U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Task Force Areas of Focus

- Protection from design basis natural phenomena
- Consideration of beyond design basis natural phenomena
- Mitigation for long-term SBO
  - Including multiple unit events
- Emergency preparedness
- NRC programs

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Protecting People and the Environment

Longer-Term Review

- Commission Direction for Longer-Term Review
  - Specific information on sequence of events and equipment status
  - Evaluate policy issues
  - Potential interagency issues
  - Lessons learned for facilities other than operating reactors
  - Receive input and interact with all key stakeholders
  - Report within six months after beginning of long-term effort
  - Advisory Committee on Reactor Safeguards to review final long-term report and provide letter report to the Commission

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Industry Initiatives

- An industry-wide assessment to verify and validate each plant site's readiness to manage extreme events
- Initiatives include licensee verification of:
  - Each plant's capability to manage major challenges, and losses of large areas of the plant due to natural events, fires or explosions
  - Each plant's capability to manage a total loss of off-site power
  - Verifying the capability to mitigate flooding and the impact of floods
  - Performing walk-downs and inspection of important equipment needed to respond successfully to extreme events like fires and flood including identification of any potential that equipment functions could be lost during seismic events appropriate for the site, and development of strategies to mitigate any potential vulnerabilities

Gilles, Nanette

From: Gilles, Nanette
Sent: Friday, May 20, 2011 4:54 PM
To: Apostolakis, George
Cc: Sosa, Belkys
Subject: RE: May 26 NRSB Meeting
Attachments: Nuclear & Radiation Studies Board 26May11.pptx; Press release - TI 183.pdf

Commissioner – Here are the revised slides (also on G). I've also attached the press release on the TI inspection results. The quotes in your slides come from Eric Leeds. There are more details about some of the findings in the press release.

Nan

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Apostolakis, George
Sent: Wednesday, May 11, 2011 4:44 PM
To: Baggett, Steven; Davis, Roger; Gilles, Nanette; Sosa, Belkys
Cc: Blake, Kathleen
Subject: FW: May 26 NRSB Meeting

I suppose we have to start getting ready for this.

Commissioner George Apostolakis
US Nuclear Regulatory Commission
One White Flint North, MS O16 G4
11555 Rockville Pike
Rockville, MD 20852

(301) 415-1810

From: Crowley, Kevin [mailto:KCrowley@nas.edu]
Sent: Wednesday, May 11, 2011 4:03 PM
To: Apostolakis, George
Cc: Greenleaf, Toni; Case, Sarah; Crowley, Kevin
Subject: May 26 NRSB Meeting

Dear George:

Attached is the draft agenda for the May 26 meeting of the Nuclear and Radiation Studies Board. I have listed the following title for your talk: "Nuclear Regulatory Commission's response to the Fukushima accident." Please let me know if this title is acceptable and, if not, please suggest a more appropriate title. We hope that you can talk about the assistance that the NRC has provided/is providing to Tepco and the Japanese Government and what steps are being taken by the Commission with respect to the U.S. nuclear industry in the aftermath of the accident. The board would also be interested in your personal perspectives on the accident, response, and recovery.

As you can see from the attached agenda, there will be a number of other presenters from the U.S. government, industry, and non-governmental organizations. The purpose of this meeting is to inform the board and other meeting attendees about the accident and steps that are being taken in its aftermath. This is intended to be a technical meeting, not a hearing or inquiry. All of the board members have technical backgrounds in science, engineering, or medicine, but not all members are nuclear power experts. The meeting is open to the public and is usually well attended by Washington, DC-based scientists and policy experts. Members of the news media may also be in attendance. You are welcome to stay for the entire open session.

The meeting will be held in Room 100 of our Keck Center facility at 500 Fifth St, NW. Our building is located about a block from the Judiciary Square (Red Line) and Gallery Place/Chinatown (Red/Green & Yellow Line) Metro Stations. There is also underground visitor parking at the back of the building off of 6th Street, NW. We have a nice refectory (aka cafeteria) on the 3rd Floor if you want to come early and stay for lunch. It opens at 11:30 am.

Please let me know if you have questions or need any additional information for this meeting.

I am looking forward to seeing you on May 26.

Regards,

Kevin

Kevin D. Crowley, Ph.D.
Director
Nuclear and Radiation Studies Board
The National Academies
500 Fifth Street, NW
Washington, DC 20001 USA
+1-202-334-3066 (voice)
+1-202-334-3077 (fax)
kcrowley@nas.edu

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UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Nuclear Regulatory Commission Response to Fukushima

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

Nuclear and Radiation Studies Board

The National Academies

May 26, 2011

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UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC Incident Response

- NRC continuously manned its Emergency Operations Center from March 11 – May 16
- NRC team in Office of Nuclear Reactor Regulation has assumed responsibility for support & coordination efforts
- Revolving teams of NRC officials with appropriate expertise have been deployed to Japan since the day after the event
- NRC playing a key role in coordinated U.S. response to the event

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC Inspection Activities

- Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"
  - Uses a combination of assessment of licensee actions and independent inspections
  - Data gathering to help evaluate whether future regulatory actions may be necessary
- Temporary Instruction 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)"
  - To determine that the SAMGs are available and assess how they are being implemented
  - To determine the nature and extent of licensee implementation of SAMG training and exercises

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Protecting People and the Environment

Inspection Results for TI 2515/183

- Inspections completed in April 2011
- Inspections reports available on NRC web site
- "A few plants have to do a better job maintaining the necessary resources and procedures."
- "Inspectors found all the reactors would be kept safe even in the case where regular safety systems were affected by extreme events."

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Protecting People and the Environment

NRC Bulletin 2011-01, "Mitigating Strategies"

- Issued May 11, 2011
- By June 10, respond with information confirming mitigative strategy equipment is in place and available, as well as that the strategies can be carried out with current plant staffing
- By July 11, respond with further information, including:
  - How essential resources are maintained, tested and controlled to ensure availability
  - How strategies are re-evaluated if plant conditions or configurations change
  - How arrangements are reached and maintained with local emergency response organizations

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Near-Term Task Force (90 days)

- Commission Direction for Near-Term Review
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
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Protecting People and the Environment

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- To date the task force has not identified any issues that undermine our confidence in the continued safety and emergency planning of U.S. plants
- Task force review likely to recommend actions to enhance safety and preparedness

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Longer-Term Review (9 months)

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NRC NEWS

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

No. 11-081 May 13, 2011

INSPECTIONS AT U.S. NUCLEAR PLANTS PROMPT CORRECTIVE ACTIONS; REPORTS BEING MADE PUBLIC

The Nuclear Regulatory Commission Friday began issuing reports to the nation's 104 operating nuclear power plants regarding inspections of the plants' abilities to deal with power losses or damage to large areas of a reactor site following extreme events.

"Our inspectors found all the reactors would be kept safe even in the event their regular safety systems were affected by these events, although a few plants have to do a better job maintaining the necessary resources and procedures," said Eric Leeds, director of the NRC's Office of Nuclear Reactor Regulation. "As with all our inspections, we're making available to the public all the information not related to security issues."

The NRC carried out the inspections in the aftermath of the March 11 earthquake and tsunami in Japan and the resulting damage to the Fukushima nuclear power plant. The NRC directed its resident inspectors at every U.S. nuclear power plant to examine several areas, including the plants' mitigative strategies, sometimes called "B5b" strategies. NRC regulations call for these strategies to ensure plants can effectively cool down reactor cores and spent fuel pools following large fires, explosions or other events. The resident inspectors also examined the plants' ability to deal with: the loss of all alternating-current electricity sources; major flooding events; and fires and flooding combined with earthquakes (although this combination is not covered by existing requirements).

The NRC will use its Reactor Oversight Process to further evaluate the inspection results and ensure any issues are fixed. Examples of inspection findings include equipment that would not start when tested and mitigative equipment being used for other purposes at the plant or being stored in potentially vulnerable areas. Because the agency set May 13 as the target date for completion of these inspection reports, the individual reports are being issued as they become available. Every plant's inspection report will soon be available in one place on the NRC's website. The NRC hopes to aggregate the information in these reports for public availability in the coming week.

###

Gilles, Nanette

From: Gilles, Nanette
Sent: Tuesday, May 24, 2011 5:14 PM
To: Bostian, Trudi
Cc: Sosa, Belkys; Apostolakis, George; Blake, Kathleen
Subject: RE: Upcoming HEPG speaker logistics
Attachments: Harvard Electircity Fukushima 2June11.pptx

Ms. Bostian,

Commissioner Apostolakis' slides for the June 2 Post Fukushima session are attached.

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Blake, Kathleen
Sent: Tuesday, May 24, 2011 10:39 AM
To: Bostian, Trudi
Cc: Gilles, Nanette
Subject: RE: Upcoming HEPG speaker logistics

The Commissioner and his Technical Assistant, Nan Gilles, just spoke with Mr. Brown regarding the details of the meeting and his slides for next week's presentation. You should be hearing from Nan shortly regarding the status of the slides. kb

Kathleen A. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: Bostian, Trudi [mailto:Trudi_Bostian@hks.harvard.edu]
Sent: Tuesday, May 24, 2011 10:35 AM
To: Blake, Kathleen
Subject: RE: Upcoming HEPG speaker logistics

Hi Kathleen,

They are all set – not sure what the question was.

Do you know if the Commissioner plans to use slides? If so, I need them by tomorrow to get them into the packets.

Thanks.

Trudi Bostian
Staff Assistant
Harvard Electricity Policy Group
Mailbox 84
79 John F. Kennedy Street
Cambridge, MA 02138
Ph: 617-496-6760
Fax: 617-495-1635

From: Blake, Kathleen [mailto:Kathleen.Blake@nrc.gov]
Sent: Tuesday, May 24, 2011 10:26 AM
To: Brown, Ashley
Cc: Bostian, Trudi; Apostolakis, George; Sosa, Belkys
Subject: FW: Upcoming HEPG speaker logistics

Mr. Brown: Yes, both Commissioner Apostolakis and Belkys Sosa have been registered for the upcoming HEPG Seminar. See attached. kb

Kathleen H. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: Blake, Kathleen
Sent: Tuesday, May 17, 2011 12:03 PM
To: 'Bostian, Trudi'
Cc: Sosa, Belkys; 'jo-ann_mahoney@harvard.edu'
Subject: RE: Upcoming HEPG speaker logistics

Trudi: This will confirm Commissioner Apostolakis' participation as a speaker at the upcoming meeting of the Harvard Electricity Policy Group to be held at the Mandarin Oriental Hotel in Washington, DC, on Thursday, June 2, 2011 from 1-4 p.m. He will be accompanied by his Chief of Staff, Belkys Sosa.

Attached please find a copy of his bio

JoAnn: Attached please find registration for both the Commissioner and Belkys Sosa.

I will discuss the status of the Commissioner's slides when he returns from travel this week.

Many thanks.

Kathleen H. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: Bostian, Trudi [mailto:Trudi_Bostian@hks.harvard.edu]
Sent: Tuesday, May 17, 2011 11:33 AM
To: Blake, Kathleen; CMRAPOSTOLAKIS Resource
Subject: Upcoming HEPG speaker logistics

Dear Commissioner Apostolakis,

We are hopeful that you can participate as a speaker at the upcoming meeting of the Harvard Electricity Policy Group to be held at the Mandarin Oriental Hotel in Washington, DC, on Thursday-Friday, June 2-3, 2011. Our draft agenda is attached. I will also be sending you a letter from Dr Hogan outlining the details of your session; these items will also arrive by regular mail next week.

I have a few requests:

1. **Registration form:** Please return the attached registration form at your earliest convenience.
2. **Bio**: please send me an updated version. This is so that the panel moderator can introduce you to the group, and it will not be distributed.
3. **Slides:** If you plan to use slides, please send them to me by **Wednesday, May 25**. It is Dr Hogan's preference to provide participants' with printed copies of the slides in a materials folder at the beginning of the conference. I will be running the laptop that projects your slides onto the screens in the room. If you prefer not to distribute your slides in advance that is perfectly fine; please just let me know. It is also Dr Hogan's preference to post presentations to our website after the event; again, if you'd prefer not to just let me know.
4. **Materials:** If you have any materials that you would like distributed in advance to participants, please send that to me at your earliest convenience and it will be distributed via email. I can also have printed copies available at the event.

If you should have any questions, please do not hesitate to contact me. I look forward to seeing you in Washington in June.

****

Trudi Bostian
Staff Assistant
Harvard Electricity Policy Group
79 John F. Kennedy Street
Cambridge, MA 02138
Ph: 617-496-6760
E: trudi_bostian@hks.harvard.edu

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Post Fukushima: NRC Response

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

Harvard Electricity Policy Group

Sixty-Third Plenary Session

June 2, 2011

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UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC Incident Response

- Initial NRC response coordinated through Headquarters Operations Center
- NRC Office of Nuclear Reactor Regulation has now assumed responsibility for support & coordination efforts
- Revolving teams of NRC officials with appropriate expertise have been deployed to Japan since the day after the event
- NRC played a key role in coordinated U.S. response to the event

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NRC Inspection Activities

- Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"

- Inspection Results for TI 2515/183
  - Observations "indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events"
  - However, "no functions were compromised that would have resulted in damage to the fuel elements or containment"

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NRC Bulletin 2011-01, "Mitigating Strategies"

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- By June 10, respond with information confirming mitigative strategy equipment is in place and available, as well as that the strategies can be carried out with current plant staffing
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  - How essential resources are maintained, tested and controlled to ensure availability
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Near-Term Task Force (90 days)

- Commission Direction for Near-Term Review
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
  - Recommendations for the content, structure, and estimated resource impact for the longer-term review
  - Independent from industry efforts
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    - ✓ 30-day Commission meeting (5/12/11)
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Task Force Areas of Focus

- Protection from design basis natural phenomena
- Consideration of beyond design basis natural phenomena
- Mitigation for long-term loss of AC power (Station Blackout)
  - Including multiple unit events
- Emergency preparedness
- NRC programs

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Protecting People and the Environment

Task Force Current Assessment

- To date the task force has not identified any issues that undermine our confidence in the continued safety and emergency planning of U.S. plants

- Task force review likely to recommend actions to enhance safety and preparedness

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UNITED STATES NUCLEAR REGULATORY COMMISSION
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Longer-Term Review (9 months)

- Commission Direction for Longer-Term Review
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  - Receive input and interact with all key stakeholders
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NOT FOR PUBLIC DISCLOSURE

Gilles, Nanette

From: Gilles, Nanette
Sent: Wednesday, May 25, 2011 5:24 PM
To: Apostolakis, George
Cc: Sosa, Belkys
Subject: FW: Update slides??

Commissioner – FYI – Scott Burnell provided a quote (below) related to Fukushima from Commissioner Ostendorff's testimony today. I'm sure you saw in the media reports what TEPCO is now saying.

NOT FOR PUBLIC DISCLOSURE

The New York Times (5/25, A10, Tabuchi, 950K) reports that Japan's TEPCO, acknowledging the "severity of Japan's nuclear disaster," said Tuesday that the "three of the stricken Fukushima Daiichi plant's reactors most likely suffered fuel meltdowns in the early days of the crisis." TEPCO also said it was possible that Daiichi plant pressure vessels, which contain the fuel rods, had been breached as well. The Times suggests the TEPCO admissions "could delay efforts to bring the plant's reactors under control." The company's earlier announced plans to bring the reactors to a "stable state known as a 'cold shutdown' in six to nine months" was based on an assumption that workers "could efficiently cool the fuel in the three reactors, a harder task if their inner pressure vessels are breached."

NOT FOR PUBLIC DISCLOSURE

Also, Scott gave us information about the expected press coverage at tomorrow's meeting.

Nan

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Burnell, Scott
Sent: Wednesday, May 25, 2011 5:15 PM
To: Gilles, Nanette; Sosa, Belkys
Subject: RE: Update slides??

If the slides don't mention specifics about the accident, we should be fine. The Commissioner should be prepared for questions based on what Commissioner Ostendorff said, of course.

Three Reactors at Japanese Plant Have Melted Fuel, NRC Says
Bloomberg
... Wed May 25 18:10:04 GMT 2011 Three reactors at Japan's stricken power plant have melted fuel rods and it may take longer than nine months to gain control at the site, said William Ostendorff, a member of the US **Nuclear Regulatory Commission**. ...

Here's the expected media presence:

Richard Harris – NPR

Brian Vastag – Washington Post

Matt Daly – AP

NOT FOR PUBLIC DISCLOSURE

Jerome Glenn – State of the Future

Randy Showstack – EOS

Simon Lomax – Bloomberg

NOT FOR PUBLIC DISCLOSURE

From: Gilles, Nanette
Sent: Wednesday, May 25, 2011 5:10 PM
To: Burnell, Scott; Sosa, Belkys
Subject: RE: Update slides??

Scott – Help me out. The Commissioner's slides don't say anything about the accident itself, just what the NRC response was. What is it that you think may be inconsistent?

Nan

Nanette V. Gilles

Technical Assistant for Reactors

to Commissoner Apostolakis

U. S. Nuclear Regulatory Commission

Phone: 301-415-1180

Email: nanette.gilles@nrc.gov

From: Burnell, Scott
Sent: Wednesday, May 25, 2011 4:56 PM
To: Sosa, Belkys; Gilles, Nanette
Subject: Update slides??

Belkys, Nan;

Commissioner Ostendorff "updated" our state of understanding on Fukushima during his confirmation hearing this morning -- perhaps Commissioner Apostolakis's presentation needs a scrub for consistancy's sake? Thanks.

NOT FOR PUBLIC DISCLOSURE

Scott

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Nuclear Regulatory Commission Response to Fukushima

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

Nuclear and Radiation Studies Board

The National Academies

May 26, 2011

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
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NRC Incident Response

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- Observations "indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events"
- However, "no functions were compromised that would have resulted in damage to the fuel elements or containment"

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

COMMISSIONER

May 27, 2011

Mr. Steve Geimann, Editor
Bloomberg.net
1399 New York Avenue, NW
Washington, DC 2005

Dear Mr. Geiman:

The story by Simon Lomax entitled "Wider U.S. Nuclear Evacuation Zone Unneeded, Official Says," published May 26 on bloomberg.com, focuses on my comments at a conference in Washington. I write to emphasize two points that provide important context for my remarks.

The article correctly notes that I am a member of the U.S. Nuclear Regulatory Commission. I want to emphasize that I was expressing my personal views as an individual Commissioner. My comments should not be construed as reflective of collective views or determinations of the Commission.

At the conference, I said it would be unreasonable to require a wider emergency planning zone in the U.S. just because U.S. citizens were urged to stay 50 miles from the damaged nuclear plant in Japan. As I indicated during my comments, I could be persuaded otherwise by new evidence on the issue. At this time the NRC's task force is reviewing the events in Japan for lessons learned and for any recommended changes in NRC's regulations or practices in such areas as emergency planning. I look forward to receiving and considering the reports and recommendations on these issues.

Sincerely,

George Apostolakis

cc Simon Lomax

1025

OFFICE OF COMMISSIONER APOSTOLAKIS

ROUTING SLIP

ROUTINE

SUBJECT: Thank you letter re: nuclear safety and emergency planning issues after the Fukushima accident

1	Belkys Sosa, EA	DATE: 6/20/11
2	Roger Davis, LA	DATE: 6/20
~~3~~	Steve Baggett, MA	DATE: 6/21
4	Nan Gilles	DATE: 6/21
5	Christiana Lui	DATE: 6/22
	Cmr Apostolakis	DATE:
	Kathleen Blake, AA	DATE:
6	Carmel Savoy, AA	DATE:

NOTES:

FILE/Recycle: Japan Event ?

1025

行政院原子能委員會
ATOMIC ENERGY COUNCIL, EXECUTIVE YUAN
No.80, Sec. 1, Chenggong Rd., Yonghe City,
Taipei County 234, Taiwan(R.O.C.)

OFFICE OF THE
VICE CHAIRMAN

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May 30, 2011

Dr. Gregory B. Jaczko
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
U.S.A.

Dear Chairman Jaczko:

I would like to thank you for your kind reception at your office of the Nuclear Regulatory Commission during my recent visit to Washington D.C. It was indeed a great pleasure to meet with you and learn your point of view on nuclear safety regulation, specially your opinion on nuclear safety and emergency planning issues after the Fukushima accident.

As you are quite aware, the NRC and the AEC are very close partners in nuclear safety regulation. The joint standing committee annual meetings for our decades-long cooperation on civilian nuclear application as well as the recently commenced bilateral technical meetings, which are hosted by two sides by turns, have been playing a vital role in ensuring the communication between the two agencies for cooperative activities review and nuclear regulatory experience exchange. I would like to take this opportunity to value outcomes of those meetings that helped the AEC in moving further along in its progress of regulation.

I appreciate the fruitful exchange on nuclear safety issues, and look forward to future opportunities for seeking your advice in this area. Until then, my best wishes for continued success.

Sincerely yours,

Shieh Der-Jhy

Der-Jhy Shieh
Deputy Minister and Vice Chairman

(b)(5)

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Post Fukushima: NRC Response

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

Harvard Electricity Policy Group

Sixty-Third Plenary Session

June 2, 2011

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Protecting People and the Environment

NRC Incident Response

- Initial NRC response coordinated through Headquarters Operations Center
- NRC Office of Nuclear Reactor Regulation has now assumed responsibility for support & coordination efforts
- Revolving teams of NRC officials with appropriate expertise have been deployed to Japan since the day after the event
- NRC played a key role in coordinated U.S. response to the event

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NRC Inspection Activities

- Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"

- Inspection Results for TI 2515/183
  - Observations "indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events"
  - However, "no functions were compromised that would have resulted in damage to the fuel elements or containment"

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NRC Bulletin 2011-01, "Mitigating Strategies"

- Issued May 11, 2011
- By June 10, respond with information confirming mitigative strategy equipment is in place and available, as well as that the strategies can be carried out with current plant staffing
- By July 11, respond with further information, including:
  - How essential resources are maintained, tested and controlled to ensure availability
  - How strategies are re-evaluated if plant conditions or configurations change
  - How arrangements are reached and maintained with local emergency response organizations

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Near-Term Task Force (90 days)

- **Commission Direction for Near-Term Review**
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
  - Recommendations for the content, structure, and estimated resource impact for the longer-term review
  - Independent from industry efforts
  - Milestones
    - ✓ 30-day Commission meeting (5/12/11)
    - ✓ 60-day Commission meeting (6/16/11)
    - ✓ 90-day final report and Commission meeting (7/19/11)

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Task Force Areas of Focus

- Protection from design basis natural phenomena
- Consideration of beyond design basis natural phenomena
- Mitigation for long-term loss of AC power (Station Blackout)
  - Including multiple unit events
- Emergency preparedness
- NRC programs

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Task Force Current Assessment

- To date the task force has not identified any issues that undermine our confidence in the continued safety and emergency planning of U.S. plants

- Task force review likely to recommend actions to enhance safety and preparedness

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Longer-Term Review (9 months)

- Commission Direction for Longer-Term Review
  - Specific information on sequence of events and equipment status
  - Evaluate policy issues
  - Potential interagency issues
  - Lessons learned for facilities other than operating reactors
  - Receive input and interact with all key stakeholders
  - Report within six months after beginning of long-term effort
  - Advisory Committee on Reactor Safeguards to review final long-term report and provide letter report to the Commission

Apostolakis, George

NOT FOR PUBLIC DISCLOSURE

m: Apostolakis, George
: Tuesday, June 07, 2011 12:32 PM
Lui, Christiana; Baggett, Steven; Gilles, Nanette; Sosa, Belkys; Davis, Roger
Subject: RE: RII Visit

Perhaps you can develop a set of bullets as a starting point.

Commissioner George Apostolakis
US Nuclear Regulatory Commission
One White Flint North, MS O16 G4
11555 Rockville Pike
Rockville, MD 20852

(301) 415-1810

-----Original Message-----
From: Lui, Christiana
Sent: Tuesday, June 07, 2011 12:00 PM
To: Baggett, Steven; Gilles, Nanette; Sosa, Belkys; Apostolakis, George
Subject: FW: RII Visit

Feedback from RII on general items of interest during the opening session with all RII staff.

From: Croteau, Rick
Sent: Tuesday, June 07, 2011 9:51 AM
Lui, Christiana
Wert, Leonard
Subject: Re: RII Visit

Correct. No slides. As far as topics, folks generally like to hear what is on the Commissioners' mind. Possible near term impacts on the Region. Thoughts on what may be in store for US based on events in Japan. Spent fuel and Yucca, if the legal council says he can discuss. Vision on new reactor and fuel facilities. Please keep in mind the audience is primarily inspector and admin folks who are not fully aware of licensing, rulemaking, and policy matters under review.
Rick

This email is being sent from an NRC mobile device.

----- Original Message -----
From: Lui, Christiana
To: Croteau, Rick
Sent: Tue Jun 07 08:19:06 2011
Subject: RII Visit

Hi Rick,

I just want to confirm that the Cmr will not speak from slides during any of the sessions. For the opening session, are there any particular topics that RII would like him to address? Let me know.

Thanks,
Chris

Gilles, Nanette

m: Blake, Kathleen
t: Wednesday, June 08, 2011 1:43 PM
: Apostolakis, George; Sosa, Belkys
Cc: Davis, Roger; Baggett, Steven; Gilles, Nanette; Lui, Christiana
Subject: FW: Challenges and Response to Fukushima
Attachments: Jaczko Statement on Safety.pdf

Fyi - kb

Kathleen M. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: CMRAPOSTOLAKIS Resource
Sent: Wednesday, June 08, 2011 1:22 PM
To: Blake, Kathleen
Subject: FW: Challenges and Response to Fukushima

m: Alan at Anbex [mailto:alan@anbex.com]
Sent: Wednesday, June 08, 2011 12:06 PM
To: CHAIRMAN Resource
Cc: CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMRMAGWOOD Resource; CMROSTENDORFF Resource
Subject: Challenges and Response to Fukushima

June 8, 2011

Dr. Gregory B. Jaczko
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Dr. Jaczko:

I have seen a copy of your May 31 Statement regarding the NRC's Commitment to Safety, and the description of actions taken in light of the recent tragic events in Japan. It is clear that much is being done as the lessons learned from the Japanese incident become clear, and I appreciate your transparency and willingness to engage in constructive dialog to assure nuclear safety in the US. Further, your decision to follow the recommendations of your most senior safety experts to expand the Fukushima safety area to 50 miles from the reactor site, despite the unpopularity of this decision within the nuclear industry, should be strongly applauded.

Unfortunately, your personal commitment to "put safety above all else" appears to put you in direct conflict with an ing NRC policy that applies in the United States. While 50 miles was recommended to protect Americans in Japan, NRC has vigorously blocked efforts to expand the distribution of potassium iodide (KI) beyond 10 miles in order to protect Americans in America. Surely, if safety considerations warrant the evacuation of everyone within 50 miles of a

release, it is difficult to understand how the Commission can oppose the far less intrusive step of quietly pre-stockpiling KI tablets to distribute to those who may be exposed while an evacuation is underway.

As I am sure you know, studies by the World Health Organization and the NRC itself clearly state that the "vast majority" of the thyroid cancer from the Chernobyl accident took place more than 30 miles from the site, and that cancer increases were seen as far away as 150 to 200 miles (Draft NUREG-1633). Despite these findings, and the conclusions of the US FDA confirming KI's safety and effectiveness, NRC and industry representatives consistently argue against the availability of KI to the general public beyond 10 miles. Instead, they promote a simplistic policy focused merely on avoiding contaminated milk, water, and food in the event of a release. While this is reasonable, it is far from sufficient.

It took great courage to ignore the challenges from the nuclear industry and expand the zone of safety in Japan to 50 miles. The time has come for the Commission to be just as courageous in the United States. Stockpiling enough KI to protect everyone who may be at risk, along with measures to avoid contaminated milk, should be an integral part of any emergency strategy to protect the American public.

