Sent:** Monday, March 21, 2011 10:55 PM  
**To:** Burns, Shawn; Gauntt, Randall O; Sheron, Brian  
**Cc:** Tinkler, Charles; Pickering, Susan Y; 'Joy.Rempe@inl.gov'  
**Subject:** RE: have any good graphics on bwr damage and melt progression... it would help with a briefing for tomorrow (to Chu) i tended to focuss on tmi-2 stuff over the years...

I spoke with Brian Sheron today and we need to be able to share data between NRC and DOE in a

CH/205

seamless manner to the extent possible as related to the Japan situation.

Brian – do you agree?

---

**From:** Burns, Shawn [mailto:spburns@sandia.gov]  
**Sent:** Monday, March 21, 2011 8:01 PM  
**To:** Gauntt, Randall O; 'Joy.Rempe@inl.gov'  
**Cc:** 'charles.tinkler@nrc.gov'; Kelly, John E (NE); Pickering, Susan Y  
**Subject:** Re: have any good graphics on bwr damage and melt progression... it would help with a briefing for tomorrow (to Chu) i tended to focuss on tmi-2 stuff over the years...

Randy,

I got it.

We will need approval from NRC.

Best regards,

Shawn

---

**From:** Gauntt, Randall O  
**Sent:** Monday, March 21, 2011 05:58 PM  
**To:** Joy L Rempe <Joy.Rempe@inl.gov>  
**Cc:** Burns, Shawn; charles.tinkler@nrc.gov <charles.tinkler@nrc.gov>; Kelly, John E (NE) <JohnE.Kelly@Nuclear.Energy.Gov>; Pickering, Susan Y  
**Subject:** RE: have any good graphics on bwr damage and melt progression... it would help with a briefing for tomorrow (to Chu) i tended to focuss on tmi-2 stuff over the years...

Shawn,

Perhaps a plot of primary system pressure typical of LTSBO from SOARCA together with some ptfread 2-D visualizations of in-vessel melt progression as found I think in the Appendix A documentation. The LTSBO pressure signature pretty much characterizes the accident progression: operator SRV depressurization, battery failure and SRV closure (or not), RCIC injection while batteries are available, and vessel re-pressurization on battery failure. The ptfread plots show the development of TMI-like melt configurations leading perhaps to vessel failure without operator mitigation (likely to have occurred in Fukushima), a plot of hydrogen generation to tie to the venting-related explosions and finally perhaps the plot of fission product distribution to show the low environmental releases that follow from the expected effective suppression pool scrubbing.

Charlie - would NRC object?

This could be lifted from the SOARCA LTSBO report as "illustrative" without being characterized as a SOARCA final result.

Randy

---

**From:** Joy L Rempe [Joy.Rempe@inl.gov]  
**Sent:** Monday, March 21, 2011 5:41 PM  
**To:** Gauntt, Randall O  
**Cc:** Burns, Shawn  
**Subject:** have any good graphics on bwr damage and melt progression... it would help with a briefing for tomorrow (to Chu) i tended to focuss on tmi-2 stuff over the years...



---

Joy Rempe • Idaho National Laboratory

Phone: (208) 526-2897 • Cell:

(b)(6)

Email: Joy.Rempe@inl.gov

Fax: (208) 526-2930 •



**From:** Holdren, John P.  
**To:** Koonin, Steven; Adams, Ian; Aoki, Steven; Binkley, Steve; Brinkman, Bill; RJBudnitz@lbl.gov; SCHU; DAgestino, Thomas; Fetter, Steve; Finck, Phillip; Garwin, Dick; Grossenbacher, John (INL); Hurlbut, Brandon; Kelly, John E (NE); McFarlane, Harold; Owens, Missy; Poneman, Daniel; Sheron, Brian; ronaldo.szilard@inl.gov; rlq2@us.ibm.com; Per F. Peterson; Lyons, Peter  
**Subject:** RE: Japanese radiological data  
**Date:** Tuesday, March 22, 2011 1:45:15 PM  
**Attachments:** Particulate radioactivity DCFs.xlsx

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(b)(5)

JOHN P. HOLDREN

Assistant to the President for Science and Technology  
and Director, Office of Science and Technology Policy  
Executive Office of the President of the United States

email (b)(6)

direct phone (b)(6)

assistant Carrie Pitzer (b)(6)

-----Original Message-----

From: Koonin, Steven [mailto:Steven.Koonin@science.doe.gov]

Sent: Tuesday, March 22, 2011 1:25 PM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Brinkman, Bill; RJBudnitz@lbl.gov; SCHU; DAgestino, Thomas; Fetter, Steve; Finck, Phillip; Garwin, Dick; Grossenbacher, John (INL); Holdren, John P.; Hurlbut, Brandon; Kelly, John E (NE); McFarlane, Harold; Owens, Missy; Poneman, Daniel; Brian.sheron@nrc.gov; ronaldo.szilard@inl.gov; rlq2@us.ibm.com; Per F. Peterson; Lyons, Peter  
Subject: Japanese radiological data

This in response to a query re isotopically resolved air sample from Japanese research labs.

The data at the publicly available links cited below (two examples attached) might be useful in validating AMS data and/or calibrating NARAC models. Haven't seen any of that done to date.

SEK

-----Original Message-----

From: Hideto En'yo [mailto:enyo@riken.go.jp]

Sent: Tuesday, March 22, 2011 11:21 AM

To: Koonin, Steven

Cc: 'tanihata@rcnp.osaka-u.ac.jp'

Subject: Re: Isotopically resolved air sample data

Dear Dr. Koonin,

We have such kind of measurements and preliminary results are already reported to MEXT. Strictly speaking our data for "Isotopically resolved air sample", which you asked, may not be comparable to others, since the machine used is not for environmental monitor but for the accelerator facility monitor, so that the filter does not collect Iodine well. We actually do not understand well the measured values yet and they are not included the data reported to MEXT.

Besides we have a sort of treaty with Wako-City (where RIKEN is located) about the disclosure of Radiation Monitor, and certainly with MEXT. We start the process to get an approval, but it may need some time.  
Meantime, MEXT already reported similar measurements at their web page.  
These may be quite useful for you.

CH/2006

[http://www.mext.go.jp/a\\_menu/saigaijohou/syousai/1303956.htm](http://www.mext.go.jp/a_menu/saigaijohou/syousai/1303956.htm)

The above page is in Japanese. I hope you have staff to translate it.  
After some delay the corresponding English versions become available at

[http://notice.yahoo.co.jp/emg/en/archives/np\\_jp.html](http://notice.yahoo.co.jp/emg/en/archives/np_jp.html)

By the way, I was (and still is ) a student of Koji Nakai, and I met you at Hakone Seminar (1980), more than 30 years ago.

It is really nice to hear from you.

Best regards  
Hideto En'yo  
Director  
RIKEN Nishina Center

(2011/03/21 20:25), Koonin, Steven wrote:

> Dr. Enyo:

>

> As I've been corresponding with Dr. Tanihata (whom I've know for more than 30 years), isotopically resolved and calibrated air sample data taken by US personnel are contained in the attached spreadsheet. Dr. Tanihata tells me you and colleagues have similar data from other sites and other times.

>

> Exchanging existing data and, on a regular basis, future data would help give all of us a better picture of what's going on.

>

> Can you send me such data? I am directly in touch with the US government team providing technical advice to the Japanese government.

>

> Dr. Steven E. Koonin  
> Under Secretary for Science  
> US Department of Energy  
> Washington DC  
> 12022854682

>

> ----- Original Message -----

> From: SEK Gmail{(b)(6)}

> To: Koonin, Steven

> Sent: Sun Mar 20 22:52:28 2011

> Subject: Mail with GoodReader attachments

>

> See files attached to this message (sent from GoodReader)

>

>

CONCENTRATIONS AND DOSES PER BILLIONTH OF A MICROCURIE PER MILLILITER  
 (i.e., per nanocurie per cubic meter) OF AIRBORNE PARTICULATE RADIOACTIVITY  
 AS SAMPLED BY USS GEORGE WASHINGTON 3-21-2011 (compiled by J Holdren 3-22-11)

	USS GW data nCi/m3	col B normal'd nCi/m3	DCF adult EDE rem/Ci	DCF 1-yr thyroid rem/Ci	4-d adult EDE mrem	4-d 1-yr thyroid mrem	adult EDE rate mrem/hr	1-yr thyr rate mrem/hr
TOTAL	0.839	1.000			4.07		0.042	
I-131	0.267	0.318	2.73E+04	5.20E+06	0.70	34.42		0.36
I-132	0.102	0.122	4.22E+02		0.00			
Te-132	0.164	0.195	7.59E+03		0.12			
Cs-134	0.136	0.162	7.55E+04		0.98			
Cs-136	0.200	0.238	1.03E+04		0.20			
Cs-137	0.150	0.179	1.45E+05		2.07			

2011.3.21. 19:00

(μSv/h)

	Prefecture(City)	2011/3/20							2011/3/21							Usual Value Band
		17-18	18-19	19-20	20-21	21-22	22-23	23-24	0-1	1-2	2-3	3-4	4-5	5-6	6-7	
1	Hokkaido(Sapporo)	0.028	0.027	0.028	0.028	0.028	0.028	0.027	0.027	0.028	0.029	0.028	0.028	0.028	0.028	0.02~0.105
2	Aomori(Aomori)	0.021	0.021	0.022	0.023	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.017~0.102
3	Iwate(Morioka)	0.027	0.029	0.030	0.039	0.040	0.038	0.037	0.036	0.035	0.036	0.036	0.036	0.036	0.036	0.014~0.084
4	Miyagi(Sendai)															0.0176~0.0513
5	Akita(Akita)	0.036	0.040	0.040	0.041	0.041	0.039	0.036	0.036	0.035	0.036	0.036	0.035	0.035	0.035	0.022~0.086
6	Yamagata(Yamagata)	0.044	0.100	0.129	0.125	0.123	0.119	0.117	0.115	0.114	0.114	0.117	0.113	0.113	0.111	0.025~0.082
7	Fukushima(Futaba)															0.037~0.071
8	Ibaraki(Mito)	0.172	0.172	0.171	0.170	0.170	0.169	0.170	0.170	0.170	0.169	0.169	0.169	0.256	0.493	0.036~0.056
9	Tochigi(Utsunomiya)	0.154	0.152	0.149	0.147	0.146	0.145	0.146	0.146	0.149	0.150	0.149	0.148	0.147	0.147	0.030~0.067
10	Gunma(Maebashi)	0.096	0.103	0.099	0.083	0.074	0.074	0.074	0.074	0.074	0.076	0.075	0.075	0.075	0.075	0.017~0.045
11	Saitama(Saitama)	0.052	0.052	0.052	0.055	0.059	0.059	0.062	0.064	0.065	0.065	0.063	0.063	0.064	0.068	0.031~0.060
12	Chiba(Ishihara)	0.032	0.032	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.030	0.030	0.022~0.044
13	Tokyo(Shinjuku)	0.045	0.044	0.045	0.044	0.044	0.048	0.049	0.051	0.051	0.050	0.050	0.051	0.052	0.054	0.028~0.079
14	kanagawa(Chigasaki)	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.045	0.044	0.046	0.049	0.035~0.069
15	Niigata(Niigata)	0.050	0.052	0.052	0.051	0.051	0.048	0.048	0.049	0.050	0.048	0.047	0.048	0.047	0.050	0.031~0.153
16	Toyama(Imizu)	0.052	0.050	0.052	0.053	0.052	0.054	0.052	0.050	0.050	0.052	0.053	0.061	0.064	0.066	0.029~0.147
17	Ishikawa(kanazawa)	0.049	0.050	0.054	0.058	0.060	0.063	0.058	0.054	0.055	0.059	0.062	0.061	0.058	0.057	0.0291~0.1275
18	Fukui(Fukui)	0.047	0.046	0.045	0.047	0.049	0.053	0.050	0.048	0.054	0.059	0.059	0.057	0.055	0.054	0.032~0.097
19	Yamanashi(Kohu)	0.044	0.045	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.045	0.045	0.045	0.045	0.046	0.040~0.064
20	Nagano(Nagano)	0.067	0.064	0.064	0.065	0.064	0.061	0.060	0.059	0.060	0.059	0.061	0.064	0.066	0.066	0.0299~0.0974
21	Gifu(Kakamigahara)	0.066	0.064	0.063	0.064	0.064	0.065	0.066	0.065	0.064	0.064	0.064	0.066	0.065	0.065	0.057~0.110
22	Shizuoka(Shizuoka)	0.037	0.039	0.040	0.038	0.037	0.036	0.035	0.034	0.034	0.034	0.034	0.035	0.037	0.040	0.0281~0.0765
23	Aichi(Nagoya)	0.042	0.040	0.040	0.041	0.041	0.042	0.042	0.042	0.041	0.042	0.045	0.045	0.046	0.045	0.035~0.074
24	Mie(Yokkaichi)	0.051	0.048	0.047	0.048	0.048	0.050	0.050	0.052	0.051	0.050	0.052	0.053	0.052	0.050	0.0416~0.0789
25	Shiga(Otsu)	0.036	0.035	0.034	0.034	0.036	0.037	0.035	0.035	0.035	0.038	0.040	0.042	0.042	0.041	0.031~0.061
26	Kyoto(Kyoto)	0.042	0.039	0.038	0.039	0.039	0.040	0.039	0.039	0.039	0.043	0.025	0.049	0.053	0.051	0.033~0.087
27	Osaka(Osaka)	0.045	0.043	0.042	0.042	0.042	0.043	0.044	0.044	0.043	0.046	0.047	0.049	0.051	0.051	0.042~0.061
28	Hyogo(Kobe)	0.037	0.037	0.036	0.036	0.036	0.037	0.037	0.037	0.037	0.039	0.040	0.041	0.043	0.043	0.035~0.076
29	Nara(Nara)	0.051	0.049	0.048	0.048	0.048	0.048	0.049	0.050	0.050	0.051	0.052	0.052	0.054	0.053	0.046~0.08
30	Wakayama(Wakayama)	0.032	0.032	0.032	0.032	0.033	0.033	0.033	0.034	0.034	0.035	0.034	0.032	0.031	0.032	0.031~0.056
31	Tottori(Tohhaku)	0.063	0.066	0.071	0.071	0.075	0.071	0.065	0.070	0.070	0.067	0.068	0.068	0.072	0.075	0.036~0.11
32	Shimane(Matsue)	0.040	0.045	0.044	0.042	0.041	0.038	0.038	0.040	0.042	0.040	0.040	0.041	0.042	0.042	0.033~0.079
33	Okayama(Okayama)	0.053	0.051	0.050	0.050	0.050	0.050	0.051	0.050	0.052	0.054	0.055	0.053	0.053	0.055	0.043~0.104
34	Hiroshima(Hiroshima)	0.049	0.048	0.048	0.049	0.050	0.049	0.049	0.051	0.053	0.053	0.050	0.051	0.055	0.054	0.035~0.069
35	Yamaguchi(Yamaguchi)	0.096	0.095	0.097	0.097	0.094	0.094	0.095	0.093	0.091	0.091	0.093	0.097	0.103	0.096	0.084~0.128
36	Tokushima(Tokushima)	0.039	0.038	0.038	0.038	0.038	0.038	0.039	0.039	0.038	0.039	0.039	0.038	0.038	0.039	0.037~0.067
37	Kagawa(Takamastu)	0.054	0.054	0.053	0.053	0.053	0.053	0.054	0.053	0.055	0.056	0.056	0.058	0.060	0.060	0.051~0.077
38	Enime(Matsuyama)	0.050	0.048	0.047	0.049	0.050	0.049	0.048	0.049	0.049	0.051	0.052	0.052	0.050	0.052	0.045~0.074
39	Kochi(Kochi)	0.028	0.028	0.027	0.028	0.030	0.030	0.030	0.030	0.029	0.028	0.028	0.027	0.027	0.028	0.023~0.076
40	Fukuoka(Dazaifu)	0.037	0.037	0.037	0.037	0.037	0.038	0.036	0.036	0.036	0.037	0.038	0.038	0.039	0.043	0.034~0.079
41	Shiga(Shiga)	0.045	0.045	0.045	0.043	0.040	0.040	0.040	0.040	0.040	0.039	0.040	0.039	0.042	0.056	0.037~0.086
42	Nagasaki(Ohmura)	0.032	0.031	0.031	0.029	0.028	0.028	0.028	0.029	0.029	0.029	0.029	0.029	0.032	0.034	0.027~0.069
43	Kumamoto(Uto)	0.031	0.031	0.032	0.030	0.028	0.027	0.027	0.026	0.027	0.026	0.026	0.026	0.026	0.026	0.021~0.067
44	Oita(Oita)	0.053	0.051	0.051	0.051	0.050	0.050	0.049	0.050	0.050	0.050	0.050	0.050	0.050	0.049	0.048~0.085
45	Miyazaki(Miyazaki)	0.028	0.028	0.028	0.027	0.027	0.027	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.0243~0.0664
46	Kagoshima(Kagoshima)	0.038	0.039	0.038	0.037	0.035	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.0306~0.0943
47	Okinawa(Uruma)	0.021	0.021	0.020	0.021	0.021	0.021	0.021	0.020	0.021	0.020	0.021	0.021	0.021	0.021	0.0133~0.0575

\*The figures in Miyagi are not measured because monitoring point has risk of collapsing.

The monitoring result of Miyagi is available on the website of Miyagi Pref. (<http://www.pref.miyagijp/gentai/Press/PressH230315.html>)

\*Refer to other title "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP" for the data in Fukushima. It could not be measured

\*Blanks are caused by device maintenance, but the area was measured by Monitoring Posts.

\*These dates are estimated as 1 μGy/h=1 μSv/h

\*The table was made by MEXT, based on the reports from prefectures.

2011.3.21. 19:00

 ( $\mu\text{Sv/h}$ )

	Prefecture(City)	2011/3/21										Usual Value Band
		7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	
1	Hokkaido(Sapporo)	0.028	0.028	0.028	0.027	0.028	0.028	0.028	0.028	0.028	0.028	0.02~0.105
2	Aomori(Aomori)	0.022	0.021	0.021	0.022	0.021	0.022	0.022	0.022	0.022	0.022	0.017~0.102
3	Iwate(Morioka)	0.037	0.037	0.035	0.034	0.035	0.034	0.035	0.034	0.034	0.034	0.014~0.084
4	Miyagi(Sendai)											0.0176~0.0513
5	Akita(Akita)	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.022~0.086
6	Yamagata(Yamagata)	0.111	0.111	0.108	0.104	0.103	0.101	0.101	0.100	0.100	0.100	0.025~0.082
7	Fukushima(Futaba)											0.037~0.071
8	Ibaraki(Mito)	0.452	0.394	0.438	0.330	0.308	0.310	0.317	0.327	0.347	0.340	0.036~0.056
9	Tochigi(Utsunomiya)	0.146	0.145	0.140	0.138	0.133	0.135	0.140	0.137	0.135	0.133	0.030~0.067
10	Gunma(Maebashi)	0.073	0.073	0.069	0.067	0.066	0.068	0.068	0.070	0.075	0.085	0.017~0.045
11	Saitama(Saitama)	0.074	0.079	0.085	0.090	0.087	0.100	0.098	0.100	0.106	0.106	0.031~0.080
12	Chiba(Ishihara)	0.036	0.041	0.091	0.074	0.070	0.074	0.081	0.081	0.083	0.082	0.022~0.044
13	Tokyo(Shinjyuku)	0.059	0.070	0.096	0.100	0.109	0.113	0.108	0.112	0.118	0.125	0.028~0.079
14	kanagawa(Chigasaki)	0.063	0.073	0.077	0.078	0.076	0.075	0.081	0.078	0.079	0.083	0.035~0.069
15	Niigata(Niigata)	0.053	0.054	0.051	0.048	0.047	0.048	0.049	0.047	0.047	0.046	0.031~0.153
16	Toyama(Irizu)	0.063	0.059	0.056	0.051	0.051	0.052	0.052	0.049	0.047	0.047	0.029~0.147
17	Ishikawa(kanazawa)	0.052	0.054	0.052	0.049	0.050	0.050	0.048	0.047	0.047	0.047	0.0291~0.1275
18	Fukui(Fukui)	0.051	0.048	0.046	0.047	0.049	0.048	0.046	0.045	0.045	0.045	0.032~0.097
19	Yamanashi(Kofu)	0.047	0.048	0.048	0.046	0.045	0.045	0.053	0.054	0.055	0.058	0.040~0.064
20	Nagano(Nagano)	0.065	0.063	0.061	0.059	0.058	0.057	0.057	0.057	0.057	0.057	0.0299~0.0974
21	Gifu(Kakamigahara)	0.066	0.065	0.063	0.061	0.060	0.060	0.061	0.060	0.060	0.060	0.057~0.110
22	Shizuoka(Shizuoka)	0.040	0.041	0.041	0.036	0.035	0.034	0.034	0.041	0.046	0.046	0.0281~0.0765
23	Aichi(Nagoya)	0.044	0.044	0.043	0.041	0.040	0.040	0.039	0.039	0.039	0.039	0.035~0.074
24	Mie(Yokkaichi)	0.050	0.048	0.047	0.046	0.046	0.046	0.046	0.046	0.046	0.045	0.0416~0.0789
25	Shiga(Otsu)	0.039	0.038	0.036	0.034	0.034	0.036	0.035	0.033	0.032	0.032	0.031~0.061
26	Kyoto(Kyoto)	0.047	0.045	0.041	0.039	0.039	0.045	0.044	0.039	0.038	0.037	0.033~0.087
27	Osaka(Osaka)	0.050	0.048	0.046	0.045	0.043	0.047	0.049	0.045	0.043	0.042	0.042~0.061
28	Hyogo(Kobe)	0.042	0.039	0.040	0.039	0.039	0.042	0.040	0.037	0.036	0.036	0.035~0.076
29	Nara(Nara)	0.056	0.055	0.052	0.050	0.048	0.049	0.052	0.050	0.047	0.047	0.046~0.08
30	Wakayama(Wakayama)	0.034	0.033	0.033	0.032	0.032	0.034	0.039	0.035	0.032	0.032	0.031~0.056
31	Tottori(Tohhaku)	0.073	0.071	0.072	0.073	0.074	0.071	0.066	0.065	0.064	0.063	0.036~0.11
32	Shimane(Matsue)	0.042	0.040	0.037	0.037	0.038	0.037	0.036	0.036	0.036	0.036	0.033~0.079
33	Okayama(Okayama)	0.053	0.058	0.055	0.056	0.055	0.055	0.050	0.048	0.048	0.048	0.043~0.104
34	Hiroshima(Hiroshima)	0.054	0.056	0.059	0.055	0.057	0.051	0.048	0.047	0.047	0.047	0.035~0.069
35	Yamaguchi(Yamaguchi)	0.095	0.099	0.100	0.099	0.100	0.092	0.090	0.089	0.089	0.090	0.084~0.128
36	Tokushima(Tokushima)	0.039	0.039	0.039	0.039	0.038	0.040	0.042	0.039	0.038	0.038	0.037~0.067
37	Kagawa(Takamastu)	0.059	0.058	0.060	0.062	0.057	0.056	0.054	0.052	0.052	0.053	0.051~0.077
38	Ehime(Matsuyama)	0.056	0.054	0.053	0.053	0.054	0.054	0.050	0.048	0.049	0.049	0.045~0.074
39	Kochi(Kochi)	0.028	0.028	0.028	0.028	0.027	0.026	0.026	0.025	0.025	0.027	0.023~0.076
40	Fukuoka(Dazaifu)	0.049	0.045	0.041	0.042	0.038	0.040	0.041	0.041	0.044	0.043	0.034~0.079
41	Shiga(Shiga)	0.059	0.053	0.043	0.040	0.040	0.041	0.043	0.045	0.043	0.041	0.037~0.086
42	Nagasaki(Ohmura)	0.036	0.033	0.031	0.030	0.030	0.029	0.029	0.029	0.029	0.029	0.027~0.069
43	Kumamoto(Uto)	0.027	0.029	0.030	0.028	0.028	0.028	0.027	0.027	0.027	0.027	0.021~0.067
44	Oita(Oita)	0.050	0.050	0.051	0.051	0.052	0.052	0.051	0.052	0.052	0.051	0.048~0.085
45	Miyazaki(Miyazaki)	0.027	0.026	0.026	0.026	0.027	0.027	0.027	0.030	0.047	0.039	0.0243~0.0664
46	Kagoshima(Kagoshima)	0.034	0.035	0.034	0.034	0.034	0.034	0.035	0.035	0.034	0.034	0.0306~0.0943
47	Okinawa(Uruma)	0.021	0.020	0.021	0.021	0.020	0.020	0.020	0.020	0.020	0.021	0.0133~0.0575

\*The figures in Miyagi are not measured because monitoring point has risk of collapsing.