Sincerely,

Alan Morris
President
Anbex, Inc.
alan@anbex.com

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 31, 2011

FOR THE RECORD

NRC CHAIRMAN GREGORY B. JACZKO'S STATEMENT ON NRC'S COMMITMENT TO SAFETY

The tragic events in Japan have understandably shined a brighter spotlight on the safety of nuclear power in the United States and on the role and actions of the U.S. Nuclear Regulatory Commission. As public servants, we pride ourselves on our transparency and openness and welcome the constructive dialogue about ensuring the facilities we license are operated safely and securely.

For more than six years I have served as a Commissioner and now Chairman of this independent federal government agency and I have personally seen the tremendous job the NRC staff does. Our employees are dedicated public servants who come to work every day to do one thing - ensure that nuclear power plants and nuclear materials are safe and secure. Most of our 4,000 employees make this a lifetime endeavor.

In the last several weeks, however, a skewed picture of the NRC has been painted in some stories -- one of missed opportunities and delayed enforcement suggesting an ineffectual regulator. Nothing could be further from the reality. Here are examples that demonstrate why I strongly disagree with these recent accounts.

First, about 18 months ago the NRC staff acted to resolve a significant design concern they identified with the Westinghouse AP1000 reactor design, proposed for construction in Georgia. This is a multi-billion dollar project, but the NRC's effort and focus has been on determining if the design meets our stringent safety requirements and at one point our staff experts determined that it did not. Consistent with our focus on safety the NRC experts told the plant designer that changes were needed or the staff would not approve the design. It was as simple as that. Because of forceful NRC action, the vendor made significant improvements. This took place in full view of the public, including a dissenting opinion by one of our staff members. Despite this transparency, there was little public recognition that this highlighted the NRC's commitment to safety.

Second, also little noticed was our work on the reactor vessel head, the lid of the metal structure that holds the nuclear fuel, of a plant in Ohio known as Davis Besse. Last year, the licensee identified problems with the interim replacement head. The NRC immediately studied the safety significance of this defective component and made certain the plant owner did the

right thing. Far from being a passive regulator, the agency demanded the plant owner accelerate replacement of the component years before the owner wanted to do so. Although this decision requires considerable cost on the part of plant owner, that had no bearing for the NRC safety experts. They simply put safety above all else, just as they had done in the case of the AP1000 reactor design. This is another example of the agency doing the right thing - something routine for the NRC staff. But unfortunately this attracted limited media attention.

Third, during our Japan nuclear incident response, I approved a courageous safety recommendation by our most senior, expert staffers. As we were monitoring the fluid situation in Japan, NRC staff became concerned that the situation could worsen and impact Americans living there. Using all of their training, the best available data, and centuries of combined nuclear safety experience, the staff recommended to me that we needed to advise American citizens to stay fifty miles away from the troubled nuclear site, recommendations that differed from the advice of the Japanese government. The staff did not focus on what might be popular with the nuclear industry but instead recommended action in the best interest of safety.

These three examples are just a few of the many ways the NRC staff works day-in and day-out to make sure nuclear power plants and nuclear materials will not cause harm to the public. I could fill the entire newspaper with just a fraction of the proactive safety measures taken by the staff in the last year. Yet as with most of our safety actions, these examples received little public attention.

Of course, we are not perfect. There are things we can do better. Among them is the need to better enforce our regulations designed to protect against the risk of fires at nuclear power plants, something the Commission continues to publicly debate. We are always striving to learn lessons and we will look to the tragedy in Japan to improve our programs, even though this event involved no U.S. nuclear facilities. In fact, just 12 days into the Japan incident the Commission created a task force to look at improvements to our regulations and oversight programs. That task force has already participated in one public meeting and is working systematically and methodically to make recommendations by July.

Ensuring nuclear safety is always challenging. We cannot guarantee the prevention of every possible accident and we seem to only make news when there are issues. But that is precisely our job – to find problems and ensure they are resolved. The knowledge that the dedicated women and men of the NRC are there to advise me and my colleagues on the Commission leaves me confident in our ability to continue to successfully protect the health and safety of the American people.

Apostolakis, George

m:	OECD Nuclear Energy Agency [nea@oecd-nea.org]
:	Wednesday, June 08, 2011 11:35 AM
ject:	PRESS RELEASE: Nuclear regulatory authorities decide on follow-up to the Fukushima Daiichi accident
Attachments:	image001.png

Pour la version française, cliquez ici.

NEA
Nuclear Energy Agency

OECD

NEA/COM(2011)4
Paris, 8 June 2011

Nuclear regulatory authorities decide on follow-up to the Fukushima Daiichi accident

The nuclear regulatory authorities of the G8, OECD Nuclear Energy Agency (NEA) member countries and associated countries including Brazil, India, Romania, South Africa and Ukraine, met today in Paris to discuss insights gained in relation to the Fukushima Daiichi nuclear power plant accident and to decide on appropriate follow-up actions at the international level.

The Forum on ***The Fukushima Accident: Insights and Approaches*** constitutes an important step in the international efforts being undertaken to learn from, to share and to implement the lessons learnt as a result of the Fukushima Daiichi accident. At the opening of the Forum, Nathalie Kosciusko-Morizet, the French Minister for Ecology, Sustainable Development, Transport and Housing, provided the key messages that the governments of 33 countries had agreed upon at the Ministerial seminar which took place at the OECD on the preceding day.

According to the Forum's Co-chairs from France, the United Kingdom and the United States, "There have been excellent discussions today on 'what we are learning' and 'what actions we are taking'. That being said, regulatory authorities recognise the ongoing seriousness of the situation at Fukushima Daiichi and the continuing efforts of Japanese workers and authorities. Further follow-up actions will continue to be taken and the Forum has focused our attention, as regulatory authorities, on these key issues and priorities."

Forum participants agreed on a number of priorities and recommendations in terms of collective learning, sharing insights and approaches, and implementation of what regulatory authorities have learnt from the Forum. The Forum's full text of final conclusions and recommendations will be made available on the NEA website (www.oecd-nea.org).

Highlights include the following:

- In line with the communiqué of the G8 summit held in Deauville on 26-27 May 2011 and the Ministerial seminar held at the OECD on 7 June 2011, nuclear safety authorities aim to continue to secure the highest levels of safety through continuous improvement of safety. In this context, they remain committed to seek ways to continue making operating and new reactors even safer by learning from the Fukushima Daiichi accident.
- Significant in-depth reviews and analyses of nuclear power plant safety have been or are being undertaken following the Fukushima Daiichi accident. The Forum participants invite all regulatory authorities responsible for nuclear facilities to launch similar reviews and analyses as soon as possible.
- Regulatory authorities will continue to systematically advance the necessary knowledge needed for all plant designs and post-accident situations. Priority areas include extreme external natural events and resilience to external shocks, including combined risks, plant design and the ability of safety systems to withstand severe accidents, emergency response and management capabilities, crisis communication, and site recovery plans and their implementation.
- Regulatory authorities will continue to increase their co-operation through the NEA Committee on Nuclear Regulatory Activities (CNRA) to improve the continuous release of reliable information they provide to the public and governmental institutions, both nationally and internationally. Further, they will reflect upon the adequacy and

challenges of the tools currently being used to communicate openly and transparently with the public on accident severity, including the INES scale, a common tool defined by the International Atomic Energy Agency (IAEA) and the OECD Nuclear Energy Agency (NEA).

- Regulatory authorities also highlighted the need for an early response to the management of such accident situations.
- Regulatory authorities stressed that the prime responsibility for nuclear safety rests with licensed operators. In this regard, they welcomed the commitments of the World Association of Nuclear Operators (WANO) and its members to *increase their efforts on nuclear safety through enhanced peer reviews, transparency and international co-operation* among operators.
- The NEA was recognised as providing an efficient expert network to ensure co-ordination among the regulatory authorities of NEA and associated countries and to disseminate nuclear safety best practices. Regulatory authorities have requested that the NEA standing technical committees, including the Committee on the Safety of Nuclear Installations (CSNI) and the Committee on Radiation Protection and Public Health (CRPPH), carry out additional technical analyses following this Forum and share the outcomes internationally.

The regulatory authorities of the G8, NEA member countries and associated countries stated their commitment to continue working together internationally. They believe that the current situation, although very unfortunate, will in time strengthen international nuclear safety. The IAEA Ministerial conference, to be held at the end of June, is the next important step of many that will enhance global nuclear safety.

For further information, please contact:

Mr. Serge Gas
Head, External Relations and Public Affairs
OECD Nuclear Energy Agency (NEA)
Tel.: +33 (0)1 45 24 10 10
E-mail: press@oecd-nea.org
Website: www.oecd-nea.org

Membership consists of 30 Organisation for Economic Co-operation and Development (OECD) countries. The mission of the NEA is to assist member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes.

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Current Commission Issues: Power Reactors

Commissioner George Apostolakis

U. S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

Nuclear Plant Safety Course

Massachusetts Institute of Technology

June 13, 2011

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Issue Overview

- Response to Fukushima
- Emergency Preparedness
- Safety Culture Policy
- Containment Accident Pressure (CAP)
- PWR Sump Performance (GSI-191)
- Seismic Requirements (GI-199)
- Fire Protection
- Small Modular Reactors (SMRs)

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NRC Response to Fukushima

- Initial NRC response coordinated through Headquarters Operations Center
- NRC Office of Nuclear Reactor Regulation has now assumed responsibility for support & coordination efforts
- Revolving teams of NRC officials with appropriate expertise have been deployed to Japan since the day after the event
- NRC played a key role in coordinated U.S. response to the event

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NRC Response to Fukushima
Regulatory Actions

- **Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"**
  - Observations "indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events"
  - However, "no functions were compromised that would have resulted in damage to the fuel elements or containment"
- **NRC Bulletin 2011-01, "Mitigating Strategies"**
  - Confirm mitigative strategy equipment is in place and available
  - Provide information on:
    - Equipment maintenance, testing, & availability controls
    - Coordination with local emergency response organizations

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NRC Response to Fukushima Task Force

- **Near-Term Review (90 days)**
  - Conduct methodical and systematic review of relevant NRC regulatory requirements, programs, and processes
  - Recommend whether the agency should make near-term improvements to our regulatory system
  - Recommend content, structure, and estimated resource impact for longer-term review
  - Report to Commission after 30, 60, & 90 days

- **Current Assessment**
  - To date the task force has not identified any issues that undermine our confidence in the continued safety and emergency planning of U.S. plants
  - Task force review likely to recommend actions to enhance safety and preparedness

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NRC Response to Fukushima Task Force

- **Longer-Term Review (9 months)**
  - Specific information on sequence of events and equipment status
  - Evaluate policy issues & potential interagency issues
  - Lessons learned for facilities other than operating reactors
  - Receive input and interact with all key stakeholders
  - Report within six months after beginning of long-term effort
  - Advisory Committee on Reactor Safeguards to review final long-term report and provide letter report to the Commission

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Emergency Preparedness Changes (10 CFR 50.47 & 10 CFR Part 50, Appendix E)

- After 9/11/2001, NRC determined it was necessary to modify certain requirements in the emergency preparedness (EP) program to ensure licensees continued to adequately protect public health and safety
- NRC issued Order EA-02-026, "Order for Interim Safeguards and Security Compensatory Measures," dated February 25, 2002
- NRC staff also performed a comprehensive review of EP regulations and guidance
- These two activities resulted in an NRC staff proposal to make changes to NRC's EP rule

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Emergency Preparedness Changes (10 CFR 50.47 & 10 CFR Part 50, Appendix E)

- Some highlights of proposed EP rule changes include:
  - Requirements for licensees to include hostile action scenarios in EP drills and exercises
  - Requirements for specific emergency plan provisions to protect onsite emergency responders in emergencies resulting from hostile action at nuclear power plants
  - Requirements for licensees to identify and describe the assistance expected from offsite response organizations during an emergency, including hostile action

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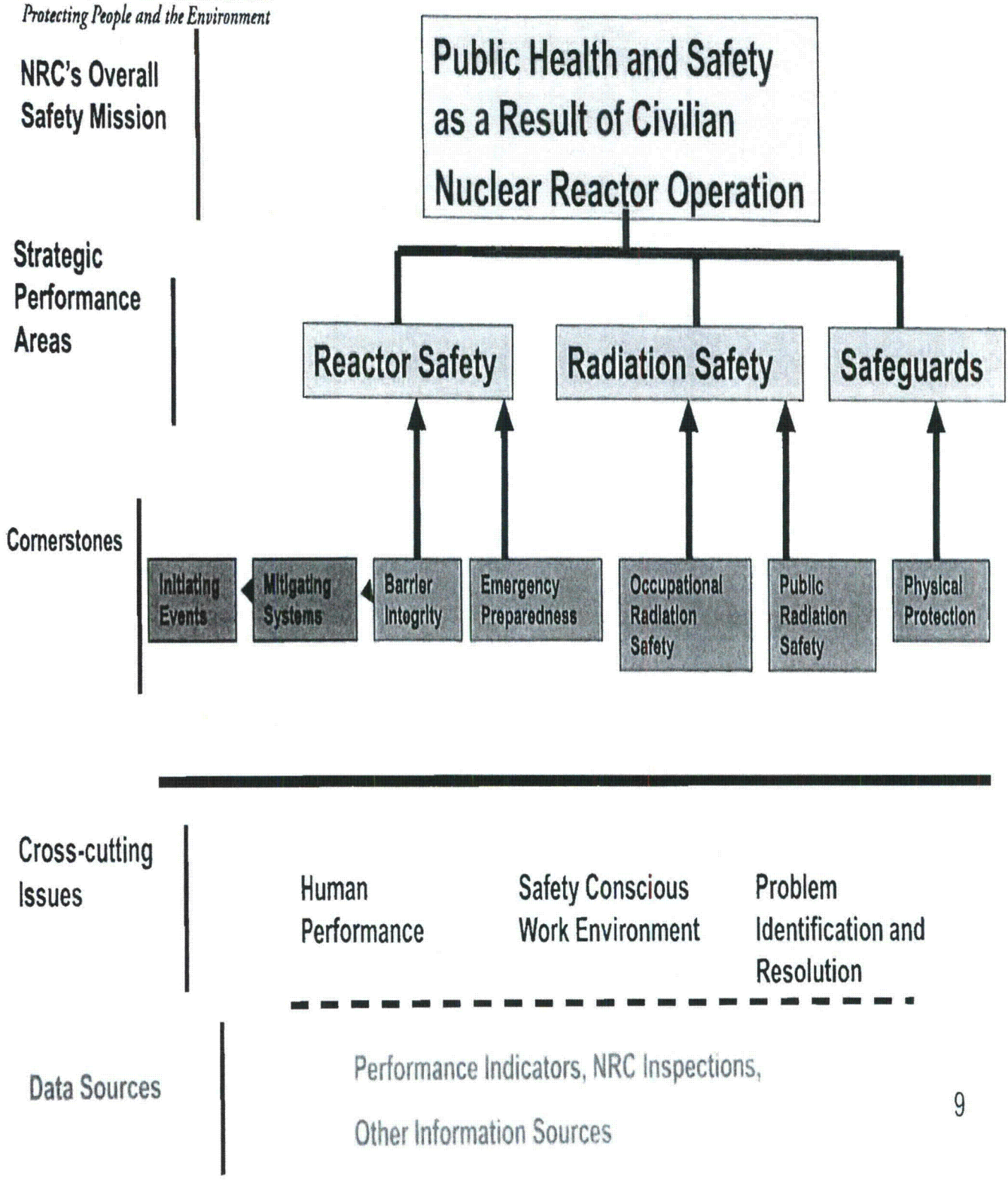
Reactor Oversight Process



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Final Safety Culture Policy Statement

- **Approved in March 2011**
- **Nuclear Safety Culture is defined as *the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment.***
- **Safety and security are equally important in a positive safety culture**
- **All entities regulated by NRC are responsible for developing and maintaining a positive safety culture**
- **NRC will include appropriate means to monitor safety culture in its oversight programs and internal management processes**

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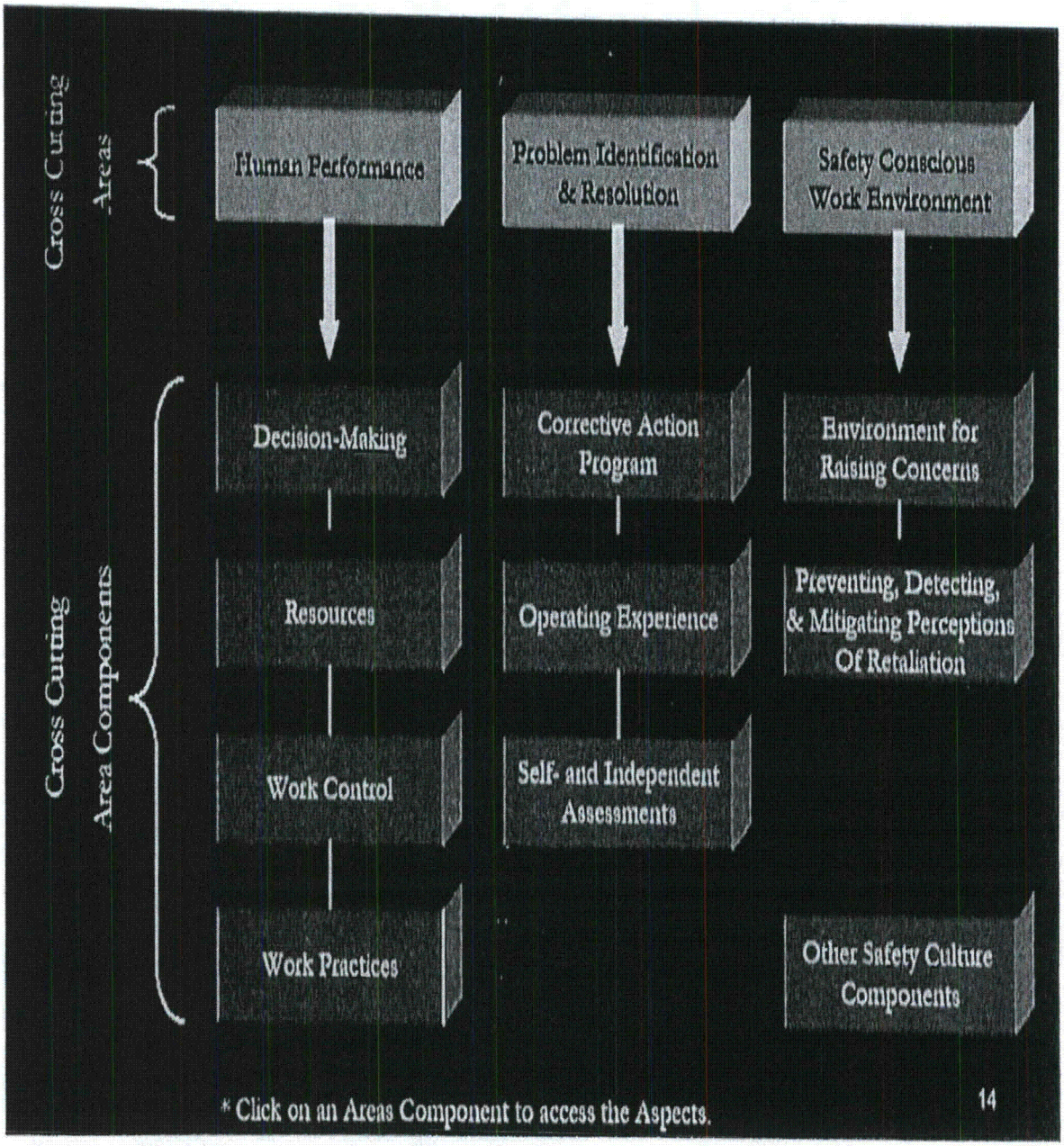
ROP Safety Culture Components



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ROP Safety Culture Components

- **Human Performance - Resources: The licensee ensures that personnel, equipment, procedures, and other resources are available and adequate to assure nuclear safety, specifically, those necessary for:**
  - Maintaining long term plant safety by maintenance of design margins, minimization of long-standing equipment issues, minimizing preventative maintenance deferrals, and ensuring maintenance and engineering backlogs which are low enough to support safety
  - Training of personnel and sufficient qualified personnel to maintain work hours within working hours guidelines
  - Complete, accurate and up-to-date design documentation, procedures, and work packages, and correct labeling of components
  - Adequate and available facilities and equipment, including physical improvements, simulator fidelity and emergency facilities and equipment

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Example of Findings

- In a 2008 regulatory inspection, it was discovered that during the replacement of a safety-related 125 VDC station battery breaker in 2004, electrical connection integrity was not adequate to ensure that the equipment would be able to perform its safety function (thus the condition existed for four years)

- The resources component in the *human performance area* was assessed to contribute to this performance deficiency because the licensee failed to establish adequate procedures and programs related to electrical connection integrity

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Containment Accident Pressure (CAP)

- Accident analyses for many operating reactors rely on pressure higher than that present before the postulated accident to provide net positive suction head (NPSH) margin for pumps in the emergency core cooling systems and containment heat removal system
- In calculating NPSH margin, inclusion of some or all of the pressure developed in the containment during an accident is referred to as CAP credit
- ACRS expressed concerns with the NRC staff's practice to credit CAP, based largely on ACRS position on defense-in-depth, which is to maintain the independence of the containment function and the accident mitigation function by not relying on CAP

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Containment Accident Pressure (CAP)

- **Commission approved current staff procedure allowing CAP credit with improved guidance that includes margin and uncertainty determinations in CAP calculations**
  - Existing regulations, guidance and plant technical specifications are intended to ensure that containment is a low-leakage, robust structure, the integrity of which is demonstrated periodically
  - ECCS and containment heat removal pumps are typically robust and have been shown to tolerate some levels of cavitation without sustaining damage
  - Risk from allowing CAP credit for a BWR/3 with a Mark I containment with a leak detection interval of once per month is very small, based on a generic risk assessment
  - Adequate protection of public health and safety is provided even when CAP credit is allowed
- **Commission directed staff to revise Regulatory Guide 1.174 because language on defense-in-depth was subject to different interpretations**

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PWR Sump Performance (GSI - 191)

- Debris blockage of the sumps during loss-of-coolant accidents could impede long-term core cooling
- Very complex issue that has many variables and requires plant specific resolution
- Critical testing regarding in-vessel effects needed for final resolution expected to be completed by end of 2011
- NRC is considering risk-informed resolution approach

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Seismic Requirements (GI-199)

- **Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants**
  - New data and models resulted in increased estimates of the seismic hazards at many plants in the Central and Eastern United States (CEUS)
  - NRC staff reviewed and evaluated this new information along with recent U.S. Geological Survey (USGS) seismic hazard estimates for the CEUS
  - Estimated seismic hazard levels at some current CEUS operating sites might be higher than seismic hazard values used in design and previous evaluations

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Seismic Requirements (GI-199)

- **Overview of GI-199 Safety/Risk Assessment Results**
  - Operating power plants are safe
  - Though still small, some seismic hazard estimates have increased
  - NRC will request needed information to perform regulatory assessments

- **Proposed Generic Letter Information Needs (expect to issue by end of 2011)**
  - Updated site specific hazard curves and response spectra
  - Fragility information
  - Contributors to seismic risk
  - Identification of potential plant-specific improvements

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Fire Protection

- Large number of licensees rely on compensatory measures to comply with their approved program
- Licensees planning to transition to a new regulatory approach using National Fire Protection Association Standard (NFPA) 805
- NFPA 805 is a national consensus standard that allows licensees to utilize performance-based methods to demonstrate that the installed fire protection systems and features are sufficient to meet specific fire protection and nuclear safety goals, objectives and performance criteria
- Pilot activities & infrastructure documents are complete

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Fire Protection

- NRC expects to begin receiving submittals from non-pilot plants this summer
- Commission has approved a staggered schedule for NFPA 805 submittals
- Fire PRAs have matured sufficiently for the NRC to make regulatory decisions in support of implementing this new approach
- Fire PRA methods will continue to evolve and the NRC staff will continue to work collaboratively with industry
- NRC will continue to grant enforcement discretion to licensees transitioning to NFPA 805

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Small Modular Reactors (SMRs)

- Near-term focus on Integral Pressurized Water Reactor (iPWR)technology reviews
- iPWRs
  - Pressurized Water Reactors with nuclear steam supply components (e.g., steam generator, control rods, reactor coolant pumps) within the reactor vessel
- Risk-Informed Review Guidance for iPWRs
  - Risk-insights enhance safety focus of reviews
  - Considers both safety importance and risk significance
  - Graded approach
  - Integrates performance-based program requirements

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Small Modular Reactors (SMRs)

- **Commission also directed NRC staff to:**
  - Provide a paper that explores the feasibility of including risk information in categorizing systems, structures and components (SSCs) as safety-related and nonsafety-related for the design-specific SMR review plans
  - Consider stakeholder input, as appropriate
  - Determine if there are legal obstacles to this approach, namely to determine if this can be done without a rule change
  - Address potential application to the overall regulatory framework and not be limited to SMRs
  - Include a review of previous Commission policies on the spectrum of new/advanced reactor policy issues that may have used "safety-related" or "non-safety related" SSC classification as part of the policy resolution

Statement of
George Apostolakis, Commissioner
United States Nuclear Regulatory Commission
Before the
U.S. Senate Committee on Environment and Public Works
June 16, 2011

Chairman Boxer, Ranking Member Inhofe, and members of the committee, good morning. I appreciate the opportunity to appear before you today.

I will summarize my impressions of the Fukushima events to date as follows.

1. The performance of the NRC Staff

I have been a Commissioner a little over a year now. During that time, as well as during my 15 years as a member of the NRC's Advisory Committee on Reactor Safeguards, I had plenty of opportunities to interact with the NRC staff at all levels. I have always been impressed by their technical excellence and dedication to our mission of protecting public health and safety. Our team in Japan confirmed what I already knew. I am told that both the U.S. Ambassador in Japan and the Japanese government have great respect for our team and its advice on technical matters. I am proud of the NRC staff and honored to be an NRC Commissioner.

2. The value of conservative decision making

The plants at Fukushima were subjected to incredibly destructive natural forces exceeding plants' design limits without reported acute health effects resulting from radiation exposure. In my view, this reflects at least in part the conservatism built into nuclear reactor designs in terms of safety margins. This is a valuable lesson for me, as I consider the application of conservatism in our regulatory framework.

3. The importance of decision making during emergencies

The terrorist events of September 11, 2001, and the aftermath of the Katrina hurricane had already brought issues related to emergency preparedness to the forefront in this country. The Fukushima accident demonstrated once again the need for a clearly defined decision-making process during emergencies.

4. A lesson in humility

There have been numerous safety studies of light-water reactors worldwide. I believe that, as a community of safety analysts, we were pretty confident that there would be no new surprises. Fukushima has challenged that belief. We must retain a questioning attitude and ensure that confidence does not translate into complacency.

Thank you.

Apostolakis, George

From: Casto, Chuck
Sent: Thursday, June 16, 2011 10:57 AM
To: Apostolakis, George
Subject: Thank you

Commissioner. On behalf of the team in Japan, thank you for your statement during the hearing today.

Your friend,

Chuck Casto

Sosa, Belkys

	Davis, Roger
	Monday, June 20, 2011 2:02 PM
::	Clark, Lisa
Cc:	Batkin, Joshua; Sosa, Belkys
Subject:	GA response to Q. 2

Lisa, please amend the GA response for the letter to Chairman Issa as shown below. We decided to add reference to the Commissioner's staff. Thanks, Roger

"Neither I, nor members of my personal staff, have informed members of the ACRs that they will not receive this information or that there will be a delay in receiving this information."

Roger K. Davis
Legal Counsel
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1762

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

~~NOT FOR PUBLIC DISCLOSURE~~

COMMISSIONER

June 21, 2011

The Honorable Darrell E. Issa
Chairman, Committee on Oversight
And Government Reform
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Issa:

I write in response to question 2 of your letter dated May 26, 2011, to Chairman Jaczko concerning information about the NRC's response to events at the Fukushima Daiichi nuclear power facility that the NRC's Advisory Committee on Reactor Safeguards (ACRS) requested from NRC staff at the ACRS' April 7, 2011 meeting.

In your letter, you asked whether "any other NRC Commissioner or employee informed members of the ACRS that they will not receive this information or that there will be a delay in receiving this information." Neither I, nor any member of my staff, informed members of the ACRS that they will not receive the requested information or that there will be a delay in receiving this information.

Sincerely,

George Apostolakis

cc: The Honorable Elijah E. Cummings, Ranking Member

~~NOT FOR PUBLIC DISCLOSURE~~

NOT FOR PUBLIC DISCLOSURE

Apostolakis, George

Davis, Roger
Tuesday, June 21, 2011 2:42 PM
Batkin, Joshua; Coggins, Angela; Schmidt, Rebecca
Cc: Sharkey, Jeffry; Nieh, Ho; Bubar, Patrice; Sosa, Belkys
Subject: FW: Letter from Cmr Apostolakis to Chairman Issa
Attachments: Untitled

Josh.

This afternoon Commissioner Apostolakis signed and sent a separate letter as shown in the attached.

Roger

From: Blake, Kathleen
Sent: Tuesday, June 21, 2011 2:35 PM
To: john.ohly@mail.house.gov; scott.lindsay@mail.house.gov
Subject: Letter from Cmr Apostolakis to Chairman Issa

Please find attached a scanned copy of Commissioner Apostolakis' letter to Chairman Issa in response to Question 2 of his letter dated May 26, 2011, to Chairman Jaczko. Original letter will be mailed today.

Kathleen H. Blake
Administrative Assistant
to Commissioner Apostolakis
Nuclear Regulatory Commission
Rockville Pike
Rockville, Maryland 20852
301-415-1810

NOT FOR PUBLIC DISCLOSURE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

COMMISSIONER

June 21, 2011

The Honorable Darrell E. Issa
Chairman, Committee on Oversight
And Government Reform
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Issa:

I write in response to question 2 of your letter dated May 26, 2011, to Chairman Jaczko concerning information about the NRC's response to events at the Fukushima Daiichi nuclear power facility that the NRC's Advisory Committee on Reactor Safeguards (ACRS) requested from NRC staff at the ACRS' April 7, 2011 meeting.

In your letter, you asked whether "any other NRC Commissioner or employee informed members of the ACRS that they will not receive this information or that there will be a delay in receiving this information." Neither I, nor any member of my staff, informed members of the ACRS that they will not receive the requested information or that there will be a delay in receiving this information.

Sincerely,

George Apostolakis

cc: The Honorable Elijah E. Cummings, Ranking Member

Gilles, Nanette

m: Gilles, Nanette
nt: Thursday, June 23, 2011 3:33 PM
: Sosa, Belkys; Davis, Roger
Cc: Baggett, Steven
Subject: RE: text we just talked about.

Looks good. Filled in language that is typically used to describe the task force below.

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Sosa, Belkys
Sent: Thursday, June 23, 2011 3:03 PM
To: Gilles, Nanette; Davis, Roger
Cc: Baggett, Steven
Subject: RE: text we just talked about.

Ok, here is the hybrid... I agree it is probably best for Kathleen to send it. Please fill in the blank, I can't remember the name of the task force.

Mr. Sikes,

On behalf of Commissioner Apostolakis, I would like to thank you for your interest in NRC activities and your views on station blackout. As you mentioned, the NRC's station blackout requirements have been the subject of much discussion following the events at Japan's Fukushima nuclear power plants. The Task Force for the review of NRC processes and regulations following the events in Japan identified the mitigation of a long-term station blackout as one of their areas of focus and issues associated with long-term station blackout will continue to be examined. The task force will brief the Commission on their findings at a July 19 public Commission meeting. The recommendations from the Task Force review will help the Commission determine what issues should be pursued in the longer-term. Citizen views are very important to Commissioner Apostolakis and he appreciates your interest in the NRC.

Please note NRC's response to the AP article can be found at http://www.nrc.gov/reading-rm/doc-collections/news/2011/FTR_06-21-2011_oped.pdf

Thank you,

m: Gilles, Nanette
t: Thursday, June 23, 2011 1:54 PM
. Sosa, Belkys; Davis, Roger
Cc: Baggett, Steven
Subject: FW: text we just talked about.

Steve has suggested a "less is more" option below, with the thought that Mr. Sikes probably always knows the information about the task force given that he is apparently reading Commission meeting transcripts. Steve also suggested that that the e-mail come from Kathleen, rather than one of us, again, to avoid the "pen pal" issue.

Your thoughts?

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Baggett, Steven
Sent: Thursday, June 23, 2011 1:40 PM
To: Gilles, Nanette
Subject: text we just talked about.

Trent

Commissioner Apostolakis thanks you for taking the time to send an email. He appreciated your interest in NRC activities and your views on station blackout. Station blackout requirements have been the subject of much discussion following the events at Japan's Fukushima nuclear power plants. While the Commissioner does not routinely respond to all his emails, he wanted you know that your concern that your email was " too presumptuous for me, an ordinary citizen to write you" is unwarranted. Citizen views are important to the Commissioner.

Please note NRC's response to the AP article can be found at http://www.nrc.gov/reading-rm/doc-collections/news/2011/FTR_06-21-2011_oped.pdf

Thanks

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Opening Remarks

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

MIT/UVA Summer Intern Event

Association of Public and Land Grant Universities

Washington, DC

29 June 2011

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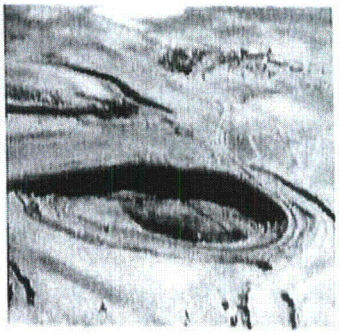
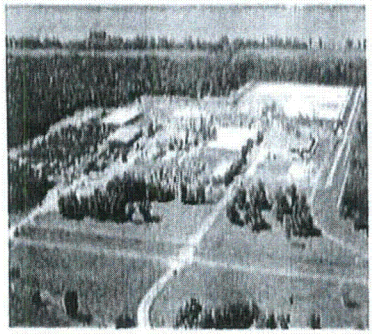
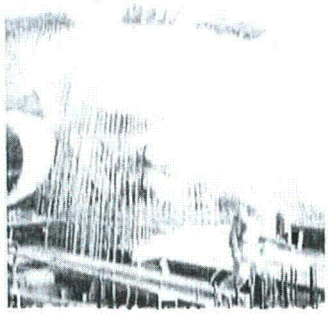
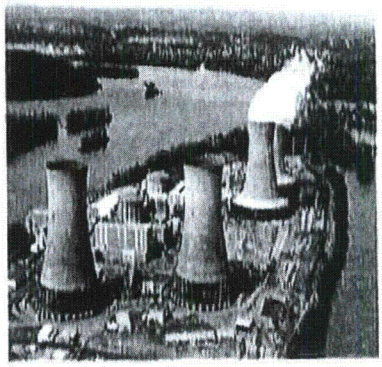
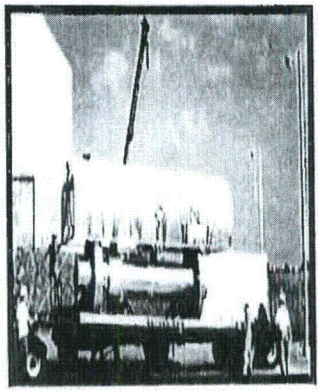
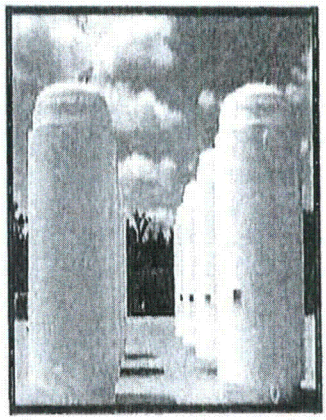
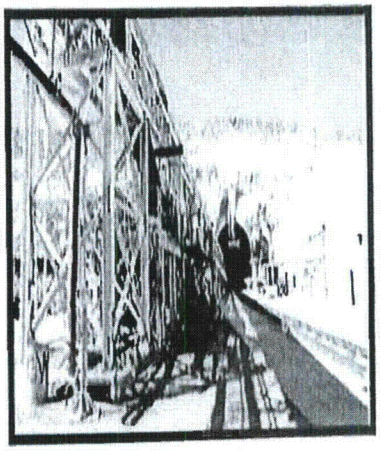
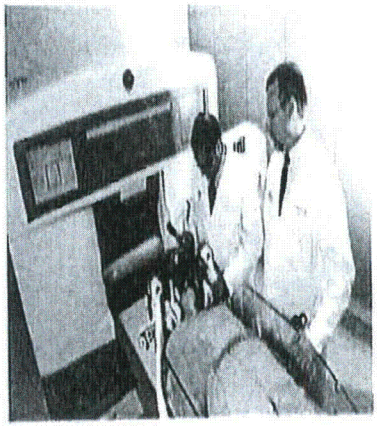
NRC Oversight



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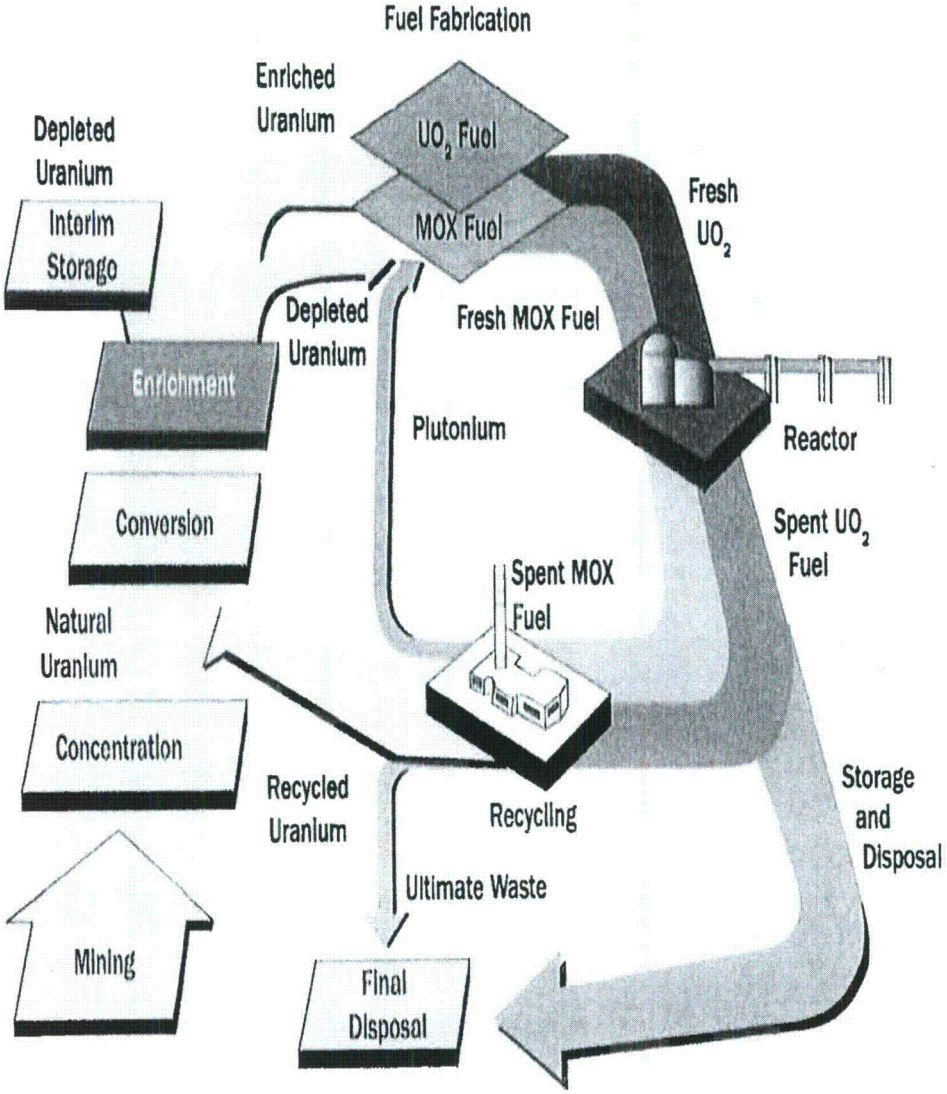
The Nuclear Fuel Cycle



Source: U.S. Nuclear Regulatory Commission

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The Agency

- The U.S. Nuclear Regulatory Commission regulates the civilian use of nuclear materials and facilities to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment.

- It is an independent agency within the Executive Branch.

- It consists of five Commissioners, appointed by the President and confirmed by the Senate, who serve staggered 5-year terms. The President designates the Chairman.

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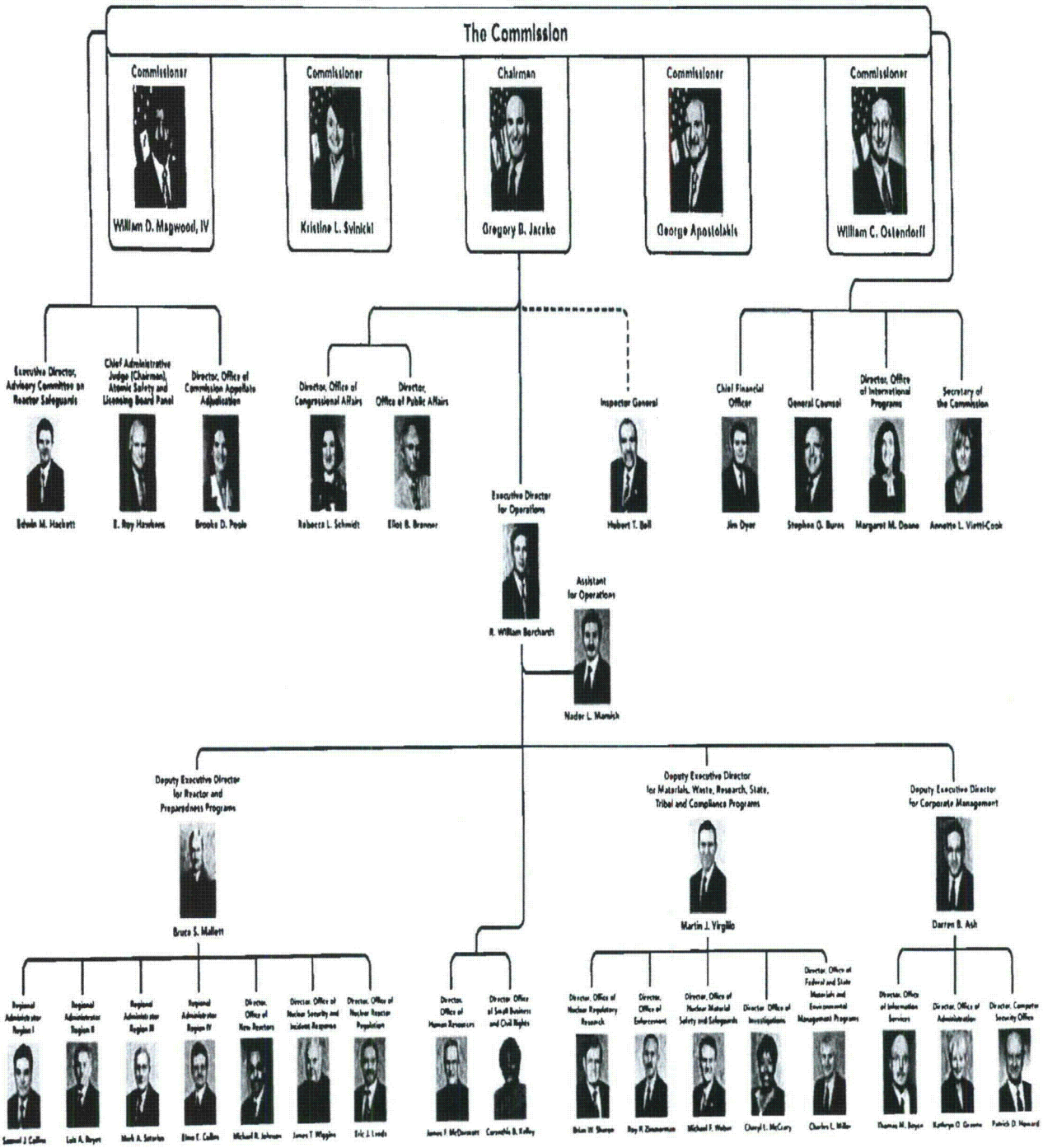
U.S. Nuclear Regulatory Commission



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Defense in Depth

"Defense-in-Depth is an element of the Nuclear Regulatory Commission's safety philosophy that employs successive compensatory measures to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility."

[Commission's White Paper, USNRC, 1999]

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Major Elements of Defense in Depth

- Accident Prevention
- Safety Systems
- Containment
- Siting and Emergency Plans

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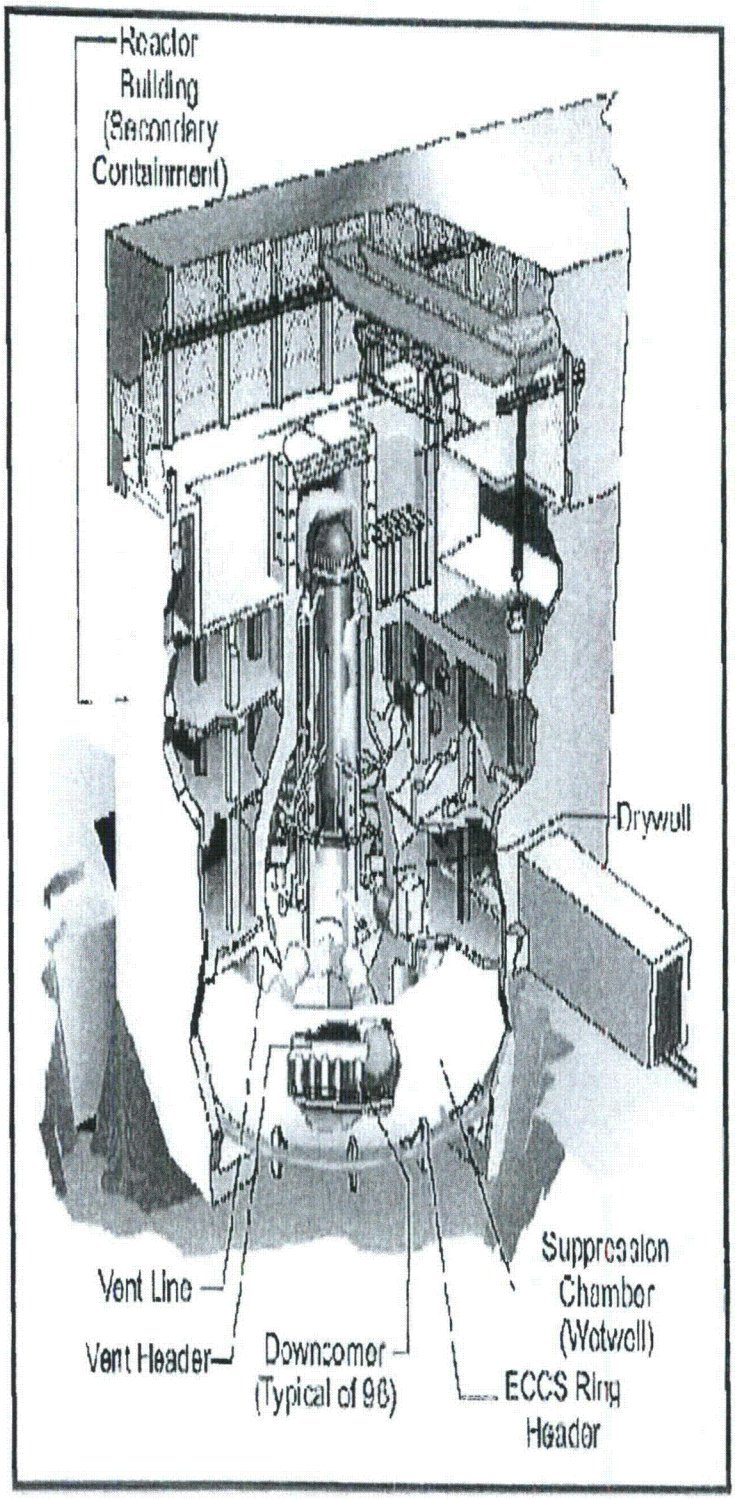
Boiling Water Reactor Design Similar to Fukushima Daiichi



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Tōhoku Earthquake and Tsunami

- **Earthquake Data***
  - Magnitude 9.0
  - Epicenter: ~109 miles from Fukushima site
  - Peak Ground Acceleration
    - ✓ 1.0g up to 2.75g at 80 miles from epicenter
    - ✓ ~0.30g to 0.58g in Fukushima Prefecture

*California Coastal Commission. "The Tōhoku Earthquake of March 11, 2011: A preliminary Report on Implications for Coastal California "

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NPP Foundation Accelerations*

Location	Design Japanese Regulatory Guide g	Observed g
Daiichi Unit 2	0.45	0.56
Daiichi Unit 6	0.46	0.45
Daini Unit 1	0.44	0.23
Daini Unit 2	0.44	0.20

*TEPCO Press Release April 01, 2011: The record of the earthquake intensity observed at Fukushima Daiichi Nuclear Power Station and the Fukushima Daini Nuclear Power Station (Interim Report).

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Tōhoku Earthquake and Tsunami

- Tsunami Data
  - Varying reports of tsunami height - approximately 14-15m (according to TEPCO)
  - Protective wall: 5.7 meters
  - Reached shore within about one hour after the earthquake
  - Up to six miles of run-up in flat regions

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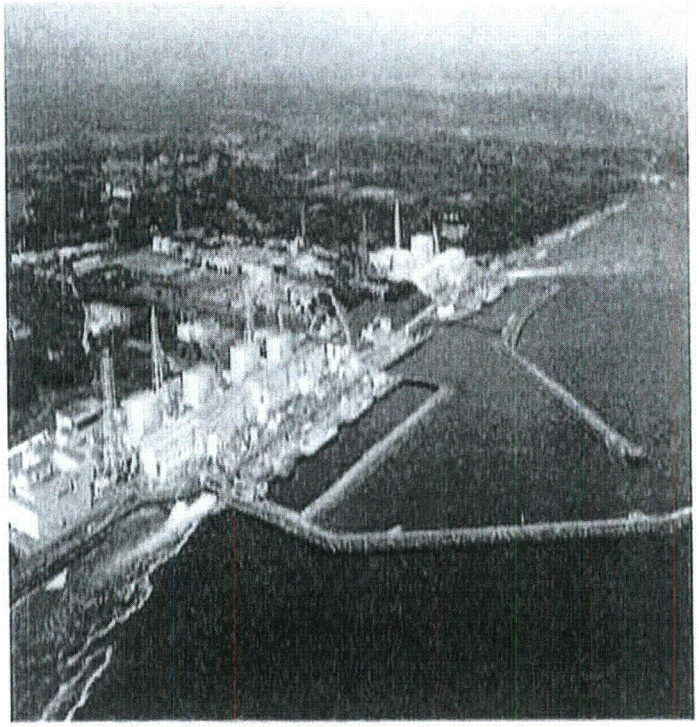
Extended Station Blackout

- Earthquake
  - Reactor Units 1, 2, and 3 scram
  - Loss of offsite power to all 6 units
- Tsunami
  - Loss of emergency AC power
- Extended Station Blackout (Total loss of ac power)



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Status: Units 1, 2, and 3

- Cores reported to be damaged
  - ✓ Extent unknown
  - ✓ Salt buildup from seawater injection
- All units have offsite AC power available
  - ✓ Equipment verification in progress
- Freshwater injection established
- High radiation levels in containment and site

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Status: Units 4, 5, and 6

- Unit 4
  - Core offloaded to spent fuel pool (SFP)
  - An explosion caused significant damage to Unit 4 reactor building
  - SFP cooling system not functional
  - SFP being cooled periodically by injection of fresh water from a concrete truck pump and or spray
  - Structural reinforcement underway
- Units 5 and 6
  - On external AC power with core cooling functional
  - SFP cooling is functional on both units

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NRC Incident Response

- NRC continuously manned its Operations Center
- Revolving teams of NRC officials with appropriate expertise have been deployed to Japan since the day after the event
- NRC played a key role in coordinated U.S. response to the event

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NRC Inspection Activities

- Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"
  - Inspection uses a combination of assessment of licensee actions and independent inspections
  - The inspection is for fact/data gathering to help evaluate whether future regulatory actions may be necessary
- Temporary Instruction 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)"
  - To determine that the SAMGs are available and assess how they are being implemented
  - To determine the nature and extent of licensee implementation of SAMG training and exercises

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Near-Term Task Force

- Commission Direction for Near-Term Review
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
  - Recommendations for the content, structure, and estimated resource impact for the longer-term review
  - Independent from industry efforts
  - Milestones
    - ✓ 30-day Commission meeting (5/12/11)
    - ✓ 60-day Commission meeting (6/16/11)
    - ✓ 90-day final report and Commission meeting (7/19/11)

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Task Force Current Assessment

- To date the task force has not identified any issues that undermine our confidence in the continued safety and emergency planning of U.S. plants
- Task force review likely to recommend actions to enhance safety and preparedness

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Longer-Term Review

- Commission Direction for Longer-Term Review
  - Specific information on sequence of events and equipment status
  - Evaluate policy issues
  - Potential interagency issues
  - Lessons learned for facilities other than operating reactors
  - Receive input and interact with all key stakeholders
  - Report within six months after beginning of long-term effort
  - Advisory Committee on Reactor Safeguards to review final long-term report and provide letter report to the Commission

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Industry Initiatives

- An industry-wide assessment to verify and validate each plant site's readiness to manage extreme events
- Initiatives include licensee verification of:
  - Each plant's capability to manage major challenges, and losses of large areas of the plant due to natural events, fires or explosions
  - Each plant's capability to manage a total loss of off-site power
  - Verifying the capability to mitigate flooding and the impact of floods
  - Performing walk-downs and inspection of important equipment needed to respond successfully to extreme events like fires and flood including identification of any potential that equipment functions could be lost during seismic events appropriate for the site, and development of strategies to mitigate any potential vulnerabilities

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Open To The Public

The NRC places a high priority on keeping the public and stakeholders informed of its activities. At www.nrc.gov, you can:

- public meeting dates and transcripts;
- NRC testimony, speeches, press releases and policy decisions; and
- the agency's Electronic Reading Room to find NRC publications and documents.

Apostolakis, George

m: Blake, Kathleen
: Thursday, June 30, 2011 5:10 PM
KeikoInoue; Apostolakis, George
Cc: 'Norio Okada'; 'Aniello Amendola'; ANA MARIA CRUZ; Hirokazu Tatano; okada@drs.dpri.kyoto-u.ac.jp; Rose, Adam; Sosa, Belkys
Subject: RE: IDRiM Conference July 14-16, 2011
Attachments: George Apostolakis 30June2011.docx

Mr. Inoue:

Attached please find the requested abstract entitled, "Regulatory Implications of Fukushima for Nuclear Power in the United States".

Kathleen M. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

-----Original Message-----
From: KeikoInoue [mailto:inoue@drs.dpri.kyoto-u.ac.jp]
t: Thursday, June 30, 2011 12:10 PM
Blake, Kathleen; Apostolakis, George
cc: 'Norio Okada'; 'Aniello Amendola'; ANA MARIA CRUZ; Hirokazu Tatano; okada@drs.dpri.kyoto-u.ac.jp; Rose, Adam; Sosa, Belkys
Subject: Re: IDRiM Conference July 14-16, 2011

Dear Dr. Apostolakis and Ms. Blake,

I am sorry that we did not ask about abstract to Dr. Apostolakis. If he can write short abstract for his presentation in "Regulatory implications for nuclear power in the United States". Please find attached format.

Again, I am sorry for sudden request.