 The monitoring result of Miyagi is available on the website of Miyagi Pref. (<http://www.pref.miyagi.jp/gentai/Press/PressH230315.html>)

\*Refer to other title "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP" for the datas in Fukushima. It could not be measured by Monitoring

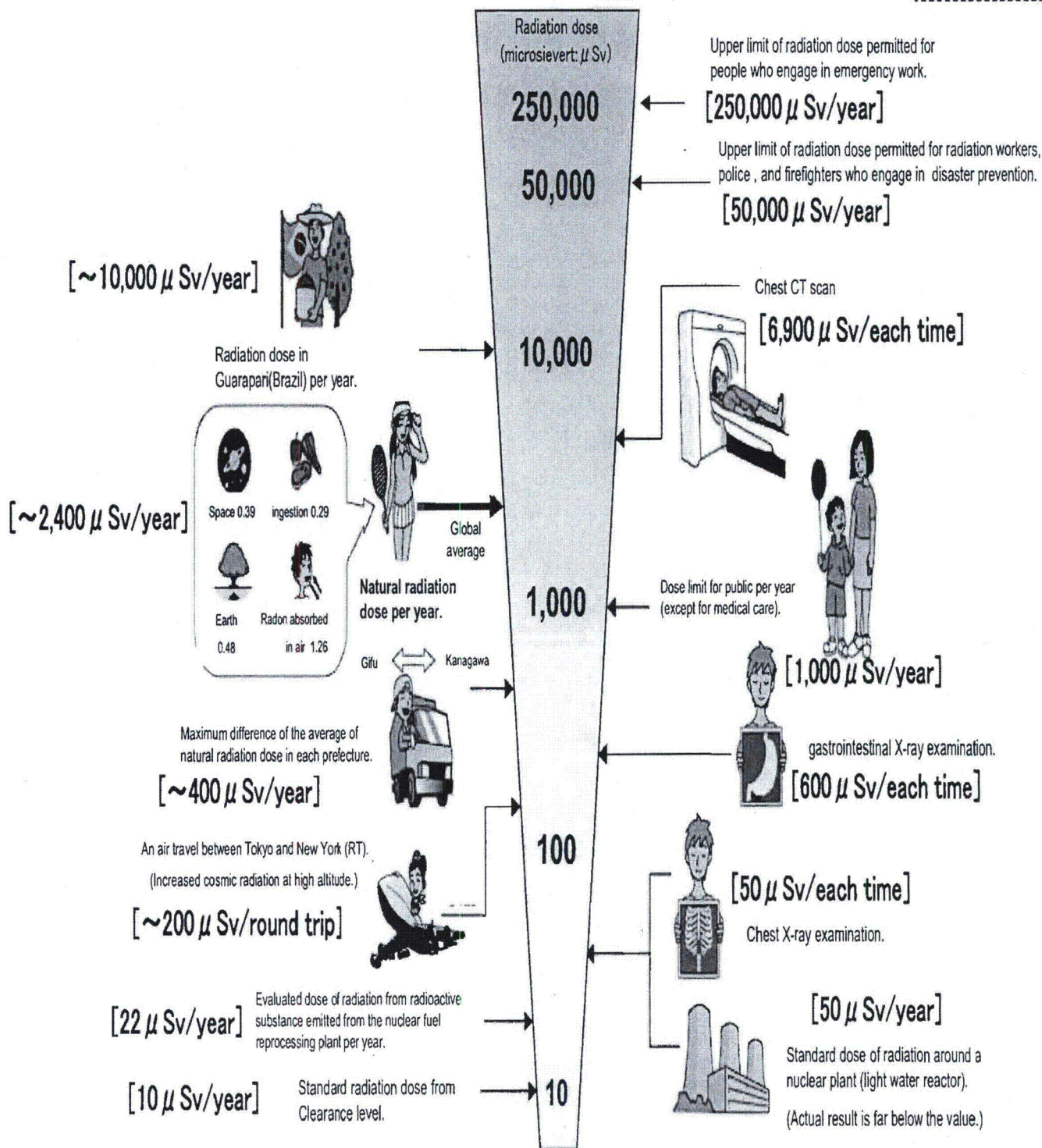
\*Blanks are caused by device maintenance, but the area was measured by Monitoring Posts.

 \*These dates are estimated as  $1\mu\text{Gy/h}=1\mu\text{Sv/h}$ .

\*The table was made by MEXT, based on the reports from prefectures.

# Radiation in Daily-life

※Unit :  $\mu\text{Sv}$



(Ref) Average dose rate at the monitoring post of Tokyo (3/17 9:00~3/18 9:00, March) :  $0.050 \mu\text{Sv}/\text{h} = 438 \mu\text{Sv}/\text{y}$

	Prefecture	Fallout		
		I-131	Cs-137	Remarks
1	Hokkaido	Not Detectable	Not Detectable	
2	Aomori	Not Detectable	Not Detectable	
3	Iwate	Not Detectable	0.24	
4	Miyagi	-	-	Not be measured because of the earthquake disaster damage
5	Akita	Not Detectable	Not Detectable	
6	Yamagata	22	20	
7	Fukushima	-	-	Not be measured because of dealing with the earthquake disaster
8	Ibaraki	490	48	Measurements arrived, though delayed due to earthquake disaster
9	Tochigi	540	45	
10	Gunma	190	63	
11	Saitama	66	Not Detectable	
12	Chiba	44	3.8	
13	Tokyo	40	Not Detectable	
14	Kanagawa	38	Not Detectable	
15	Niigata	2.5	Not Detectable	
16	Toyama	Not Detectable	Not Detectable	
17	Ishikawa	Not Detectable	Not Detectable	
18	Fukui	Not Detectable	Not Detectable	
19	Yamanashi	Not Detectable	Not Detectable	
20	Nagano	Not Detectable	Not Detectable	
21	Gifu	Not Detectable	Not Detectable	
22	Shizuoka	Not Detectable	Not Detectable	
23	Aichi	Not Detectable	Not Detectable	
24	Mie	Not Detectable	Not Detectable	
25	Shiga	Not Detectable	Not Detectable	
26	Kyoto	Not Detectable	Not Detectable	
27	Osaka	Not Detectable	Not Detectable	
28	Hyogo	Not Detectable	Not Detectable	
29	Nara	-	-	On Setting up the equipment
30	Wakayama	Not Detectable	Not Detectable	
31	Tottori	Not Detectable	Not Detectable	
32	Shimane	Not Detectable	Not Detectable	
33	Okayama	Not Detectable	Not Detectable	
34	Hiroshima	Not Detectable	Not Detectable	
35	Yamaguchi	Not Detectable	Not Detectable	
36	Tokushima	Not Detectable	Not Detectable	
37	Kagawa	Not Detectable	Not Detectable	
38	Ehime	Not Detectable	Not Detectable	
39	Kochi	Not Detectable	Not Detectable	
40	Fukuoka	Not Detectable	Not Detectable	
41	Shiga	Not Detectable	Not Detectable	
42	Nagasaki	Not Detectable	Not Detectable	
43	Kumamoto	Not Detectable	Not Detectable	
44	Oita	Not Detectable	Not Detectable	
45	Miyazaki	Not Detectable	Not Detectable	
46	Kagoshima	Not Detectable	Not Detectable	
47	Okinawa	Not Detectable	Not Detectable	

\*The table was made by MEXT, based on the reports from prefectures



**From:** Sheron, Brian  
**To:** OST02 HOC  
**Subject:** RE: Japanese Earthquake ERO Staffing March 18-26, 2011  
**Date:** Tuesday, March 22, 2011 2:15:00 PM

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What you sent was blank.

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**From:** OST02 HOC

**Sent:** Tuesday, March 22, 2011 12:03 PM

**To:** Abrams, Charlotte; Abu-Eid, Bobby; Adams, John; Afshar-Tous, Mugeh; Ahn, Hosung; Alemu, Bezakulu; Alter, Peter; Anderson, Brian; Anderson, James; Arribas-Colon, Maria; Ashkeboussi, Nima; Athey, George; Baker, Stephen; Ballam, Nick; Barnhurst, Daniel; Barr, Cynthia; Barss, Dan; Bazian, Samuel; Bensi, Michelle; Bergman, Thomas; Berry, Rollie; Bhachu, Ujagar; Bloom, Steven; Blount, Tom; Boger, Bruce; Bonnette, Cassandra; Borchardt, Bill; Bowers, Anthony; Bowman, Gregory; Boyce, Tom (RES); Brandon, Lou; Brandt, Philip; Brenner, Eliot; Brock, Kathryn; Brown, Cris; Brown, David; Brown, Eva; Brown, Frederick; Brown, Michael; Bukharin, Oleg; Burnell, Scott; Bush-Goddard, Stephanie; Campbell, Stephen; Camper, Larry; Carpenter, Cynthia; Carter, Mary; Case, Michael; Casto, Greg; Cecere, Bethany; Cervera, Margaret; Chazell, Russell; Chen, Yen-Ju; Cheok, Michael; Chokshi, Niles; Chowdhury, Prosanta; Circle, Jeff; Clement, Richard; Clinton, Rebecca; Coggins, Angela; Collins, Frank; Cool, Donald; Correia, Richard; Costa, Arlon; Couret, Ivonne; Crutchley, Mary Glenn; Cruz, Zahira; Cuadrado, Leira; Dacus, Eugene; DeCicco, Joseph; Decker, David; Dembek, Stephen; Devlin, Stephanie; Dimmick, Lisa; Doane, Margaret; Dorman, Dan; Dorsey, Cynthia; Dozier, Jerry; Drake, Margaret; Droggitis, Spiros; Dube, Donald; Dudes, Laura; Eads, Johnny; Emche, Danielle; English, Lance; Erlanger, Craig; Esmaili, Hossein; Figueroa, Roberto; Fiske, Jonathan; Flannery, Cindy; Floyd, Daphene; Foggie, Kirk; Foster, Jack; Fragoyannis, Nancy; Franovich, Rani; Frazier, Alan; Freshman, Steve; Fuller, Edward; Galletta, Thomas; Gambone, Kimberly; Gibson, Kathy; Giitter, Joseph; Gilmer, James; Gordon, Dennis; Gott, William; Grant, Jeffery; Greenwood, Carol; Grimes, Kelly; Grobe, Jack; Gross, Allen; Gulla, Gerald; Hale, Jerry; Hardesty, Duane; Harrington, Holly; Harris, Tim; Hart, Ken; Hart, Michelle; Harvey, Brad; Hasselberg, Rick; Hayden, Elizabeth; Helton, Donald; Henderson, Karen; Hiland, Patrick; Holahan, Patricia; Holahan, Vincent; Holian, Brian; Howard, Tabitha; Huffert, Anthony; Hurd, Sapna; Huyck, Doug; Imboden, Andy; Isom, James; Jackson, Karen; Jacobson, Jeffrey; Jervy, Richard; Jessie, Janelle; Johnson, Michael; Jolicoeur, John; Jones, Andrea; Jones, Cynthia; Jones, Henry; Kahler, Carolyn; Kammerer, Annie; Karas, Rebecca; Kauffman, John; Khan, Omar; Kolb, Timothy; Kotzalas, Margie; Kowalczyk, Jeffrey; Kratchman, Jessica; Kugler, Andrew; Lamb, Christopher; Lane, John; Larson, Emily; Laur, Steven; LaVie, Steve; Lewis, Robert; Li, Yong; Lichatz, Taylor; Lising, Jason; Lombard, Mark; Lubinski, John; Lui, Christiana; Lukes, Kim; Lynch, Jeffery; Ma, John; Mamish, Nader; Manahan, Michelle; Marksberry, Don; Marshall, Jane; Masao, Nagai; Maupin, Cardelia; Mayros, Lauren; Mazaika, Michael; McConnell, Keith; McCoppin, Michael; McDermott, Brian; McGinty, Tim; McGovern, Denise; McIntyre, David; McMurtry, Anthony; Merritt, Christina; Meyer, Karen; Miller, Charles; Miller, Chris; Milligan, Patricia; Miranda, Samuel; Mohseni, Aby; Moore, Scott; Morlang, Gary; Morris, Scott; Mroz (Sahm), Sara; Munson, Clifford; Murray, Charles; Nerret, Amanda; Nguyen, Caroline; Norris, Michael; Norton, Charles; Ordaz, Vonna; Owens, Janice; Padovan, Mark; Parillo, John; Patel, Jay; Patel, Pravin; Patrick, Mark; Perin, Vanice; Pope, Tia; Powell, Amy; Purdy, Gary; Quinlan, Kevin; Raddatz, Michael; Ragland, Robert; Ralph, Melissa; Ramsey, Jack; Reed, Elizabeth; Reed, Sara; Reed, Wendy; Reis, Terrence; Resner, Mark; Riley (OCA), Timothy; Riner, Kelly; Rini, Brett; Robinson, Edward; Rodriguez-Luccioni, Hector; Roggenbrodt, William; Roop, Kimberly; Rosenberg, Stacey; Ross-Lee, MaryJane; Roundtree, Amy; Ruland, William; Ryan, Michelle; Salay, Michael; Salter, Susan; Salus, Amy; Sanfilippo, Nathan; Scarbrough, Thomas; Schaperow, Jason; Schmidt, Duane; Schmidt, Rebecca; Schoenebeck, Greg; Schrader, Eric; Schwartzman, Jennifer; Seber, Dogan; See, Kenneth; Shane, Raeann; Shea, James; Shepherd, Jill; Sheron, Brian; Skarda, Raymond; Skeen, David; Sloan, Scott; Smirolido, Elizabeth; Smith, Brooke; Smith, Stacy; Smith, Theodore; Stahl, Eric; Stang, Annette; Steger (Tucci), Christine; Stieve, Alice; Stone, Rebecca; Stransky, Robert; Sturz, Fritz; Sullivan, Randy; Summers, Robert; Sun, Casper; Tappert, John; Tegeler, Bret; Temple, Jeffrey; Thaggard, Mark; Thomas, Eric; Thorp, John; Tiruneh, Nebiyu; Tobin, Jennifer; Trefethen, Jean; Tschiltz, Michael; Turtill, Richard; Uhle, Jennifer; Valencia, Sandra; Vaughn, James; Versluis, Robert; Vick, Lawrence; Virgilio, Martin; Virgilio, Rosetta; Ward, Leonard; Ward, William; Wastler, Sandra; Watson, Bruce; Webber, Robert; Weber, Michael; White, Bernard; Wiggins, Jim; Williams, Donna; Williams, Joseph; Williamson, Linda; Willis, Dori; Wimbush, Andrea; Wittick, Brian; Wray, John; Wright, Lisa (Gibney); Wright, Ned; Wunder, George; Young, Francis; Zimmerman, Jacob; Zimmerman, Roy

CH/207



**Subject:** Japanese Earthquake ERO Staffing March 18-26, 2011

Good Afternoon,

Attached is the OPS Center watchbill for March 18-26<sup>th</sup>, you will be receiving the watchbill for the week of March 26-April 2<sup>nd</sup>, in the future. If you need to change the schedule, please send an email to OST02 HOC.

**From:** Sheron, Brian  
**To:** HOO Hoc  
**Subject:** FW: Japanese radiological data  
**Date:** Tuesday, March 22, 2011 2:23:00 PM  
**Attachments:** [110321fukushima\\_1900a\[1\].pdf](#)  
[110320fallout\\_1900a\[1\].pdf](#)

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Please forward to PMT. Thx.

-----Original Message-----

**From:** Koonin, Steven [<mailto:Steven.Koonin@science.doe.gov>]  
**Sent:** Tuesday, March 22, 2011 1:25 PM  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Brinkman, Bill; [RJBudnitz@lbl.gov](mailto:RJBudnitz@lbl.gov); SCHU; DAgostino, Thomas; (b)(6) Finck, Phillip; (b)(6) Grossenbacher, John (INL); John Holdren; Hurlbut, Brandon; Kelly, John E (NE); McFarlane, Harold; Owens, Missy; Poneman, Daniel; Sheron, Brian; [ronaldo.szilard@inl.gov](mailto:ronaldo.szilard@inl.gov); [rlg2@us.ibm.com](mailto:rlg2@us.ibm.com); Per F. Peterson; Lyons, Peter  
**Subject:** Japanese radiological data

This in response to a query re isotopically resolved air sample from Japanese research labs.

The data at the publicly available links cited below (two examples attached) might be useful in validating AMS data and/or calibrating NARAC models. Haven't seen any of that done to date.

SEK

-----Original Message-----

**From:** Hideto En'yo [<mailto:enyo@riken.go.jp>]  
**Sent:** Tuesday, March 22, 2011 11:21 AM  
**To:** Koonin, Steven  
**Cc:** 'tanihata@rcnp.osaka-u.ac.jp'  
**Subject:** Re: Isotopically resolved air sample data

Dear Dr. Koonin,

We have such kind of measurements and preliminary results are already reported to MEXT. Strictly speaking our data for "Isotopically resolved air sample", which you asked, may not be comparable to others, since the machine used is not for environmental monitor but for the accelerator facility monitor, so that the filter does not collect Iodine well. We actually do not understand well the measured values yet and they are not included the data reported to MEXT.

Besides we have a sort of treaty with Wako-City (where RIKEN is located) about the disclosure of Radiation Monitor, and certainly with MEXT. We start the process to get an approval, but it may need some time. Meantime, MEXT already reported similar measurements at their web page. These may be quite useful for you.

[http://www.mext.go.jp/a\\_menu/saigaijohou/syousai/1303956.htm](http://www.mext.go.jp/a_menu/saigaijohou/syousai/1303956.htm)

The above page is in Japanese. I hope you have staff to translate it. After some delay the corresponding English versions become available at

[http://notice.yahoo.co.jp/emg/en/archives/np\\_jp.html](http://notice.yahoo.co.jp/emg/en/archives/np_jp.html)

By the way, I was (and still is ) a student of Koji Nakai, and I met you at Hakone Seminar (1980), more than 30 years ago.  
It is really nice to hear from you.

CH/2008

Best regards  
Hideto En'yo  
Director  
RIKEN Nishina Center

(2011/03/21 20:25), Koonin, Steven wrote:

> Dr. Enyo:

>

> As I've been corresponding with Dr. Tanihata (whom I've know for more than 30 years), isotopically resolved and calibrated air sample data taken by US personnel are contained in the attached spreadsheet. Dr. Tanihata tells me you and colleagues have similar data from other sites and other times.

>

> Exchanging existing data and, on a regular basis, future data would help give all of us a better picture of what's going on.

>

> Can you send me such data? I am directly in touch with the US government team providing technical advice to the Japanese government.

>

> Dr. Steven E. Koonin

> Under Secretary for Science

> US Department of Energy

> Washington DC

> 12022854682

>

> ----- Original Message -----

> From: SEK Gmail<steven.koonin@gmail.com>

> To: Koonin, Steven

> Sent: Sun Mar 20 22:52:28 2011

> Subject: Mail with GoodReader attachments

>

> See files attached to this message (sent from GoodReader)

>

>

2011.3.21. 19:00

( $\mu$ Sv/h)

Prefecture(City)	2011/3/20										2011/3/21										Usual Value Band
	17-18	18-19	19-20	20-21	21-22	22-23	23-24	0-1	1-2	2-3	3-4	4-5	5-6	6-7							
Hokkaido(Sapporo)	0.028	0.027	0.028	0.028	0.028	0.028	0.027	0.027	0.028	0.029	0.028	0.028	0.028	0.028							
Aomori(Aomori)	0.021	0.021	0.022	0.023	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022							
Iwate(Morioka)	0.027	0.029	0.030	0.030	0.030	0.038	0.037	0.037	0.036	0.036	0.036	0.036	0.036	0.036							
Miyagi(Sendai)																					
Akita(Akita)	0.036	0.040	0.040	0.041	0.041	0.039	0.036	0.036	0.035	0.036	0.036	0.036	0.035	0.035							
Yamagata(Yamagata)	0.044	0.100	0.129	0.125	0.123	0.119	0.117	0.115	0.114	0.114	0.117	0.113	0.113	0.111							
Fukushima(Futaba)																					
Ibaraki(Mito)	0.172	0.172	0.171	0.170	0.170	0.169	0.170	0.170	0.146	0.149	0.150	0.149	0.148	0.147							
Tochigi(Utsunomiya)	0.154	0.152	0.149	0.147	0.146	0.145	0.146	0.146	0.074	0.074	0.074	0.075	0.075	0.075							
Gunma(Meibashi)	0.096	0.103	0.099	0.083	0.074	0.074	0.074	0.074	0.064	0.065	0.065	0.063	0.064	0.068							
Saitama(Saitama)	0.052	0.052	0.052	0.055	0.059	0.062	0.064	0.064	0.065	0.065	0.063	0.063	0.064	0.068							
Chiba(Ishihara)	0.032	0.032	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.030	0.030							
Tokyo(Shinjuku)	0.045	0.044	0.045	0.044	0.044	0.048	0.048	0.049	0.051	0.051	0.050	0.050	0.051	0.052							
Kanagawa(Chigasaki)	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.045	0.044	0.046							
Niigata(Niigata)	0.050	0.052	0.052	0.051	0.051	0.048	0.048	0.049	0.050	0.048	0.047	0.048	0.047	0.050							
Toyama(Imizu)	0.052	0.050	0.050	0.052	0.053	0.054	0.052	0.050	0.050	0.052	0.053	0.053	0.054	0.050							
Ishikawa(Kanazawa)	0.049	0.050	0.054	0.058	0.060	0.063	0.063	0.058	0.054	0.055	0.059	0.062	0.061	0.058							
Fukui(Fukui)	0.047	0.046	0.045	0.047	0.049	0.053	0.050	0.048	0.054	0.059	0.062	0.061	0.061	0.064							
Yamaguchi(Kobu)	0.044	0.045	0.044	0.044	0.044	0.044	0.044	0.045	0.045	0.045	0.045	0.045	0.045	0.046							
Nagano(Nagano)	0.067	0.064	0.064	0.064	0.064	0.061	0.060	0.060	0.060	0.059	0.061	0.064	0.066	0.066							
Gifu(Kakamigahara)	0.066	0.064	0.063	0.064	0.064	0.064	0.065	0.066	0.065	0.064	0.064	0.064	0.065	0.065							
Shizuoka(Shizuoka)	0.037	0.039	0.040	0.038	0.037	0.036	0.036	0.036	0.035	0.034	0.034	0.035	0.037	0.040							
Aichi(Nagoya)	0.042	0.040	0.040	0.041	0.041	0.042	0.042	0.042	0.041	0.042	0.042	0.045	0.046	0.045							
Mie(Yokkaichi)	0.051	0.048	0.047	0.048	0.048	0.050	0.052	0.051	0.050	0.052	0.053	0.052	0.052	0.050							
Shiga(Otsu)	0.036	0.035	0.034	0.034	0.036	0.037	0.035	0.035	0.035	0.038	0.040	0.042	0.042	0.041							
Kyoto(Kyoto)	0.042	0.039	0.038	0.039	0.039	0.040	0.039	0.039	0.039	0.043	0.043	0.049	0.049	0.053							
Osaka(Osaka)	0.045	0.043	0.042	0.042	0.042	0.042	0.043	0.044	0.043	0.046	0.047	0.049	0.051	0.051							
Hyogo(Kobe)	0.037	0.037	0.036	0.036	0.036	0.037	0.037	0.037	0.037	0.039	0.040	0.041	0.043	0.043							
Nara(Nara)	0.051	0.049	0.048	0.048	0.048	0.048	0.049	0.050	0.050	0.051	0.052	0.052	0.054	0.053							
Wakayama(Wakayama)	0.032	0.032	0.032	0.032	0.033	0.033	0.033	0.034	0.034	0.035	0.034	0.034	0.032	0.032							
Tottori(Tohaku)	0.063	0.066	0.071	0.071	0.075	0.071	0.065	0.070	0.070	0.067	0.068	0.068	0.072	0.075							
Shimane(Matsue)	0.040	0.045	0.044	0.042	0.041	0.038	0.038	0.040	0.042	0.040	0.040	0.041	0.042	0.042							
Okayama(Okayama)	0.053	0.051	0.050	0.050	0.050	0.050	0.051	0.050	0.052	0.054	0.055	0.053	0.053	0.055							
Hiroshima(Hiroshima)	0.049	0.048	0.048	0.049	0.050	0.049	0.049	0.051	0.053	0.053	0.050	0.051	0.055	0.054							
Yamaguchi(Yamaguchi)	0.096	0.095	0.097	0.097	0.094	0.094	0.094	0.095	0.093	0.091	0.093	0.097	0.103	0.096							
Tokushima(Tokushima)	0.039	0.038	0.038	0.038	0.038	0.038	0.038	0.039	0.039	0.038	0.039	0.038	0.038	0.039							
Kagawa(Takamatsu)	0.054	0.054	0.053	0.053	0.053	0.053	0.054	0.053	0.055	0.056	0.056	0.058	0.060	0.060							
Ehime(Matsuyama)	0.050	0.048	0.047	0.049	0.050	0.049	0.048	0.049	0.049	0.051	0.052	0.052	0.050	0.052							
Kochi(Kochi)	0.028	0.028	0.027	0.028	0.030	0.030	0.030	0.030	0.030	0.029	0.028	0.028	0.027	0.028							
Fukuoka(Dazaifu)	0.037	0.037	0.037	0.037	0.037	0.038	0.036	0.036	0.036	0.037	0.037	0.038	0.039	0.043							
Saga(Saga)	0.045	0.045	0.045	0.043	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.042	0.042	0.042							
Nagasaki(Nagasaki)	0.032	0.031	0.031	0.031	0.029	0.028	0.028	0.028	0.029	0.029	0.029	0.029	0.032	0.034							
Kumamoto(Uto)	0.031	0.031	0.032	0.030	0.028	0.027	0.027	0.027	0.026	0.027	0.026	0.026	0.026	0.026							
Oita(Oita)	0.053	0.051	0.051	0.051	0.050	0.050	0.050	0.049	0.050	0.050	0.050	0.050	0.050	0.049							
Miyazaki(Miyazaki)	0.028	0.028	0.028	0.028	0.028	0.027	0.027	0.026	0.026	0.026	0.026	0.026	0.026	0.026							
Kagoshima(Kagoshima)	0.038	0.039	0.038	0.037	0.035	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034							
Okinawa(Uruba)	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.020	0.020	0.021	0.021	0.021	0.021	0.021							