Best regards,

Keiko Inoue

(2011/06/30 21:57), Blake, Kathleen wrote:
> Many thanks. I will let the Commissioner know. kb
>
> Kathleen M. Blake
> Administrative Assistant
> to Commissioner Apostolakis
> S. Nuclear Regulatory Commission
> 1555 Rockville Pike
> Rockville, Maryland 20852
> 301-415-1810

>
>
> -----Original Message-----
> From: KeikoInoue [mailto:inoue@drs.dpri.kyoto-u.ac.jp]
> Sent: Thursday, June 30, 2011 8:50 AM
> To: Blake, Kathleen
> Cc: 'Norio Okada'; 'Aniello Amendola'; ANA MARIA CRUZ; Hirokazu
> Tatano; keiko inoue; okada@drs.dpri.kyoto-u.ac.jp; Rose, Adam; Sosa,
> Belkys
> Subject: Re: IDRiM Conference July 14-16, 2011
>
> Dear Ms. Blake,
>
> I am sorry for our late responses. Of cause we will waive the
> registration fee for Dr. Apostolakis.
>
> We are looking forward to seeing him soon.
>
> Keiko Inoue
>
>
>
>
> (2011/06/28 5:13), Blake, Kathleen wrote:
>> Dear Professor Okada:
>>
>> Before I register Commissioner Apostolakis for the upcoming conference, I wanted to
confirm that his registration was required or was the $400.00 fee waived?

>> Kathleen M. Blake
>> Administrative Assistant
>> to Commissioner Apostolakis
>> U.S. Nuclear Regulatory Commission
>> 11555 Rockville Pike
>> Rockville, Maryland 20852
>> 301-415-1810
>>
>>
>> -----Original Message-----
>> From: Apostolakis, George
>> Sent: Tuesday, June 07, 2011 3:08 PM
>> To: 'Norio Okada'; 'Aniello Amendola'; ANA MARIA CRUZ; Hirokazu
>> Tatano; keiko inoue; 井上さん; okada@drs.dpri.kyoto-u.ac.jp; Rose, Adam
>> Cc: Blake, Kathleen; Sosa, Belkys
>> Subject: RE: thank you and invitation
>>
>> Dear Professor Okada:
>>
>> Thank you for the kind invitation.
>>
>> Yes, I will give the keynote speech giving an overview of what happened in Fukushima and,
then, I will participate in the panel discussion.
>>
>> My expenses will be covered by the US Government. Thank you for the offer.

>> Regards,
>>

>> Commissioner George Apostolakis
>> US Nuclear Regulatory Commission
>> One White Flint North, MS O16 G4
>> 11555 Rockville Pike
>> Rockville, MD 20852
>>
>> (301) 415-1810
>>
>>
>> -----Original Message-----
>> From: Norio Okada [mailto:n okada@drs.dpri.kyoto-u.ac.jp]
>> Sent: Tuesday, June 07, 2011 8:25 AM
>> To: Apostolakis, George; 'Aniello Amendola'; ANA MARIA CRUZ; Hirokazu
>> Tatano; keiko inoue; 井上さん; okada@drs.dpri.kyoto-u.ac.jp; Rose, Adam
>> Subject: thank you and invitation
>>
>> Dr. George Apostolakis,
>> cc: Aniello Amendola
>> cc: Ana Maria Cruz
>> cc: Hirokazu Tatano
>> cc: Adam Rose
>> cc: Keiko Inoue
>>
>> Dear Dr. George Apostolakis,
>> It was my great pleasure talking to you over the phone yesterday.
>> Please accept our (particularly my) deep apology for contacting you directly not much sooner.
>>
>> Thank you very much for kindly accepting our invitation to attend the IDRiM Conference.
>> As mentioned in the invitation letter, your roles are two folds: keynote speaker and a panel at the plenary session on the same day.
>>
>> Just in case, let me note that what I meant by the practically first
>> (opening) day is
>> July 15 and NOT June14 (which evening is for our IDRiM Business meeting and Reception).
>> So we expect you to take the dual roles on July 15.
>> .
>> As you requested, attached please find a PDF file of our invitation letter to you.
>> It would be great if you could send us just a short note to confirm your attendance.
>> Upon receipt of your confirmation, Prof. Adam Rose at USC will be sending you an official invitation from the conference hosting institute.
>>
>> If you have further inquiries or clarification, please do not hesitate to contact us.
>>
>> Best regards,
>>
>> Norio Okada
>> professor
>> DPRI, Kyoto University
>>
>> PS
>> If you need the original copy of this invitation letter from myself, please let us know.
>>
>>
>

--
iko Inoue
I, Kyoto University
akasho, Uji, Kyoto, Japan
+81-774-38-4651
inoue@drs.dpri.kyoto-u.ac.jp

Regulatory Implications of Fukushima for Nuclear Power in the U.S.

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission, CmrApostolakis@nrc.gov

The March 11, 2011 earthquake and tsunami in Japan and the resulting nuclear accident at the Fukushima Daiichi nuclear power plants have reinvigorated the debate over the safety of nuclear power in the U.S. These discussions have also brought increased attention to the role of the U.S. Nuclear Regulatory Commission (NRC) as the independent regulator of the nation's commercial nuclear power facilities. The NRC has played a leading role in the U.S. response to the Fukushima Daiichi accident and NRC staff members remain in Japan advising the U.S. Ambassador to Japan and the Japanese government. The NRC took prompt action to confirm the safety of U.S. nuclear power plants in the early days and weeks following the accident at Fukushima. The NRC conducted inspections at all 104 operating nuclear power plants to confirm the plants' abilities to deal with power losses or damage to large areas of the reactor site following extreme events and to verify the availability of severe accident management guidelines. The NRC also formed a task force to examine the agency's regulatory requirements, programs, processes, and implementation in light of information from the Fukushima Daiichi accident. Results from the NRC inspections and from the task force's near-term review are providing important information about where the lessons from Fukushima may prove most valuable to the NRC's mission of ensuring the health and safety of the public.

Keywords: nuclear , Fukushima, NRC

July 8, 2011

The Honorable George Apostolakis
Commissioner
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Commissioner Apostolakis:

A nuclear accident in Japan should not be automatically viewed as an indictment of U.S. institutional structures and nuclear safety requirements. Reconstructing a detailed sequence of events and the technological aspects of the Fukushima accident will take some time to be thoroughly examined and understood. However, I believe that a comparison of U.S. regulatory requirements with those in Japan is essential and can be accomplished in the near term. A regulatory comparison should not be an effort to criticize the Japanese regulatory framework. Rather it should be rooted in an acknowledgement that our regulatory systems and culture are fundamentally different, most notably with the establishment in the U.S. of an independent agency early in the industry's history whose sole focus is to regulate the safe use of nuclear materials.

A systematic and methodical regulatory comparison should determine if there are differences that either indicate necessary safety enhancements or provide added confidence that our nuclear safety regime appropriately reflects lessons learned from past accidents and provides adequate protection of public health and safety. The absence of such a review would diminish the credibility of any new regulatory requirements since there would be no clear basis for assessing whether the recommended changes accurately and adequately address actual problems highlighted by the Fukushima accident.

I am concerned that the Nuclear Regulatory Commission's efforts in this area are inadequate. The Commission's March 23 memo directing the staff to establish a task force fails to mention a comparison of US regulations with Japanese requirements. It appears it was not until June 8th that the staff was directed to make such an evaluation and that direction was limited to station blackouts and given a very low emphasis. Information is emerging from the International Atomic Energy Agency (IAEA), the Japanese Government, the media, and other sources that indicate differences may exist between US and Japanese regulatory institutions and requirements that are relevant and should be evaluated:

a. The IAEA observed and the Japanese Government acknowledged that they underestimated the magnitude of a tsunami for which the Fukushima Daiichi plant was at risk. What method was used for that estimation and how does it compare to methods used by the NRC?

b. The NRC has strict design, maintenance, and testing requirements in place to ensure the operability of emergency diesel generators when needed. These requirements begin with locating multiple, redundant diesel generators, their fuel tanks, and electrical equipment within robust structures designed to withstand hurricanes, earthquakes, tornados, floods and other phenomena. Each generator is strictly maintained and required to be tested weekly or monthly to ensure it will get up to speed in less than 10 seconds when called on, resulting in a 97% reliability rate. How do these requirements compare with the Japanese requirements in place at the time of the Fukushima accident?

c. U.S. reactor operators are not only empowered but required to take all necessary actions to protect the public. In the wake of the Fukushima accident, there are several press articles about corporate and government officials influencing decision-making about plant operations during the emergency at Fukushima. How do these different approaches impact efforts to respond in an emergency situation?

d. The Three Mile Island accident raised awareness in the U.S. of the vital importance of operator training. As a result, the NRC, the Institute of Nuclear Power Operations, and the nuclear industry have invested heavily and continuously in operator training, including licensing by the NRC, rigorous standardized training programs, and site-specific simulators at every plant. How does the Japanese training regime compare and how might those differences impact how operators might respond in an emergency?

e. At the time of the Fukushima accident, did the Japanese have anything comparable to our nuclear industry's Severe Accident Management Guidelines?

These are a few areas, and there are surely others, where comparison and analysis need not wait until there is complete understanding of the technical details of the full event. I suggest you and your colleagues promptly work together to provide direction to the staff to develop a charter for a rapid-response study in these and other closely related areas with consideration given to specific design and beyond design basis requirements. I would ask that this comparison and analysis be accomplished with all deliberate speed.

Lastly, the NRC's Efficiency Principle of Good Regulation states: "Regulatory activities should be consistent with the degree of risk reduction they achieve." I hope this statement will inform your perspective as you proceed to consider any potential regulatory changes in response to the Fukushima accident.

Sincerely,

James M. Inhofe
Ranking Member
Committee on Environment and Public Works

CC: Chairman Gregory Jaczko
Cmsr. Kristine Svinicki
Cmsr. William Magwood
Cmsr. William Ostendorff

Sosa, Belkys

m: Baggett, Steven
t: Tuesday, July 12, 2011 11:02 AM
Gilles, Nanette; Sosa, Belkys; Apostolakis, George; Davis, Roger; Lui, Christiana
Subject: RE: Task Force Orders

Nan,

Any indication as to what NRC would find acceptable in responses to the orders?

Thank

Steve

From: Gilles, Nanette
Sent: Tuesday, July 12, 2011 10:33 AM
To: Sosa, Belkys; Apostolakis, George; Baggett, Steven; Davis, Roger; Lui, Christiana
Subject: Task Force Orders

There are 12 orders recommended by the Task Force:

1-Reevaluate seismic and flooding hazards against current requirements and update SSCs and design basis;
2-Perofrm seismic and flood protection walkdowns;
3-Protect B.5.b equipment from external events & add equipment to address multiunit events;
4-Include a reliable hardened vent in BWR Mark I and II containments;
5-Provide safety-related instrumentation to monitor key SFP parameters from the control room;
6-Provide safety-related AC power for SFP make up system;
7-Revise technical specifications to have one train of onsite emergency power operable for SFP makeup and instrumentation;
8-Have an installed, seismically qualified SFP spray including a means to supply water from outside the building;
9-Modify EOP technical guidelines to (1) include EOPs, SAMGs, & EMDGs in an integrated manner; (2) specify clear command and control strategies; and (3) stipulate appropriate qualification and training for decision-makers;
10-Modify each plant technical specifications to reference the approved EOP guidelines;
11-Do the following until rulemaking is complete: (1) Implement required staff to fill all necessary positions for responding to a multiunit event; (2) conduct period training and exercises for multiunit and prolonged SBO scenarios; (3) ensure EP equipment and facilities are sufficient for multiunit and prolonged SBO scenarios; and (4) provide means to power communication equipment during a prolonged SBO and to maintain ERDS capability throughout the event.
12-Complete ERDS modernization initiative by June 2012 to ensure multiunit site monitoring capability.

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

Davis, Roger

From: Gilles, Nanette
Sent: Tuesday, July 12, 2011 10:33 AM
To: Sosa, Belkys; Apostolakis, George; Baggett, Steven; Davis, Roger; Lui, Christiana
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Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

Savoy, Carmel

:	Savoy, Carmel
.:	Tuesday, July 12, 2011 4:39 PM
.o:	Sosa, Belkys
Subject:	SECY-11-0093 and article
Attachments:	Article.pdf; SECY-11-0093.pdf

I have attached the SECY paper and the article.

Carmel L. Savoy, Administrative Assistant
Office of Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1801
carmel.savoy@nrc.gov

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

THE WALL STREET JOURNAL.
WSJ.com

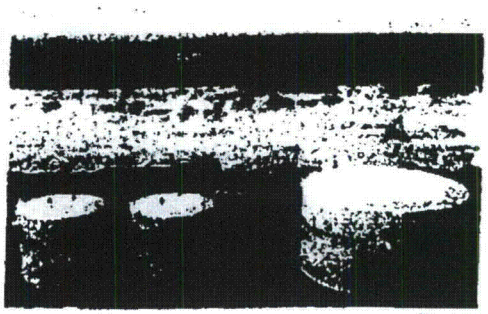
ASIA NEWS | JULY 12, 2011

Fateful Move Exposed Japan Plant

Tokyo Electric Lowered Elevation of Land Before Building Nuclear Facility, Weakening Tsunami Defense

By CHESTER DAWSON And YUKA HAYASHI

TOKYO—When Tokyo Electric Power Co. broke ground on the now defunct Fukushima Daiichi nuclear-power station 44 years ago, the utility made a fateful construction decision that raised the plant's vulnerability to the tsunami that ultimately crippled its reactors.



Reuters

The tsunami flooded the Fukushima Daiichi plant on March 11, reaching five meters above the reactor floors.

In 1967, Tepco chopped 25 meters off the 35-meter natural seawall where the reactors were to be located, according to documents filed at the time with Japanese authorities. That little-noticed action was taken to make it easier to ferry equipment to the site and pump seawater to the reactors. It was also seen as an efficient way to build the complex atop the solid base of bedrock needed to better protect the plant from earthquakes.

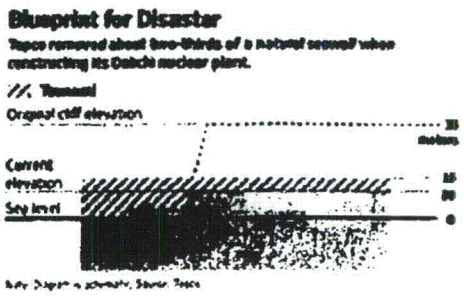
But the razing of the cliff also placed the reactors five meters below the level of 14- to 15-meter tsunami hitting the plant March 11, triggering a major nuclear disaster resulting in the meltdown of three reactor cores.

"It's a typical act based on the thinking of the high-growth era. People were attracted to the idea of 'reforming the land' back then," said seismologist Kazuo Oike, a former president of Kyoto University who now serves on a government committee investigating the Fukushima accident. "When you inflict significant change to nature, nature will eventually get back at you with a significant force."

In the 1960s Tepco began purchasing the land needed for the plant in coastal Fukushima, the largest chunk of which was a former Imperial Japanese Army air base during World War II. At the time, a 35-meter seaside cliff running the length of the property was a prominent feature of the site.

But Tepco outlined its intention to clear away about two-thirds of the bluff in its official request for permission from the government to build its first nuclear plant, according to a copy of the application reviewed by The Wall Street Journal.

"While the tsunami countermeasures at Fukushima Daiichi were considered sufficient when the plant was constructed, the fact that those defenses were overwhelmed is something that we take very seriously," said Kouichi Shiraga, a public-affairs official at Japan's Nuclear and Industrial Safety Agency. "It was common practice at the time to build on bedrock, but that is no longer the case today as long as the ground meets standards for firmness."



In the application, the company said it wanted to build the Daiichi facility on bedrock to stabilize it and help it absorb vibrations from earthquakes and aftershocks, a process that required significant excavation of topsoil.

"The important thing is that the plant was built on a solid foundation of bedrock," said Tepco spokesman Hiro Hasegawa, noting the decision was made by employees who have long since retired. "It would appear that height was one factor, but not necessarily the only—or even the biggest—factor involved in where to build."

The destruction of that natural tsunami barrier at the Fukushima Daiichi site contrasts starkly with later decisions in the 1970s to build the nearby Fukushima Daini and Onagawa nuclear-power plants at higher elevations. Despite being rocked by the massive March earthquake, both of those plants' reactors achieved "cold shutdowns" shortly after the tsunami struck and thereby avoided the damage wreaked upon the crippled Daiichi plant.

Both of those plants, located along the same coastline as Daiichi, survived primarily because they were built at higher elevations, on top of floodwalls that came with the landscape. As a result, the tsunami didn't result in an extended loss of power at those plants, allowing their operators to quickly cool active reactors and avoid meltdowns.

Tepco's 1966 application for permission to start construction at Daiichi—stretching more than 1,000 pages—devotes much space to the threat posed by earthquakes, but makes relatively few references to tsunami. The document states a solid base of bedrock was detected at 10 meters above sea level and explains that building upon that firmament would reduce the impact from any earthquakes.

Even so, it notes confidently that "there is no recorded history of a severe earthquake in the immediate vicinity" of the plant.

The document included no discussion of tsunami-dedicated defenses, though it did review tsunami history in a three-page list of seismic activity dating from 1273. In that chart, Tepco does reference a tsunami of unspecified height that struck the immediate area of Daiichi in 1677. It destroyed 1,000 homes and killed 300 people.

The application cites typhoons as the bigger threat, noting an 8-meter-tall wave generated in 1960. "Most large waves in this coastal area are the product of strong winds and low pressure weather patterns, such as Typhoon No. 28 in February of 1960, which produced peak waves measured at 7.94 meters," it stated.

A former senior Tepco executive involved in the decision-making says there were two main reasons for removing the cliff. First, a lower escarpment made it easier to deliver heavy equipment used in the plant, such as the reactor vessels, turbines and diesel generators, all of which were transported to the site by sea. Second, the

design of the plant required seawater to keep the reactor cool, which was facilitated by a shorter distance to the ocean.

"It would have been a very difficult and major engineering task to lift all that equipment up over the cliff," says Masatoshi Toyota, 88 years old, the former top Tepco executive who helped oversee the building of the reactors at Fukushima Daiichi. "For similar reasons, we figured it would have been a major endeavor to pump up seawater from a plateau 35 meters above sea level," he said in a telephone interview.

To this day, Tepco doesn't consider that method of construction to be inherently flawed, noting that, before March 11, there were no records of major tsunami hitting in the immediate vicinity of the town where the plant was located in at least 300 years.

"The plant met all government standards at the time of its construction," said Mr. Hasegawa, the Tepco spokesman.

But critics say that reflects a certain arrogance by the engineers involved at the time. "Of course there is no record of big tsunami damage there because there was a high cliff at the very same spot" to prevent it, said Mr. Oike, the seismologist on the investigation committee.

And Daiichi's lower elevation contrasted with plants that were built in the following years along the same coast.

The newer Fukushima Daini plant, where construction began in 1975, is located seven miles south of Daiichi, and stands three meters higher: at 13 meters above sea level. The size of the tsunami that struck there on March 11 measured from 6.5 to 7 meters, Tepco said in an April 9 report.

Tepco officials said the Daini plant was not built at the higher elevation out of acute fear of tsunami, but rather that the elevation was a feature of the land that the plant was built upon.

But the Onagawa site, 60 miles north of Daiichi, was selected in large part because of its height beyond the reach of any recorded tsunami, according to a former executive at a Japanese manufacturer involved in the work.

The reactors stand at 13.8 meters above sea level, according to plant operator Tohoku Electric Power Co., which started construction in 1980. The March tsunami reached 13 meters in Onagawa, according to an April 7 report from the utility. The Onagawa plant's construction permit specified a minimum height of 9.1 meters above sea level, according to the Japanese government's official June 7 report to the International Atomic Energy Agency.

Yet in 2002, the Japan Society of Civil Engineers calculated a tsunami risk near the Onagawa plant of 13.6 meters based on a magnitude 8.3 earthquake in 1896, the Japanese government report said. The foresight to build higher than required by permit proved to be a critical distinction with the Daiichi plant.

Another of Tohoku Electric's reports, one dated April 7, states the lower floors of the building housing Onagawa's reactors were constructed below ground level to reach the bedrock, thus retaining much of the natural seawall for protection instead of shearing the wall away.

—Norihiko Shirouzu contributed to this article.

Write to Yuka Hayashi at yuka.hayashi@wsj.com

(b)(5)

~~NOT FOR PUBLIC DISCLOSURE~~

Davis, Roger

From: Sosa, Belkys
Sent: Tuesday, July 12, 2011 5:03 PM
To: Apostolakis, George; Gilles, Nanette; Davis, Roger; Baggett, Steven
Subject: SECY-11-0093 and article
Attachments: Article.pdf; SECY-11-0093.pdf

Commissioner, attached you will find the wall street article on Japan and the new (much shorter version) of the SECY paper on the Task Force report.

Also, I got a phone call from the Associated Press (AP) reporter Dina Cappiolo?? She wanted to know when the Commission will make the Task Force report public. I explained that the Commission had to decide if they would release the report to the public earlier than Commission procedures call for (10days).

Thanks,
Belkys

~~NOT FOR PUBLIC DISCLOSURE~~

THE WALL STREET JOURNAL.
WSJ.com

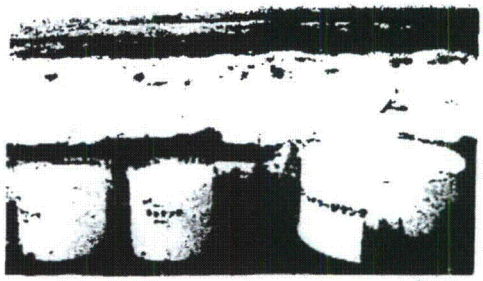
ASIA NEWS | JULY 12, 2011

Fateful Move Exposed Japan Plant

Tokyo Electric Lowered Elevation of Land Before Building Nuclear Facility, Weakening Tsunami Defense

By CHESTER DAWSON And YUKA HAYASHI

TOKYO—When Tokyo Electric Power Co. broke ground on the now defunct Fukushima Daiichi nuclear-power station 44 years ago, the utility made a fateful construction decision that raised the plant's vulnerability to the tsunami that ultimately crippled its reactors.



Reuters

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But Tepco outlined its intention to clear away about two-thirds of the bluff in its official request for permission from the government to build its first nuclear plant, according to a copy of the application reviewed by The Wall Street Journal.

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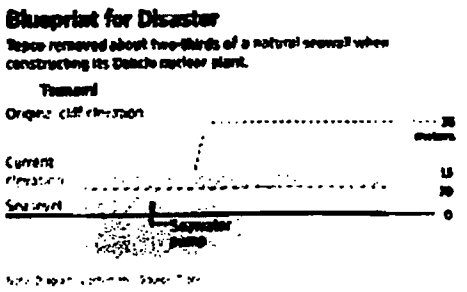

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—Norihiko Shirouzu contributed to this article.

Write to Yuka Hayashi at yuka.hayashi@wsj.com

Gilles, Nanette

From: Gilles, Nanette
Sent: Wednesday, July 13, 2011 11:42 AM
To: Sosa, Belkys
Subject: FW: Chairman Jaczko's vote on COMWDM-11-0001/COMWCO-11-0001 (Engagement of Stakeholders Regarding the Events in Japan)
Attachments: GBJ-cmt-CmWDM11-0001 CmWCO11-0001.pdf

I confirmed that GA voted to approve without comment on this COM.

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Speiser, Herald
Sent: Wednesday, July 13, 2011 11:13 AM
To: Baggett, Steven; Batkin, Joshua; Blake, Kathleen; Bozin, Sunny; Bradford, Anna; Bubar, Patrice; Bupp, Margaret; Chairman Temp; Clark, Lisa; Coggins, Angela; Cordes, John; Crawford, Carrie; Davis, Roger; Fopma, Melody; Franovich, Mike; Gibbs, Catina; Hart, Ken; Herr, Linda; Hipschman, Thomas; KLS Temp; Kock, Andrea; Lepre, Janet; Loyd, Susan; Mamish, Nader; Marshall, Michael; Monninger, John; Orders, William; Pace, Patti; Poole, Brooke; Reddick, Darani; Laufer, Richard; Bavol, Rochelle; Rothschild, Trip; Savoy, Carmel; Sharkey, Jeffry; Shea, Pamela; Sosa, Belkys; Speiser, Herald; Virinicki, Kristine; Temp, WCO; Temp, WDM; Warren, Roberta; Apostolakis, George; Temp, GEA; Tadesse, Rebecca; Castleman, Patrick; Montes, David; Dhir, Neha; Adler, James; Jimenez, Patricia; Nieh, Ho; Ostendorff, William; Lui, Christiana; Lisann, Elizabeth; Gilles, Nanette; Le, Hong; Sexton, Kimberly; Beasley, Benjamin; Riddick, Nicole
Cc: Mitchell-Funderburk, Natalie; Wright, Darlene
Subject: Chairman Jaczko's vote on COMWDM-11-0001/COMWCO-11-0001 (Engagement of Stakeholders Regarding the Events in Japan)

Attached please find Chairman Jaczko's vote.

****
Herald M. Speiser - (301) 415-1830
Administrative Assistant
Office of the Chairman
Nuclear Regulatory Commission
11555 Rockville Pike
Mailstop: O-16G4
Rockville, MD 20852

Gilles, Nanette

From: Gilles, Nanette
Sent: Friday, July 15, 2011 11:14 AM
To: Taylor, Robert
Subject: RE: Historical Information on Tsunamis near Fukushima

Sounds good.

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Taylor, Robert
Sent: Friday, July 15, 2011 11:13 AM
To: Gilles, Nanette
Subject: RE: Historical Information on Tsunamis near Fukushima

Ok. I think we have a presentation prepared by the "tsunami expert" in NRO. If memory serves, it has very good historical information. We will find that for you and send it along.

Rob

From: Gilles, Nanette
Sent: Friday, July 15, 2011 11:11 AM
To: Taylor, Robert
Subject: RE: Historical Information on Tsunamis near Fukushima

Thanks, Rob. I need whatever information we already have by Monday. No need to try and generate new information.

Nan

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Taylor, Robert
Sent: Friday, July 15, 2011 11:05 AM
To: Skeen, David; Gilles, Nanette
Subject: RE: Historical Information on Tsunamis near Fukushima

We can get this for you. When do you need it by?

Rob

~~NOT FOR PUBLIC DISCLOSURE~~

rom: Skeen, David
ent: Friday, July 15, 2011 11:00 AM
To: Gilles, Nanette
Cc: Taylor, Robert
Subject: RE: Historical Information on Tsunamis near Fukushima

Nan,

I'm out of the office today.

I'll ask Rob to see what we have on the tsunami design basis for Fukushima, and get back to you.

From: Gilles, Nanette
Sent: Friday, July 15, 2011 9:35 AM
To: Skeen, David
Subject: Historical Information on Tsunamis near Fukushima

Dave – What information do we have on the historical record for tsunamis in the Fukushima area and how that information was considered in setting the design basis for the plants?

Nanette V. Gilles
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~~NOT FOR PUBLIC DISCLOSURE~~

Gilles, Nanette

m: Apostolakis, George
t: Friday, July 15, 2011 4:25 PM
: Gilles, Nanette
Subject: FW: Greetings from USC and as promised ....
Attachments: TEPCO Ignored Tsunami - WP pdf March 24th.pdf

I just received the attached from USC.

Also, Professor Costas Synolakis, a USC tsunami expert, is quoted in the New York Times, March 26, 2011. Please find the article.

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DISASTER IN JAPAN

Sailors aboard the USS Ronald Reagan, off the coast of Japan, scrubbed the deck Wednesday to remove potential radiation contamination.

Tokyo water unfit for infants; radiation alert on vegetables

BY DAVID NAKAMURA

TOKYO — Fears over Japan's food and water supply escalated Wednesday after authorities announced they had discovered radioactive material above the legal limit in 11 types of vegetables and radioactive substances in water produced at a Tokyo purifying station.

Officials warned residents not to eat the vegetables produced in several prefectures near the badly damaged Fukushima Daiichi nuclear facility and recommended that infants not drink tap water in Tokyo.

Tokyo officials said they would distribute three 500-milliliter bottles of water to every household in the capital where an infant was living — about 80,000 households.

Meanwhile, emergency work to repair the Daiichi plant was halted again when smoke was seen billowing from the complex Wednesday afternoon, prompting the second evacuation of workers in three days.

Crews have been attempting to restore electrical power to four of Daiichi's six nuclear reactors, which are in various states of overheating.

The situation at Daiichi still warranted "serious concern," said Graham Andrew, technical adviser to the director general of the International Atomic Energy Agency, although radiation readings at the site were declining. He added that since partial power was restored to the facility, IAEA had been receiving better data from Japanese authorities regarding the status of each stricken reactor. Andrew said IAEA experts were analyzing temperature and pressure readings from the reactors and would send advice on proposed actions to Japanese authorities.

Some of the reactors have spewed radioactive particles into the air, leading to the contamination of crops, milk and water.

The March 11 earthquake and tsunami have left 9,487 dead and 15,617 missing, the National Police Agency reported. And the Japanese government said Wednesday that the escalating catastrophes have caused up to 25 trillion yen ($308 billion) in damages. This estimate is far higher than the $235 billion figure suggested by the World Bank this week.

The Japanese government's warning on tap water sparked fears among many mothers of young children in Tokyo, including Mizuo Watanabe, 39, who said she was "really worried." She said she called a couple of stores in town to find bottled water, but the stores were sold out.

"They say they don't know when they will get more," Watanabe said. "I breast-feed, but my child is starting solids, and I have to cook her meals using tap water. I have been exchanging e-mails with mom-friends with babies sharing concerns and to get tips on what to do."

The list of contaminated vegetables includes broccoli, cabbage, turnips, parsley and other green leaf vegetables, the Health, Labor and Welfare Ministry said. This week, government officials found elevated radiation levels in raw milk and spinach in several prefectures near the Daiichi plant.

Though officials had said the radiation in milk and spinach was not high enough to be harmful to humans, the latest tests show contamination that is high enough to be unsafe if the vegetables are consumed on a regular basis. Eating 100 grams for 10 days would be equivalent to the amount of radiation a person receives from the natural environment for a year, health officials said.

Concerns about Japan's agricultural exports spread to the United States Thursday, when the Food and Drug Administration banned the import of dairy products, fruit and vegetables from four prefectures — Fukushima, Ibaraki, Tochigi and Gunma. Japanese seafood will be allowed into the U.S. market after being screened, the agency said.

The Japanese government has said it will offer subsidies to farmers whose crops have been affected by the nuclear fallout, but some farmers fear their livelihoods will be severely disrupted as consumers change their eating habits.

The dangers associated with food that has been contaminated by radioactive material was highlighted in the wake of the Chernobyl nuclear accident in 1986, when thousands of children who ingested milk developed thyroid cancer.

Tokyo resident Hiaki Sato, 39, who is pregnant with her third child, said she doesn't know what to do now that she cannot use water to cook.

"What to me was something that was happening far away," Sato said, "has all of a sudden become an immediate concern."

Also Wednesday, the Department of Energy released radiation data collected from 40 hours of flights near the Daiichi facility. The flights found more radiation to the northwest of the plant than elsewhere. The maximum radiation recorded by the team was 300 microsieverts per hour, by comparison, a round-trip flight from Tokyo to New York exposes passengers to about 200 microsieverts of radiation from cosmic rays.

Meanwhile, wisps of radioactivity from the facility were detected in Washington state and California, the Environmental Protection Agency reported. While the EPA's monitors detected a few radioactive isotopes that likely originated at Daiichi, the amounts detected "are hundreds of thousands to millions of times below levels of concern," the agency said in a statement.

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Staff writer Brian Vastag and special correspondent Akiko Yamamoto contributed to this report.

People buying groceries in Ishinomaki, Japan, and elsewhere were cautioned about vegetables.

Nuclear plant's panel ignored risk of tsunami

SAFETY JUDGED SUFFICIENT

Reactor owner, agency feared quakes more

BY DAVID NAKAMURA AND CHICO HARLAN

TOKYO — A Japanese government agency that spent several years evaluating the Fukushima Daiichi nuclear plant declared the facility safe after dismissing concerns from a member of its own expert panel that a tsunami could jeopardize its reactors.

Kaiichiro Okazaki, a prominent seismologist, warned of a debilitating tsunami in June 2009 at one of a series of meetings held by the Nuclear and Industrial Safety Agency (NISA) to evaluate the readiness of Daiichi, as well as Japan's 54 other nuclear power plants, to withstand a massive natural disaster. But in the discussion about Daiichi, Okazaki was rebuffed by an executive from Tokyo Electric Power Co., which operates the plant, because the utility and the government believed that earthquakes posed a greater threat.

That conclusion left Daiichi vulnerable to what unfolded on March 11, when a 9.0-magnitude earthquake struck off Japan's northeast coast. Experts now say that Daiichi, as designed, withstood the quake. It was the ensuing tsunami, which waves more than 20 feet high, that knocked out the facility's critical backup power supply and triggered a nuclear emergency, resulting in widespread release of radiation.

The disaster highlights the government's miscalculation in prioritizing one natural disaster over another and casts scrutiny on a review that more often reaffirmed NISA's and Tepco's standards than challenged them.

"Now I regret that I didn't assess this more strongly, to push them to research this," said Okazaki, a director at a government-funded research institution.

The triple catastrophe, Japan's greatest crisis since World War II, has left more than 23,000 people dead or missing and caused more than $300 billion in damage, according to a government estimate. The consequences from the nuclear crisis, though, are likely to have the broadest and longest-lasting implications, as nations reassess their own nuclear safety standards and their reliance on nuclear energy.

No tsunami expert sought

In earthquake-prone Japan, an island nation that depends on its 54 reactors at 17 power plants for 30 percent of its energy supply, the disastrous 8.9-magnitude Kobe quake in 1995 prompted the government to require improved nuclear safeguards and construction standards. The new guidelines tailored standards for each plant based on historical seismic activity in its region.

In 2008, NISA appointed a panel of engineers, geologists and seismologists to review the safeguards and suggest revisions. Tepco officials were not on the panel but attended the meetings.

The experts were assigned to examine each nuclear power plant, but what they focused on was largely predetermined by NISA, based on each facility's geography and the historical record, according to a member of the group. For example, at the Hamaoka facility in Shizuoka prefecture, to the southwest of Tokyo, the reviewers were asked to look closely at the risks posed by both earthquakes and tsunamis. That power plant is located along a major fault line.

But at Fukushima Daiichi, along the northeast coast, the review panel was instructed to focus on earthquakes because a major tsunami was considered unlikely, said Takashi Arima, a panel member who studies earthquake fault lines at the National Institute of Advanced Industrial Science and Technology.

Of the seven panel members assigned to study Daiichi, none was a tsunami expert, Arima said. From April 2008 through June 2009, the group met 32 times, he said, talking mostly about the earthquake dangers posed by the fault line closest to the plant. The risk of a tsunami "never came up," Arima said.

The Daiichi panel wrapped up its review and, on June 24, 2009, presented its findings to a larger working group of 40, which included just two tsunami experts. It was there that Okazaki, who also works at the science and technology institute, first raised the idea that a tsunami could be as risky as an earthquake.

In A.D. 869, Okazaki said the panel, a massive quake struck off the coast of Sendai, in northeastern Japan, sending a tsunami wave more than two miles inland. Only in recent years had a handful of Japan's tsunami experts concluded that the disaster was more than allegorical, based on evidence collected in geological layers and sediment deposits.

"Research results are out, but there is no mention of that [tsunami] here, and I would like to ask why," Okazaki asked a Tepco official at the meeting, according to a transcript Arima provided to The Washington Post.

Initially, the Tepco official played down the danger, saying that the guidelines for Fukushima had instead focused on a far more recent earthquake, whose magnitude measured 7.9. Okazaki pressed on, pointing out that the so-called Jogan earthquake of 869 knocked down a castle.

"As you know, it is a historic earthquake," the Tepco official said, dismissing its relevance.

"I don't know how this conclusion can be drawn," Okazaki said. "We have no mention of that, to me, leaves me unsatisfied."

According to the transcript, a NISA official ended the debate by promising to follow up. At the next meeting, the working group approved the Daiichi safety report that declared the complex's safeguards sufficient.

Review was in progress

Tepco defenders say that the power company made a good-faith effort last year to learn more Japanese tsunami expert Kenji Satake said that company executives consulted with him last year, asking about the 869 disaster. "They were in the midst of analysis when this earthquake hit," Satake said.

Masaru Kobayashi of NISA's seismic safety office described the panel's work as part of a mid-term report and said NISA and Tepco were building on it with more research on tsunamis, landslides and other risk factors.

"We were about to start moving on to the next check and this disaster occurred," Kobayashi said. "It is now too late to say that we wish we checked earlier."

Yoshimi Hitorugi, a Tepco spokesman, said there was little reason to predict a quake the size of March 11's, noting that scientists believe the Jogan earthquake had a magnitude of 8.4.

The Fukushima Daiichi plant had been built with retaining walls to withstand a 30-foot-tall wave, according to panel members and Japan's nuclear agency. Tepco officials now believe a wave reached well above the retaining wall and flooded the low-lying backup generators. The tsunami overwhelmed the facility, drowning the generators and shutting down the cooling system essential to preventing spent fuel rods and reactor cores from overheating.

"The diesels were in a very low area," said Ken Brockman, former director of nuclear installation safety at the International Atomic Energy Agency. "That would make them very susceptible to a tsunami or even an inland flooding event."

The resulting nuclear emergency raises questions: To what degree must regulators design expensive safeguards against once-a-millennium disasters, particularly as researchers learn more about the world's rarest ancient catastrophes?

"This is a question that addresses very much the political will of the country," Brockman said. "The engineers will say, 'You tell me what you want, we'll protect it to that level.' It's just an issue of raising the dimension, building the retaining walls. The engineering can be done. You just have to give them the criteria."

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Special correspondents Kyoko Tanaka and Akiko Yamamoto in Tokyo contributed to this report.

Colombia has been using U.S. drones since 2006

WikiLeaks releases cable detailing joint counterterrorism effort

BY KAREN DEYOUNG

The Colombian military began using U.S.-supplied surveillance drones for counterterrorism and counter-narcotics operations in 2006, according to a classified State Department cable released Wednesday by WikiLeaks.

The small, Scan Eagle unmanned aircraft transmits real-time video of stationary and moving targets. According to the December 2006 cable from then-U.S. Ambassador to Colombia William B. Wood, the aircraft initially were to be used "in support U.S. hostage rescue efforts and assist" the Colombian military's pursuit of guerrilla leaders. "But it promises to be equally useful for combat against narcotrafficking and in rewarding drug interdiction," Wood wrote.

The cable, which referred to a "test package" of drones that arrived in Colombia in July 2006, called them a "potentially high-impact new addition" to U.S.-Colombian intelligence cooperation.

It was not clear from the cable whether the drones were maintained by U.S. military forces in Colombia or given to that country's armed forces as part of the multibillion-dollar military aid program there.

Scan Eagles, which are four feet long with a 10-foot wingspan, are launched by a hydraulic catapult system and have no need for runways. Manufactured by Boeing, they were first deployed in 2005 by the U.S. Navy and Marines for intelligence-gathering in and around Iraq.

They have been used in Afghanistan by both U.S. and Canadian forces, and by the U.S. Navy in counter-piracy operations.

Wood wrote that the drones "have proven useful before, during, and after strikes against the FARC," or Revolutionary Armed Forces of Colombia, the main guerrilla group. He described them as in use by all branches of the Colombian military.

"When a UAV 'pops' five by chance over a truck unloading FARC fighters, and the [Colombian Air Force] happened to have a bomber available nearby," he said, "an aerial assault was launched within 30 minutes."

In another incident, a drone camera "caught two vehicles being loaded with coca," and a helicopter gunship was dispatched to destroy them.

The cable described the drones' ability to provide Colombian army forces with "real-time, bird's eye" views of military assaults, and to track drug traffic along rivers for interdiction by the Colombian navy.

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Gilles, Nanette

From: Gilles, Nanette
Sent: Friday, July 15, 2011 9:35 AM
To: Skeen, David
Subject: Historical Information on Tsunamis near Fukushima

Dave – What information do we have on the historical record for tsunamis in the Fukushima area and how that information was considered in setting the design basis for the plants?

Nanette V. Gilles
Technical Assistant for Reactors
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Gilles, Nanette

From: Gilles, Nanette
Sent: Friday, July 15, 2011 4:33 PM
To: Apostolakis, George
Subject: RE: Greetings from USC and as promised ....
Attachments: NYT Tsunami Article-March 26.docx

Commissioner - The article is attached. You can also find it here (don't know why it doesn't show up as a link):

http://www.nytimes.com/2011/03/27/world/asia/27nuke.html?pagewanted=1&sq=tsunami japan professor&st=cse&scp=5

Nan

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Email: nanette.gilles@nrc.gov

-----Original Message-----
From: Apostolakis, George
Sent: Friday, July 15, 2011 4:25 PM
To: Gilles, Nanette
Subject: FW: Greetings from USC and as promised ....

I just received the attached from USC.

Also, Professor Costas Synolakis, a USC tsunami expert, is quoted in the New York Times, March 26, 2011. Please find the article.

Commissioner George Apostolakis
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March 26, 2011

Japanese Rules for Nuclear Plants Relied on Old Science

By NORIMITSU ONISHI and JAMES GLANZ

TOKYO — In the country that gave the world the word tsunami, the Japanese nuclear establishment largely disregarded the potentially destructive force of the walls of water. The word did not even appear in government guidelines until 2006, decades after plants — including the Fukushima Daiichi facility that firefighters are still struggling to get under control — began dotting the Japanese coastline.

The lack of attention may help explain how, on an island nation surrounded by clashing tectonic plates that commonly produce tsunamis, the protections were so tragically minuscule compared with the nearly 46-foot tsunami that overwhelmed the Fukushima plant on March 11. Offshore breakwaters, designed to guard against typhoons but not tsunamis, succumbed quickly as a first line of defense. The wave grew three times as tall as the bluff on which the plant had been built.

Japanese government and utility officials have repeatedly said that engineers could never have anticipated the magnitude 9.0 earthquake — by far the largest in Japanese history — that caused the sea bottom to shudder and generated the huge tsunami. Even so, seismologists and tsunami experts say that according to readily available data, an earthquake with a magnitude as low as 7.5 — almost garden variety around the Pacific Rim — could have created a tsunami large enough to top the bluff at Fukushima.

After an advisory group issued nonbinding recommendations in 2002, Tokyo Electric Power Company, the plant owner and Japan's biggest utility, raised its maximum projected tsunami at Fukushima Daiichi to between 17.7 and 18.7 feet — considerably higher than the 13-foot-high bluff. Yet the company appeared to respond only by raising the level of an electric pump near the coast by 8 inches, presumably to protect it from high water, regulators said.

"We can only work on precedent, and there was no precedent," said Tsuneo Futami, a former Tokyo Electric nuclear engineer who was the director of Fukushima Daiichi in the late 1990s. "When I headed the plant, the thought of a tsunami never crossed my mind."

The intensity with which the earthquake shook the ground at Fukushima also exceeded the criteria used in the plant's design, though by a less significant factor than the tsunami, according to data Tokyo Electric has given the Japan Atomic Industrial Forum, a professional group. Based on what is known now, the tsunami set off the nuclear crisis by flooding the backup generators needed to power the reactor cooling system.

Japan is known for its technical expertise. For decades, though, Japanese officialdom and even parts of its engineering establishment clung to older scientific precepts for protecting nuclear plants, relying heavily on records of earthquakes and tsunamis, and failing to make use of advances in seismology and risk assessment since the 1970s.

For some experts, the underestimate of the tsunami threat at Fukushima is frustratingly reminiscent of the earthquake — this time with no tsunami — in July 2007 that struck Kashiwazaki, a Tokyo Electric nuclear plant on Japan's western coast.. The ground at Kashiwazaki shook as much as two and a half times the maximum intensity envisioned in the plant's design, prompting upgrades at the plant.

"They had years to prepare at that point, after Kashiwazaki, and I am seeing the same thing at Fukushima," said Peter Yanev, an expert in seismic risk assessment based in California, who has studied Fukushima for the United States Nuclear Regulatory Commission and the Energy Department.

There is no doubt that when Fukushima was designed, seismology and its intersection with the structural engineering of nuclear power plants was in its infancy, said Hiroyuki Aoyama, 78, an expert on the quake resistance of nuclear plants who has served on Japanese government panels. Engineers employed a lot of guesswork, adopting a standard that structures inside nuclear plants should have three times the quake resistance of general buildings.

"There was no basis in deciding on three times," said Mr. Aoyama, an emeritus professor of structural engineering at the University of Tokyo. "They were shooting from the hip," he added, making a sign of a pistol with his right thumb and index finger. "There was a vague target."

Evolution of Designs

When Japanese engineers began designing their first nuclear power plants more than four decades ago, they turned to the past for clues on how to protect their investment in the energy of the future. Official archives, some centuries old, contained information on how tsunamis had flooded coastal villages, allowing engineers to surmise their height.

So seawalls were erected higher than the highest tsunamis on record. At Fukushima Daiichi, Japan's fourth oldest nuclear plant, officials at Tokyo Electric used a contemporary tsunami — a 10.5-foot-high wave caused by a 9.5-magnitude earthquake in Chile in 1960 — as a reference point. The 13-foot-high cliff on which the plant was built would serve as a natural seawall, according to Masaru Kobayashi, an expert on quake resistance at the Nuclear and Industrial Safety Agency, Japan's nuclear regulator.

Eighteen-foot-high offshore breakwaters were built as part of the company's anti-tsunami strategy, said Jun Oshima, a spokesman for Tokyo Electric. But regulators said the breakwaters — mainly intended to shelter boats — offered some resistance against typhoons, but not tsunamis, Mr. Kobayashi said.

Over the decades, preparedness against tsunamis never became a priority for Japan's power companies or nuclear regulators. They were perhaps lulled, experts said, by the fact that no tsunami had struck a nuclear plant until two weeks ago. Even though tsunami simulations offered new ways to assess the risks of tsunamis, plant operators made few changes at their aging facilities, and nuclear regulators did not press them.

Engineers took a similar approach with earthquakes. When it came to designing the Fukushima plant, official records dating from 1600 showed that the strongest earthquakes off the coast of present-day Fukushima Prefecture had registered between magnitude 7.0 and 8.0, Mr. Kobayashi said.

"We left it to the experts," said Masatoshi Toyoda, a retired Tokyo Electric vice president who oversaw the construction of the plant. He added, "they researched old documents for information on how many tombstones had toppled over and such."

Eventually, experts on government committees started pushing for tougher building codes, and by 1981, guidelines included references to earthquakes but not to tsunamis, according to the Nuclear and Industrial Safety Agency. That pressure grew exponentially after the devastating Kobe earthquake in 1995, said Kenji Sumita, who was deputy chairman of the government's Nuclear Safety Commission of Japan in the late 1990s.

Mr. Sumita said power companies, which were focused on completing the construction of a dozen reactors, resisted adopting tougher standards, and did not send representatives to meetings on the subject at the Nuclear Safety Commission.

"Others sent people immediately," Mr. Sumita said, referring to academics and construction industry experts. "But the power companies engaged in foot-dragging and didn't come."

Meanwhile, the sciences of seismology and risk assessment advanced around the world. Although the United States Nuclear Regulatory Commission has come under severe criticism for not taking the adoption of those new techniques far enough, the agency did use many of them in new, plant-by-plant reviews, said Greg S. Hardy, a structural engineer at Simpson Gumpertz & Heger who specializes in nuclear plant design and seismic risk.

For whatever reasons — whether cultural, historical or simply financial — Japanese engineers working on nuclear plants continued to predict what they believed were maximum earthquakes based on records.

Those methods, however, did not take into account serious uncertainties like faults that had not been discovered or earthquakes that were gigantic but rare, said Mr. Hardy, who visited Kashiwazaki after the 2007 quake as part of a study sponsored by the Electric Power Research Institute.

"The Japanese fell behind," Mr. Hardy said. "Once they made the proclamation that this was the maximum earthquake, they had a hard time re-evaluating that as new data came in."

The Japanese approach, referred to in the field as "deterministic" — as opposed to "probabilistic," or taking unknowns into account — somehow stuck, said Noboru Nakao, a consultant who was a nuclear engineer at Hitachi for 40 years and was president of Japan's training center for operators of boiling-water reactors.

"Japanese safety rules generally are deterministic because probabilistic methods are too difficult," Mr. Nakao said, adding that "the U.S. has a lot more risk assessment methods."

The science of tsunamis also advanced, with far better measurements of their size, vastly expanded statistics as more occurred, and computer calculations that help predict what kinds of tsunamis are produced by earthquakes of various sizes. Two independent draft research papers by leading tsunami experts — Eric Geist of the United States Geological Survey and Costas Synolakis, a professor of civil engineering at the University of Southern California — indicate that earthquakes of a magnitude down to about 7.5 can create tsunamis large enough to go over the 13-foot bluff protecting the Fukushima plant.

Mr. Synolakis called Japan's underestimation of the tsunami risk a "cascade of stupid errors that led to the disaster" and said that relevant data was virtually impossible to overlook by anyone in the field.

Underestimating Risks

The first clear reference to tsunamis appeared in new standards for Japan's nuclear plants issued in 2006.

"The 2006 guidelines referred to tsunamis as an accompanying phenomenon of earthquakes, and urged the power companies to think about that," said Mr. Aoyama, the structural engineering expert.

The risk had received some attention in 2002, when a government advisory group, the Japan Society of Civil Engineers, published recommended tsunami guidelines for nuclear operators.

A study group at the society, including professors and representatives from utilities like Tokyo Electric, scrutinized data from past tsunamis, as well as fresh research on fault lines and local geography, to come up with the guidelines, according to a member of the study group who spoke on condition of anonymity, citing the sensitivity of the situation.

The same group had recently been discussing revisions to those standards, according to the member. At the group's last meeting, held just over a week before the recent tsunami, researchers debated the usefulness of three-dimensional simulations to predict the potential damage of tsunamis on nuclear plants, according to minutes from those meetings. "We took into account more than past data," the member said. "We tried to predict. Our objective was to reduce uncertainties."

Perhaps the saddest observation by scientists outside Japan is that, even through the narrow lens of recorded tsunamis, the potential for easily overtopping the anti-tsunami safeguards at Fukushima should have been recognized. In 1993 a magnitude 7.8 quake produced tsunamis with heights greater than 30 feet off Japan's western coast, spreading wide devastation, according to scientific studies and reports at the time.

On the hard-hit island of Okushiri, "most of the populated areas worst hit by the tsunami were bounded by tsunami walls" as high as 15 feet, according to a report written by Mr. Yanev. That made the walls a foot or two higher than Fukushima's bluff.

But in a harbinger of what would happen 18 years later, the walls on Okushiri, Mr. Yanev, the expert in seismic risk assessment, wrote, "may have moderated the overall tsunami effects but were ineffective for higher waves."

And even the distant past was yielding new information that could have served as fresh warnings.

Two decades after Fukushima Daiichi came online, researchers poring through old records estimated that a quake known as Jogan had actually produced a tsunami that reached nearly one mile inland in an area just north of the plant. That tsunami struck in 869.

Norimitsu Onishi reported from Tokyo, and James Glanz from New York. Ken Belson and Hiroko Tabuchi contributed reporting from Tokyo.

Apostolakis, George

m: Apostolakis, George
: Friday, July 15, 2011 4:41 PM
Costas Synolakis (costas@usc.edu)
Subject: Fukushima

Costa:

I am trying to understand whether the Japanese underestimated the design-basis tsunami given the historical record. Is this true? Can you send me relevant articles?

Thanks.

George

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U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

The Fukushima Nuclear Accident
U.S.NRC Response

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

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Integrated Disaster Risk Management Conference

University of Southern California

July 15, 2011

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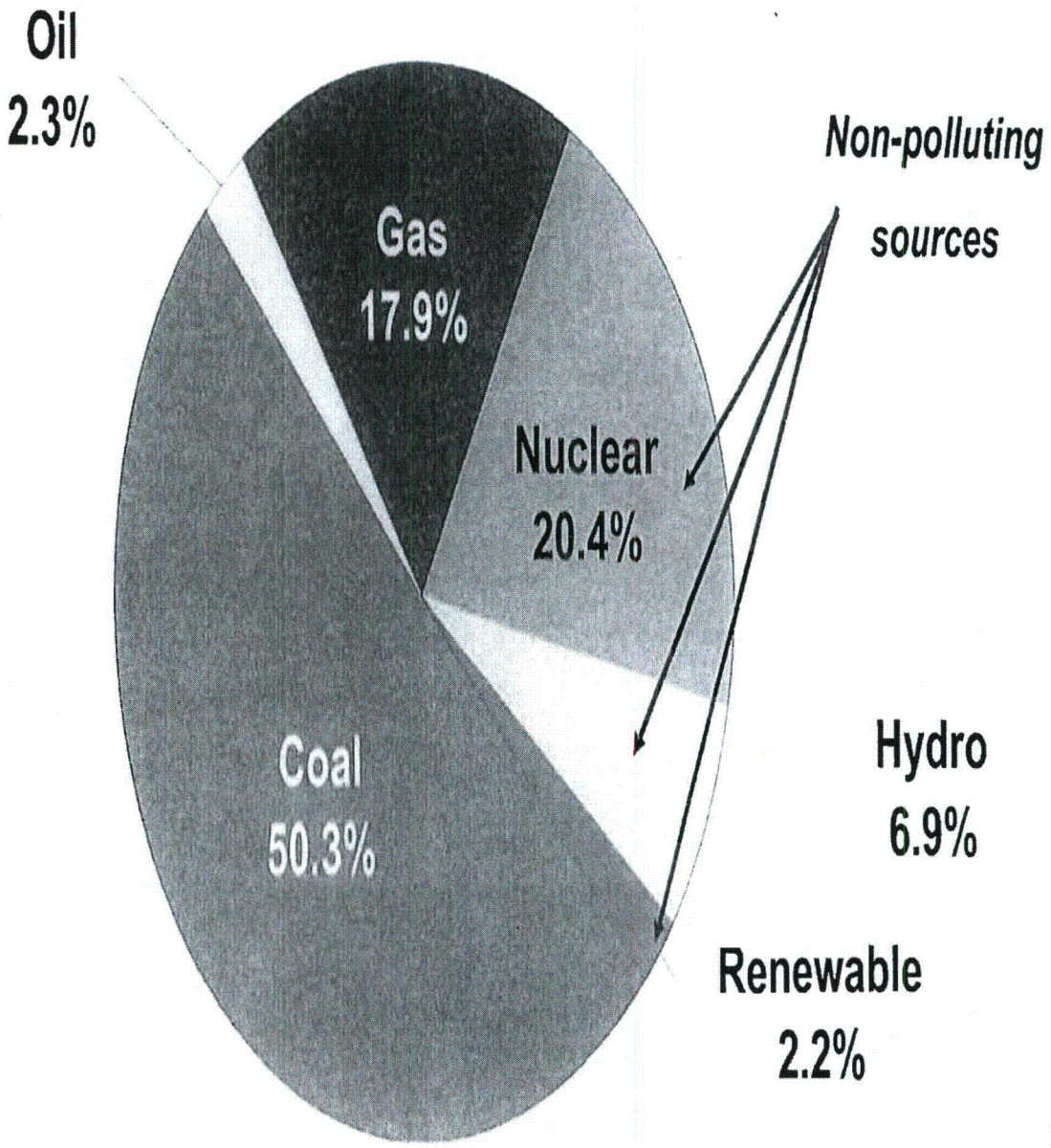
Protecting People and the Environment