\*The figures in Miyagi are not measured because monitoring point has risk of collapsing

The monitoring result of Miyagi Pref. (<http://www.pref.miyagi.jp/genai/Press/PressH230315.html>)  
 \*Refer to other title "Readings at Monitoring Post out of 20 km Zone of Fukushima Dai-ichi NPP" for the data in Fukushima. It could not be measured  
 \*Blanks are caused by device maintenance, but the area was measured by Monitoring Posts  
 \*These dates are estimated as 1  $\mu$  Gy/h=1  $\mu$  Sv/h  
 \*The table was made by MEXT, based on the reports from prefectures

Heading of environmental radioactivity level by prefecture

2011.3.21. 19:00

( $\mu\text{Sv/h}$ )

	Prefecture(City)	2011/3/21										Usual Value Band
		7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	
1	Hokkaido(Sapporo)	0.028	0.028	0.028	0.027	0.028	0.028	0.028	0.028	0.028	0.028	0.02~0.105
2	Aomori(Aomori)	0.022	0.021	0.021	0.022	0.021	0.022	0.022	0.022	0.022	0.022	0.017~0.102
3	Iwate(Morioka)	0.037	0.037	0.035	0.034	0.035	0.034	0.035	0.034	0.034	0.034	0.014~0.084
4	Miyagi(Sendai)											0.0176~0.0513
5	Akita(Akita)	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.022~0.086
6	Yamagata(Yamagata)	0.111	0.111	0.108	0.104	0.103	0.101	0.101	0.100	0.100	0.100	0.025~0.082
7	Fukushima(Futaba)											0.037~0.071
8	Ibaraki(Mito)	0.452	0.394	0.438	0.330	0.308	0.310	0.317	0.327	0.347	0.340	0.036~0.056
9	Tochigi(Utsunomiya)	0.146	0.145	0.140	0.138	0.133	0.135	0.140	0.137	0.135	0.133	0.030~0.067
10	Gunma(Maebashi)	0.073	0.073	0.069	0.067	0.066	0.068	0.068	0.070	0.075	0.085	0.017~0.045
11	Saitama(Saitama)	0.074	0.079	0.085	0.090	0.087	0.100	0.098	0.100	0.106	0.106	0.031~0.060
12	Chiba(Ishihara)	0.036	0.041	0.091	0.074	0.070	0.074	0.081	0.081	0.083	0.082	0.022~0.044
13	Tokyo(Shinjyuku)	0.059	0.070	0.096	0.100	0.109	0.113	0.108	0.112	0.118	0.125	0.028~0.079
14	kanagawa(Chigasaki)	0.063	0.073	0.077	0.078	0.076	0.075	0.081	0.078	0.078	0.083	0.035~0.069
15	Niigata(Niigata)	0.053	0.054	0.051	0.048	0.047	0.048	0.049	0.047	0.047	0.046	0.031~0.153
16	Toyama(Imizu)	0.063	0.059	0.056	0.051	0.051	0.052	0.052	0.049	0.047	0.047	0.029~0.147
17	Ishikawa(kanazawa)	0.052	0.054	0.052	0.049	0.050	0.050	0.048	0.047	0.047	0.047	0.0291~0.1275
18	Fukui(Fukui)	0.051	0.048	0.046	0.047	0.049	0.048	0.046	0.045	0.045	0.045	0.032~0.097
19	Yamanashi(Kofu)	0.047	0.048	0.048	0.046	0.045	0.045	0.053	0.054	0.055	0.058	0.040~0.064
20	Nagano(Nagano)	0.065	0.063	0.061	0.059	0.058	0.057	0.057	0.057	0.057	0.057	0.0299~0.0974
21	Gifu(Kakamigahara)	0.066	0.065	0.063	0.061	0.060	0.060	0.061	0.060	0.060	0.060	0.057~0.110
22	Shizuoka(Shizuoka)	0.040	0.041	0.041	0.036	0.035	0.034	0.034	0.041	0.046	0.046	0.0281~0.0765
23	Aichi(Nagoya)	0.044	0.044	0.043	0.041	0.040	0.040	0.039	0.039	0.039	0.039	0.035~0.074
24	Mie(Yokkaichi)	0.050	0.048	0.047	0.046	0.046	0.046	0.046	0.046	0.046	0.045	0.0416~0.0789
25	Shiga(Otsu)	0.039	0.038	0.036	0.034	0.034	0.036	0.035	0.033	0.032	0.032	0.031~0.061
26	Kyoto(Kyoto)	0.047	0.045	0.041	0.039	0.039	0.045	0.044	0.039	0.038	0.037	0.033~0.087
27	Osaka(Osaka)	0.050	0.048	0.046	0.045	0.043	0.047	0.049	0.045	0.043	0.042	0.042~0.061
28	Hyogo(Kobe)	0.042	0.039	0.040	0.039	0.039	0.042	0.040	0.037	0.036	0.036	0.035~0.076
29	Nara(Nara)	0.056	0.055	0.052	0.050	0.048	0.049	0.052	0.050	0.047	0.047	0.046~0.08
30	Wakayama(Wakayama)	0.034	0.033	0.033	0.032	0.032	0.034	0.039	0.035	0.032	0.032	0.031~0.056
31	Tottori(Tohhoku)	0.073	0.071	0.072	0.073	0.074	0.071	0.066	0.065	0.064	0.063	0.036~0.11
32	Shimane(Matsue)	0.042	0.040	0.037	0.037	0.038	0.037	0.036	0.036	0.036	0.036	0.033~0.079
33	Okayama(Okayama)	0.053	0.058	0.055	0.056	0.056	0.055	0.050	0.048	0.048	0.048	0.043~0.104
34	Hiroshima(Hiroshima)	0.054	0.056	0.059	0.055	0.057	0.051	0.048	0.047	0.047	0.047	0.035~0.069
35	Yamaguchi(Yamaguchi)	0.095	0.099	0.100	0.099	0.100	0.092	0.090	0.089	0.089	0.090	0.084~0.128
36	Tokushima(Tokushima)	0.039	0.039	0.039	0.039	0.038	0.040	0.042	0.039	0.038	0.038	0.037~0.067
37	Kagawa(Takamatsu)	0.059	0.058	0.060	0.062	0.057	0.056	0.054	0.052	0.052	0.053	0.051~0.077
38	Ehime(Matsuyama)	0.056	0.054	0.053	0.053	0.054	0.054	0.050	0.048	0.049	0.049	0.045~0.074
39	Kochi(Kochi)	0.028	0.028	0.028	0.028	0.027	0.026	0.026	0.025	0.025	0.027	0.023~0.076
40	Fukuoka(Dazaifu)	0.049	0.045	0.041	0.042	0.038	0.040	0.041	0.041	0.044	0.043	0.034~0.079
41	Shiga(Shiga)	0.059	0.053	0.043	0.040	0.040	0.041	0.043	0.045	0.043	0.041	0.037~0.086
42	Nagasaki(Ohmura)	0.036	0.033	0.031	0.030	0.030	0.029	0.029	0.029	0.029	0.029	0.027~0.069
43	Kumamoto(Uto)	0.027	0.029	0.030	0.028	0.028	0.028	0.027	0.027	0.027	0.027	0.021~0.067
44	Oita(Oita)	0.050	0.050	0.051	0.051	0.052	0.052	0.051	0.052	0.052	0.051	0.048~0.085
45	Miyazaki(Miyazaki)	0.027	0.026	0.026	0.026	0.027	0.027	0.027	0.030	0.047	0.039	0.0243~0.0664
46	Kagoshima(Kagoshima)	0.034	0.035	0.034	0.034	0.034	0.034	0.035	0.035	0.034	0.034	0.0306~0.0943
47	Okinawa(Uruma)	0.021	0.020	0.021	0.021	0.020	0.020	0.020	0.020	0.020	0.021	0.0133~0.0575

\*The figures in Miyagi are not measured because monitoring point has risk of collapsing.

The monitoring result of Miyagi is available on the website of Miyagi Pref. (<http://www.pref.miyagi.jp/gentai/Press/PressH230315.html>)

\*Refer to other title "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP" for the datas in Fukushima. It could not be measured by Monitoring

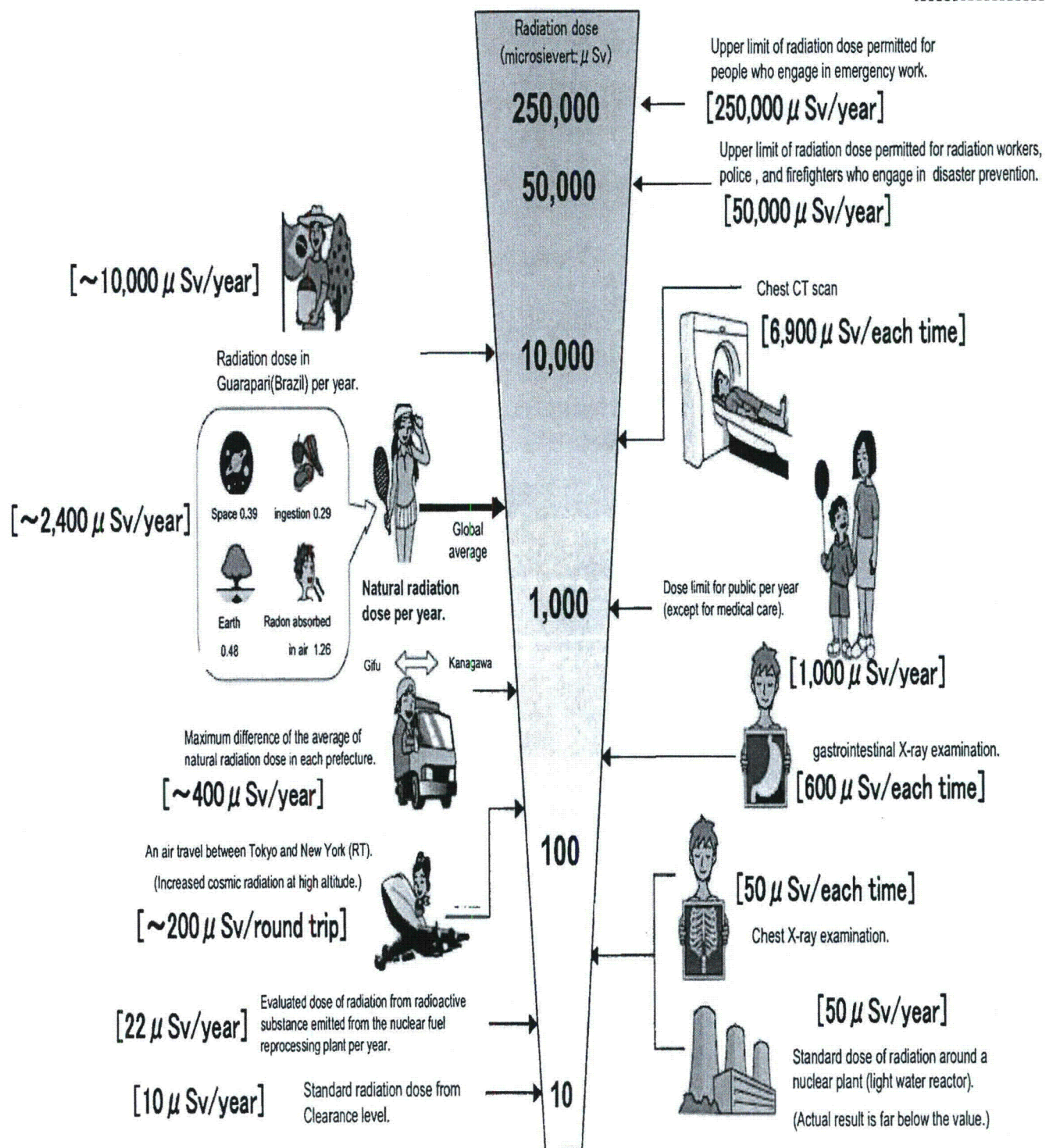
\*Blanks are caused by device maintenance, but the area was measured by Monitoring Posts.

\*These dates are estimated as  $1 \mu\text{Gy/h} = 1 \mu\text{Sv/h}$ .

\*The table was made by MEXT, based on the reports from prefectures.

# Radiation in Daily-life

※Unit :  $\mu\text{Sv}$



(Ref) Average dose rate at the monitoring post of Tokyo (3/17 9:00~3/18 9:00, March) :  $0.050 \mu\text{Sv/h} = 438 \mu\text{Sv/y}$

	Prefecture	Fallout		
		I-131	Cs-137	Remarks
1	Hokkaido	Not Detectable	Not Detectable	
2	Aomori	Not Detectable	Not Detectable	
3	Iwate	Not Detectable	0.24	
4	Miyagi	-	-	Not be measured because of the earthquake disaster damage
5	Akita	Not Detectable	Not Detectable	
6	Yamagata	22	20	
7	Fukushima	-	-	Not be measured because of dealing with the earthquake disaster
8	Ibaraki	490	48	Measurements arrived, though delayed due to earthquake disaster
9	Tochigi	540	45	
10	Gunma	190	63	
11	Saitama	66	Not Detectable	
12	Chiba	44	3.8	
13	Tokyo	40	Not Detectable	
14	Kanagawa	38	Not Detectable	
15	Niigata	2.5	Not Detectable	
16	Toyama	Not Detectable	Not Detectable	
17	Ishikawa	Not Detectable	Not Detectable	
18	Fukui	Not Detectable	Not Detectable	
19	Yamanashi	Not Detectable	Not Detectable	
20	Nagano	Not Detectable	Not Detectable	
21	Gifu	Not Detectable	Not Detectable	
22	Shizuoka	Not Detectable	Not Detectable	
23	Aichi	Not Detectable	Not Detectable	
24	Mie	Not Detectable	Not Detectable	
25	Shiga	Not Detectable	Not Detectable	
26	Kyoto	Not Detectable	Not Detectable	
27	Osaka	Not Detectable	Not Detectable	
28	Hyogo	Not Detectable	Not Detectable	
29	Nara	-	-	On Setting up the equipment
30	Wakayama	Not Detectable	Not Detectable	
31	Tottori	Not Detectable	Not Detectable	
32	Shimane	Not Detectable	Not Detectable	
33	Okayama	Not Detectable	Not Detectable	
34	Hiroshima	Not Detectable	Not Detectable	
35	Yamaguchi	Not Detectable	Not Detectable	
36	Tokushima	Not Detectable	Not Detectable	
37	Kagawa	Not Detectable	Not Detectable	
38	Ehime	Not Detectable	Not Detectable	
39	Kochi	Not Detectable	Not Detectable	
40	Fukuoka	Not Detectable	Not Detectable	
41	Shiga	Not Detectable	Not Detectable	
42	Nagasaki	Not Detectable	Not Detectable	
43	Kumamoto	Not Detectable	Not Detectable	
44	Oita	Not Detectable	Not Detectable	
45	Miyazaki	Not Detectable	Not Detectable	
46	Kagoshima	Not Detectable	Not Detectable	
47	Okinawa	Not Detectable	Not Detectable	

\*The table was made by MEXT, based on the reports from prefectures

**From:** Sheron, Brian  
**To:** HOO Hoc  
**Subject:** FW: Japanese radiological data  
**Date:** Tuesday, March 22, 2011 2:24:00 PM  
**Attachments:** Particulate radioactivity DCFs.xlsx

---

Please forward to the PMT.

-----Original Message-----

From: Holdren, John P. (b)(6)  
Sent: Tuesday, March 22, 2011 1:45 PM  
To: Koonin, Steven; Adams, Ian; Aoki, Steven; Binkley, Steve; Brinkman, Bill; RJBudnitz@lbl.gov; SCHU; DAGostino, Thomas; Fetter, Steve; Finck, Phillip; Garwin, Dick; Grossenbacher, John (INL); Hurlbut, Brandon; Kelly, John E (NE); McFarlane, Harold; Owens, Missy; Poneman, Daniel; Sheron, Brian; ronaldo.szilard@inl.gov; rlg2@us.ibm.com; Per F. Peterson; Lyons, Peter  
Subject: RE: Japanese radiological data

(b)(5)

JOHN P. HOLDREN

Assistant to the President for Science and Technology and Director, Office of Science and Technology Policy Executive Office of the President of the United States email (b)(6) direct phone

(b)(6) assistant Karrie Pitzer (b)(6)

-----Original Message-----

From: Koonin, Steven [mailto:Steven.Koonin@science.doe.gov]  
Sent: Tuesday, March 22, 2011 1:25 PM  
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Brinkman, Bill; RJBudnitz@lbl.gov; SCHU; DAGostino, Thomas; Fetter, Steve; Finck, Phillip; Garwin, Dick; Grossenbacher, John (INL); Holdren, John P.; Hurlbut, Brandon; Kelly, John E (NE); McFarlane, Harold; Owens, Missy; Poneman, Daniel; Brian.sheron@nrc.gov; ronaldo.szilard@inl.gov; rlg2@us.ibm.com; Per F. Peterson; Lyons, Peter  
Subject: Japanese radiological data

This in response to a query re isotopically resolved air sample from Japanese research labs.

The data at the publicly available links cited below (two examples attached) might be useful in validating AMS data and/or calibrating NARAC models. Haven't seen any of that done to date.

SEK

-----Original Message-----

From: Hideto En'yo [mailto:enyo@riken.go.jp]  
Sent: Tuesday, March 22, 2011 11:21 AM  
To: Koonin, Steven  
Cc: 'tanihata@rcnp.osaka-u.ac.jp'  
Subject: Re: Isotopically resolved air sample data

Dear Dr. Koonin,

We have such kind of measurements and preliminary results are already reported to MEXT. Strictly speaking our data for "Isotopically resolved air sample", which you asked, may not be comparable to others, since the machine used is not for environmental monitor but for the accelerator facility monitor, so that the filter does not collect Iodine well. We actually do not understand well the measured values yet and they are not included the data reported to MEXT.

CH/209



Besides we have a sort of treaty with Wako-City (where RIKEN is located) about the disclosure of Radiation Monitor, and certainly with MEXT. We start the process to get an approval, but it may need some time.

Meantime, MEXT already reported similar measurements at their web page.

These may be quite useful for you.

[http://www.mext.go.jp/a\\_menu/saigaijohou/syousai/1303956.htm](http://www.mext.go.jp/a_menu/saigaijohou/syousai/1303956.htm)

The above page is in Japanese. I hope you have staff to translate it.

After some delay the corresponding English versions become available at

[http://notice.yahoo.co.jp/emg/en/archives/np\\_jp.html](http://notice.yahoo.co.jp/emg/en/archives/np_jp.html)

By the way, I was (and still is ) a student of Koji Nakai, and I met you at Hakone Seminar (1980), more than 30years ago.

It is really nice to hear from you.

Best regards

Hideto En'yo

Director

RIKEN Nishina Center

(2011/03/21 20:25), Koonin, Steven wrote:

> Dr. Enyo:

>

> As I've been corresponding with Dr. Tanihata (whom I've know for more than 30 years), isotopically resolved and calibrated air sample data taken by US personnel are contained in the attached spreadsheet. Dr. Tanihata tells me you and colleagues have similar data from other sites and other times.

>

> Exchanging existing data and, on a regular basis, future data would help give all of us a better picture of what's going on.

>

> Can you send me such data? I am directly in touch with the US government team providing technical advice to the Japanese government.

>

> Dr. Steven E. Koonin

> Under Secretary for Science

> US Department of Energy

> Washington DC

> 12022854682

>

> ----- Original Message -----

> From: SEK(b)(6)

> To: Koonin, Steven

> Sent: Sun Mar 20 22:52:28 2011

> Subject: Mail with GoodReader attachments

>

> See files attached to this message (sent from GoodReader)

>

>

CONCENTRATIONS AND DOSES PER BILLIONTH OF A MICROCURIE PER MILLILITER  
 (i.e., per nanocurie per cubic meter) OF AIRBORNE PARTICULATE RADIOACTIVITY  
 AS SAMPLED BY USS GEORGE WASHINGTON 3-21-2011 (compiled by J Holdren 3-22-11)

	USS GW data nCi/m3	col B normal'd nCi/m3	DCF adult EDE rem/Ci	DCF 1-yr thyroid rem/Ci	4-d adult EDE mrem	4-d 1-yr thyroid mrem	adult EDE rate mrem/hr	1-yr thyr rate mrem/hr
TOTAL	0.839	1.000			4.07		0.042	
I-131	0.267	0.318	2.73E+04	5.20E+06	0.70	34.42		0.36
I-132	0.102	0.122	4.22E+02		0.00			
Te-132	0.164	0.195	7.59E+03		0.12			
Cs-134	0.136	0.162	7.55E+04		0.98			
Cs-136	0.200	0.238	1.03E+04		0.20			
Cs-137	0.150	0.179	1.45E+05		2.07			

**From:** Boska, John  
**To:** Leeds, Eric  
**Cc:** Grobe, Jack; Salgado, Nancy; Schwarz, Sherry; Sheron, Brian; Bickett, Brice; Hiland, Patrick; Galloway, Melanie; Salgado, Nancy  
**Subject:** Outcomes from Meeting With New York State Officials  
**Date:** Tuesday, March 22, 2011 2:31:12 PM  
**Attachments:** Outcomes From Meeting With New York State On Indian Point Seismic Concerns.doc  
**Importance:** High

---

Attached are the agreements and the items we promised during the meeting, with a proposed responsible organization.