Worldwide Electricity Production

- Coal: 39%
- Natural gas: 18%
- Nuclear: 17%
- Hydroelectric: 17%
- Oil: 8%

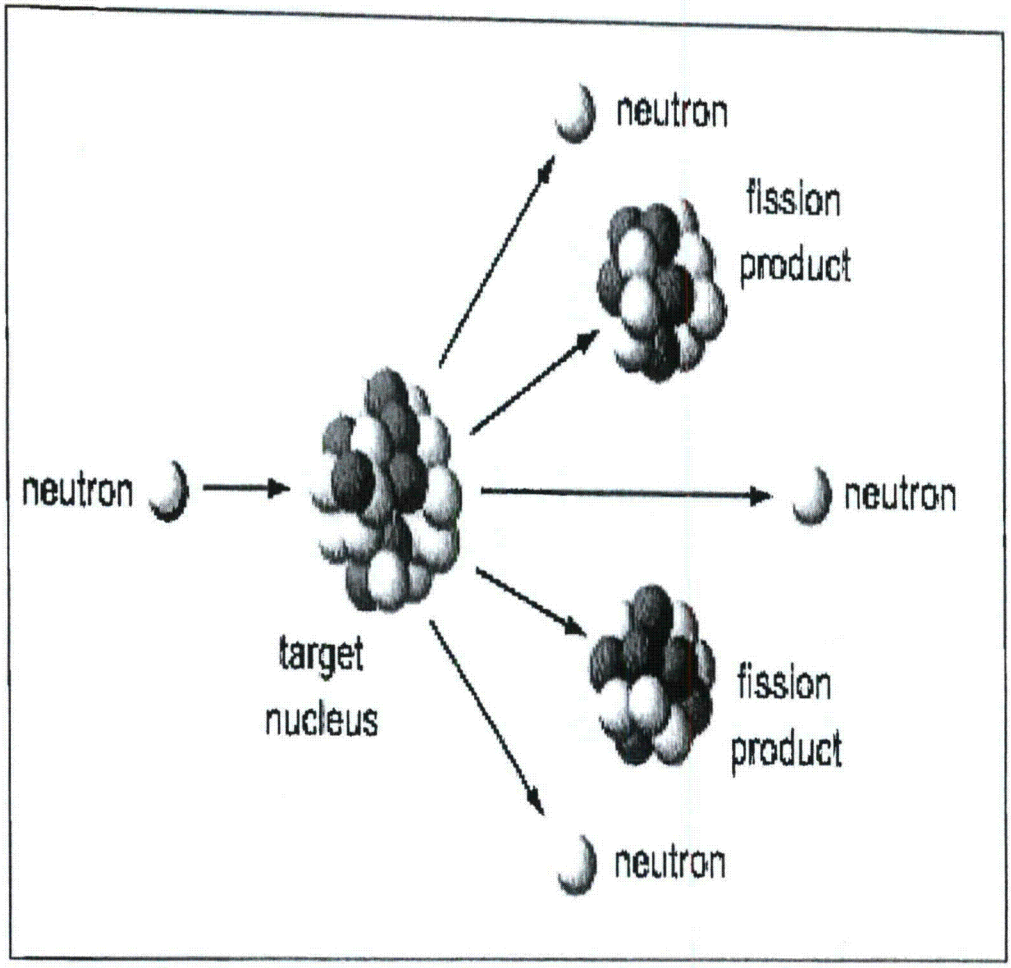
U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Electric Power Production (USA)



U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Where does the energy come from?
Nuclear Fission



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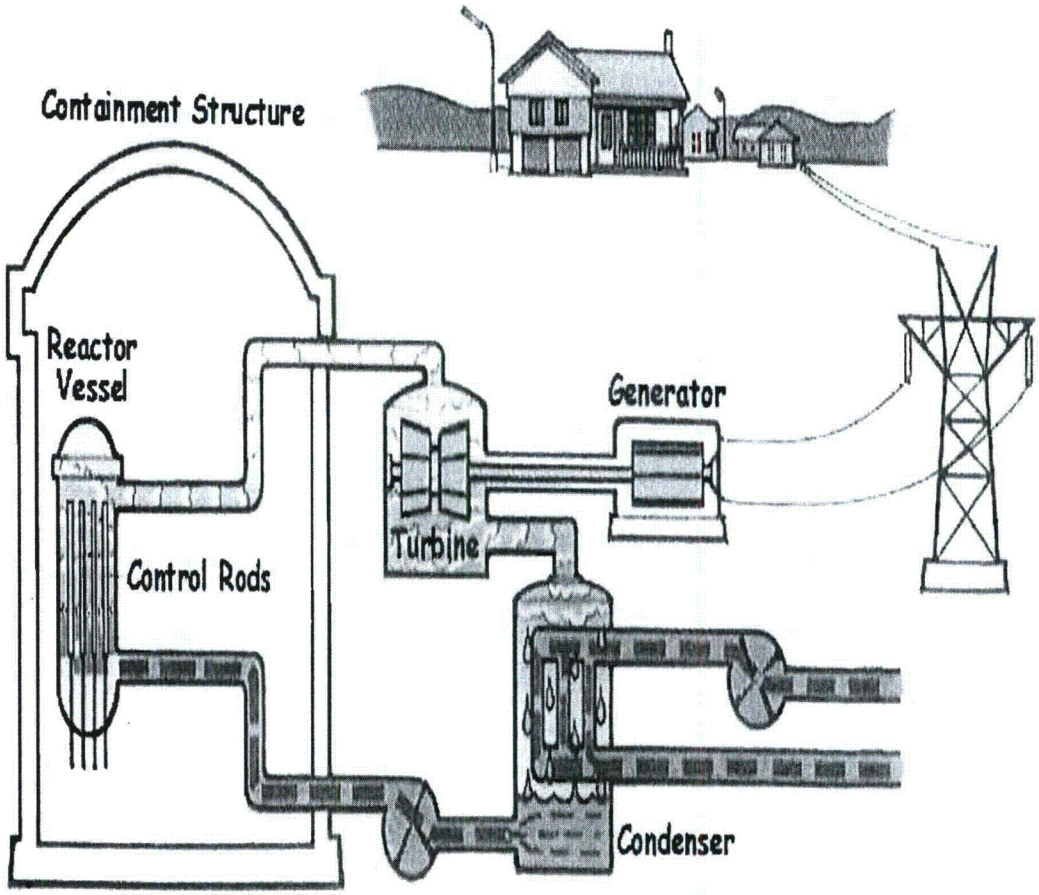
Energy Release

- 1 gram of U-235 releases 24,000 kWh (sufficient for a small town for one night)
- Equivalent amounts:
  - 3.2 tons of coal, or
  - 12.6 barrels of oil

The Boiling Water Reactor (BWR)



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The Hazard

Isotope	Half-Life	Volatility	Health Hazard
^{131}I (Iodine-131)	8 d	Gaseous	Thyroid
^{137}Cs (Cesium-137)	33 y	Highly volatile	Internal hazard to whole body

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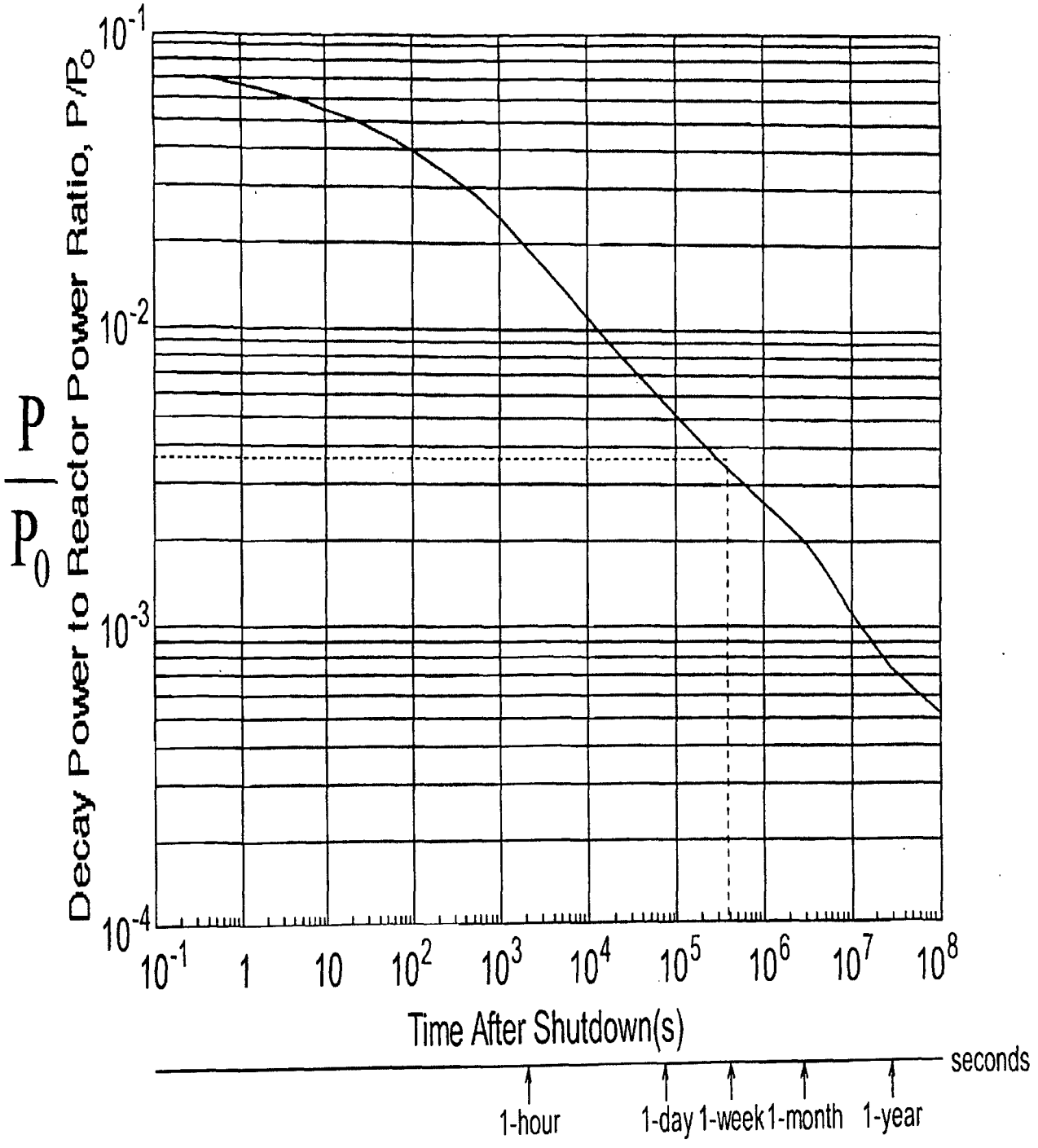
Decay Heat



Source: Todreas & Kazimi Vol. 1

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Defense in Depth

"Defense-in-Depth is an element of the Nuclear Regulatory Commission's safety philosophy that employs successive compensatory measures to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility."

[Commission's White Paper, USNRC, 1999]

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Major Elements of Defense in Depth

- Accident Prevention
- Safety Systems
- Containment
- Siting and Emergency Plans

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Refueling/Spent Fuel/Waste

- Every 18 to 24 months the reactors need to be shutdown and refueled
- Approximately 1/3 of the core is replaced and the remaining is readjusted to provide for efficient fissioning of fuel (reactor physics and safety analysis)
- Used fuel is stored at plant sites in storage pools underwater until shipped to repository or placed in dry storage casks

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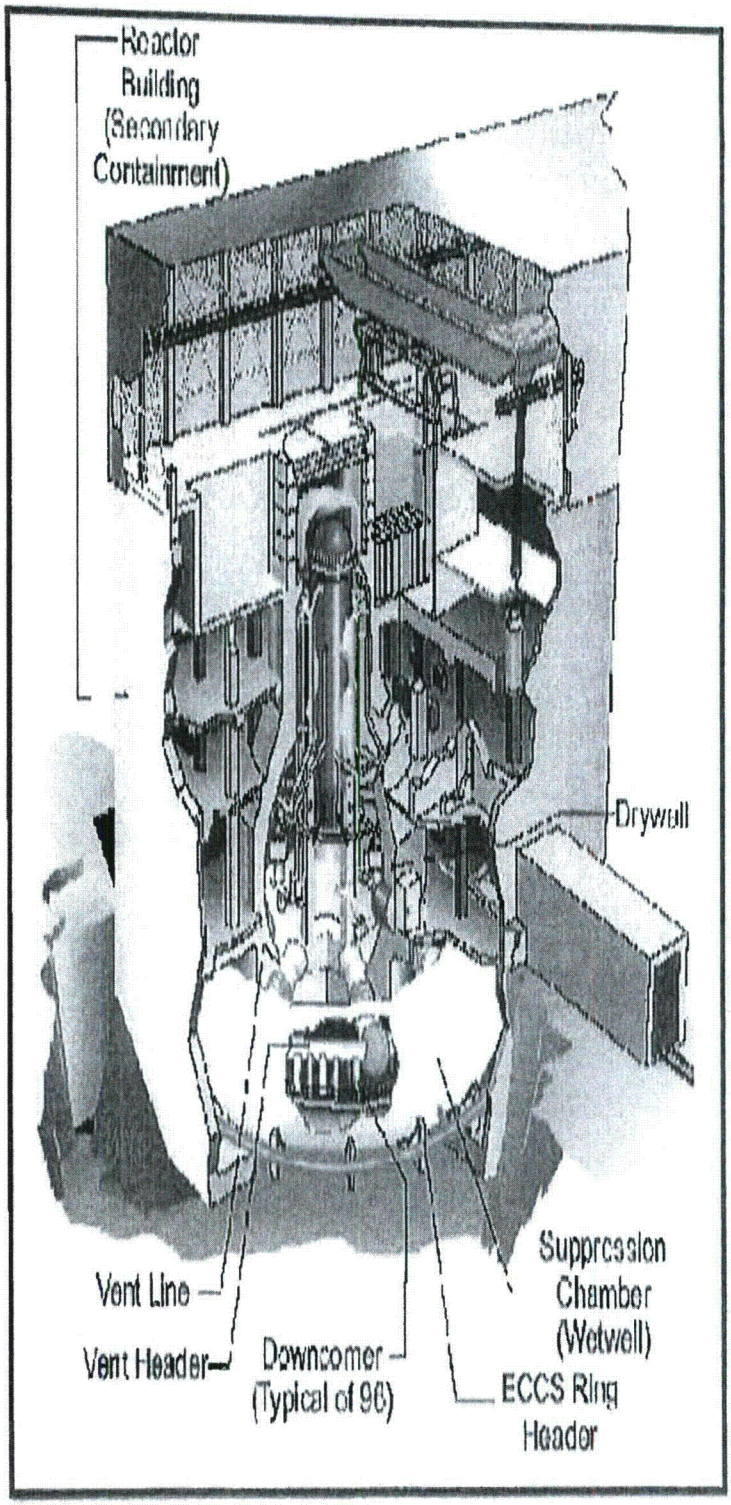
Boiling Water Reactor Design Similar to Fukushima Daiichi



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Tōhoku Earthquake and Tsunami

- Earthquake Data*
  - Magnitude 9.0
  - Epicenter: ~109 miles from Fukushima site
  - Peak Ground Acceleration
    - ✓ 1.0g up to 2.75g at 80 miles from epicenter
    - ✓ ~0.30g to 0.58g in Fukushima Prefecture

*California Coastal Commission. "The Tōhoku Earthquake of March 11, 2011: A preliminary Report on Implications for Coastal California "

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NPP Foundation Accelerations*

Location	Design Japanese Regulatory Guide g	Observed g
Daiichi Unit 2	0.45	0.56
Daiichi Unit 6	0.46	0.45
Daini Unit 1	0.44	0.23
Daini Unit 2	0.44	0.20

*TEPCO Press Release April 01, 2011: The record of the earthquake intensity observed at Fukushima Daiichi Nuclear Power Station and the Fukushima Daini Nuclear Power Station (Interim Report).

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Tōhoku Earthquake and Tsunami

- Tsunami Data
  - Varying reports of tsunami height - approximately 14-15m
  - Protective wall: 5.7 meters
  - Reached shore within about one hour after the earthquake
  - Up to six miles of run-up in flat regions

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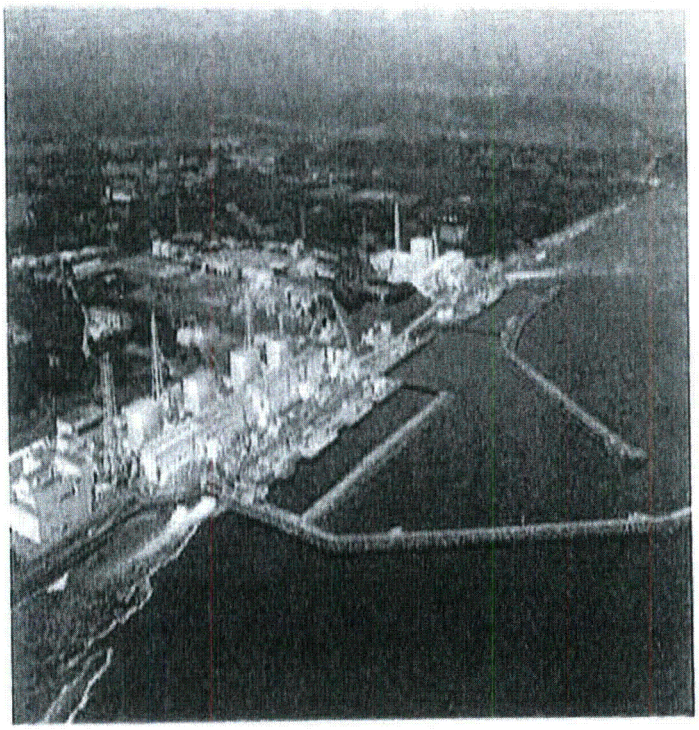
Extended Station Blackout

- Earthquake
  - Reactor Units 1, 2, and 3 scram
  - Loss of offsite power to all 6 units
- Tsunami
  - Loss of emergency AC power
- Extended Station Blackout (Total loss of ac power)



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Status: Units 1, 2, and 3

- Cores damaged and uncovered
- Primary containments likely breached
- Freshwater injection to reactors via installed feedwater systems
- Spent fuel pools (SFPs) intact & water level maintained with installed SFP cooling systems

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Status: Units 4, 5, and 6

- Unit 4
  - Unit was shut down at time of event
  - Core offloaded to SFP
  - An explosion caused significant damage to Unit 4 reactor building
  - SFP structural reinforcements being constructed
  - SFP cooling system not initially functional
  - SFP cooling now provided by installed alternate injection line
- Units 5 and 6
  - Units were shut down at time of event
  - Both units in cold shutdown since March 20

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NRC Incident Response

- Initial NRC response coordinated through Headquarters Operations Center
- NRC Office of Nuclear Reactor Regulation has now assumed responsibility for support & coordination efforts
- Revolving teams of NRC officials with appropriate expertise have been deployed to Japan since the day after the event
- NRC played a key role in coordinated U.S. response to the event

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NRC Inspection Activities

- Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"
  - Inspection uses a combination of assessment of licensee actions and independent inspections
  - The inspection is for fact/data gathering to help evaluate whether future regulatory actions may be necessary
- Results
  - Nuclear plants have multiple, redundant, strategies to mitigate damage to the facility's fuel elements and containment
  - Some deficiencies were identified that would have caused a single strategy to be compromised or fail
  - No functions were compromised that would have resulted in damage to the fuel elements or containment
  - Observations indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events

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NRC Inspection Activities

- Temporary Instruction 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)"
  - To determine that the SAMGs are available and assess how they are being implemented
  - To determine the nature and extent of licensee implementation of SAMG training and exercises
- SAMGs were implemented as a voluntary initiative in the 1990s to address plant response during a severe accident
- Spent fuel cooling not included

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NRC Inspection Activities

- Temporary Instruction 2515/184 results
  - Confirmed that every site has SAMGs
  - Revealed inconsistent implementation
    - ✓ Procedure availability and control
    - ✓ Plant configuration control
    - ✓ Training and exercises

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NRC Bulletin 2011-01, "Mitigating Strategies"

- Issued May 11, 2011
- By June 10, respond with information confirming mitigative strategy equipment is in place and available, as well as that the strategies can be carried out with current plant staffing
- By July 11, respond with further information, including:
  - How essential resources are maintained, tested and controlled to ensure availability
  - How strategies are re-evaluated if plant conditions or configurations change
  - How arrangements are reached and maintained with local emergency response organizations

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Near-Term Task Force

- Commission Direction for Near-Term Review
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
  - Recommendations for the content, structure, and estimated resource impact for the longer-term review
  - Independent from industry efforts
  - Milestones
    - ✓ 30-day Commission meeting (5/12/11)
    - ✓ 60-day Commission meeting (6/16/11)
    - ✓ 90-day final report and Commission meeting (7/19/11)

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Task Force Areas of Focus

- Protection from design basis natural phenomena
- Consideration of beyond design basis natural phenomena
- Mitigation for long-term SBO
  - Including multiple unit events
- Emergency preparedness
- NRC programs

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Longer-Term Review

- Commission Direction for Longer-Term Review
  - Specific information on sequence of events and equipment status
  - Evaluate policy issues
  - Potential interagency issues
  - Lessons learned for facilities other than operating reactors
  - Receive input and interact with all key stakeholders
  - Report within six months after beginning of long-term effort
  - Advisory Committee on Reactor Safeguards to review final long-term report and provide letter report to the Commission

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Regulatory Implications of Fukushima for Nuclear Power in the U.S.

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

Integrated Disaster Risk Management Conference

University of Southern California

July 15, 2011

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Near-Term Task Force Areas of Focus

- Protection
  - Protection from design-basis natural phenomena
  - Consideration of beyond-design-basis natural phenomena
- Mitigation
  - Mitigation for long-term station blackout
    - ✓ Including multiple unit events
- Emergency preparedness
- NRC programs
  - Regulatory oversight

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Near-Term Task Force Conclusions on U.S. Plant Safety

- Similar sequence of events in the U.S. is unlikely
- Existing mitigation measures could reduce the likelihood of core damage and radiological releases
- No imminent risk from continued operation and licensing activities

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Near-Term Task Force Key Recommendations

- Require licensees to reevaluate and upgrade as necessary the design-basis seismic and flooding protection
- Strengthen plant capability to mitigate a station blackout
- Enhance spent fuel pool makeup capability and instrumentation

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Near-Term Key Recommendations on Emergency Preparedness

- Require that facility emergency plans address prolonged station blackout and multiunit events
  - Personnel and staffing for multiunit events
  - Dose assessment capability for multiunit events
  - Training and exercises
  - Equipment and facilities
  - Communication capability during a prolonged station blackout
  - Emergency Response Data System (ERDS) capabilities

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Longer-Term Review Items for Emergency Preparedness

- Analyze current protective equipment requirements for emergency responders
- Evaluate command and control structure and qualifications of decision makers for a prolonged station blackout or multiunit event
- Evaluate Emergency Response Data System (ERDS)
  - Determine an alternate method to transmit ERDS data that does not rely on hardwired infrastructure
  - Determine whether current data set is sufficient for modern assessment needs
  - Determine whether ERDS should be required to transmit continuously so that no operator action is needed

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Longer-Term Review Items for Emergency Preparedness

- Study whether enhanced onsite emergency response resources are needed, including the ability to deliver equipment to the site under conditions involving significant natural events
- Work with FEMA, States, and other external stakeholders to evaluate insights from implementation of EP at Fukushima
- Study the efficacy of real-time radiation monitoring onsite and within the emergency planning zones
- Conduct training on radiation, radiation safety, and appropriate use of potassium iodide (KI) in the local communities

Gilles, Nanette

From: George Apostolakis [apostola@MIT.EDU]
Sent: Monday, July 18, 2011 8:43 AM
To: Gilles, Nanette
Subject: Fwd: TEPCO study
Attachments: ATT00004.htm; TEPCO_tsunami_NPP_Study.pdf; ATT00005.htm; 2007 _Pageoph_Japanese_NPPs.pdf; ATT00006.htm

---- Forwarded message from costas@usc.edu ----
Date: Sun, 17 Jul 2011 17:59:34 -0700
From: Costas Synolakis <costas@usc.edu>
Reply-To: Costas Synolakis <costas@usc.edu>
Subject: TEPCO study
To: apostola@mit.edu

George, I am afraid I didn't send you the TEPCO study, presented in Nov 2010 "we assessed and confirmed the safety..." I attach it

I am also attaching another paper on the Japanese methodology about tsunami assessment, followed in the TEPCO study - it is essentially the journal version of their standards and guidelines. At the outset it says "Earthquakes of magnitude 8 would periodically occur in and around Japan". The last author is Nobu Shuto, the most senior Japanese tsunamista, and ex-Professor at Tohoky University. What I found interesting is that they don't discuss anything about benchmarking numerical models, but only describe how scenario modeling should produce results that exceed historical events. Yes, thank you. However, in the example they provide on a M=7.8 earthquake in the Sea of Japan, the max tsunami height they calculate is about 20m. Why the TEPCO engineers who were aware of this paper didn;t question their results where a M=8.4 event produces a <6m runup, hopefully Hollywood will eventually find out.

Take care,

Costas

Costas Synolakis
Professor of Civil and Environmental Engineering, Director, Tsunami Research Center Viterbi School of Engineering, University of Southern California Los Angeles, California 90089-2531
www.usc.edu/dept/tsunamis

Beauty is truth, truth beauty
this is all you know on earth,
and all you need to know.
John Keats.

---- End forwarded message ----

Tsunami Assessment for Nuclear Power Plants in Japan.