John Boska  
Indian Point Project Manager, NRR/DORL  
U.S. Nuclear Regulatory Commission  
301-415-2901  
email: john.boska@nrc.gov

CH/210

Outcomes From Meeting With New York State On Indian Point Seismic Concerns  
March 22, 2011  
Notes by John Boska

**Agreements between NRC and NYS:**

1. State inspectors may join NRC inspectors for seismic inspections at Indian Point. (Region I)
2. NRC will share our data on seismic studies with NYS as soon as it is available, as long as there is no legal prohibition (such as proprietary). (Research)
3. When the plant information on seismic is received from a response to the NRC's Generic Letter that will be issued to the licensees, the NRC will give top priority to reviewing the Indian Point data. (DE)
4. Spent fuel pool leakage and its effect on the spent fuel pool structure was part of the license renewal review. (DLR)

**Items we promised to New York State:**

1. We will provide the GI-199 Risk Assessment Review report to NYS. (Research)
2. We will provide information on why the spent fuel pools are not included in GI-199, including any information we have on the seismic ruggedness of the pools. (Research)
3. We will provide examples of improvements made at Indian Point during the IPEEE seismic review. (DORL)
4. We will provide the raw data being used to develop the new consensus seismic hazard curves, or will meet with NYS experts to explain it. (Research)

**From:** Leeds, Eric  
**To:** Boska, John  
**Cc:** Grobe, Jack; Salgado, Nancy; Schwarz, Sherry; Sheron, Brian; Bickett, Brice; Hiland, Patrick; Galloway, Melanie; Salgado, Nancy  
**Subject:** RE: Outcomes from Meeting With New York State Officials  
**Date:** Tuesday, March 22, 2011 2:41:48 PM

---

Nice job, John – thank you!

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

---

**From:** Boska, John  
**Sent:** Tuesday, March 22, 2011 2:31 PM  
**To:** Leeds, Eric  
**Cc:** Grobe, Jack; Salgado, Nancy; Schwarz, Sherry; Sheron, Brian; Bickett, Brice; Hiland, Patrick; Galloway, Melanie; Salgado, Nancy  
**Subject:** Outcomes from Meeting With New York State Officials  
**Importance:** High

Attached are the agreements and the items we promised during the meeting, with a proposed responsible organization.

John Boska  
Indian Point Project Manager, NRR/DORL  
U.S. Nuclear Regulatory Commission  
301-415-2901  
email: john.boska@nrc.gov

CH/211

**From:** Dacus, Eugene  
**To:** Sheron, Brian  
**Cc:** Powell, Amy; Lund, Louise  
**Subject:** FW: House E&C request  
**Date:** Tuesday, March 22, 2011 2:48:17 PM

---

Brian,

Help. One of the staffers you briefed last week has asked for some documentation. See trail below.

Grrr

---

**From:** Lund, Louise  
**Sent:** Tuesday, March 22, 2011 10:14 AM  
**To:** Dacus, Eugene  
**Cc:** Galloway, Melanie; Holian, Brian  
**Subject:** RE: House E&C request

Gene,

Brian H. brings up a good point. You may want to close the loop with Brian Sheron to see if he was referring to the SAMA reviews or the SORCA.

Louise

---

**From:** Holian, Brian  
**Sent:** Tuesday, March 22, 2011 9:59 AM  
**To:** Dacus, Eugene; Lund, Louise  
**Cc:** Galloway, Melanie  
**Subject:** Re: House E&C request

I believe sheron is talking about SORCA reviews. These were done independent of license renewal. PB was one plant looked at in depth

---

**From:** Dacus, Eugene  
**To:** Lund, Louise  
**Cc:** Holian, Brian  
**Sent:** Mon Mar 21 16:49:47 2011  
**Subject:** RE: House E&C request

Thanks Louise. Really appreciate your help on this. You always come through for us.

---

**From:** Lund, Louise  
**Sent:** Monday, March 21, 2011 4:47 PM  
**To:** Dacus, Eugene  
**Cc:** Holian, Brian  
**Subject:** RE: House E&C request

Gene,

I talked with Sam Lee (DRA), and we both think Brian was referring to the SAMA (Severe Accident Mitigation Alternatives) analysis in the plant-specific supplement to the

CH/212

Environmental Impact Statement that DLR issues as part of the license renewal process. It is publicly available, and contained in Section 5 of the following link on our web page to the Supplemental EIS:

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/supplement10/>

Louise

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**From:** Dacus, Eugene  
**Sent:** Monday, March 21, 2011 4:17 PM  
**To:** Lund, Louise  
**Subject:** FW: House E&C request

Louise,

I hate to bug you, but I don't have a contact for PB. The e-mail below is from a staffer on the House Energy and Commerce Committee. He's asking for data relating to the Peach Bottom relicensing.

---

**From:** Baran, Jeff [mailto:Jeff.Baran@mail.house.gov]  
**Sent:** Friday, March 18, 2011 4:56 PM  
**To:** Powell, Amy  
**Cc:** Dotson, Greg; Cassady, Alison  
**Subject:** Follow-up

Hi Amy,

We had a very informative discussion with Brian Sheron earlier. Thanks for helping to set that up. He mentioned that, for the Peach Bottom license renewals, NRC ran several scenarios as part of a risk assessment to calculate the consequences of certain severe events. We're interested in reviewing the documentation regarding these scenarios. If the document(s) is/are on ADAMS and you can point me in the right direction, that'd be great. If it's not publicly available, we'd still be very interested in getting copies of the documents next week.

Feel free to call if you have any questions.

Thanks,

Jeff

**From:** Coe, Doug  
**To:** Rini, Brett  
**Cc:** Rivera-Lugo, Richard; Armstrong, Kenneth; Ibarra, Jose; Ramirez, Annie; Sheron, Brian; Uhle, Jennifer; Case, Michael; Richards, Stuart; Gibson, Kathy; Elkins, Scott; Coyne, Kevin  
**Subject:** RE: ACTION: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Date:** Tuesday, March 22, 2011 4:10:56 PM

(b)(5)

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**From:** Rini, Brett  
**Sent:** Tuesday, March 22, 2011 3:27 PM  
**To:** Case, Michael; Richards, Stuart; Gibson, Kathy; Elkins, Scott; Coe, Doug; Coyne, Kevin  
**Cc:** Rivera-Lugo, Richard; Armstrong, Kenneth; Ibarra, Jose; Ramirez, Annie; Sheron, Brian; Uhle, Jennifer  
**Subject:** ACTION: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Importance:** High

Division Directors,

Please see the attached SRM regarding follow-up actions from the events in Japan. As indicated below, "as provided in the Internal Commission Procedures, the staff is "...afforded an opportunity to review the SRM to ensure that the Commission decision is clear and understandable and that resource, scheduler, and legal constraints are properly considered."

Please send me any major problems that you see with the attached by COB today.

Thank you in advance for addressing this (additional) short turnaround request.

Brett

---

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 2:04 PM  
**To:** Rini, Brett  
**Subject:** FW: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Importance:** High

Brett, please have division review and let me know if any major problems or show-stoppers.

---

**From:** RidsEdoDraftSrmVote Resource  
**Sent:** Tuesday, March 22, 2011 1:58 PM  
**To:** Ash, Darren; Borchardt, Bill; Boyd, Lena; Buckley, Patricia; Clarke, Deanna; Cohen, Miriam;

CH/213



EDO\_Staff\_Assistants; Flory, Shirley; Fry, Jeannie; Garland, Stephanie; Johnson, Michael; Mamish, Nader; Matakas, Gina; Miles, Patricia; Miller, Charles; Owen, Lucy; Riddick, Nicole; RidsAdmMailCenter Resource; RidsCsoMailCenter Resource; RidsFsmeOd Resource; RidsHrMailCenter Resource; RidsNmssOd Resource; RidsNroMailCenter Resource; RidsNrrOd Resource; RidsNsirMailCenter Resource; RidsOeMailCenter Resource; RidsOiMailCenter Resource; RidsOIS' Resource; RidsResOd Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource; RidsSbcrMailCenter Resource; Thomas, Loretta; Virgilio, Martin; Walker, Dwight; Weber, Michael

**Subject:** FW: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)

**Importance:** High

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**From:** Wright, Darlene

**Sent:** Tuesday, March 22, 2011 1:19 PM

**To:** Baggett, Steven; Bates, Andrew; Batkin, Joshua; Baval, Rochelle; Blake, Kathleen; Bozin, Sunny; Bradford, Anna; Bubar, Patrice; Bupp, Margaret; Burns, Stephen; Chairman Temp; Clark, Lisa; Coggins, Angela; Cordes, John; Crawford, Carrie; Davis, Roger; Fopma, Melody; Franovich, Mike; Gibbs, Catina; Hackett, Edwin; Hart, Ken; Harves, Carolyn; Henderson, Karen; Herr, Linda; Hipschman, Thomas; Hudson, Sharon; Joosten, Sandy; KLS Temp; Kock, Andrea; Laufer, Richard; Lepre, Janet; Loyd, Susan; Mamish, Nader; Marshall, Michael; Monninger, John; Moore, Scott; Orders, William; Pace, Patti; Poole, Brooke; Reddick, Darani; RidsEdoDraftSrmVote Resource; Rothschild, Trip; Savoy, Carmel; Sharkey, Jeffry; Shea, Pamela; Snodderly, Michael; Sosa, Belkys; Speiser, Herald; Svinicki, Kristine; Temp, GEA; Temp, WCO; Temp, WDM; Thoma, John; Vietti-Cook, Annette; Warren, Roberta; Zorn, Jason; Tadesse, Rebecca; Joosten, Sandy; Castleman, Patrick; Montes, David; Dhir, Neha; Adler, James; Jimenez, Patricia; Muessle, Mary; Nieh, Ho; Ostendorff, William; Warnick, Greg; Apostolakis, George; Pearson, Laura; Lui, Christiana; Lisann, Elizabeth

**Cc:** Lewis, Antoinette

**Subject:** DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)

**Importance:** High

The attached file contains a draft SRM which is being circulated for Commission review. Your response is requested as soon as practical today. As provided in the Internal Commission Procedures, the staff is "...afforded an opportunity to review the SRM to ensure that the Commission decision is clear and understandable and that resource, schedular, and legal constraints are properly considered." Please provide any responses to Ken Hart (KRH), Richard Laufer (RJL), Rochelle Baval (RCB5), and Pam Shea (PWS).

**From:** Grobe, Jack  
**To:** Hiland, Patrick; Skeen, David; Grobe, Jack; Leeds, Eric; Meighan, Sean; Nguyen, Quynh; Mathew, Roy; Wittick, Brian; Andersen, James; Wilson, George; Sheron, Brian; Uhle, Jennifer; Johnson, Michael; Holahan, Gary; Boger, Bruce  
**Subject:** FW: Draft scheduling note for SBO  
**Date:** Tuesday, March 22, 2011 4:12:55 PM  
**Attachments:** Draft.sbo note.docx

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Couple thoughts.

|not sure we need Pat and me both.

|Should we have some perspective from new reactors?

|Is there anything that RES is doing that should be addressed?

|What about routing baseline inspection and how it addresses station blackout?

|Who should address these topics if we include them?

---

**From:** Wilson, George  
**Sent:** Tuesday, March 22, 2011 3:36 PM  
**To:** Hiland, Patrick; Skeen, David; Grobe, Jack; Leeds, Eric; Meighan, Sean; Nguyen, Quynh; Mathew, Roy; Wittick, Brian; Andersen, James  
**Subject:** Draft scheduling note for SBO

See attached

George Wilson  
USNRC  
EICB Branch Chief, Division of Engineering  
Mail Stop O12H2  
301-415-1711

CH/214

Draft: 03/22/11

### SCHEDULING NOTE

**Title:** BRIEFING ON Status of Events in Japan and U.S. Fleet status on Station Blackout (Public)

**Purpose:** To provide the Commission with an updated status of the Japanese Event and to provide an overview of the Station Blackout Rule.

**Scheduled:** April 28, 2011  
0900 a.m.

**Duration:** Approx. 1 hour and 45 minutes

**Location:** Commissioners' Conference Room, 1<sup>st</sup> floor OWFN

<b>Participants:</b>	<b>Presentation</b>
<b><u>NRC Staff Panel</u></b>	<b>50 mins.*</b>
<b>R. William Borchardt</b> , Executive Director for Operations <u>Topic:</u> Update to Japanese Response	15 mins.*
<b>Jack Grobe</b> , Deputy Director for Engineering and Support Office of Nuclear Reactor Regulation <u>Topic:</u> Station Blackout Overview	5 mins.*
<b>Patrick Hiland</b> , Director for Engineering, Office of Nuclear Reactor Regulation <u>Topic:</u> Station Blackout Rule Background	10 mins.*
<b>George Wilson</b> , Chief of Instrumentation and Control Branch, Division of Engineering, Office of Nuclear Reactor Regulation <u>Topic:</u> Station Blackout Review and Approval Process	20 mins.*
<b>Commission Q &amp; A</b>	<b>50 mins.</b>
<b>Discussion – Wrap-up</b>	

**From:** Kammerer, Annie  
**To:** Schmidt, Rebecca; Sheron, Brian  
**Cc:** Powell, Amy; Dricks, Victor; Uselding, Lara  
**Subject:** RE: Earthquake info  
**Date:** Tuesday, March 22, 2011 4:35:31 PM  
**Attachments:** NRC activities related to DCNP and SONGS.docx

---

Becky,

I apologize for the delay. This is not a document that existed and the information about everything that we have done in terms of reassessing seismic tsunami hazard at these sites is mostly in my head and files.

There are two things. First, please see the note highlighted. I'm not sure what became of that communication back and forth with Capps since I got dropped out of the loop. This relates to the 3D seismic stuff that the Senators staff was discussing with Josh.

Also you may want to note the very last item at SONGS. There is a new "shoreline fault" showing up in literature discussing seismology of the region around SONGS (sound familiar?). I'm almost scared to bring it up, but we are on top of it and are trying to get information about it.

A lot of what we are doing with regard to SONGS is keeping an eye on things...but not formal actions yet, since it isn't part of relicensing. Of course everyone uses the SAMA to bring up other issues, and we expect this for SONGS as well and are preparing.

Please have someone read through this before sending it on. I tried to brainstorm everything that is outside of the stuff I can't talk about (legal actions).

I hope this is what you need. Please call me with any questions. 415.307.6922.

Also, I didn't realize the senator was going to SONGS today as well (that's quite the tour). If I can get a fact sheet done in an hour, would it be too late? I had already started at Victor's request this morning...and may be able to pull it off.

Annie

CH/215

## Information on NRC activities in support of assessment of seismic safety at California Nuclear Plants for Senator Boxer's staff

### General

- NRC staff assisted California Energy Commission staff tasked with development of the report to respond to California AB 1632. This report ultimately led to the report entitled, "An Assessment of California's Nuclear Power Plants" Commission Report, adopted November 20, 2008. Publication # CEC-100-2008-009-CMF. NRC staff supported CEC staff in understanding NRC's seismic regulations and in also understanding technical subjects of a mutual interest.
- In September 2010, the NRC convened a public informational Seismic Workshop in San Luis Obispo that was well attended by both the public and by staff of Pacific, Gas & Electric and Southern California Edison. The first day was devoted to a general understanding of topics related to seismic hazard and seismic design. Presentations were given by faculty from UC Berkeley, UC Santa Barbara, and Cal Poly, and also by scientists from the USGS and the California Geologic Survey. The second day the presentations focused around Diablo Canyon. Among the presentations the second day was one by the California Energy Commission.
- NRC staff has performed an informal review of information provided in the studies performed for the California-wide Uniform California Earthquake Rupture Forecast (UCERF) program report and discussions with UCERF scientists to understand how the work related to hazard assessments around Diablo Canyon and SONGS. This program was sponsored by the California Earthquake Authority, the Southern California Energy Center, the USGS, the California Geologic Survey and the National Science Foundation. This review was to determine if there is new information of interest or concern, not as part of a licensing action.
- The NRC, USGS, and IAEA are conducting a joint program to develop and implement a custom version of the USGS ShakeCast system for post-earthquake real-time notification of ground shaking at nuclear power plant sites. The custom system, tentatively called Nuclear ShakeCast, is being developed to meet the unique needs of the nuclear community and will improve NRC's response time and regional situational awareness in case of an earthquake near a nuclear plant. This notification system would provide real time notification and important technical information to key staff within the NRC and to the NRC Operations Center. The goal is to have a beta version of this system running in time for the National Level Exercise in May.
- NRC staff have also been working with NOAA/PMEL and IAEA to develop a tsunami notification system called TsunamiCast. This notification system would tie into the NOAA tsunami warning system and would provide real time notification to key staff within the NRC and the NRC Operations Center. In later stages of development it would provide estimates of wave heights at California nuclear plant locations in real time. This system is principally of use for the California nuclear plants.
- Based on information available to NRC staff, it is believed that both California plants are considering performing new probabilistic seismic hazard assessments in line with the NRC's current guidance as outlined in Regulatory Guide 1.208 and NUREG/CR-6372.

Discussions regarding NRC staff acting in a review capacity as part of the Participatory Peer Review Panel (as described in NUREG/CR-6372) have occurred during recent public meetings with PG&E in which PG&E described their plans in this area. It should be noted, however, that the NRC has not received formal communications or commitments with regard to these potential new state-of-the-art studies.

## Diablo Canyon

- NRC has performed an informal review of, "Methodology for Probabilistic Tsunami Hazard Analysis: Trial Application for the Diablo Canyon Power Plant Site Pacific Gas & Electric Company, Submitted to the PEER Workshop on Tsunami Hazard Analyses for Engineering Design Parameters, Berkeley CA. This is essentially a state-of-the-art tsunami hazard assessment for Diablo Canyon. The report also proposes a methodology that can be used for a similar study at SONGS.
- In response to the discovery of the Shoreline fault The NRC staff has performed a preliminary evaluation of the tsunami hazard and an independent deterministic seismic hazard analysis of the Shoreline fault based on the information provided by the licensee to confirm the licensee's conclusions regarding the operability of DCCP. This is detailed in Research Information Letter 09-001.
- The staff has continued to monitor the progress of the fault investigation study by maintaining an open line of communication with the licensee on this subject. The staff reviewed new information as it became available on an ongoing basis.
- The NRC staff has reviewed interim seismic studies related to the Shoreline Fault. These include a study on possible secondary deformation resulting from a primary rupture on the Shoreline Fault. The NRC's independent analysis on this topic will be published as part of a publically available Research Information Letter.
- The final study was completed on January 7, 2011. NRC staff is now performing a review of the information and are developing an independent deterministic model for a final deterministic assessment of the hazard from the Shoreline Fault. The results of this study will be published in a new Research Information Letter. This is expected to be completed and be publically available by the end of the year.
- The staff will continue discussions with PG&E on an amendment to codify a long term seismic program methodology for the management of new geotechnical seismic information.
- In July 2010, the NRC received a letter from representatives Capp and Filer requesting that the NRC participate on a newly formed panel, composed of California's regulatory agencies, that had been formed to review the new 3D seismic information being collected off the coast by PG&E. The NRC responded with a request for clarification of the nature of the participation requested. Once received, the NRC will consider participating in this work.

Although seismic hazard is not part of licensing per se. The NRC staff has begun preparation for review of related studies, such as the required Severe Accident Mitigation and Analysis, that have seismic components. As noted, staff have also been performing limited reviews on new information to assure that no surprises are identified. Among the items that NRC staff are aware of and are reviewing in preparation for SONGS relicensing.

- Southern California Edison's Evaluation of California Energy Commission AB 1632 Report Recommendations, February 2011
- NRC staff has been following research performed by the University of Southern California Tsunami Research Center regarding tsunami hazard in the area around San Onofre. NRC staff have discussed recent research with tsunami hazard experts at URS Corporation regarding work in the SONGS area.
- Staff is collecting and reviewing information related to a recently discovered potential fault offshore SONGS that may be part of the Newport-Inglewood-Rose Canyon fault system. Similar to the Shoreline Fault offshore Diablo Canyon, this fault is much smaller (and likely capable of a much smaller magnitude) than the fault used to determine the design basis ground shaking. However, staff are trying to determine a best estimate of magnitude and activity of the potential fault to determine a preliminary estimate of possible ground shaking.

**From:** Per F. Peterson  
**To:** Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; kpitzer@ostp.eop.gov; Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
**Subject:** Radiation levels in RHR equipment area  
**Date:** Tuesday, March 22, 2011 4:45:49 PM

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All,

As I mentioned on the telecon, once the residual heat removal system starts running, radiation dose rates will go up around the equipment because the fluid in the piping will be much more radioactive. The RHR heat exchangers will be located in a separate room with shielding, but it could be important to understand how much the dose rates may increase in the area around the pumps and valves, in case they need further maintenance or replacement after they start running.

Since one has multiple trains of the equipment that have some physical isolation, also, if one train has problems the dose rate near the other pumps may be lower and one might then fix one of the other pumps to restart RHR. This is worth checking too, since there is a question of whether one should start up once a single RHR pump is functional, or fix more than one pump before starting up (hopefully one can start up immediately after fixing one pump).

-Per

--

-----  
Per F. Peterson  
Professor and Chair  
Department of Nuclear Engineering  
University of California  
4153 Etcheverry Hall  
Berkeley, California 94720-1730  
peterson@nuc.berkeley.edu  
Office: (510) 643-7749 Fax: (510) 643-9685  
[http://www.nuc.berkeley.edu/People/Per\\_Peterson](http://www.nuc.berkeley.edu/People/Per_Peterson)  
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CH/216



**From:** Weber, Michael  
**To:** Leeds, Eric; Sheron, Brian; Boger, Bruce; Grobe, Jack; Uhle, Jennifer  
**Cc:** Muessle, Mary; Andersen, James; Wittick, Brian  
**Subject:** FYI - Meeting with New York City  
**Date:** Tuesday, March 22, 2011 4:56:46 PM

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**From:** Droggitis, Spiros  
**Sent:** Tuesday, March 22, 2011 4:54 PM  
**To:** Borchardt, Bill; Weber, Michael; Virgilio, Martin; Brenner, Eliot; Schmidt, Rebecca  
**Cc:** Powell, Amy; Wittick, Brian; Andersen, James; Muessle, Mary  
**Subject:** FW: Meeting with New York City

NYC wants to come in to provide a "different perspective". I'm working with Jane to find out when they are available to come down and whether the discussions will be policy or technical.

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**From:** OCA\_Web Resource [mailto:OCA\_Web.Resource@nrc.gov]  
**Sent:** Tuesday, March 22, 2011 2:56 PM  
**To:** Droggitis, Spiros; Belmore, Nancy  
**Subject:** FW: Meeting with New York City

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**From:** Rudolph, Jane[SMTP:JRUDOLPH@CITYHALL.NYC.GOV]  
**Sent:** Tuesday, March 22, 2011 2:55:29 PM  
**To:** OCA\_Web Resource  
**Subject:** Meeting with New York City  
**Auto forwarded by a Rule**

Hi Spiros –

I work for New York City's Mayor's Office and was hoping you can help me set up a meeting with some of my team and the NRC. NYC's Deputy Mayor Stephen Goldsmith and Department of Environmental Protection Commissioner Cas Holloway would like a chance to meet with the NRC to brief you on the City's position on Indian Point as well as quickly discuss our energy needs. We would be happy to come to DC to meet.

Please let me know who I should speak to set this up.

Thanks,  
Jane

Jane Rudolph  
Legislative Representative  
New York City Office of Federal Affairs

CH/217

1301 Pennsylvania Avenue, NW, Suite 350  
Washington DC, 20004  
Office: 202-624-5911  
Fax: 202-624-5926

**From:** Per F. Peterson  
**To:** Phillip.Finck@inl.gov; Per F. Peterson; Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Dick Garwin; Dick Garwin; John.Grossenbacher@inl.gov; John Kelly; Koonin, Steven; Pete Lyons; Harold.McFarlane@inl.gov; Ronaldo.Szilard@inl.gov; Steve Fetter  
**Cc:** Narendra, Blake; Fitzgerald, Paige; koitzer@ostp.eop.gov; Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
**Subject:** Re: Radiation levels in RHR equipment area  
**Date:** Tuesday, March 22, 2011 5:01:07 PM

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Phillip,

You raise a good point. We are concerned primarily about water-soluble gamma emitters. I think that it is reasonable to assume that 10% to 50% of the Cs-137 that was in the fuel is now in the suppression pool and primary coolant. A question is, are there any other shorter-lived water-soluble fission products that are strong gamma emitters? The other question is what volume of water to assume these fission products are diluted in.

This raises also another issue. As soon as RHR is available, it may be possible to align the circulation to let down primary coolant into the suppression pool, and flush water from the suppression pool through the primary circuit. This would provide a method to remove salt. Also, if the primary coolant has higher dose rates than the water in the suppression pool, flushing the primary system with suppression pool water will bring down the dose rates in the RHR system.

-Per

>Per: it might be hard to know the dissolution rates because we do  
>not know the fuel geometry. Is there a way to do sampling of that  
>water? If not you might want to repair as much as you can before  
>cooling.

>  
>Phillip  
>  
>

>----- Original Message -----

>From: "Per F. Peterson" [peterson@nuc.berkeley.edu]  
>Sent: 03/22/2011 01:45 PM MST  
>To: "Adams, Ian" <Ian.Adams@Hq.Doe.Gov>; "Aoki, Steven"  
><Steven.Aoki@nnsa.doe.gov>; "Binkley, Steve"  
><Steve.Binkley@science.doe.gov>; Bob Budnitz <RBudnitz@lbl.gov>;  
>Brian Sheron <Brian.sheron@nrc.gov>; Dick Garwin  
>(b)(6) Dick Garwin <rlg2@us.ibm.com>; Phillip  
>Finck; John Grossenbacher; "Kelly, John E (NE)"  
><JohnE.Kelly@Nuclear.Energy.Gov>; "Koonin, Steven"  
><Steven.Koonin@science.doe.gov>; "Lyons, Peter"  
><Peter.Lyons@Nuclear.Energy.Gov>; Harold McFarlane; Per Peterson  
><peterson@nuc.berkeley.edu>; Ronaldo Szilard; Steve Fetter  
>(b)(6)  
>Cc: Narendra, Blake <Blake.Narendra@nnsa.doe.gov>; "Fitzgerald,  
>Paige" <Paige.Fitzgerald@Hq.Doe.Gov>; (b)(6)  
>(b)(6) "Claxton, Dionne (CONTR)"  
><Dionne.Claxton@science.doe.gov>; "Chambers, Megan (S4)"  
><Megan.Chambers@science.doe.gov>; "Smith, Haley"  
><Haley.Smith@Hq.Doe.Gov>

CH/218

>Subject: Radiation levels in RHR equipment area  
>  
>  
>  
>All,  
>  
>As I mentioned on the telecon, once the residual heat removal system  
>starts running, radiation dose rates will go up around the equipment  
>because the fluid in the piping will be much more radioactive. The  
>RHR heat exchangers will be located in a separate room with  
>shielding, but it could be important to understand how much the dose  
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>Since one has multiple trains of the equipment that have some  
>physical isolation, also, if one train has problems the dose rate  
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>other pumps to restart RHR. This is worth checking too, since there  
>is a question of whether one should start up once a single RHR pump  
>is functional, or fix more than one pump before starting up  
>(hopefully one can start up immediately after fixing one pump).  
>  
>-Per  
>--  
>  
>-----  
>Per F. Peterson  
>Professor and Chair  
>Department of Nuclear Engineering  
>University of California  
>4153 Etcheverry Hall  
>Berkeley, California 94720-1730  
>peterson@nuc.berkeley.edu  
>Office: (510) 643-7749 Fax: (510) 643-9685  
>[http://www.nuc.berkeley.edu/People/Per\\_Peterson](http://www.nuc.berkeley.edu/People/Per_Peterson)  
>-----

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Per F. Peterson  
Professor and Chair  
Department of Nuclear Engineering  
University of California  
4153 Etcheverry Hall  
Berkeley, California 94720-1730  
peterson@nuc.berkeley.edu  
Office: (510) 643-7749 Fax: (510) 643-9685  
[http://www.nuc.berkeley.edu/People/Per\\_Peterson](http://www.nuc.berkeley.edu/People/Per_Peterson)  
-----

**From:** Sheron, Brian  
**To:** Bowman, Gregory  
**Subject:** FW: REPLY: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Date:** Tuesday, March 22, 2011 5:44:00 PM  
**Importance:** High

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Greg, our comments. None are show-stoppers.

---

**From:** Rini, Brett  
**Sent:** Tuesday, March 22, 2011 5:00 PM  
**To:** Sheron, Brian  
**Cc:** Uhle, Jennifer  
**Subject:** REPLY: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Importance:** High

Brian,

(b)(5)

Near Term Review Comments

(b)(5)

Longer Term Review Comments

(b)(5)

(b)(5)

Thanks,

CH/219

Brett

---

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 2:04 PM  
**To:** Rini, Brett  
**Subject:** FW: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Importance:** High

Brett, please have division review and let me know if any major problems or show-stoppers.

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**From:** Flory, Shirley  
**Sent:** Tuesday, March 22, 2011 2:00 PM  
**To:** Sheron, Brian; Uhle, Jennifer  
**Subject:** FW: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Importance:** High

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**From:** RidsEdoDraftSrmVote Resource  
**Sent:** Tuesday, March 22, 2011 1:58 PM  
**To:** Ash, Darren; Borchardt, Bill; Boyd, Lena; Buckley, Patricia; Clarke, Deanna; Cohen, Miriam; EDO\_Staff\_Assistants; Flory, Shirley; Fry, Jeannie; Garland, Stephanie; Johnson, Michael; Mamish, Nader; Matakas, Gina; Miles, Patricia; Miller, Charles; Owen, Lucy; Riddick, Nicole; RidsAdmMailCenter Resource; RidsCsoMailCenter Resource; RidsFsmeOd Resource; RidsHrMailCenter Resource; RidsNmssOd Resource; RidsNroMailCenter Resource; RidsNrrOd Resource; RidsNsirMailCenter Resource; RidsOeMailCenter Resource; RidsOiMailCenter Resource; RidsOIS Resource; RidsResOd Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource; RidsSbcrMailCenter Resource; Thomas, Loretta; Virgilio, Martin; Walker, Dwight; Weber, Michael  
**Subject:** FW: DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Importance:** High

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**From:** Wright, Darlene  
**Sent:** Tuesday, March 22, 2011 1:19 PM  
**To:** Baggett, Steven; Bates, Andrew; Batkin, Joshua; Baval, Rochelle; Blake, Kathleen; Bozin, Sunny; Bradford, Anna; Bubar, Patrice; Bupp, Margaret; Burns, Stephen; Chairman Temp; Clark, Lisa; Coggins, Angela; Cordes, John; Crawford, Carrie; Davis, Roger; Fopma, Melody; Franovich, Mike; Gibbs, Catina; Hackett, Edwin; Hart, Ken; Harves, Carolyn; Henderson, Karen; Herr, Linda; Hipschman, Thomas; Hudson, Sharon; Joosten, Sandy; KLS Temp; Kock, Andrea; Laufer, Richard; Lepre, Janet; Loyd, Susan; Mamish, Nader; Marshall, Michael; Monninger, John; Moore, Scott; Orders, William; Pace, Patti; Poole, Brooke; Reddick, Darani; RidsEdoDraftSrmVote Resource; Rothschild, Trip; Savoy, Carmel; Sharkey, Jeffry; Shea, Pamela; Snodderly, Michael; Sosa, Belkys; Speiser, Herald; Svinicki, Kristine; Temp, GEA; Temp, WCO; Temp, WDM; Thoma, John; Vietti-Cook, Annette; Warren, Roberta; Zorn, Jason; Tadesse, Rebecca; Joosten, Sandy; Castleman, Patrick; Montes, David; Dhir, Neha; Adler, James; Jimenez, Patricia; Muessle, Mary; Nieh, Ho; Ostendorff, William; Warnick, Greg; Apostolakis, George; Pearson, Laura; Lui, Christiana; Lisann, Elizabeth  
**Cc:** Lewis, Antoinette  
**Subject:** DRAFT SRM - COMGBJ-11-0002 (NRC Actions Following the Events in Japan)  
**Importance:** High

The attached file contains a draft SRM which is being circulated for Commission review. Your response is requested as soon as practical today. As provided in the Internal Commission Procedures, the staff is "...afforded an opportunity to review the SRM to ensure that the Commission decision is clear and understandable and that resource,

schedular, and legal constraints are properly considered." Please provide any responses to Ken Hart (KRH), Richard Laufer (RJL), Rochelle Bivol (RCB5), and Pam Shea (PWS).

**From:** Sheron, Brian  
**To:** Bonaccorso, Amy; Calvo, Antony; Case, Michael; Coe, Doug; Correia, Richard; Dion, Jeanne; Gibson, Kathy; Lui, Christiana; Richards, Stuart; Rini, Brett; Sangimino, Donna-Marie; Uhle, Jennifer; Valentin, Andrea  
**Subject:** FW: Tomorrow's news tonight -- read and delete  
**Date:** Tuesday, March 22, 2011 5:52:00 PM

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**From:** Brenner, Eliot  
**Sent:** Tuesday, March 22, 2011 5:18 PM  
**To:** Brenner, Eliot  
**Subject:** Tomorrow's news tonight -- read and delete

~~Internal use only - no distribution outside NRC - no redistribution~~  
~~May contain material proprietary to news agencies~~

1: JAPAN STUFF – Questions continue at headquarters on a raft of topics. Here are some of the other Japan event-related queries:

OCONEE – Sen. Lindsay Graham (R-SC) toured the Oconee plant near Seneca, S.C. today along with about 20 media representatives. Region II OPA was at the plant site and observed but did not participate in the event. However, OPA did answer follow-up questions from the *State* (Columbia, S.C.) and the *Greenville* (S.C.) *News*. The CNN and Fox News crews are likely to produce segments from the visit for airing this evening and beyond..

INDIAN POINT – We provided information to CNN, NYPost, Platts, NHK, Bloomberg, WNYC radio, Channel 7 News (NY) and others about the outcome of this morning's meeting of NRR and RES with the NY Lt. Governor and his delegation about what the NRC would do with regard to seismic reviews of Indian Point NPP. We told them that we agreed to have state inspectors accompany us on seismic inspections, that NRC will share our data on seismic studies with NYS as soon as it is available, that we will give top priority to reviewing the Indian Point data from the GL when we get it (likely sometime next year); and that the Chairman will visit the plant. New York authorities put out their take on the meeting.

<http://www.governor.ny.gov/press/032211nuclearplantseismicrisk>

CALIFORNIA PLANTS – California Democratic Sens. Barbara Boxer (chairwoman of the NRC's Senate authorizing committee) and Diane Feinstein toured Diablo Canyon today with Commissioner Apostolakis and Region 4 Administrator Elmo Collins. They later put out a press release saying they were privy to new information that the west coast is a seismically active area ... and went on about things they would like done for plants out there.

OYSTER CREEK – The 3<sup>rd</sup> Circuit Court of Appeals, which is handling the appeal of our relicensing decision on Oyster Creek, has asked the NRC for more information on how the Japan reactor events might impact the renewal of the plant's license. The Sierra Club of New Jersey did a media blast advising reporters that the request was unprecedented. We are fielding questions from numerous outlets on this, including the Chicago Tribune, the Asbury Park (N.J.) Press, the Star-Ledger (of Newark, N.J.) and the New Jersey Spotlight

CH/220



news web site.

**CALLAWAY-** We spoke to reporter writing story about the plant for the St. Louis Post – Dispatch that covered topics ranging from emergency response, seismic design and overall ROP procedures and NRC inspections to ensure the safe operation of the plant.

**PRICE ANDERSON ACT** – We spoke to reporter from the Daily Journal and discussed all aspects of the PAA as it relates to the industry.

**FERMI**—OPA spoke to Slate magazine about how the NRC conducts inspections at plants. OPA explained how the NRC uses resident inspectors, regional and HQ staff to conduct inspections year round.

**MINNESOTA PLANTS** – Responded to an inquiry from Minneapolis Star Tribune regarding the safety of spent fuel pools and dry cask storage.

**DAVIS-BESSE** – Cleveland Plain Dealer asked for our input on some of the alarmist stories out there – seismic issues, spent fuel pool, Mark 1 containment, etc. The reporter said he didn't want to write an "end-of-the-world" story and was looking for a balanced view. Which we provided, of course. OPA also spoke to the Warren Tribune Chronicle about safety at the plants, NRC inspections, emergency requirements and the commitments Davis-Besse made to replace the reactor head in 2010. OPA explained the agency's safety mission and stressed that the plants are safe but if they were not safe the NRC would shut the plant down to protect the people, workers and environment.

**PEACH BOTTOM** – The Aegis, a bi-weekly newspaper in Harford County, Md., is reviewing key events and NRC reviews at the plant over the years in response to the Japan reactor events. We are pointing the reporters to the appropriate inspection reports and Annual Assessment letters, and answering related questions.

**BACKGROUND RADIATION** – Michigan Messenger had a questions about the origin of our figure of 610 mrem background dose for US citizens. We explained to the reporter that we don't do our own calculations but use the information from the National Council on Radiation Protection and Measurements

**PLANT FIRES** – Back from a six-month hiatus in bugging the NRC is a freelance reporter trying to peddle a story to Propublica.com about plant fire safety. He was told to submit his questions and get in line. In a related development, a website called publicintegrity.com approached a RES staffer asking about an individual who was involved in fire issues but was terminated several years ago. Should this "reporter" follow through, we have a list of requirements before we will talk about the former NRC employee.

And in other news .....

**PILGRIM** – The Patriot Ledger (of Quincy, Mass.) asked for additional information on an upcoming meeting between Entergy and NRC staff on quality control changes involving the company's fleet of nuclear power plants.

**DUANE ARNOLD AND QUAD CITIES** – OPA spoke to DesMoines Register about performance records at Duane Arnold and Quad city. Explained the difference between

color findings and traditional enforcement and went over annual assessment letters.

FORT CALHOUN – We spoke with a reporter from the Des Moines Register about the performance of Fort Calhoun and Cooper nuclear plants. We described our Reactor Oversight Process and how it is used to assess nuclear power plant safety performance and described results from our most recent annual assessments, as well as providing the reporter with info about the upcoming end of cycle meeting for Fort Calhoun scheduled for April 6.

**From:** Sheron, Brian  
**To:** Weber, Michael; Virgilio, Martin  
**Subject:** FW: Request from MA for RI to Meet w/Governor  
**Date:** Tuesday, March 22, 2011 5:53:00 PM

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FYI.

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**From:** Wittick, Brian  
**Sent:** Tuesday, March 22, 2011 5:25 PM  
**To:** McNamara, Nancy  
**Cc:** Ellmers, Glenn; Andersen, James; OST05 Hoc; Grobe, Jack; Leeds, Eric; Meighan, Sean; Nguyen, Quynh; Sheron, Brian; Coe, Doug  
**Subject:** FW: Request from MA for RI to Meet w/Governor

Hi Nancy,

We would be happy to assist RI with discussions similar to what we just did for NYS for Massachusetts. Let's talk tomorrow about plans.

Thanks,  
Brian Wittick  
Executive Technical Assistant for Reactors  
Office of the Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
301-415-2496 (w); (b)(6) (c)

---

**From:** OST05 Hoc  
**To:** Wittick, Brian; Andersen, James  
**Cc:** McNamara, Nancy; Sanfilippo, Nathan  
**Sent:** Tue Mar 22 16:56:04 2011  
**Subject:** FW: Request from MA for RI to Meet w/Governor

Brian,  
Please see request below from Region I requesting assistance with coordination of a meeting with the Governor of Massachusetts.  
Nathan suggested that in light of the NY meeting today Region I coordinate this through you.  
Will you be able to assist Region I/ Nancy McNamara with this?

Thanks  
Michelle

Michelle Ryan  
State Liaison – Liaison Team  
Incident Response Center

---

**From:** McNamara, Nancy

CH/201

**Sent:** Tuesday, March 22, 2011 4:40 PM  
**To:** LIA04 Hoc; OST05 Hoc  
**Subject:** Request from MA for RI to Meet w/Governor  
**Importance:** High

This afternoon, the Governor of Massachusetts has requested a meeting with him and his staff and the NRC to discuss the event in Japan, seismic study (GI-199) and spent fuel pools. The Governor stated that the level of participation could be at the Regional level with experts to support the information sharing session.

The RI Regional Administrator is available to support such a meeting with assistance from subject matter experts from our HQ staff.

Would you like us to coordinate this request through the EDO's office or through the Liaison Team?

Nancy

**From:** LIA07 Hoc  
**Subject:** 1800 EDT (March 22, 2011) USNRC Earthquake/Tsunami Status Update  
**Date:** Tuesday, March 22, 2011 6:12:16 PM  
**Attachments:** USNRC Earthquake-Tsunami Update.032211.1800EDT.pdf

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Attached, please find an 1800 EDT (March 22, 2011) status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

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

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

-Sara

Sara K. Mroz  
Communications and Outreach  
Office of Nuclear Security and Incident Response  
US Nuclear Regulatory Commission  
Sara.Mroz@nrc.gov  
LIA07.HOC@nrc.gov (Operations Center)

CH/222

**From:** Sheron, Brian  
**To:** Lee, Richard  
**Subject:** RE: Nuclear science group conference call - Wednesday  
**Date:** Tuesday, March 22, 2011 9:33:09 PM

---

You need to respond to Ian, tell him you will be participating for me, and let him know if both times are acceptable to you.

---

From: Lee, Richard  
Sent: Tuesday, March 22, 2011 9:29 PM  
To: Sheron, Brian  
Subject: RE: Nuclear science group conference call - Wednesday

Brian: Any time is fine with me. Just let me know when they want the conference call.

---

From: Sheron, Brian  
Sent: Tuesday, March 22, 2011 9:27 PM  
To: Lee, Richard  
Subject: FW: Nuclear science group conference call - Wednesday

Richard, note request for time change. Please respond. Thanks.

---

From: Aoki, Steven [Steven.Aoki@nnsa.doe.gov]  
Sent: Tuesday, March 22, 2011 7:25 PM  
To: Adams, Ian; Binkley, Steve; Bob Budnitz; Sheron, Brian; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
Subject: RE: Nuclear science group conference call - Wednesday

Both times are fine for me

---

From: Adams, Ian  
Sent: Tuesday, March 22, 2011 7:04 PM  
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter  
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley  
Subject: Nuclear science group conference call - Wednesday

Good evening,

We need to change the time of tomorrow's call to later in the day. Please let me know if 6:00pm EDT Wednesday and 5:00pm EDT Thursday would work for you.

Thanks,  
Ian

Nuclear science group conference call - proposed schedule:  
Wednesday: 6:00pm-7:00pm EDT  
Thursday: 5:00pm-6:00pm EDT

Conference call information:

CH/223

Please dial into (202) 586-2535  
No PIN is needed.

**From:** Hqc, PMT12  
**To:** Hqc, PMT12; Jaczko, Gregory  
**Cc:** Carpenter, Cynthia; Lewis, Robert; Ordaz, Vonna; Camper, Larry; Holahan, Patricia; Miller, Charles; Gibson, Kathy; Sullivan, Randy; Jones, Cynthia; Reis, Terrence; Cool, Donald; Holahan, Vincent; Milligan, Patricia; Tappert, John; Lui, Christiana; Lubinski, John; Coe, Doug; Zimmerman, Roy; Wiggins, Jim; Sheron, Brian; Johnson, Michael; Virgilio, Martin; Weber, Michael; Boger, Bruce; Batkin, Joshua; Coggins, Angela; Borchardt, Bill; Weber, Michael; Casto, Chuck; Dorman, Dan; FOIA Response.hqc Resource  
**Subject:** Assumptions for Trans Pacific Dose Modeling  
**Date:** Tuesday, March 22, 2011 9:43:50 PM  
**Attachments:** Assumptions for Trans Pacific Dose Modeling.doc

---

Mr. Chairman,

Attached is the staff's summary of the assumptions underlying the calculation of doses that was done by DOE NARAC for the trans-pacific movement of the plume. This information is provided to support you Deputies meeting tomorrow morning at 8 AM.

CH/224



(b)(5)

(b)(5)

**From:** Weber, Michael  
**To:** Sheron, Brian  
**Cc:** Borchardt, Bill; Virgilio, Martin; Leeds, Eric; Johnson, Michael; Haney, Catherine; Evans, Michele; Wiggins, Jim; Miller, Charles; Sanfilippo, Nathan  
**Subject:** Response - Tasking Memo  
**Date:** Tuesday, March 22, 2011 10:16:51 PM

---

All valid topics, Brian. Planning for the near-term and longer-term task forces remains somewhat fluid and adjustable to meet Commission expectations. For now, the near-term Task Force will consist of 3 senior execs from NRC, 1 rehired annuitant, 1 ETA from OEDO, and 1 administrative assistant. No impacts on RES.

The longer-term review will be structured differently. Early thinking is that will be a senior steering committee, perhaps chaired by or reporting to Marty. You or Jennifer could be on that committee. Specific teams would be tasked to assess and make recommendations on specific topics such as the ones you identified. We're not envisioning this as a line organization review, so the impact at this stage on RES programs should be limited and contained. The larger impacts will flow later based on the Commission decisions on the recommendations developed in the near-term and longer-term recommendations. These will be worked on in FY2012 and beyond.

Keep those ideas coming. These will be helpful to the task force and the steering committee.

Thanks

---

**From:** Sheron, Brian  
**To:** Weber, Michael  
**Sent:** Tue Mar 22 18:12:21 2011  
**Subject:** Tasking Memo

Mike, I understand that there is an intention of using rehired annuitants to staff the task force looking at short and longer term evaluation of our regulations in light of the Fukushima event.

For the longer-term effort, I envisioned that RES would have a role to play in the task force. There are a number of issues I think need to be evaluated. For example,

- 1.) Is there a justifiable cost-benefit to off-loading from spent fuel pools all of the fuel that can be safely stored in dry casks? Removing all of the fuel that can be safely loaded in casks will not substantially reduce the heat load in the pool, but removing the fuel will increase the water volume in the pool. This will provide more time to boil off and uncover in a SBO. Also, spreading the fuel out in the pool will enhance cooling in the event of an uncover (e.g., no radiation heat source from adjacent assemblies) and may prevent or substantially delay melting.
- 2.) Are East and Gulf coast plants adequately protected from natural phenomena? There are reports that say that global warming is heating up the oceans, and this, in turn, spawns more violent hurricanes (e.g., Katrina). Have we conservatively estimated the storm surges associated with worst-case hurricanes that could hit the coasts, and are the plants along those coasts adequately protected from those storm surges and associated flooding?

I envision these as longer-term studies that need to be done, and assume RES would

CH/225

have the lead for them. Thus, I would assume we would somehow be represented on these task forces.

**From:** Sheron, Brian  
**To:** Gibson, Kathy  
**Subject:** RE: Conference call  
**Date:** Tuesday, March 22, 2011 9:35:27 PM

---

OK, thanks.

---

**From:** Gibson, Kathy  
**Sent:** Tuesday, March 22, 2011 7:14 PM  
**To:** Sheron, Brian  
**Subject:** RE: Conference call

Yes I believe so, and if for some reason he can't, I will find somebody else.

Feel free to delegate, that's what you have a staff for. I don't understand why people come directly to you for things (e.g. Cathy Haney's TA, NEI), maybe you can discourage this behavior by passing more stuff off to us.

BTW, Jason is going with Cathy on Monday. He did the original briefing and wanted to support this one for consistency.

[cid:image001.jpg@01CBE8C5.5B524230]

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 6:20 PM  
**To:** Gibson, Kathy  
**Subject:** Conference call

Recall last week Richard Lee and I went down to a meeting at DOE with secretary Chu. He was pulling together a brain trust from academia and the national labs to "think outside the box" about ways to help the Japanese cope with the Fukushima disaster.

After the meeting, they agreed to get back together via conference calls.

I missed the call yesterday because I was briefing hill staffers at the time of the call.