Makoto TAKAO, PE

東京電力

TEPCO

TOKYO ELECTRIC POWER COMPANY

Agenda

1. Tsunami assessment for NPP on the Pacific coast.

2. Operational status of NPP after the Feb. 28, 2010 tsunami from Chile.

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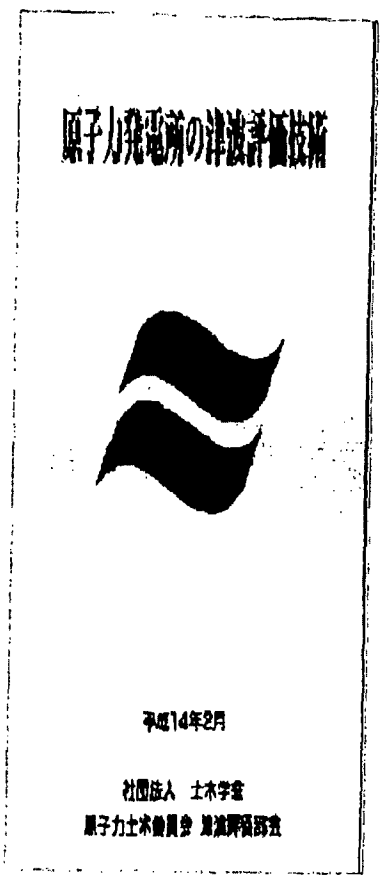
Agenda

1. Tsunami assessment for NPP on the Pacific coast.

JSCE Method

"Tsunami Assessment Method for Nuclear Power Plants in Japan (2002)"



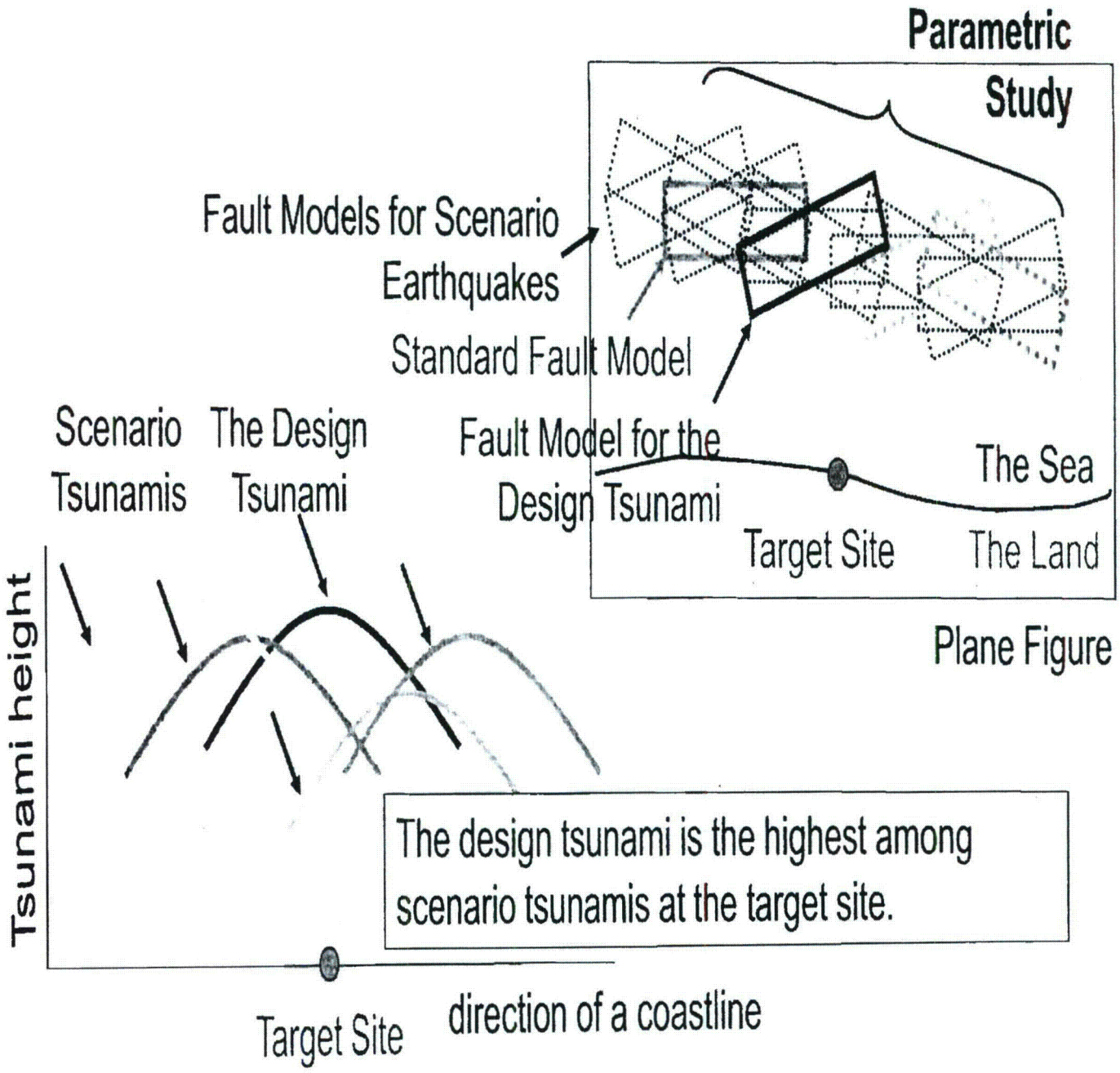
published by

Tsunami Evaluation Subcommittee,
Nuclear Civil Engineering Committee,
JSCE (Japan Society of Civil Engineers)

English version

http://www.jsce.or.jp/committee/ceofnp/Tsunami/eng/tsunami_eng.html

Parametric Study of Tsunami Source



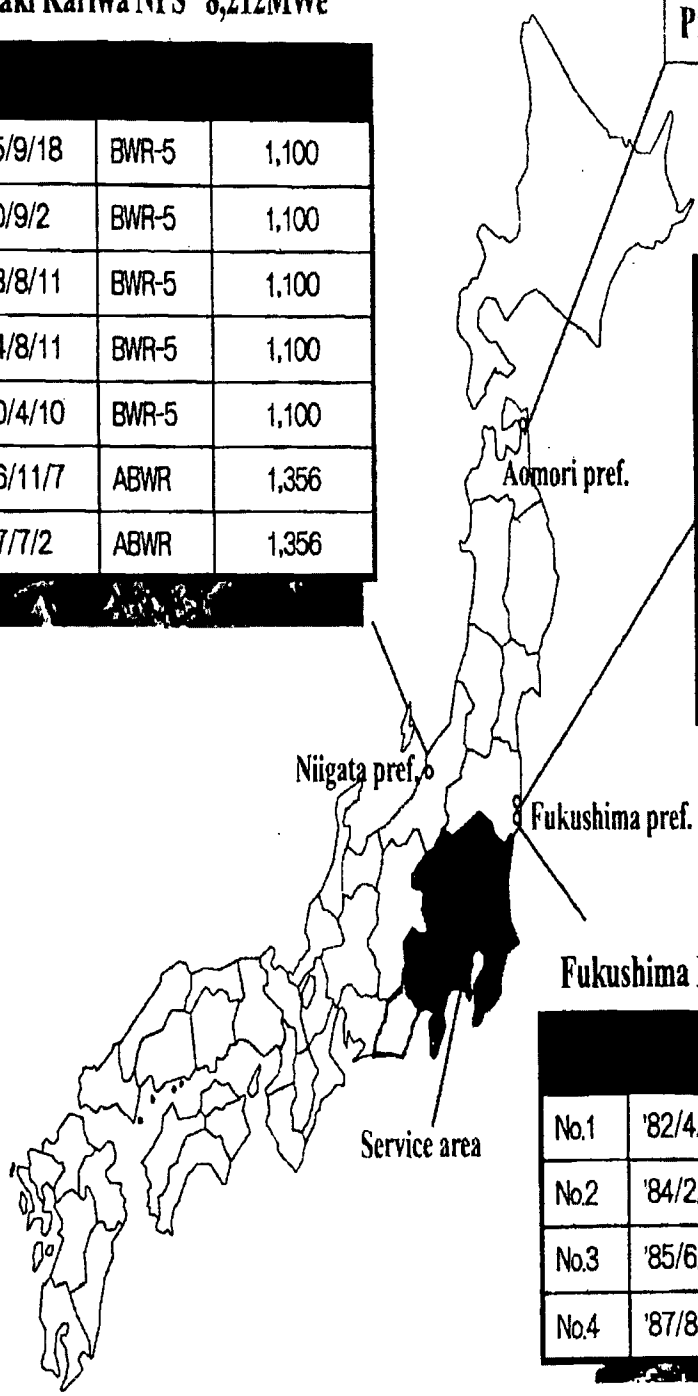
The design tsunami is the highest among scenario tsunamis at the target site.

TEPCO's Nuclear Power Stations

Higashidori Nuclear Power Construction Preparation Office

Kashiwazaki Kariwa NPS 8,212MWe

No.1	'85/9/18	BWR-5	1,100
No.2	'90/9/2	BWR-5	1,100
No.3	'93/8/11	BWR-5	1,100
No.4	'94/8/11	BWR-5	1,100
No.5	'90/4/10	BWR-5	1,100
No.6	'96/11/7	ABWR	1,356
No.7	'97/7/2	ABWR	1,356



Fukushima Daiichi NPS 4,696MWe

No.1	'71/3/26	BWR-3	460
No.2	'74/7/18	BWR-4	784
No.3	'76/3/27	BWR-4	784
No.4	'78/10/12	BWR-4	784
No.5	'78/4/18	BWR-4	784
No.6	'79/10/24	BWR-5	1,100

Fukushima Daini NPS 4,400MWe

No.1	'82/4/20	BWR-5	1,100
No.2	'84/2/3	BWR-5	1,100
No.3	'85/6/21	BWR-5	1,100
No.4	'87/8/25	BWR-5	1,100

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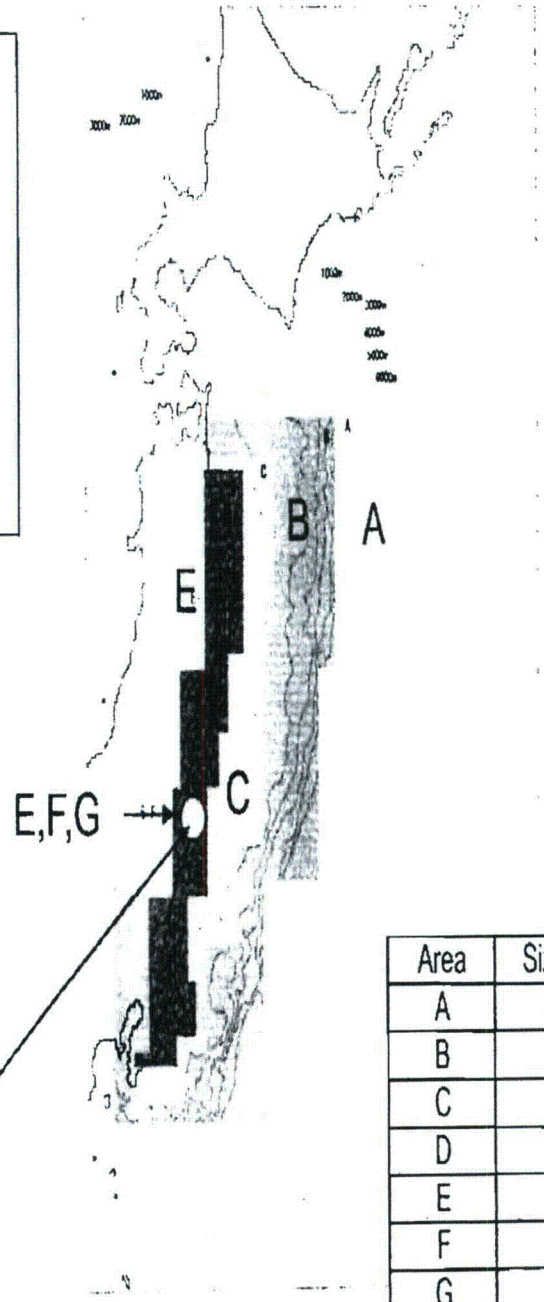
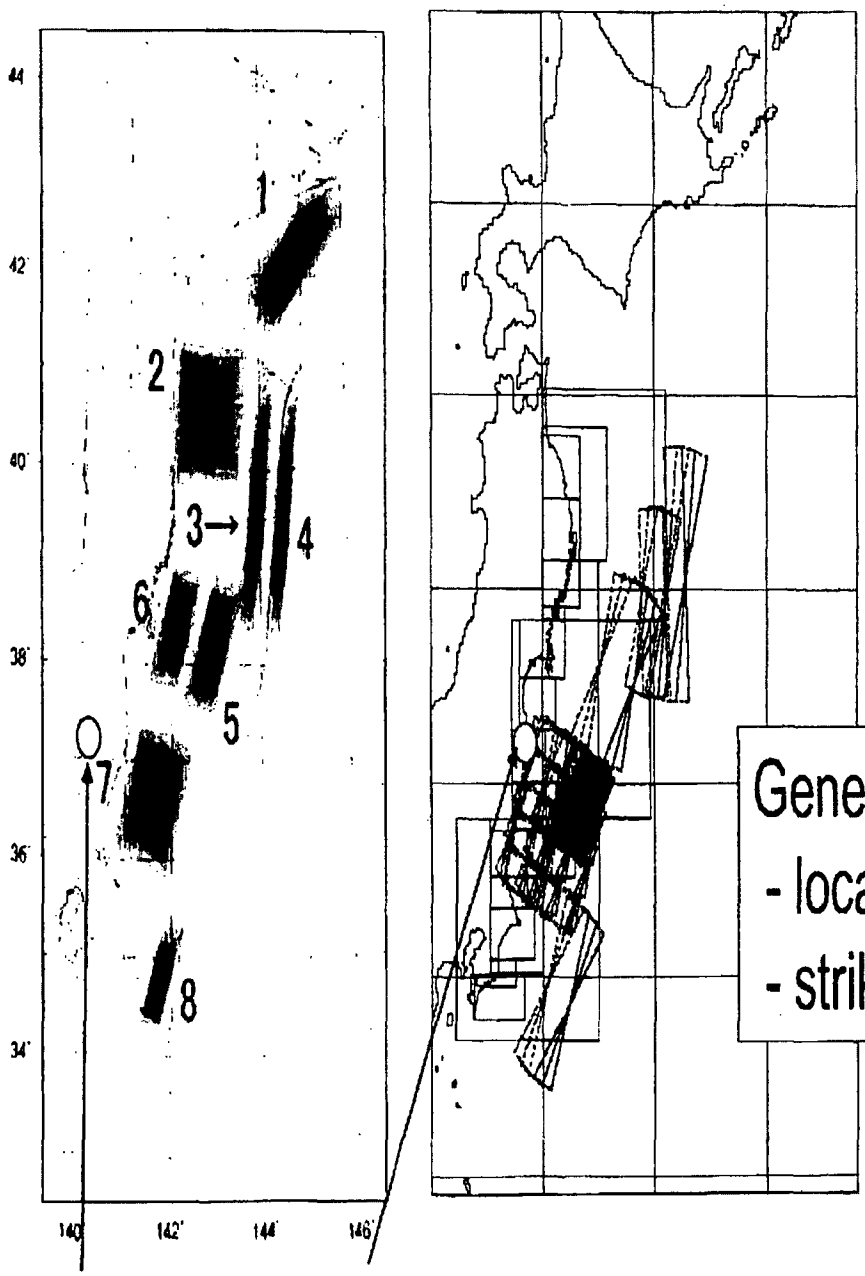
Numerical Model for the near field

- ✓ Non-linear long wave theory (shallow water)
- ✓ Staggered mesh
- ✓ Leap frog method



Area	Size of Grid
A	4320m
B	2160m
C	720m
D	240m
E	80m
F	40m
G	20m

General parametric study in the near field

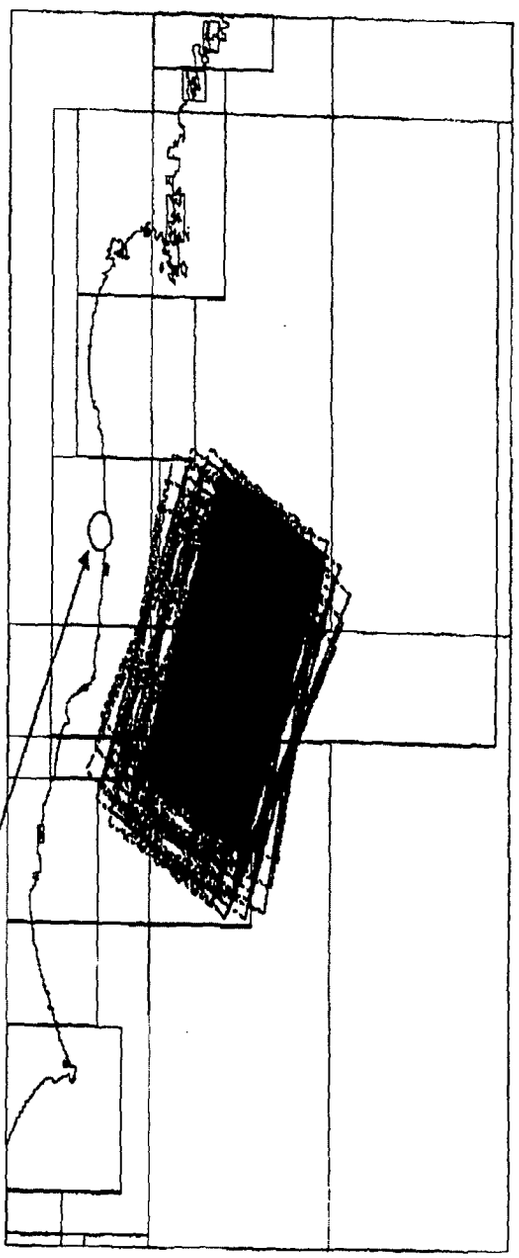


General parametric study
- location
- strike

Fukushima Daiichi NPS

Detailed parametric study in the near field

Detailed parametric study
- location
- strike
- depth
- dip angle
- slip angle



Fukushima Daiichi NPS

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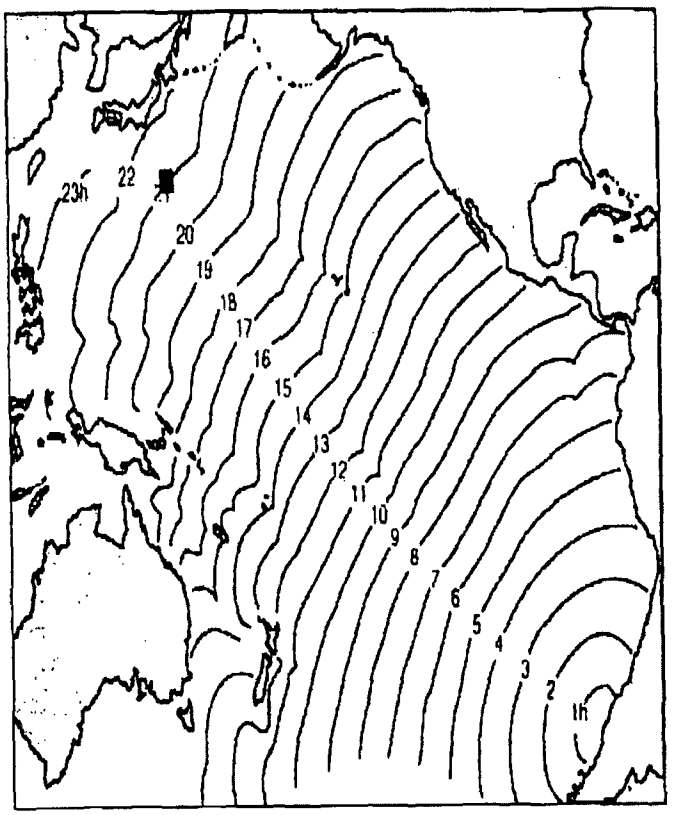
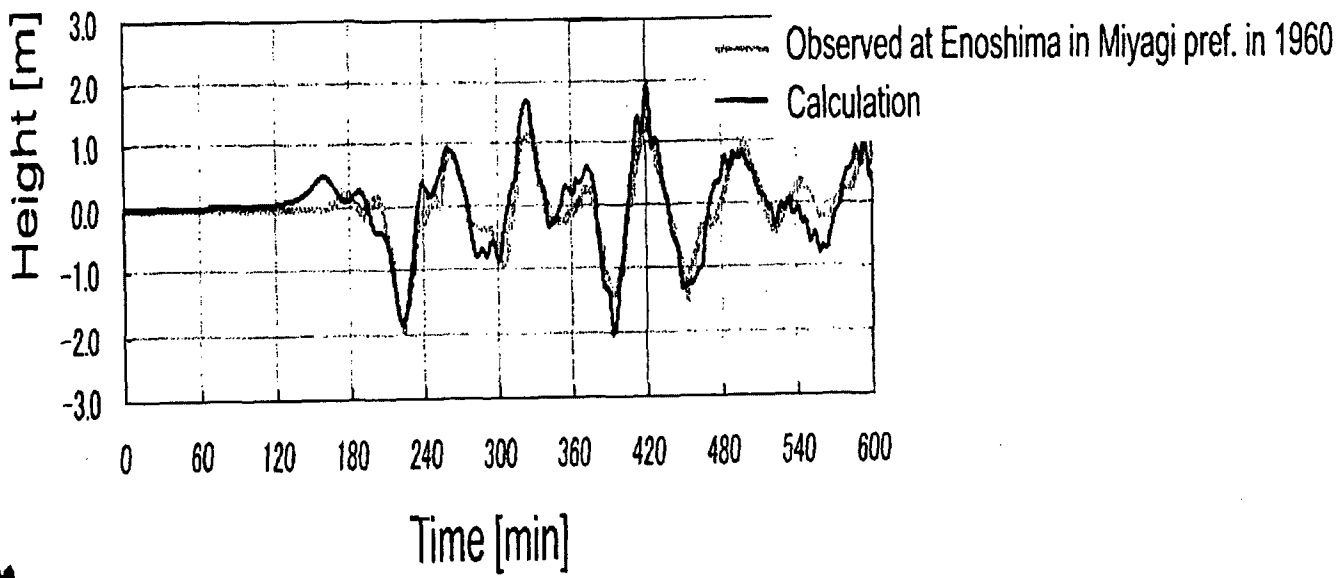
Tsunami from far field

- ✓ Linear dispersive theory for far field (spherical-coordinate system)
- ✓ Non-linear long wave theory for near field (Cartesian coordinate system)
- ✓ Staggered mesh
- ✓ Leap frog method





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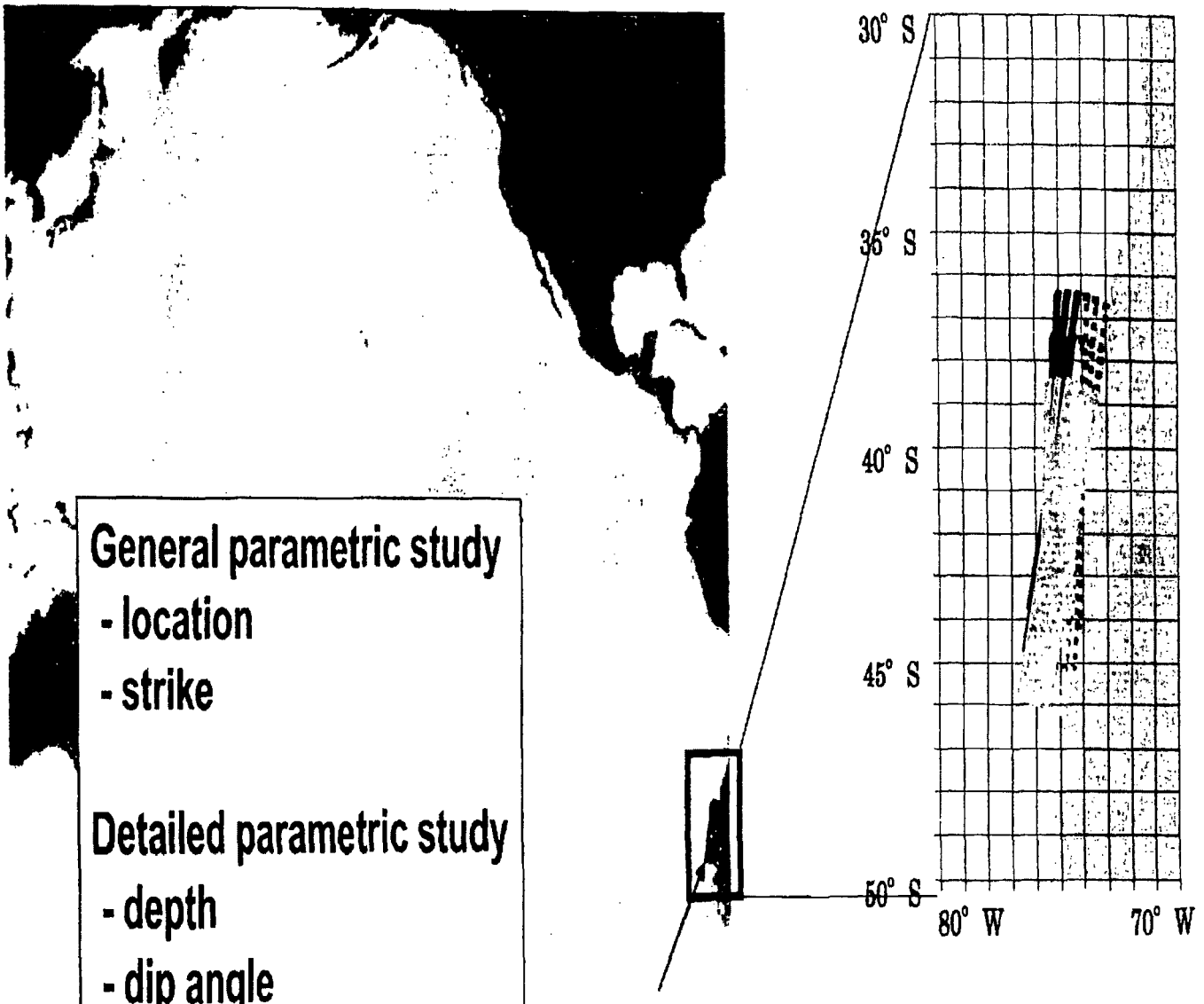
Parametric study in the far field



General parametric study
- location
- strike

Detailed parametric study
- depth
- dip angle
- slip angle

Standard fault model
1960 Chilean earthquake

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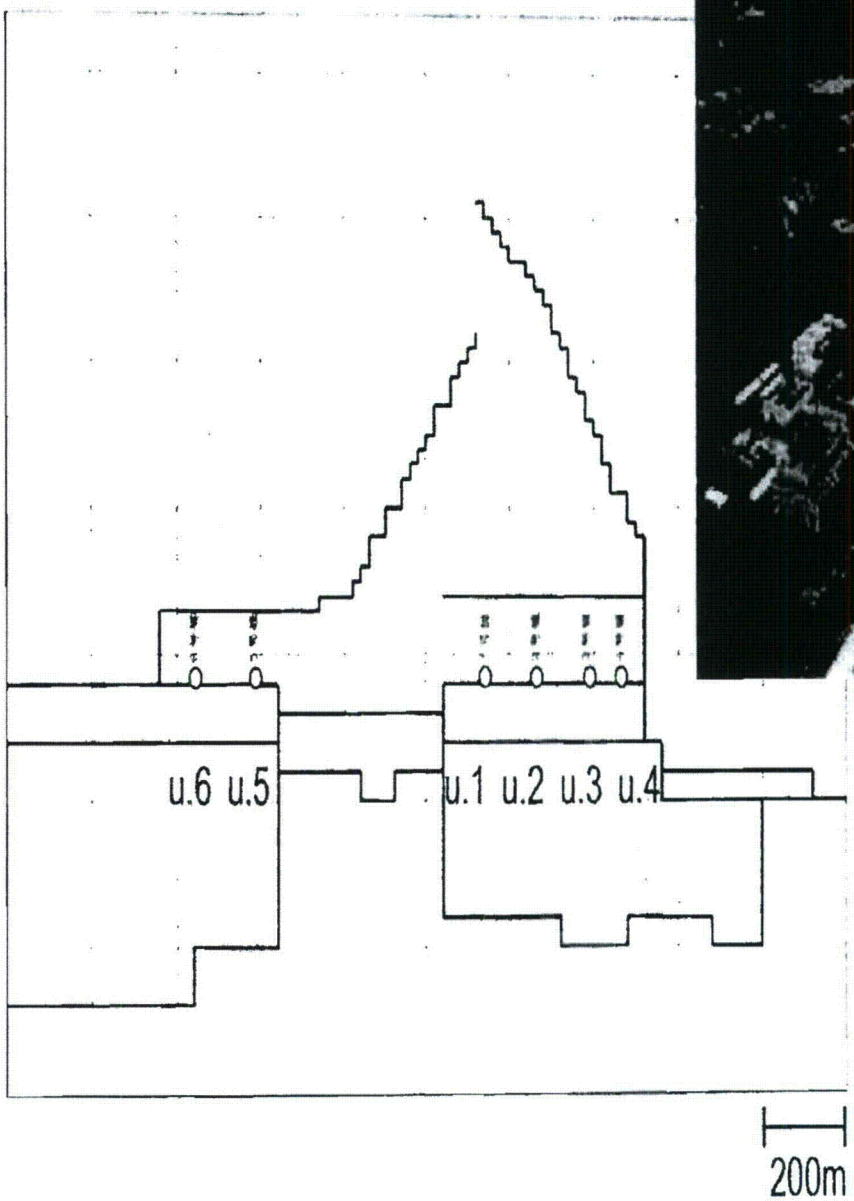
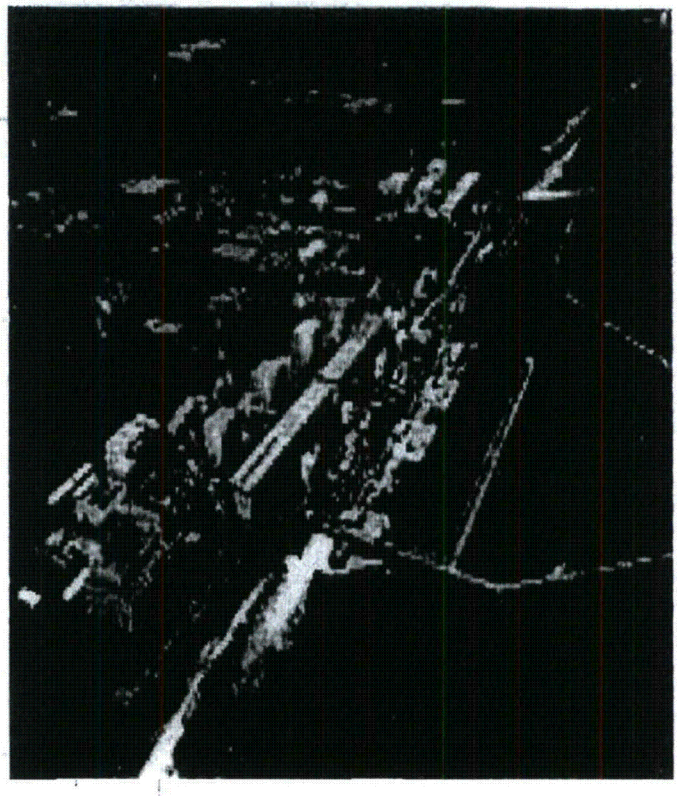
Location of assessment points