I participated in the one today. It was scheduled for an hour, but took 1.5 hours. The Secretary of Energy was on the call initially, although I did not hear him participate in the conversations, so he might have slipped out the back door.

The gist of these conversations is this brain trust pontificating about how to measure water level in the SFP, how to get fresh water into the reactor, etc.

Interesting as it is, I think I have more important things to focus on right now. Is it possible for Richard to participate in these calls for me? He attended the meeting, so he know who the people are that are on the phone.

The next conference call is at 12:30 pm tomorrow. The call-in number is 202-586-2535.

Let me know if Richard can participate in the call. Thanks.

CH/226

**From:** Sheron, Brian  
**To:** Valentin, Andrea  
**Subject:** RE: E-mail Concurrence  
**Date:** Tuesday, March 22, 2011 4:55:00 PM

---

Super, thanks.

---

**From:** Valentin, Andrea  
**Sent:** Tuesday, March 22, 2011 4:54 PM  
**To:** Sheron, Brian  
**Subject:** RE: E-mail Concurrence

I took care of it that same day.

---

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 4:51 PM  
**To:** Valentin, Andrea  
**Subject:** FW: E-mail Concurrence

See below. Not sure if Jennifer focused on this. Can PMDA handle?

---

**From:** Rossi, Anthony  
**Sent:** Friday, March 18, 2011 12:22 PM  
**To:** Gusack, Barbara; Schaeffer, James; Tracy, Glenn; Uhle, Jennifer  
**Cc:** Atsalinos, Mike; Shay, Jason; Huth, Virginia; Daly, Jill; Sanchez, Alba; Stewart, Sharon; Ficks, Ben; Price, Georgetown; Corbett, James; Cohen, Miriam; Boyce, Thomas (OIS); Sheron, Brian; Dyer, Jim; Brown, Milton; Mitchell, Reggie; Kaplan, Michele  
**Subject:** E-mail Concurrence

Deputy Directors,

Thank-you and your staff for the timely response to the data call to respond to the March 8 information request from the HR Committee on Oversight and Government Reform.

I am requesting your email concurrence on the attached response (FYI - all attached letters are the same, different addressees).

Thanks again,

**Anthony C. Rossi**  
**Senior Level Advisor**  
**Division of the Controller, OCFO**  
**Phone 301-415-7341**

C4/227

**From:** Sheron, Brian  
**To:** Dacus, Eugene  
**Cc:** Gibson, Kathy; Uhle, Jennifer; Weber, Michael  
**Subject:** RE: House E&C request  
**Date:** Tuesday, March 22, 2011 3:17:00 PM

---

Probably not. We need to mark it "DRAFT." Call Kathy Gibson. Her staff can get it to you.

---

**From:** Dacus, Eugene  
**Sent:** Tuesday, March 22, 2011 3:09 PM  
**To:** Sheron, Brian  
**Cc:** Powell, Amy; Lund, Louise  
**Subject:** RE: House E&C request

Thanks Brian. Is there a reason we cannot provide the information to Congress?

---

**From:** Sheron, Brian  
**Sent:** Tuesday, March 22, 2011 2:58 PM  
**To:** Dacus, Eugene  
**Cc:** Powell, Amy; Lund, Louise  
**Subject:** RE: House E&C request

During the briefing I gave to House staffers last week, I referred to the SOARCA analysis of Peach Bottom. I did not mention relicensing or license renewal.

The SOARCA results are not yet publicly available.

---

**From:** Dacus, Eugene  
**Sent:** Tuesday, March 22, 2011 2:48 PM  
**To:** Sheron, Brian  
**Cc:** Powell, Amy; Lund, Louise  
**Subject:** FW: House E&C request

Brian,

Help. One of the staffers you briefed last week has asked for some documentation. See trail below.

Gnr

---

**From:** Lund, Louise  
**Sent:** Tuesday, March 22, 2011 10:14 AM  
**To:** Dacus, Eugene  
**Cc:** Galloway, Melanie; Holian, Brian  
**Subject:** RE: House E&C request

Gene,

Brian H. brings up a good point. You may want to close the loop with Brian Sheron to see if he was referring to the SAMA reviews or the SORCA.

CH/228

Louise

---

**From:** Holian, Brian  
**Sent:** Tuesday, March 22, 2011 9:59 AM  
**To:** Dacus, Eugene; Lund, Louise  
**Cc:** Galloway, Melanie  
**Subject:** Re: House E&C request

I believe sheron is talking about SORCA reviews. These were done independent of license renewal. PB was one plant looked at in depth

---

**From:** Dacus, Eugene  
**To:** Lund, Louise  
**Cc:** Holian, Brian  
**Sent:** Mon Mar 21 16:49:47 2011  
**Subject:** RE: House E&C request

Thanks Louise. Really appreciate your help on this. You always come through for us.

---

**From:** Lund, Louise  
**Sent:** Monday, March 21, 2011 4:47 PM  
**To:** Dacus, Eugene  
**Cc:** Holian, Brian  
**Subject:** RE: House E&C request

Gene,

I talked with Sam Lee (DRA), and we both think Brian was referring to the SAMA (Severe Accident Mitigation Alternatives) analysis in the plant-specific supplement to the Environmental Impact Statement that DLR issues as part of the license renewal process. It is publicly available, and contained in Section 5 of the following link on our web page to the Supplemental EIS:

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/supplement10/>

Louise

---

**From:** Dacus, Eugene  
**Sent:** Monday, March 21, 2011 4:17 PM  
**To:** Lund, Louise  
**Subject:** FW: House E&C request

Louise,

I hate to bug you, but I don't have a contact for PB. The e-mail below is from a staffer on the House Energy and Commerce Committee. He's asking for data relating to the Peach Bottom relicensing.

---

**From:** Baran, Jeff [mailto:Jeff.Baran@mail.house.gov]  
**Sent:** Friday, March 18, 2011 4:56 PM  
**To:** Powell, Amy

**Cc:** Dotson, Greg; Cassady, Alison

**Subject:** Follow-up

Hi Amy,

We had a very informative discussion with Brian Sheron earlier. Thanks for helping to set that up. He mentioned that, for the Peach Bottom license renewals, NRC ran several scenarios as part of a risk assessment to calculate the consequences of certain severe events. We're interested in reviewing the documentation regarding these scenarios. If the document(s) is/are on ADAMS and you can point me in the right direction, that'd be great. If it's not publicly available, we'd still be very interested in getting copies of the documents next week.

Feel free to call if you have any questions.

Thanks,

Jeff



**From:** LIA01 Hoc  
**To:** Uhle, Jennifer  
**Subject:** FW: Japan earthquake: project management support for NRC  
**Date:** Wednesday, March 23, 2011 2:49:53 AM  
**Attachments:** CryoRain[1].pdf  
[11384663-independent-scientists-propose-use-of-cryorain-technology-to-mitigate-reactor-meltdowns-in-japan.pdf](#)

---

Jennifer-

In case you are in today, I shared this with the RST tonight, but also thought perhaps someone in research might have come across these folks or this technology? DTRA is looking for a response by NOON on Wednesday March 23, 2011.

Thanks  
Lisa Gibney Wright  
Federal Liaison Officer  
US Nuclear Regulatory Commission  
Desk ph: 301-816-5186

-----Original Message-----

**From:** DTRA Operations Center (b)(6)  
**Sent:** Tuesday, March 22, 2011 9:27 PM  
**To:** LIA01 Hoc  
**Subject:** RE: Japan earthquake: project management support for NRC

Sir/Ma'am

I am seeking some information and am wondering if you can assist. DTRA's LNO to TRANSCOM received tasking to see if a company known as CryoRain, Inc, which claims to have technology that can "contain and mitigate effects of the disaster and that it can effectively stop the release of toxic gases..." has any validity, or is it suspect/sham. CryoRain, Inc. is seeking an audience with COMUSTRANSCOM and TRANSCOM would like to know if this technology is recognized.

I am attaching CryoRain background paper and info paper.

Your assistance is greatly appreciated.

V/R

Steve Van Doren  
Watch Officer  
DTRA Operations Center

(b)(6)

703.767.2003 DSN 427.2003

CH/229

# **CryoRain Inc.**

**Presents**

## **Nitrogen**

**as it has never been used before**

CryoRain Inc. holds the proprietary rights to patents  
providing new methods of controlling old problems  
as Fires, Flooding, Spills, Broken pipes, and more.

November 5, 2010

1 Webster Street, Arlington MA 02474-5203 USA

937 766-4660

# What makes it Exclusive...

**Nitrogen**, is 78% of the atmosphere. What are its uses?

- **Liquid Nitrogen**, is a clear, water-like liquid with surface tension of Mercury, is the fourth coldest liquid on earth, evaporating into Nitrogen gas at or above  $-195.8^{\circ}\text{C}$ .
- Evaporating Liquid Nitrogen makes a cloud of clean, pure, inert Nitrogen that is very cold, very dense.
- This cold Nitrogen passes on the cold freezing things. It pushes air with Oxygen away as it expands.
- This power ends fires in an instant, hardens a gasoline spill, freezes a levee core, ends a century old coal mine fire.

**Nitrogen: pure, inert, abundant, everywhere**

# Background

- 1959: DuBrucq encountered Liquid Nitrogen (LN)
- 1991: Proposed first use in ending Kuwait Oil Well Fires
- 2003: Discovered how to free the Nitrogen gas usefully
  - Submitted first Liquid Nitrogen Enabler patent
  - First patent issued December 15, 2009 in the USA, USP 7,631,506
  - Other patents are pending here and abroad

Current: CryoRain Inc. is established to license patents for:  
Marketing the technology in USA and abroad  
Ending situations not handled or handled too slowly  
Preparing CryoRain and others' crews to use Nitrogen  
Manufacturing the equipment, selling, leasing.....

**Nitrogen: Currently the Earth's cleanest technology**

# Nitrogen Uses: FIRE

## Fire Department

- Home and Business Fires
- Spill Recovery
- End Flow from Broken pipes
- Abate Toxin Releases
- Crime and Animal Control

## Fixed Control Systems

- Replace Sprinkler Systems
- Replace Halon Fire Control
- Directed Release handling
- Terrorists and Robbers
- Kitchen Safety

## Major Fire Control

- Oil & Gas Events
- Chemical, Industrial Fires
- Wild land Fire Control
- Coal Mine Fire Control and
- Ending Other Embedded Fires

## Specialty Installations

- Gas Stack Scrubbers for
- Electric Power Facilities
- Chemical Companies
- Airliner, Bus, Train Systems
- Pipeline Rupture Response

# **Nitrogen Uses - Other**

## **Flood control**

Freezing Levee Core

Stopping flow from broken pipes

Freezing Sandbag Dams

Plugging breaches in dams and dikes

## **Ordinance Safer Removal**

Freeze IEDs and landmines to below ingredient reaction temperature enabling safer removal of ordnance in war zones, abandoned sites

## **Weaponry – Non-lethal and Pest Control**

Induce Nitrogen Coma

Bed Bug eradication

## **Oil & Gas Extraction**

Oil shale seams

Uses no water in process, no chemical reaction

Landfill seams

Pulls organics from landfill allowing refilling

Remediation

Cleanup – ending contamination of aquifers

# Advantages

Nitrogen is available everywhere on earth.

Liquid Nitrogen available from industrial gas companies

Liquid Nitrogen plants from Cosmodyne are moveable

## IN FIRES:

No Water Damage

No Electrical Arcing

No Residual Chemicals

Instant Response

Where liquids as water and chemicals pass and puddle,  
the pure Nitrogen cloud continues displacing Oxygen.

Where foams drop and stay, Nitrogen is pulled into fire.

IN FREEZING: Starting with the world's fourth coldest liquid,  
Nitrogen gas transfers cold instantly.

**CryoRain provides Exclusivity, Affordability, and Cleanliness**

# Competition

Q. What other control agent or method derives its power from temperature, works because of inertness and prevents chemical reaction or change?

A. NONE.

Fire Control – Competition is with WATER, available, damages contents, causes electrical arcing, carries pollutants into water and soil. Arid areas use water in fire control needed for residents, industry and agriculture.

Chemical agents – fire suppressants, retardants remain after fires polluting the ground and water. DuPont, United Technologies, Ansul

Foams – some mix with water, others fill with Nitrogen sourced from tank Nitrogen – compressed, not liquid, for passive control.

Flood Control – Totally under US Army Corps of Engineers and contractors like Halliburton.

Non-Lethal Weaponry – Nitrogen – Nitrogen coma with resuscitation within six minutes leaves no damaging effects. Taser, inflicts electric shock. Gun – wounding requires medical care and damages environment.



# Earnings Potential

- Fire Control:

- Equipment Manufacturing: dies: \$102K, parts \$50K
- Equipment Wholesale: dewars and tanks – Taylor Wharton  
pipes, fittings etc. – Swagelok
- Liquid Nitrogen Group Purchase Contract – Praxair, etc.
- Lead time required: Four Months
- Fire Departments in USA – 30,000 plus military, industrial
- Underwriters' Laboratory testing methods – NFPA accept

- Pest Control – Bed Bugs

- License or contract with Ecolab, Inc. of St. Paul, MN
- US EPA Preliminary Session – If Nitrogen is inert,  
approval is not necessary. Meeting, Nov. 18, 2010.

# Earnings Potential

- Fuel Extraction:

Equipment Cost: \$500K/Zone Efficiency at Nine Zones.

Revenue – crude at \$50/barrel per zone: \$1,725,152

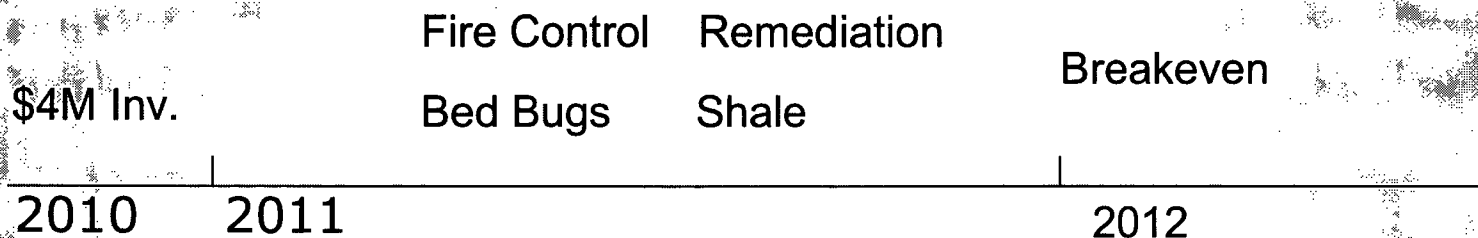
Cost – Personnel, deprec. Equipment, insur. 787,750

Gross Profit per Zone – 2.5 acres 938,402

ROI (6 months) 2.5 acres, 22% fuel shale 219%

Cost per barrel when working 20 Acres \$22.82

- Milestones:



Anticipate four years for investment return of 500%

## Tracking RIGHTS

- USP 7,631,506: Retains 16 years coverage
- Other pending patents cover specific tasks and will have 17 years coverage from date of issue.
- No international patent coverage is in place though some patents are still available for Nations filing.
- Time sensitive investment needed for \$100,000 licensing fee to AirWars Defense.

# Investor Opportunities

- Desire to Discuss

- Investment level suggested - \$4,000,000
- Obligated Shares = 45%
- Company leadership – Good board, mentor leadership
- Funding Options – Shares, loan and equity, other

## Contact –

Denyse DuBrucq

CEO, CryoRain Inc., a Delaware Corporation

1 Webster Street      Anticipated Commercial Address:

Arlington, MA 02474 USA

Phone: 937 766-4660

E-mail: [CryoRaininc@aol.com](mailto:CryoRaininc@aol.com)

5 Water Street

Arlington, Massachusetts

02476-4807 USA

## **Independent Scientists Propose Use of CryoRain Technology to Mitigate Reactor Meltdowns in Japan**

*By Dr. Joseph A. Resnick, PhD MPH*

*Dated: Mar 19, 2011*

*Scientists propose use of Nitrogen gas technology to cool leaking reactor containment vessels at Fukushima*

Warner Robins, GA --- On March 11, 2011 an earthquake registering over 8.9 on the Richter Scale hit Japan's eastern coast killing hundreds of people, spawning fires, and sweeping cars, boats, debris and bodies inland. Effects of the earthquake were felt throughout the Pacific Rim, South America, Canada, Alaska and the US West Coast. Several hours after the initial earthquake a tsunami wave which some estimated as high as 40 feet impacted major population areas while more than 50 aftershocks in excess of 6.0 continued to shake the region.

Within 24 hours of the initial catastrophe the Tokyo Electric Power Company, known as Tepco, announced that the Fukushima Daiichi Nuclear Power Station that provides as much as 30% of Japan's electricity had experienced a loss of power and capability to continue cooling radioactive rods in the main reactor's core.

Amid much secrecy and confusion officials at Tepco and the Japanese Government have been less than forthcoming in releasing facts about the gravity of the situation even though more nuclear power stations along the coastline of Japan continue to fail placing survivors and inhabitants of the Pacific in grave danger of exposure to radioactive poisoning.

On March 12, Tepco announced that it planned to start pouring a mixture of boric acid into the Fukushima Daiichi power plant Unit 1 reactor's partially melted core. On Sunday TEPCO released air containing radioactive materials for more than 2 hours and injected water at the Unit 3 nuclear reactor container vessel to reduce pressure and temperature to save the reactor from a possible meltdown.

Concerns among the global scientific community that the attempt to use boric acid and release toxic fumes have sparked hundreds of complaints to the U.S. Nuclear Regulatory Commission, particularly Americans living along California's coastline, citing Japan's apparent inability to contain the nuclear reactor cores and releasing potentially deadly gasses without disclosure to the world community.

A group of concerned scientists led by NASA Scholar/Scientist Dr. Joseph A. Resnick, Inventor of Stealth Radex Technology, includes Dr. Denyse DeBrucq, Inventor of the CryoRain Technology, Professor Ron Stewart, Inventor of the ORIE technology and GLO-Officer, Joy Mann-Simmons. The group has proposed deployment of Dr. DeBrucq's technology called 'CryoRain'. Stewart's technology, called, 'ORIE' (Optical Remote Image Enhancement), was used to examine the inner areas of the damaged reactor cores utilizing photo's taken by the US Army several days ago. The ORIE technology enabled exact location of the damaged nuclear fuel rods and included data about the sizes of the various rods, location of cracks in cooling ponds and enabled the team to make recommendations to on-scene environmental teams as to exactly where the damaged components were located.

The researchers believe that the CryoRain technology offers Tepco and Mankind the most viable prospect for containing and mitigating effects of the disaster and that it can effectively stop the release of toxic gasses that must be released into the atmosphere as a result of using the boric acid mixture to cool the damaged reactor cores.

In a statement released today to the Fox News Network affiliate, WRWR Radio in Warner Robins, GA, Resnick said that he is in direct contact with the US NRC, AOP, NATO, the Japanese Embassy in Washington, D.C., and has engaged Congressman Jason Altmire (D-PA) in an effort to offer use of the CryoRain technology to Tepco, immediately. In the statement Dr. Resnick said, 'The continued deterioration of the condition leading to the sustained meltdowns of Reactors 1, 2 and 3 could be managed through deployment of the CryoRain technology, and this could be done safely, without fear of any

explosions or release of toxic gasses into the atmosphere. Further, reactor # 4 could be isolated and probably salvaged or at minimum be preserved in its present state until Tepco can devise. Without the oxygen, which is contained in the boric acid solution, there can be no explosions, no off-gassing, and no release of toxicity. The CryoRain technology which uses nitrogen gas to 'fix' oxygen and contaminants in place, is the best chance that Mankind has to deal with this particular situation, at this moment in time, with time being of the essence'.

The CryoRain technology, invented by Dr. DeBrucq, was published more than 8 years ago as US Patent # 7,631,506 and spawned the birth of a new industry known as 'Thermistry'. An example of how and where this technology is used is in extinguishing oil well fires. Thermistry, is the study of or related to using temperature differences to drive change or motion using an inert material, in this instance Nitrogen, or N2, molecules capable of creating an action without risk of a dangerous chemical reaction.

Thermal events include atmospheric weather and all its ramifications, hot air heating and air conditioning. All these deal with the 78% Nitrogen air mass, and, until lightning occurs it avoids other sciences - even to include clouds and tornados, hurricane systems, and hail storms.

Thermal techniques start cryogenically using Liquid Nitrogen rained through a spaced-hole sieve descended in drops through warmer air causing the drops to change phase and evaporate into pure Nitrogen gas. Nitrogen's wrapped-tight molecule prefers to neighbor itself and in the evaporation process will force other air components out of the cloud of pure Nitrogen gas giving an inert gas cloud at cryogenic temperature. On evaporating the Liquid Nitrogen drops in a calm environment, one can see the size of the pure gas cloud because its rim is clouded with condensed water vapor and a burning match placed in the clear air will no longer burn.

###

[www.vansforvets.org](http://www.vansforvets.org) provides handicap-equipped vehicles and other conveyances to disabled and homeless Vet's and family members who care for the disabled, free of charge.

Category	Environment, Health, Technology
Tags	tepc, japan, nuclear reactor, Radiation Poisoning, nitrogen, solutions, iodine, prussian blue
Email	<a href="#">Click to email author</a>
Phone	724-427-7551
Fax	724-224-2606
Address	2954 Moody Road Bonaire, GA
City/Town	<a href="#">Warner Robins</a>
State/Province	<a href="#">Georgia</a>
Zip	31005
Country	<a href="#">United States</a>

**From:** Virgilio, Martin  
**To:** (b)(6) Miller, Charles; Holahan, Gary; Grobe, Jack; Sanfilippo, Nathan  
**Cc:** Borchardt, Bill; Weber, Michael; Muesle, Mary; Andersen, James; Ash, Darren  
**Subject:** Near Term Review  
**Date:** Wednesday, March 23, 2011 3:04:47 AM

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All

Let me start by thanking you for agreeing to participate on the Task Group that will be chartered to identify near term actions in response to the ongoing accident at Fukushima Daiichi reactors.

Yesterday, I spoke with Bill Borchardt and Charlie Miller about this assignment. Bill expects that you will be working on this project full time at least until the 30 day quick look report is developed and the Commission is briefed on its contents.

While the specifics of the actions are still being finalized through the SRM development, it is likely that we will be asked to consider whether NRC should take actions to improve NRC and licensee programs to enhance safety; and, identify specific topics/areas for longer term assessment.

I have suggested to Charlie that we have a kick off meeting on Thursday morning. This would be an opportunity to align on the charter of the group, expected products and methods for conducting the review and developing recommendations.

One item that I would like to see us address on Thursday is internal stakeholder involvement. We may want to have a session early next week with the folks who have been serving on the site team and in the ops center to gather their insights.

I have periodically pulsed Chuck Casto about areas that we should consider as part of our near term lessons learned. Chuck has suggested we look at B5b and in particular the location of the equipment, environmental conditions where actions will have to be taken, and whether there will be sufficient number of licensee staff needed to execute the recovery strategies. He also suggested we consider multiple simultaneous accidents at a single site, NPPs where fire coping strategies include an induced SBO, and that we look at our SBO requirements.

Marty

CH/230

**From:** LIA01 Hoc  
**To:** Lee, Richard  
**Cc:** Uhle, Jennifer  
**Subject:** FW: Japan earthquake: project management support for NRC  
**Date:** Wednesday, March 23, 2011 4:06:57 AM  
**Attachments:** CryoRain[1].pdf  
11384663-independent-scientists-propose-use-of-cryorain-technology-to-mitigate-reactor-meltdowns-in-japan.pdf

---

Hi Richard--

I found a note in our turnover that indicated that you were the contact person for Research items. Could you please review the items and let the Defense Threat Reduction Agency (DTRA) Watch Officer know your thoughts? They are basically asking if there is any creditability to this technology and/or whether or not anyone has worked with this company? (In other words, should their management take time to speak with them?)

Jennifer--you can disregard my earlier request now that I have found Richard.

Thanks--

Lisa Gibney Wright  
Federal Liaison Officer  
US Nuclear Regulatory Commission  
Desk ph: 301-816-5186

-----Original Message-----

**From:** DTRA Operations Center (b)(6)  
**Sent:** Tuesday, March 22, 2011 9:27 PM  
**To:** LIA01 Hoc  
**Subject:** RE: Japan earthquake: project management support for NRC

Sir/Ma'am

I am seeking some information and am wondering if you can assist. DTRA's LNO to TRANSCOM received tasking to see if a company known as CryoRain, Inc, which claims to have technology that can "contain and mitigate effects of the disaster and that it can effectively stop the release of toxic gases..." has any validity, or is it suspect/sham. CryoRain, Inc. is seeking an audience with COMUSTRANSCOM and TRANSCOM would like to know if this technology is recognized.

I am attaching CryoRain background paper and info paper.

Your assistance is greatly appreciated.

V/R

Steve Van Doren  
Watch Officer  
DTRA Operations Center

(b)(6)

703.767.2003 DSN 427.2003

CH/231



# **CryoRain Inc.**

Presents

## **Nitrogen**

**as it has never been used before**

CryoRain Inc. holds the proprietary rights to patents  
providing new methods of controlling old problems  
as Fires, Flooding, Spills, Broken pipes, and more.

November 5, 2010

1 Webster Street, Arlington MA 02474-5203 USA

937 766-4660

## What makes it Exclusive...

- **Nitrogen**, is 78% of the atmosphere. What are its uses?
- **Liquid Nitrogen**, is a clear, water-like liquid with surface tension of Mercury, is the fourth coldest liquid on earth, evaporating into Nitrogen gas at or above  $-195.8^{\circ}\text{C}$ .
- Evaporating Liquid Nitrogen makes a cloud of clean, pure, inert Nitrogen that is very cold, very dense.
- This cold Nitrogen passes on the cold freezing things. It pushes air with Oxygen away as it expands.
- This power ends fires in an instant, hardens a gasoline spill, freezes a levee core, ends a century old coal mine fire.

**Nitrogen: pure, inert, abundant, everywhere**

# Background

- 1959: DuBrucq encountered Liquid Nitrogen (LN)
- 1991: Proposed first use in ending Kuwait Oil Well Fires
- 2003: Discovered how to free the Nitrogen gas usefully
  - Submitted first Liquid Nitrogen Enabler patent
  - First patent issued December 15, 2009 in the USA, USP 7,631,506
  - Other patents are pending here and abroad

Current: CryoRain Inc. is established to license patents for:

Marketing the technology in USA and abroad

Ending situations not handled or handled too slowly

Preparing CryoRain and others' crews to use Nitrogen

Manufacturing the equipment, selling, leasing.....

**Nitrogen: Currently the Earth's cleanest technology**

# Nitrogen Uses: FIRE

## Fire Department

Home and Business Fires  
Spill Recovery  
End Flow from Broken pipes  
Abate Toxin Releases  
Crime and Animal Control

## Major Fire Control

Oil & Gas Events  
Chemical, Industrial Fires  
Wild land Fire Control  
Coal Mine Fire Control and  
Ending Other Embedded Fires

## Fixed Control Systems

Replace Sprinkler Systems  
Replace Halon Fire Control  
Directed Release handling  
Terrorists and Robbers  
Kitchen Safety

## Specialty Installations

Gas Stack Scrubbers for  
Electric Power Facilities  
Chemical Companies  
Airliner, Bus, Train Systems  
Pipeline Rupture Response

# Nitrogen Uses - Other

## Flood control

Freezing Levee Core

Stopping flow from broken pipes

Freezing Sandbag Dams

Plugging breaches in dams and dikes

## Ordnance Safer Removal

Freeze IEDs and landmines to below ingredient reaction temperature enabling safer removal of ordnance in war zones, abandoned sites

## Weaponry - Non-lethal and Pest Control

Induce Nitrogen Coma

Bed Bug eradication

## Oil & Gas Extraction

Oil shale seams

Uses no water in process, no chemical reaction

Landfill seams

Pulls organics from landfill allowing refilling

Remediation

Cleanup - ending contamination of aquifers

# Advantages

Nitrogen is available everywhere on earth.

Liquid Nitrogen available from industrial gas companies

Liquid Nitrogen plants from Cosmodyne are moveable

## IN FIRES:

No Water Damage

No Electrical Arcing

No Residual Chemicals

Instant Response

Where liquids as water and chemicals pass and puddle,  
the pure Nitrogen cloud continues displacing Oxygen.

Where foams drop and stay, Nitrogen is pulled into fire.

IN FREEZING: Starting with the world's fourth coldest liquid,  
Nitrogen gas transfers cold instantly.

**CryoRain provides Exclusivity, Affordability, and Cleanliness**

# Competition

Q. What other control agent or method derives its power from temperature, works because of inertness and prevents chemical reaction or change?

A. NONE.

Fire Control - Competition is with WATER, available, damages contents, causes electrical arcing, carries pollutants into water and soil. Arid areas use water in fire control needed for residents, industry and agriculture.

Chemical agents - fire suppressants, retardants remain after fires polluting the ground and water. DuPont, United Technologies, Ansul

Foams - some mix with water, others fill with Nitrogen sourced from tank Nitrogen - compressed, not liquid, for passive control.

Flood Control - Totally under US Army Corps of Engineers and contractors like Halliburton.

Non-Lethal Weaponry - Nitrogen - Nitrogen coma with resuscitation within six minutes leaves no damaging effects. Taser, inflicts electric shock. Gun - wounding requires medical care and damages environment.

# Earnings Potential

- Fire Control:

- Equipment Manufacturing: dies: \$102K, parts \$50K
- Equipment Wholesale: dewars and tanks – Taylor Wharton
- pipes, fittings etc. – Swagelok
- Liquid Nitrogen Group Purchase Contract – Praxair, etc.
- Lead time required: Four Months
- Fire Departments in USA – 30,000 plus military, industrial
- Underwriters' Laboratory testing methods – NFPA accept

- Pest Control – Bed Bugs

License or contract with Ecolab, Inc. of St. Paul, MN

- US EPA Preliminary Session – If Nitrogen is inert, approval is not necessary. Meeting, Nov. 18, 2010.

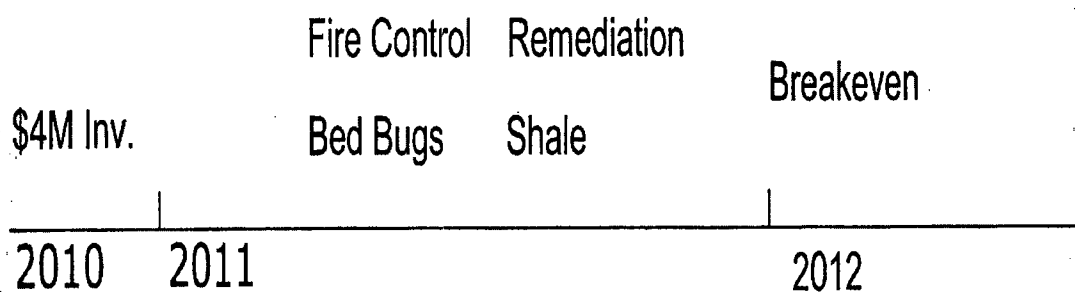


# Earnings Potential

- Fuel Extraction:

- Equipment Cost: \$500K/Zone Efficiency at Nine Zones.
- Revenue – crude at \$50/barrel per zone: \$1,725,152
- Cost – Personnel, deprec. Equipment, insur. 787,750
- Gross Profit per Zone – 2.5 acres 938,402
- ROI (6 months) 2.5 acres, 22% fuel shale 219%
- Cost per barrel when working 20 Acres \$22.82

- Milestones:



Anticipate four years for investment return of 500%

## Tracking RIGHTS

- USP 7,631,506: Retains 16 years coverage
- Other pending patents cover specific tasks and will have 17 years coverage from date of issue.
- No international patent coverage is in place though some patents are still available for Nations filing.
- Time sensitive investment needed for \$100,000 licensing fee to AirWars Defense.

# Investor Opportunities

- Desire to Discuss

- Investment level suggested - \$4,000,000
- Obligated Shares = 45%
- Company leadership - Good board, mentor leadership
- Funding Options - Shares, loan and equity, other

## Contact -

Denyse DuBrucq

CEO, CryoRain Inc., a Delaware Corporation

1 Webster Street    Anticipated Commercial Address:

Arlington, MA 02474 USA

5 Water Street

Phone: 937 766-4660

Arlington, Massachusetts

E-mail: [CryoRaininc@aol.com](mailto:CryoRaininc@aol.com)

02476-4807 USA

## **Independent Scientists Propose Use of CryoRain Technology to Mitigate Reactor Meltdowns in Japan**

*By Dr. Joseph A. Resnick, PhD MPH*

*Dated: Mar 19, 2011*

*Scientists propose use of Nitrogen gas technology to cool leaking reactor containment vessels at Fukushima*

Warner Robins, GA --- On March 11, 2011 an earthquake registering over 8.9 on the Richter Scale hit Japan's eastern coast killing hundreds of people, spawning fires, and sweeping cars, boats, debris and bodies inland. Effects of the earthquake were felt throughout the Pacific Rim, South America, Canada, Alaska and the US West Coast. Several hours after the initial earthquake a tsunami wave which some estimated as high as 40 feet impacted major population areas while more than 50 aftershocks in excess of 6.0 continued to shake the region.

Within 24 hours of the initial catastrophe the Tokyo Electric Power Company, known as Tepco, announced that the Fukushima Daiichi Nuclear Power Station that provides as much as 30% of Japan's electricity had experienced a loss of power and capability to continue cooling radioactive rods in the main reactor's core.

Amid much secrecy and confusion officials at Tepco and the Japanese Government have been less than forthcoming in releasing facts about the gravity of the situation even though more nuclear power stations along the coastline of Japan continue to fail placing survivors and inhabitants of the Pacific in grave danger of exposure to radioactive poisoning.

On March 12, Tepco announced that it planned to start pouring a mixture of boric acid into the Fukushima Daiichi power plant Unit 1 reactor's partially melted core. On Sunday TEPCO released air containing radioactive materials for more than 2 hours and injected water at the Unit 3 nuclear reactor container vessel to reduce pressure and temperature to save the reactor from a possible meltdown.

Concerns among the global scientific community that the attempt to use boric acid and release toxic fumes have sparked hundreds of complaints to the U.S. Nuclear Regulatory Commission, particularly Americans living along California's coastline, citing Japan's apparent inability to contain the nuclear reactor cores and releasing potentially deadly gasses without disclosure to the world community.

A group of concerned scientists led by NASA Scholar/Scientist Dr. Joseph A. Resnick, Inventor of Stealth Radex Technology, includes Dr. Denyse DeBrucq, Inventor of the CryoRain Technology, Professor Ron Stewart, Inventor of the ORIE technology and GLO-Officer, Joy Mann-Simmons. The group has proposed deployment of Dr. DeBrucq's technology called 'CryoRain'. Stewart's technology, called, 'ORIE' (Optical Remote Image Enhancement), was used to examine the inner areas of the damaged reactor cores utilizing photo's taken by the US Army several days ago. The ORIE technology enabled exact location of the damaged nuclear fuel rods and included data about the sizes of the various rods, location of cracks in cooling ponds and enabled the team to make recommendations to on-scene environmental teams as to exactly where the damaged components were located.

The researchers believe that the CryoRain technology offers Tepco and Mankind the most viable prospect for containing and mitigating effects of the disaster and that it can effectively stop the release of toxic gasses that must be released into the atmosphere as a result of using the boric acid mixture to cool the damaged reactor cores.

In a statement released today to the Fox News Network affiliate, WRWR Radio in Warner Robins, GA, Resnick said that he is in direct contact with the US NRC, AOP, NATO, the Japanese Embassy in Washington, D.C., and has engaged Congressman Jason Altmire (D-PA) in an effort to offer use of the CryoRain technology to Tepco, immediately. In the statement Dr. Resnick said, 'The continued deterioration of the condition leading to the sustained meltdowns of Reactors 1, 2 and 3 could be managed through deployment of the CryoRain technology, and this could be done safely, without fear of any

explosions or release of toxic gasses into the atmosphere. Further, reactor # 4 could be isolated and probably salvaged or at minimum be preserved in its present state until Tepco can devise. Without the oxygen, which is contained in the boric acid solution, there can be no explosions, no off-gassing, and no release of toxicity. The CryoRain technology which uses nitrogen gas to 'fix' oxygen and contaminants in place, is the best chance that Mankind has to deal with this particular situation, at this moment in time, with time being of the essence'.

The CryoRain technology, invented by Dr. DeBrucq, was published more than 8 years ago as US Patent # 7,631,506 and spawned the birth of a new industry known as 'Thermistry'. An example of how and where this technology is used is in extinguishing oil well fires. Thermistry, is the study of or related to using temperature differences to drive change or motion using an inert material, in this instance Nitrogen, or N<sub>2</sub>, molecules capable of creating an action without risk of a dangerous chemical reaction.

Thermal events include atmospheric weather and all its ramifications, hot air heating and air conditioning. All these deal with the 78% Nitrogen air mass, and, until lightning occurs it avoids other sciences - even to include clouds and tornados, hurricane systems, and hail storms.

Thermal techniques start cryogenically using Liquid Nitrogen rained through a spaced-hole sieve descended in drops through warmer air causing the drops to change phase and evaporate into pure Nitrogen gas. Nitrogen's wrapped-tight molecule prefers to neighbor itself and in the evaporation process will force other air components out of the cloud of pure Nitrogen gas giving an inert gas cloud at cryogenic temperature. On evaporating the Liquid Nitrogen drops in a calm environment, one can see the size of the pure gas cloud because its rim is clouded with condensed water vapor and a burning match placed in the clear air will no longer burn.

###

[www.vansforvets.org](http://www.vansforvets.org) provides handicap-equipped vehicles and other conveyances to disabled and homeless Vet's and family members who care for the disabled, free of charge.

Category	Environment, Health, Technology
Tags	tepc, japan, nuclear reactor, Radiation Poisoning, nitrogen, solutions, iodine, prussian blue
Email	<a href="#">Click to email author</a>
Phone	724-427-7551
Fax	724-224-2606
Address	2954 Moody Road
	Bonaire, GA
City/Town	<a href="#">Warner Robins</a>
State/Province	<a href="#">Georgia</a>
Zip	31005
Country	<a href="#">United States</a>

**From:** Hoc, PMT12  
**To:** Jaczko, Gregory  
**Cc:** Carpenter, Cynthia; Lewis, Robert; Ordaz, Vonna; Camper, Larry; Holahan, Patricia; Miller, Charles; Gibson, Kathy; Sullivan, Randy; Jones, Cynthia; Reis, Terrence; Cool, Donald; Holahan, Vincent; Milligan, Patricia; Tappert, John; Lui, Christiana; Lubinski, John; Coe, Doug; Zimmerman, Roy; Wiggins, Jim; Sheron, Brian; Johnson, Michael; Virgilio, Martin; Weber, Michael; Boger, Bruce; Batkin, Joshua; Coggins, Angela; Borchardt, Bill; Weber, Michael; Casto, Chuck; Hoc, PMT12; Dorman, Dan; FOIA Response.hoc Resource  
**Subject:** Deputies Meeting  
**Date:** Wednesday, March 23, 2011 5:10:02 AM

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Mr. Chairman,

(b)(5)

CH/232

**From:** Sheron, Brian  
**To:** Bowman, Gregory  
**Cc:** Uhle, Jennifer; Gibson, Kathy; Coe, Doug  
**Subject:** RE: Agenda Planning Meeting - Level 3 PRA Paper  
**Date:** Wednesday, March 23, 2011 8:43:00 AM

---

Greg, we have been significantly impacted by the Japanese event. I would make a rough guess that about 10% of the RES staff has been involved in some way or another with supporting the response to the Japanese event. Moreover, our contractor on SOARCA (Sandia) has been heavily involved in the Japanese response. We haven't even had time to figure out what the impacts on some of our programs are.

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 23, 2011 8:26 AM  
**To:** Bowman, Gregory; Coe, Doug  
**Cc:** Santiago, Patricia; Tinkler, Charles; Sheron, Brian; Uhle, Jennifer  
**Subject:** Re: Agenda Planning Meeting - Level 3 PRA Paper

Greg,  
That was our plan, but progress on SOARCA is being significantly impacted by the Fukushima event response. All our severe accident/MELCOR staff are working shifts on the RST in the Ops Center or supporting in other capacities (including our contractors @ Sandia). We also think we will need to include with the report a discussion of the PB SBO analysis vs Fukushima event. We haven't determined what the delay will be other than we will need an extension beyond the December 2011 date we originally planned to request.

---

**From:** Bowman, Gregory  
**To:** Gibson, Kathy; Coe, Doug  
**Sent:** Wed Mar 23 07:28:53 2011  
**Subject:** RE: Agenda Planning Meeting - Level 3 PRA Paper

Thanks...This helps a lot.

Can you give me a very quick update on where things are with SOARCA? Assuming the Level III PRA meeting doesn't get moved, is the intent to have the draft SOARCA NUREG out for public comment before the Commission meeting?

---

**From:** Coe, Doug  
**Sent:** Tuesday, March 22, 2011 5:56 PM  
**To:** Bowman, Gregory  
**Cc:** Gibson, Kathy; Scott, Michael; Sheron, Brian; Uhle, Jennifer; Coyne, Kevin; Hudson, Daniel; Stutzke, Martin  
**Subject:** RE: Agenda Planning Meeting - Level 3 PRA Paper

Greg,

RES can support providing a Level III PRA SECY paper to the Commission by June 20 (in support of a Commission meeting on July 5 or later). This would entail a due date to OEDO of June 13.

However, our original plan of a paper with joint Level III/SOARCA recommendations will need to be modified to include ONLY the Level III PRA options/recommendations.

CH/233

Note that we were planning to meet with the ACRS subcommittees in May and the ACRS full Committee in June (June 8-10) and would not be able to incorporate any ACRS letter recommendations into our paper before sending it to OEDO on June 13. However, the Committee had already offered to provide its letter in June, so the staff and Commission will still have the benefit of ACRS views at a Commission meeting in July.

Since this approach constitutes a change from the previous joint PRA/SOARCA SECY paper strategy, please let us know if Mike Weber would like to be briefed.

We are happy to help with any communication you need to make to the Chairman's office.

Thanks,  
Doug

---

**From:** Bowman, Gregory  
**Sent:** Tuesday, March 22, 2011 10:05 AM  
**To:** Sheron, Brian; Uhle, Jennifer; Coe, Doug; Coyne, Kevin  
**Cc:** Gibson, Kathy; Scott, Michael  
**Subject:** Agenda Planning Meeting - Level 3 PRA Paper  
**Importance:** High

I'm not sure if you saw this on the Chairman's agenda that Mike sent out over the weekend, but the Chairman is looking to move the Level 3 PRA meeting up to early July. That would mean the paper would need to come to the Commission in mid-June (several weeks earlier than currently scheduled).

Can you let me know if that's even doable? I know there was some coordination between the Level 3 paper and SOARCA (if I remember right, you were trying to publish the draft SOARCA paper for public comment before the Commission meeting, but I might have that wrong), and that might add some additional complications.

If either you can't move up the Level 3 paper or moving it up is going to cause significant consequences (e.g., you won't be able to discuss SOARCA), please let me know as soon as possible. If that's the case, we'll need to communicate those concerns to the Chairman's office. I'll take care of that, but I'll need some help in coming up with language.

---

**From:** Weber, Michael  
**Sent:** Sunday, March 20, 2011 6:52 PM  
**To:** Sheron, Brian; Uhle, Jennifer; Haney, Catherine; Kinneman, John; Miller, Charles; Moore, Scott; Zimmerman, Roy; McCrary, Cheryl  
**Cc:** Brock, Kathryn; Frazier, Alan; Bowman, Gregory  
**Subject:** FYI - Agenda Planning Meeting

Early awareness of potential proposed changes to the Commission calendar...stay tuned

---



**From:** Andersen, James

**To:** Borchardt, Bill; Virgilio, Martin; Weber, Michael; Ash, Darren; Muesle, Mary; Landau, Mindy; Leeds, Eric

**Cc:** Bovol, Rochelle; Laufer, Richard; Vietti-Cook, Annette

**Sent:** Sun Mar 20 18:18:07 2011

**Subject:** Agenda Planning Meeting

Over the weekend, I have been called into a number of Agenda Planning discussions with the Chairman's office and finally today with the Chairman. I believe the attached is close to what the Chairman plans to propose during the 11:00am meeting. The Chairman understands this is aggressive and may push the staff to far. A point I tried to make a couple times in a nice manner. I can discuss more during the 8:00am meeting if needed. Since I created this document, I don't know how close this will be to the actual document the Chairman's office creates for the Chairman's use.

I have copied SECY to give them a heads up.

Jim A.

**From:** Leeds, Eric  
**To:** Sheron, Brian  
**Cc:** Weber, Michael  
**Subject:** FW: Heads up: Meeting today with EDO  
**Date:** Wednesday, March 23, 2011 8:43:48 AM

---

As we discussed. Please share with Mike Weber's other direct reports. Thanks!

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

---

**From:** Leeds, Eric  
**Sent:** Wednesday, March 23, 2011 8:28 AM  
**To:** Collins, Elmo; Howell, Art; Pederson, Cynthia; West, Steven; McCree, Victor; Wert, Leonard; Dean, Bill; Lew, David; Johnson, Michael; Holahan, Gary; Evans, Michele; Wiggins, Jim  
**Cc:** Boger, Bruce; Grobe, Jack; Ruland, William; Virgilio, Martin  
**Subject:** Heads up: Meeting today with EDO

At this morning's 8 am, Bill asked EDO staff to set up a meeting between him and the ODs/RAs to discuss (1) impacts of responding to Fukushima – what isn't getting done (2) our need for deputies, BCs, TLs, etc to step up while folks are responding and (3) the need to keep work moving even if key members in the concurrence chain are not available.

Last I heard the meeting was to be set up for 12:30 to 1:30 eastern time in the ACRS room, but that could change.

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

CH/234

**From:** Sheron, Brian  
**To:** Valentin, Andrea  
**Subject:** RE: FOR TICKETING: FW: Guidance for Developing the FY 2013 Budget  
**Date:** Wednesday, March 23, 2011 9:29:00 AM

---

OK.

---

**From:** Valentin, Andrea  
**Sent:** Wednesday, March 23, 2011 8:44 AM  
**To:** Sheron, Brian  
**Subject:** FW: FOR TICKETING: FW: Guidance for Developing the FY 2013 Budget

See Teresa's notes on this.

---

**From:** Grancorvitz, Teresa  
**Sent:** Wednesday, March 23, 2011 8:30 AM  
**To:** Valentin, Andrea  
**Cc:** RidsResPmdaMail Resource  
**Subject:** FW: FOR TICKETING: FW: Guidance for Developing the FY 2013 Budget

Andrea,

I don't think there is anything to ticket on this guidance. As a support office, RES's input to the budget was due back in February. This guidance document establishes no due dates in the future that RES must meet.

We will continue to work with Lead Offices on follow-up questions and to attend the meetings on the Budget Cycle Calendar.

Thanks,  
Teresa

---

**From:** Valentin, Andrea  
**Sent:** Tuesday, March 22, 2011 5:10 PM  
**To:** Grancorvitz, Teresa  
**Subject:** FW: FOR TICKETING: FW: Guidance for Developing the FY 2013 Budget

---

**From:** Flory, Shirley **On Behalf Of** RidsResOd Resource  
**Sent:** Tuesday, March 22, 2011 5:02 PM  
**To:** Sheron, Brian; Uhle, Jennifer; Valentin, Andrea; RidsResPmdaMail Resource  
**Subject:** FOR TICKETING: FW: Guidance for Developing the FY 2013 Budget

For ticketing.

Thanks - Shirley

---

**From:** Hudson, Sharon  
**Sent:** Tuesday, March 22, 2011 4:15 PM  
**To:** RidsAcrsAcnw\_MailCTR Resource; RidsAslbpManagement Resource; RidsOgcMailCenter Resource; RidsOcaaMailCenter Resource; RidsOcfoMailCenter Resource; RidsOigMailCenter Resource;

CH/235

RidsOipMailCenter Resource; RidsOcaMailCenter Resource; RidsOpaMail Resource; RidsSecyMailCenter Resource; RidsSecyCorrespondenceMCTR Resource; RidsEdoMailCenter Resource; RidsEdoMailCenter Resource; RidsEdoMailCenter Resource; RidsEdoMailCenter Resource; RidsAdmMailCenter Resource; RidsCsoMailCenter Resource; RidsOeMailCenter Resource; RidsFsmeOd Resource; RidsOiMailCenter Resource; RidsOIS Resource; RidsHrMailCenter Resource; RidsNroOd Resource; RidsNroOd Resource; RidsNroMailCenter Resource; RidsNmssOd Resource; RidsNrrOd Resource; RidsNrrMailCenter Resource; RidsResOd Resource; RidsResPmdaMail Resource; RidsSbcrMailCenter Resource; RidsNsirPmda Resource; RidsNsirMailCenter Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource; RidsNroMailCenter Resource

**Subject:** Guidance for Developing the FY 2013 Budget

*Please find attached the Memorandum from J. E. Dyer, CFO, and R. W. Borchardt, EDO, to Office Directors and Regional Administrators RE: Guidance for Developing the FY 2013 Budget.*

*Thank you,  
Sharon Hudson/OCFO*

**From:** Langlie, Liz  
**To:** Prescott, Paul; Hall, Victor; Zhang, Deanna; Rebstock, Paul; Hilton, Nick; Cool, Donald; Dehmel, Jean-Claude; Jankovich, John; Poole, Brooke; Dube, Donald; Lois, Erasmia; Stutzke, Martin; Hudson, Daniel; Drouin, Mary; Nove, Carol; Scarbrough, Thomas; Lee, Mike; Dean, Bill; McCree, Victor; Satorius, Mark; Collins, Elmo; Denissen, Christie; Munson, Clifford; Ake, Jon; Manoly, Kamal; Kokaiko, Lawrence; Miller, Kenn; Daley, Robert; Tappert, John; Casto, Chuck; Kahler, Robert; Dozier, Jerry; Imboden, Andy; Stone, AnnMarie; Galloway, Melanie; Howe, Andrew; Tjader, Theodore; Mrowca, Lynn; Sieracki, Diane; Cheok, Michael; Cai, June; Dion, Jeanne; Pederson, Perry; Costello, Ralph; Hiser, Allen; Carpenter, Gene; Frumkin, Daniel; Held, Wesley; Scales, Kerby; Roquecruz, Carla; Concepcion, Milton; Day, Kerstun; Shaffer, Vered; Cullingford, Michael; Bailey, Stewart; Cloyd, SherVerne; Tetter, Keith; Moyer, Carol; Carpenter, Robert; Stevens, Gary; Kennedy, James; Barkley, Richard; Markley, Michael; Doolittle, Elizabeth; Som, Swagata; Rivera-Varona, Aida; Mroz (Sahm), Sara; Sangimino, Donna-Marie; Drucker, David; Evans, Jonathan; Thompson, Catherine; Cai, June; Emche, Danielle; VandenBerghe, John; Tregoning, Robert; Oudinot, Daniele; Mills, Daniel; Gall, Jennifer; Calvo, Antony; Anooosheppoor, Rasool; Miller, Barry; Sakai, Stacie; Williams, Donna; Cartwright, William; Tene, Kimberly; Sallman, Ahsan; Sall, Basia; Reed, Wendy; Snyder, Amy; Cupidon, Les; Shropshire, Alan; Chang, Richard; Barrett, Harold; Xu, Jim; Lu, Shanlai; Park, Sunwoo; Hernandez, Raul; Gall, Jennifer; Ruland, William; Zigh, Ghani; Gingrich, Chester; Whitman, Josh; Esmaili, Hossein; Gibson, Kathy; Brock, Terry; Khanna, Meena; Klein, Paul; Hardies, Robert; Kozal, Jason; Powell, Raymond; Pederson, Cynthia; Guthrie, Eugene; Daley, Robert; Vegel, Anton; Brown, Frederick; Kelly, Joseph; Srinivasan, Makuteswara; Lobel, Richard; Laur, Steven; Mitchell, Reggie; Rheume, Cynthia; Noggle, James; Libby, Earl; Case, Michael; Mizuno, Geary; Benowitz, Howard; Whitney, James; Schnetzler, Bonnie; Giantelli, Adelaide; Barry, Terrence; Chang, Richard; Schaperow, Jason; Tinkler, Charles; Santiago, Patricia; Patel, Jigar  
**Cc:** Givvines, Mary; Kipfer, Lorna; Oliveto, Betsy; Reckley, William; Murphy, Martin; Sydnor, Russell; Zimmerman, Roy; Bush-Goddard, Stephanie; Cullingford, Michael; Ruland, William; Karlin, Alex; Demoss, Gary; Norris, Wallace; Camper, Larry; Virgilio, Martin; Markley, Michael; Haney, Catherine; Wilson, George; Tappert, John; McDermott, Brian; Sheron, Brian; Holian, Brian; Harrison, Donnie; Elliott, Robert; Campbell, Andy; Doane, Margaret; Erlanger, Craig; Case, Michael; Klein, Alex; Mrowca, Lynn; Ulses, Anthony; Uhle, Jennifer; Gibson, Kathy; Gavrilas, Mirela; Virgilio, Martin; Holahan, Gary; Morris, Scott; Pederson, Cynthia; Scott, Michael; Dennig, Robert; Dyer, Jim; Nicholson, Thomas; Matthews, David; Johnson, Clay; Coffin, Stephanie; Bonaccorso, Amy; Anderson, Patricia; Schum, Constance; Wright, Jason; Padilla, William; Doan, Brian; Coates, Carlotta; Emche, Danielle; Doolittle, Elizabeth; Galloway, Melanie; Case, Michael; Dudes, Laura; Lorson, Raymond; Cullingford, Michael; Machalek, Woody; Wilson, George; Knowles, Eric; Valentin, Andrea; Oliveto, Betsy  
**Subject:** REMINDER: ACTION: Unanswered Session Questions due Today; Send Speaker Thank yous  
**Date:** Wednesday, March 23, 2011 9:35:24 AM  
**Attachments:** [Sample Speaker TY Ltr.doc](#)  
[Sample Format for Qs&As.docx](#)  
**Importance:** High

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Dear All,

I have received questions and answers from several of you, but if you have not sent them to me, please do so today. If you cannot meet today's deadline, please let me know as well. We would like to post all responses to questions that were not answered at the RIC on our website by April 1.

Attached is the question and answer sample. If you have unanswered questions from your session, please respond in the **Option A** format listed on the sample; or, if you do not have unanswered questions from your session, respond in the **Option B** format.

In addition, please send thank you letters to your speakers soon and feel free to use the attached sample thank you letter as a guide. Please just let me know when you have completed this action – there is no need to copy me on the letters.

Thanks very much and please contact me if you have any questions.

Liz

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**From:** Langlie, Liz  
**Sent:** Thursday, March 17, 2011 1:00 PM  
**Subject:** THANK YOU and ACTION: Sample Speaker Thank you Letter and Template for Unanswered Session Questions  
**Importance:** High

CH/236

Dear Session Coordinators and Chairs,

The 2011 RIC was very successful and I thank you on behalf of Lorna Kipfer, Betsy Oliveto and the RIC Planning Committee for greatly adding to that success! We have received many compliments on the technical session content and we appreciate the hard work you and your speakers put into making RIC sessions educational, timely and interesting.

It is now time for conference wrap up actions, which include thanking all speakers for their participation and responding to unanswered session questions, which will be posted on the RIC website. Attached is a sample speaker thank you letter for your reference – feel free to customize the letter to meet your needs. Please send thank you notes to your speakers in the next couple of weeks and let us know via email when this action has been completed – *we do not need to be copied on thank you notes*. Feel free to send your thank you letters via regular mail or email.

Also attached is a question and answer template. If you have unanswered questions from your session, please respond in the *Option A* format listed on the attached template; or, if all questions were answered at your session onsite, please respond in the *Option B* format. Please send your responses to me at [liz.langlie@nrc.gov](mailto:liz.langlie@nrc.gov) by March 23.

Our goal is to have audio and video of plenary sessions, audio of technical sessions, transcripts for plenary and technical sessions, updated technical presentations and unanswered questions on the external website by the end of March. We understand that it is an extremely busy time for many of you as a result of the Japan earthquake and tsunami, so please let us know if you are unable to send responses to unanswered questions by March 23.

I enjoyed working with each of you on the RIC technical sessions this year and I hope to work with you again on RIC 2012! Please don't hesitate to contact me or Lorna Kipfer if you have any questions and thank you again for your efforts to make the RIC such a successful conference.

Best,  
Liz

Liz Langlie  
Program Specialist, NRR/PMDA  
U.S. Nuclear Regulatory Commission (NRC)  
301/415-7237  
O-13E9  
[liz.langlie@nrc.gov](mailto:liz.langlie@nrc.gov)



## SAMPLE THANK YOU LETTER TO TECHNICAL SESSION SPEAKERS

DATE

NAME  
TITLE  
ORGANIZATION  
ADDRESS

Dear Mr./Mrs./Ms. \_\_\_\_\_:

Thank you for presenting at the U.S. Nuclear Regulatory Commission's 23rd Annual Regulatory Information Conference (RIC), March 8 – 10, 2011, in Rockville, Maryland. This year the total number of participants reached over 2,900 participants including international representatives from 28 countries.

Initial feedback from participants indicates that this year's RIC was another resounding success. Your dedication and support helps the NRC "raise the bar" each year to develop a comprehensive program filled with discussion topics that are timely and relevant.

Your presentation on "\_\_\_\_(speaker presentation title)\_\_\_\_\_"  
during the \_\_\_\_ (session number and title) \_\_\_\_\_  
session provided important information and another perspective about initiatives that are underway in the nuclear arena. *[optional: The interest of the attendees was evident by the range of questions raised during the question-and-answer period following the panel presentations.]*

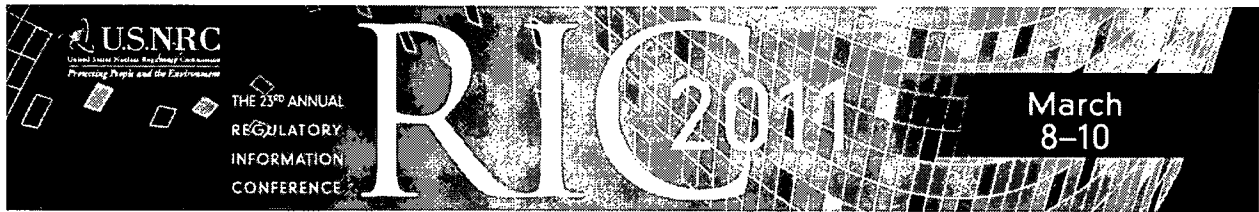
All final presentation slides and questions that were not addressed during the conference are being compiled and will be posted on the NRC's RIC website at: <http://www.nrc.gov/public-involve/conference-symposia/ric/index.html>. Again, thank you for your participation at NRC's 2011 Regulatory Information Conference. It is your commitment and support that helped to make the RIC a success.

We hope you will join us for the 24th Annual RIC March 13-15, 2012, scheduled to be held at the Bethesda North Marriott Hotel and Conference Center, Rockville, Maryland.

Warm regards,

Session Chair or Coordinator (as appropriate)





## **SUGGESTED FORMATS FOR PROVIDING QUESTIONS AND ANSWERS**

*Option A - Please follow the sample format below for sessions that have unanswered questions:*

**Session Day and Time:** *[ex: Tuesday, March 8, 1:30 p.m. - 3:00 p.m.]*

**Session Number and Title:** *[ex: T1 10 CFR Part 21 and Commercial-Grade Degradation]*

**Session Chair:** *[enter name and office of Session Chair]*

**Session Coordinator:** *[enter name, office, telephone number and email address of Session Coordinator]*

**Question 1:**

**Answer 1:**

**Question 2:**

**Answer 2:**

*Option B - Please follow the sample format below for sessions where all the questions received were answered during the session:*

**Session Day and Time:** *[ex: Tuesday, March 8, 1:30 p.m. - 3:00 p.m.]*

**Session Number and Title:** *[ex: T1 10 CFR Part 21 and Commercial-Grade Degradation]*

**Session Chair:** *[enter name and office of Session Chair]*

**Session Coordinator:** *[enter name, office, telephone number and email address of Session Coordinator]*

All questions received were answered during the session.

**From:** Sheron, Brian  
**To:** Sangimino, Donna-Marie  
**Cc:** Valentin, Andrea  
**Subject:** FW: REMINDER: ACTION: Unanswered Session Questions due Today; Send Speaker Thank yous  
**Date:** Wednesday, March 23, 2011 9:39:00 AM  
**Attachments:** Sample Speaker TY Ltr.doc  
Sample Format for Qs&As.docx  
**Importance:** High

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Can you and your staff handle?

**From:** Langlie, Liz

**Sent:** Wednesday, March 23, 2011 9:35 AM

**To:** Prescott, Paul; Hall, Victor; Zhang, Deanna; Rebstock, Paul; Hilton, Nick; Cool, Donald; Dehmelt, Jean-Claude; Jankovich, John; Poole, Brooke; Dube, Donald; Lois, Erasmia; Stutzke, Martin; Hudson, Daniel; Drouin, Mary; Nove, Carol; Scarbrough, Thomas; Lee, Mike; Dean, Bill; McCree, Victor; Satorius, Mark; Collins, Elmo; Denissen, Christie; Munson, Clifford; Ake, Jon; Manoly, Kamal; Kokajko, Lawrence; Miller, Kenn; Daley, Robert; Tappert, John; Casto, Chuck; Kahler, Robert; Dozier, Jerry; Imboden, Andy; Stone, AnnMarie; Galloway, Melanie; Howe, Andrew; Tjader, Theodore; Mrowca, Lynn; Sieracki, Diane; Cheok, Michael; Cai, June; Dion, Jeanne; Pederson, Perry; Costello, Ralph; Hiser, Allen; Carpenter, Gene; Frumkin, Daniel; Held, Wesley; Scales, Kerby; Roquecruz, Carla; Concepcion, Milton; Day, Kerstun; Shaffer, Vered; Cullingford, Michael; Bailey, Stewart; Cloyd, SherVerne; Tetter, Keith; Moyer, Carol; Carpenter, Robert; Stevens, Gary; Kennedy, James; Barkley, Richard; Markley, Michael; Doolittle, Elizabeth; Som, Swagata; Rivera-Varona, Aida; Mroz (Sahm), Sara; Sangimino, Donna-Marie; Drucker, David; Evans, Jonathan; Thompson, Catherine; Cai, June; Emche, Danielle; VandenBerghe, John; Tregoning, Robert; Oudinot, Daniele; Mills, Daniel; Gall, Jennifer; Calvo, Antony; Anooshehpour, Rasool; Miller, Barry; Sakai, Stacie; Williams, Donna; Cartwright, William; Tene, Kimberly; Sallman, Ahsan; Sall, Basia; Reed, Wendy; Snyder, Amy; Cupidon, Les; Shropshire, Alan; Chang, Richard; Barrett, Harold; Xu, Jim; Lu, Shanlai; Park, Sunwoo; Hernandez, Raul; Gall, Jennifer; Ruland, William; Zigh, Ghani; Gingrich, Chester; Whitman, Josh; Esmaili, Hossein; Gibson, Kathy; Brock, Terry; Khanna, Meena; Klein, Paul; Hardies, Robert; Kozal, Jason; Powell, Raymond; Pederson, Cynthia; Guthrie, Eugene; Daley, Robert; Vegel, Anton; Brown, Frederick; Kelly, Joseph; Srinivasan, Makuteswara; Lobel, Richard; Laur, Steven; Mitchell, Reggie; Rheume, Cynthia; Noggle, James; Libby, Earl; Case, Michael; Mizuno, Geary; Benowitz, Howard; Whitney, James; Schnetzler, Bonnie; Giantelli, Adelaide; Barry, Terrence; Chang, Richard; Schaperow, Jason; Tinkler, Charles; Santiago, Patricia; Patel, Jigar

**Cc:** Givvines, Mary; Kipfer, Lorna; Oliveto, Betsy; Reckley, William; Murphy, Martin; Sydnor, Russell; Zimmerman, Roy; Bush-Goddard, Stephanie; Cullingford, Michael; Ruland, William; Karlin, Alex; Demoss, Gary; Norris, Wallace; Camper, Larry; Virgilio, Martin; Markley, Michael; Haney, Catherine; Wilson, George; Tappert, John; McDermott, Brian; Sheron, Brian; Holian, Brian; Harrison, Donnie; Elliott, Robert; Campbell, Andy; Doane, Margaret; Erlanger, Craig; Case, Michael; Klein, Alex; Mrowca, Lynn; Ulses, Anthony; Uhle, Jennifer; Gibson, Kathy; Gavrilas, Mirela; Virgilio, Martin; Holahan, Gary; Morris, Scott; Pederson, Cynthia; Scott, Michael; Dennig, Robert; Dyer, Jim; Nicholson, Thomas; Matthews, David; Johnson, Clay; Coffin, Stephanie; Bonaccorso, Amy; Anderson, Patricia; Schum, Constance; Wright, Jason; Padilla, William; Doan, Brian; Coates, Carlotta; Emche, Danielle; Doolittle, Elizabeth; Galloway, Melanie; Case, Michael; Dudes, Laura; Lorson, Raymond; Cullingford, Michael; Machalek, Woody; Wilson, George; Knowles, Eric; Valentin, Andrea; Oliveto, Betsy

**Subject:** REMINDER: ACTION: Unanswered Session Questions due Today; Send Speaker Thank yous

**Importance:** High

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CH/237

have unanswered questions from your session, respond in the **Option B** format.

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Thanks very much and please contact me if you have any questions.

Liz

---

**From:** Langlie, Liz

**Sent:** Thursday, March 17, 2011 1:00 PM

**Subject:** THANK YOU and ACTION: Sample Speaker Thank you Letter and Template for Unanswered Session Questions

**Importance:** High

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Best,  
Liz

Liz Langlie  
Program Specialist, NRR/PMDA  
U.S. Nuclear Regulatory Commission (NRC)  
301/415-7237  
O-13E9  
liz.langlie@nrc.gov



## SAMPLE THANK YOU LETTER TO TECHNICAL SESSION SPEAKERS

DATE

NAME  
TITLE  
ORGANIZATION  
ADDRESS

Dear Mr./Mrs./Ms. \_\_\_\_\_:

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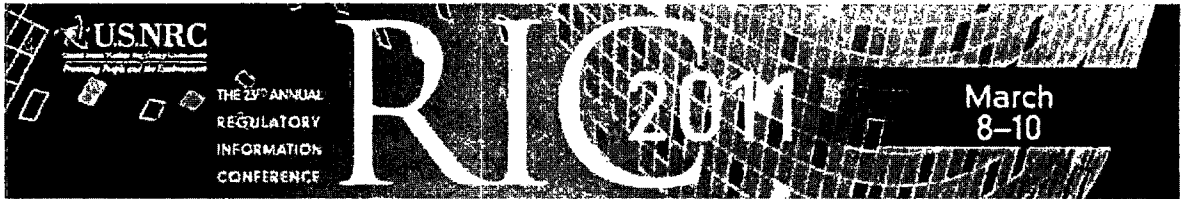
Your presentation on "\_\_\_\_\_(speaker presentation title)\_\_\_\_\_" during the \_\_\_\_\_(session number and title)\_\_\_\_\_ session provided important information and another perspective about initiatives that are underway in the nuclear arena. *[optional: The interest of the attendees was evident by the range of questions raised during the question-and-answer period following the panel presentations.]*

All final presentation slides and questions that were not addressed during the conference are being compiled and will be posted on the NRC's RIC website at: <http://www.nrc.gov/public-involve/conference-symposia/ric/index.html>. Again, thank you for your participation at NRC's 2011 Regulatory Information Conference. It is your commitment and support that helped to make the RIC a success.

We hope you will join us for the 24th Annual RIC March 13-15, 2012, scheduled to be held at the Bethesda North Marriott Hotel and Conference Center, Rockville, Maryland.

Warm regards,

Session Chair or Coordinator (as appropriate)



## **SUGGESTED FORMATS FOR PROVIDING QUESTIONS AND ANSWERS**

*Option A - Please follow the sample format below for sessions that have unanswered questions:*

**Session Day and Time:** *[ex: Tuesday, March 8, 1:30 p.m. - 3:00 p.m.]*

**Session Number and Title:** *[ex: T1 10 CFR Part 21 and Commercial-Grade Degradation]*

**Session Chair:** *[enter name and office of Session Chair]*

**Session Coordinator:** *[enter name, office, telephone number and email address of Session Coordinator]*

**Question 1:**

**Answer 1:**

**Question 2:**

**Answer 2:**

*Option B - Please follow the sample format below for sessions where all the questions received were answered during the session:*

**Session Day and Time:** *[ex: Tuesday, March 8, 1:30 p.m. - 3:00 p.m.]*

**Session Number and Title:** *[ex: T1 10 CFR Part 21 and Commercial-Grade Degradation]*

**Session Chair:** *[enter name and office of Session Chair]*

**Session Coordinator:** *[enter name, office, telephone number and email address of Session Coordinator]*

All questions received were answered during the session.

**From:** Uhle, Jennifer  
**To:** Evans, Michele  
**Cc:** Sheron, Brian; Flory, Shirley; Veltri, Debra  
**Subject:** RE: ET Director - shift schedule  
**Date:** Wednesday, March 23, 2011 10:03:50 AM  
**Attachments:** ET Directors Schedule.docx

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Added my name to some other shifts. Jim can have Sun unless he would rather have me take it. Thanks, J

---

**From:** Evans, Michele  
**Sent:** Tuesday, March 22, 2011 2:59 PM  
**To:** Uhle, Jennifer  
**Subject:** ET Director - shift schedule

Jennifer,

Can you take the 3/27 11 – 7 shift? Jim said he would cover that shift if you can't.

Also, do you want me to insert your name in any other vacant spots, before I send this back out to get Grobe and Boger to take some other spots.

Thanks.

*Michele*

CH/238

3/22/2011

3:00 pm

## ET Director Schedule

### March 18 – March 25, 2011

Shift	3/18 (Fri)	3/19 (Sat)	3/20 (Sun)	3/21 (Mon)	3/22 (Tues)	3/23 (Wed)	3/24 (Thur)	3/25 (Fri)
7am–3pm	J. Wiggins	J. Wiggins	J. Wiggins	M. Weber	M. Weber	M. Weber	M. Weber	J. Dyer
3pm–11pm	B. Boger	B. Sheron	B. Sheron	J. Wiggins	J. Wiggins	R. Zimmerman	R. Zimmerman	R. Zimmerman
11pm–7am	R. Zimmerman	M. Johnson	M. Johnson	M. Johnson	B. Boger	B. Boger	J. Uhle	J. Uhle

### March 26 – April 2, 2011

Shift	3/26 (Sat)	3/27 (Sun)	3/28 (Mon)	3/29 (Tues)	3/30 (Wed)	3/31 (Thur)	4/1 (Fri)	4/2 (Sat)
7am–3pm	J. Dyer	J. Dyer	M. Weber	M. Weber	M. Weber			
3pm–11pm	B. Sheron	B. Sheron	R. Zimmerman	R. Zimmerman	R. Zimmerman	B. Sheron		
11pm–7am	J. Uhle		J. Wiggins	J. Wiggins	J. Wiggins			

### April 3 – April 10, 2011

Shift	4/3 (Sun)	4/4 (Mon)	4/5 (Tues)	4/6 (Wed)	4/7 (Thur)	4/8 (Fri)	4/9 (Sat)	4/10 (Sun)
7am–3pm		J. Wiggins	J. Wiggins	J. Wiggins	M. Weber	M. Weber		
3pm–11pm	B. Sheron			R. Zimmerman	R. Zimmerman	R. Zimmerman		
11pm–7am	M. Johnson	M. Johnson	M. Johnson	M. Johnson	J. Uhle	J. Uhle	J. Uhle	J. Uhle