Fukushima Daiichi NPS





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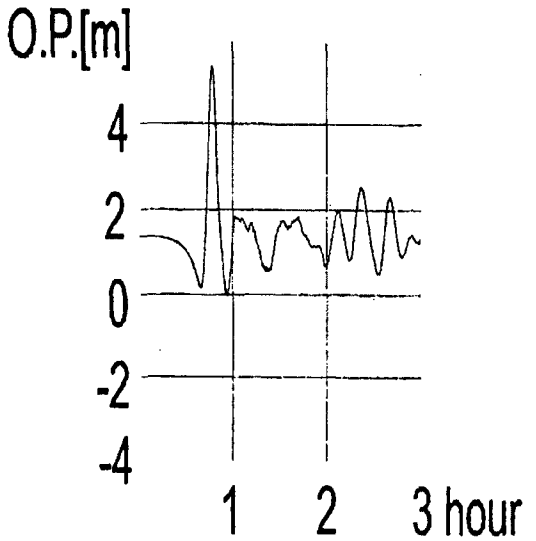
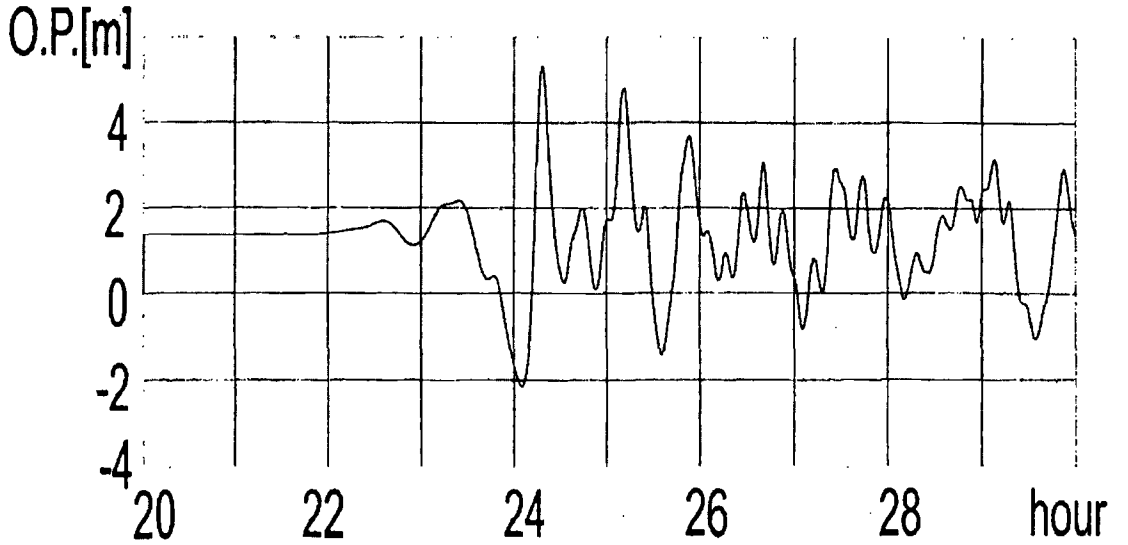
Time History of the design tsunamis

Near Field Tsunami



elapsed time since earthquake occurred

Far Field Tsunami - Chili -



elapsed time since earthquake occurred

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Consideration of tide and safety evaluation

The Design Tsunami

⇩ ⇦ Tidal Conditions

Design High Water Level

= Maximum water rise + Mean of high tides

Design Low Water Level

= Maximum water fall + Mean of low tides

⇩

Evaluation of the safety of NPP

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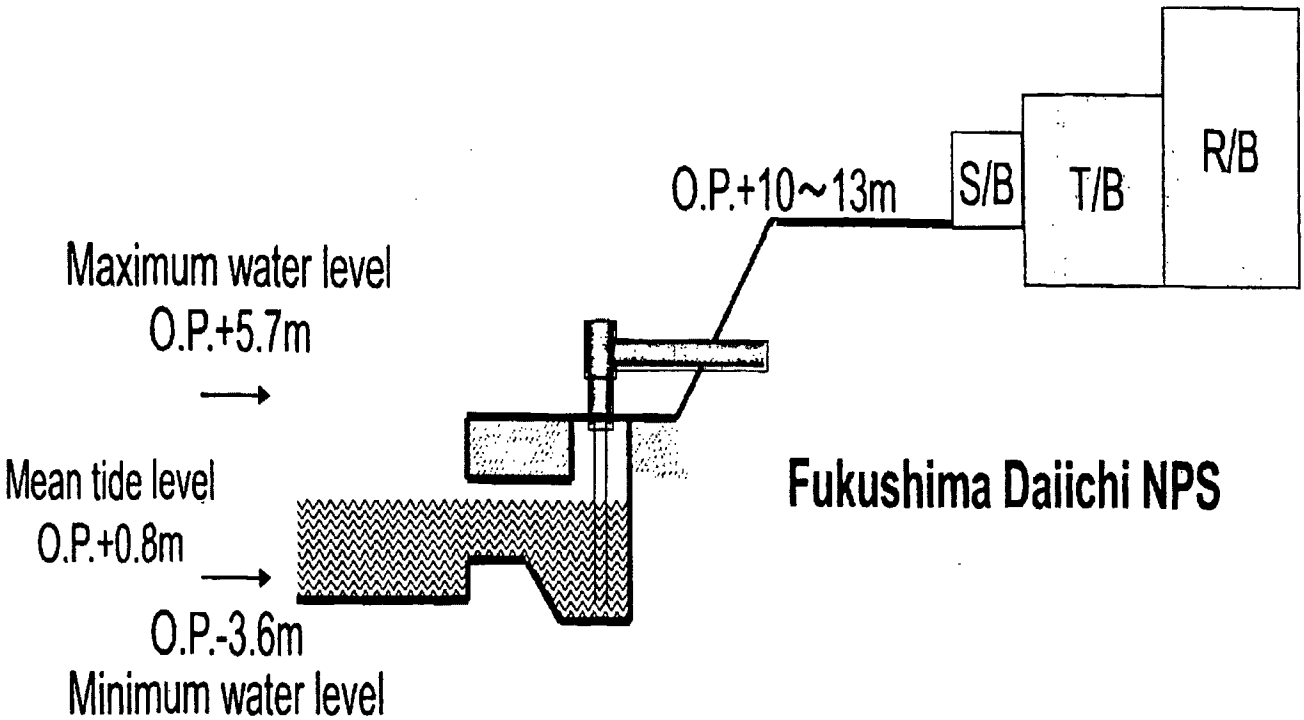
Summary of Evaluation

Maximum water level = 4.4m + O.P.+1.3m = O.P.+5.7m
Minimum water level = -3.6m – O.P.±0.0m = O.P.-3.6m



We assessed and confirmed the safety of the nuclear plants based on the JSCE method which was published in 2002.

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Agenda

2. Operational status of NPP after the Feb. 28, 2010 tsunami from Chile.

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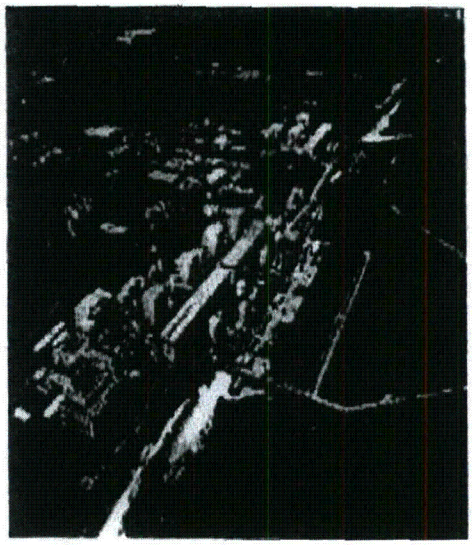
Operational status of NPP on Feb.28

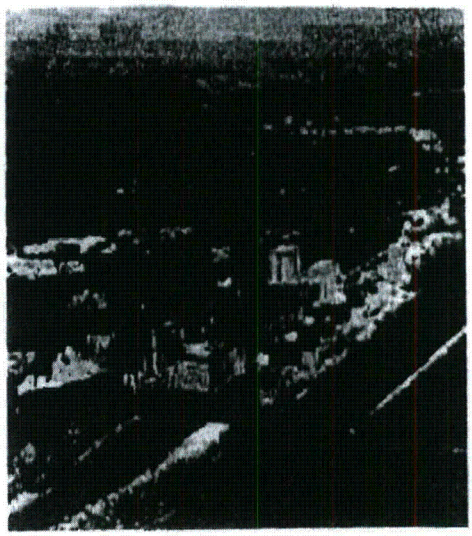
Fukushima Daiichi NPS

unit 1	in operation	459 MWe
unit 2	in operation	786 MWe
unit 3	in operation	789 MWe
unit 4	in operation	789 MWe
unit 5	in operation	823 MWe
unit 6	in operation	1,152 MWe



Fukushima Daini NPS

unit 1	in operation	1,113 MWe
unit 2	in operation	1,116 MWe
unit 3	regular maintenance	
unit 4	in operation	1,117 MWe



東京電力 TEPCO

Feb. 28th NPS Correspondence (1/2)

A manual containing emergency and restoration protocol in the event of a major disaster has been created.

In the event that the Japan Meteorological Agency (JMA) issues a "Tsunami Warning" for the coastline near the NPS, the following measures are to be executed:

1. The Central Control Room Operators are to maintain vigilance in monitoring plant operations.
2. The Site Superintendent is to contact employees who are on standby in a separate office room or at home.
3. If necessary, an emergency headquarter is to be set up.

Feb. 28th NPS Correspondence (2/2)

Both Fukushima Daiichi NPS and Fukushima Daini NPS executed the below measures in response to a "Tsunami warning" issued by JMA on Feb.28.

✓Discontinued the work and inspection of the area facing the ocean.

✓Measured the sea level utilizing a tide gauge and via several installed TV cameras monitored the ocean conditions .

✓Contacted employees to ready them for the execution of emergency disaster measures.

Correspondence based on Sea Level Measurements

- ✓ Utilizing the JSCE method, we assessed the ability of the NPP to withstand potential tsunamis.
- ✓ Based on the assessment results, the level of the seawater pumps was improved.
- ✓ "Accident Operating Procedure (AOP)" for tsunamis was established.

Acquiring tsunami information from JMA

↓

Drawdown of the sea level in response to the tsunami

↓

Monitoring of relevant parameters

↓

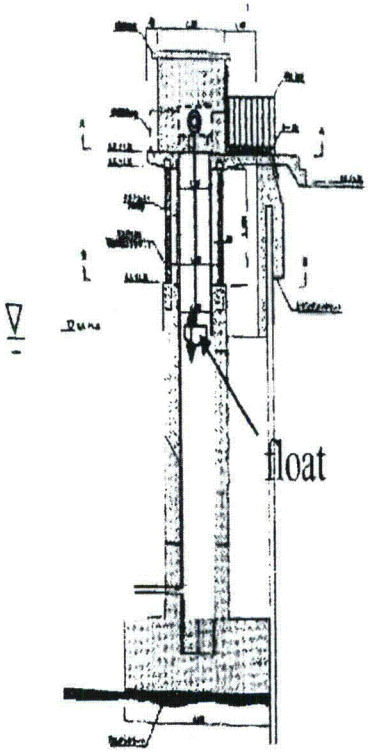
In case relevant parameter abnormalities continue, one of the circulating water pumps should be stopped.

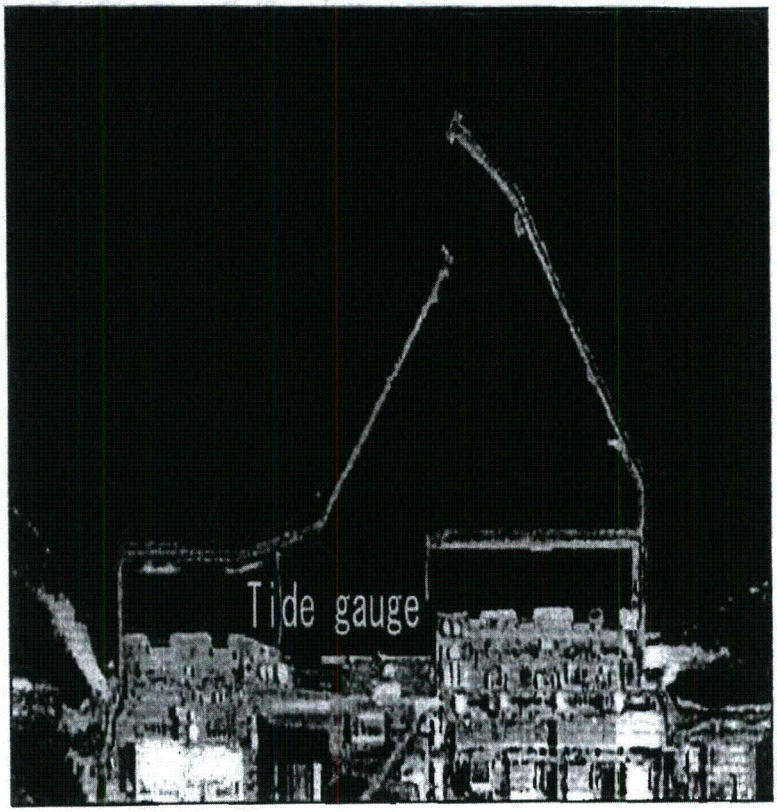
↓

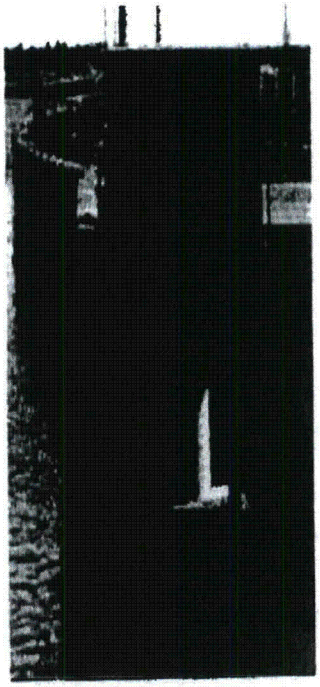
In case relevant parameter abnormalities continue, the other circulating water pumps should be stopped and the plant shut down.

Flowchart on the basis of AOP

Tide gauge at Fukushima Daiichi NPS

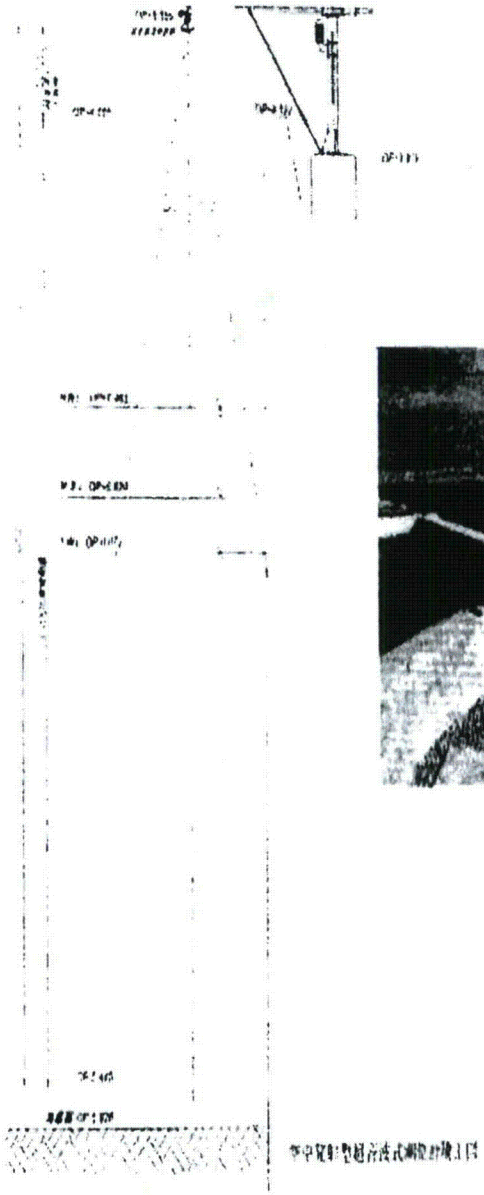




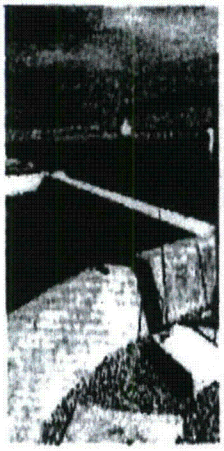


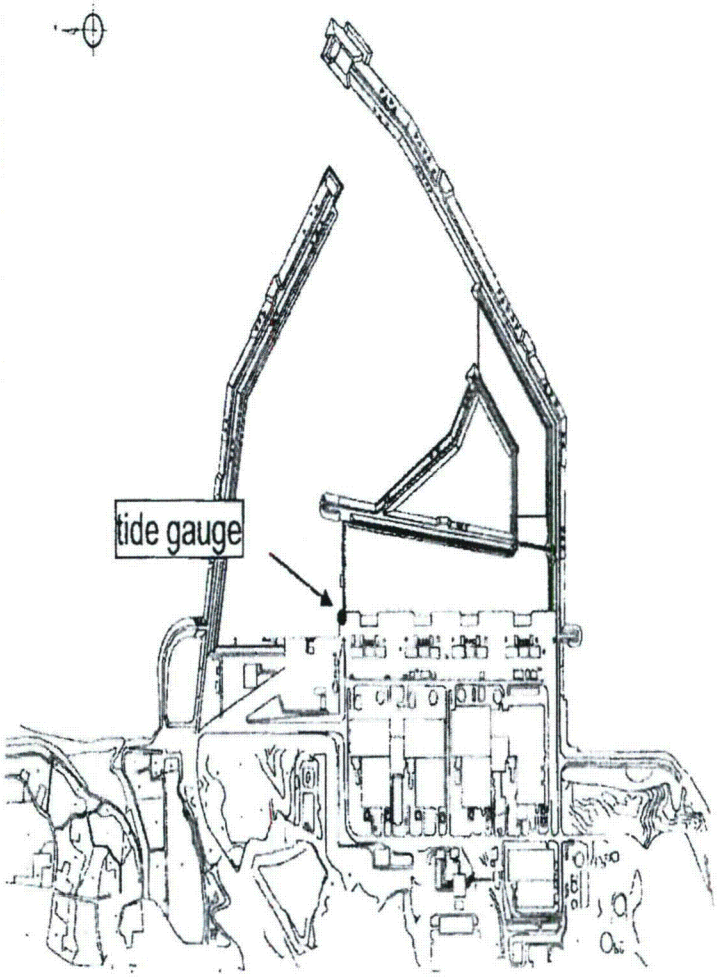
A float-type tide gauge is set up inside the harbor of the NPP.

Wave gauge at Fukushima Daini NPS



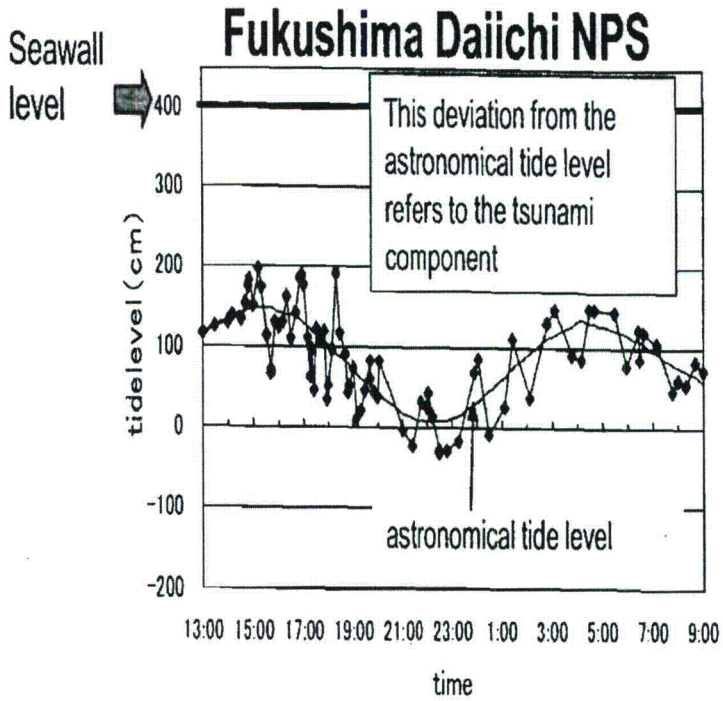
An ultrasonic-type tide gauge is installed inside the harbor of the NPP.



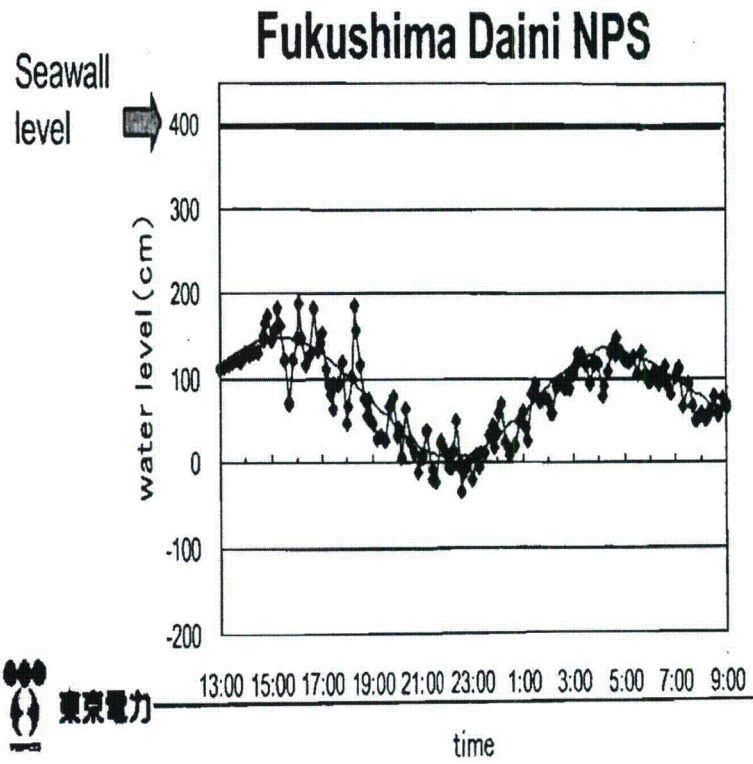


東京電力

Observational result of Chile tsunami on Feb.28



- ✓ Deviation from the astronomical tide was observed.
- ✓ The highest sea level did not reach the seawall level.
- ✓ The lowest sea level did not fall below the intake water level of the circulating pumps.
- ✓ Normal operations were not impacted.



	Tsunami component	
	rising	drawdown
Fukushima Daiichi	+ 0.6m	- 0.8m
Fukushima Daini	+ 1.0m	- 0.8m

東京電力

Summary

- ✓ We assessed and confirmed the safety of the nuclear power plants based on the JSCE method which was published in 2002.
- ✓ On Feb. 28, in response to the "Tsunami warning" issued by the Japan Meteorological Agency, appropriate measures in accordance with "Accident Operating Procedures (AOP) " were executed.
- ✓ Daily operations were NOT impacted.

Thank you very much for your kind attention.

ANDOU Hiroshige

Pure appl. geophys. 164 (2007) 565–576
0033–4553/07/030565–12
DOI 10.1007/s00024-006-0176-1

Pure and Applied Geophysics

Tsunami Assessment for Risk Management at Nuclear Power Facilities in Japan

KEN YANAGISAWA,[1] FUMIHIKO IMAMURA,[2] TSUTOMU SAKAKIYAMA,[3] TADASHI ANNAKA,[4] TOMOYOSHI TAKEDA,[1] and NOBUO SHUTO[5]

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(b)(4)

(b)(4)

Apostolakis, George

m: Apostolakis, George
: Monday, July 18, 2011 8:41 AM
Costas Synolakis
Subject: RE: TEPCO study

Costa:

There are no attachments.

George

Commissioner George Apostolakis
US Nuclear Regulatory Commission
One White Flint North, MS O16 G4
11555 Rockville Pike
Rockville, MD 20852

(301) 415-1810

From: Costas Synolakis [mailto:costas@usc.edu]
Sent: Sunday, July 17, 2011 9:00 PM
To: apostola@mit.edu
Subject: TEPCO study

ge, I am afraid I didn't send you the TEPCO study, presented in Nov 2010 "we assessed and confirmed the safety..." I attach it

I am also attaching another paper on the Japanese methodology about tsunami assessment, followed in the TEPCO study - it is essentially the journal version of their standards and guidelines. At the outset it says "Earthquakes of magnitude 8 would periodically occur in and around Japan". The last author is Nobu Shuto, the most senior Japanese tsunamista, and ex-Professor at Tohoky University. What I found interesting is that they don't discuss anything about benchmarking numerical models, but only describe how scenario modeling should produce results that exceed historical events. Yes, thank you. However, in the example they provide from a M=7.8 earthquake in the Sea of Japan, the max tsunami height they calculate is about 20m. Why the TEPCO engineers who were aware of this paper didn;t question their results where a M=8.4 event produces a <6m runup, hopefully Hollywood will eventually find out.

Take care,

Costas

Costas Synolakis
Professor of Civil and Environmental Engineering,
Director, Tsunami Research Center
Viterbi School of Engineering, University of Southern California
Los Angeles, California 90089-2531
www.usc.edu/dept/tsunamis

truth, truth beauty
you know on earth,
u need to know.
John Keats

Apostolakis, George ~~NOT FOR PUBLIC DISCLOSURE~~

om: Apostolakis, George
nt: Tuesday, July 19, 2011 5:09 PM
: Sosa, Belkys; Davis, Roger; Gilles, Nanette; Lui, Christiana
Subject: Please comment

Dear Mr. Boffey:

The commission is in the process of voting on how to proceed with the Task Force's recommendations. Chairman Jaczko's proposal is one of several being proposed. I cannot comment on it at this time.

Regarding the Task Force's report, I offer the following.

It is an excellent job given the short time that authors had to complete their work.

One point that I would like to emphasize, however, is something the report does not mention. The tsunami hazard had been seriously underestimated by the Japanese authorities. There is growing evidence that the historical record of tsunamis had not been used properly to determine the appropriate design basis at Fukushima, i.e., the required protection. What happened there was not "unthinkable", as some people proclaim.

I hope this is helpful to you.

Commissioner George Apostolakis
US Nuclear Regulatory Commission
e White Flint North, MS O16 G4
55 Rockville Pike
Rockville, MD 20852

(301) 415-1810

~~NOT FOR PUBLIC DISCLOSURE~~

MICHAEL FASSBENDER

July 23, 2011

In the Wake of Fukushima

After the devastating accident at Japan's Fukushima nuclear plant, many Americans have asked whether something just as horrible could happen here.

The odds are remote that this country will confront a similarly powerful earthquake followed by an even more destructive tsunami — the twin blows that disabled Fukushima. But the possibility that something equally unexpected and unplanned for could exceed current defenses at American plants cannot be discounted.

If nuclear power is to have a future in this country, Americans have to have confidence that regulators and the industry are learning the lessons of Fukushima and taking all steps necessary to ensure safety.

The Japanese plant was first hit by the shocks from one of the most powerful earthquakes ever recorded, which knocked out connections with the electrical grid. Soon after, a 45-foot-high tsunami wave inundated the plant and knocked out its backup diesel generators, leaving insufficient emergency power to keep cooling water flowing through the reactor cores. The exposed fuel was partially damaged, and there were explosions of hydrogen.

Radiation spread beyond the plant. Tens of thousands of local residents were forced from homes, and tens of thousands more were urged to evacuate more distant areas. No one knows when they will be able to return or when a final cleanup will be completed.

In the wake of the disaster, this country's Nuclear Regulatory Commission assembled a task force to look at what happened in Japan and to assess the United States' ability to withstand a disaster of its own. This month the group issued thoughtful and common-sense recommendations. The five commissioners should quickly adopt them.

The group's most important finding is that our nation's oversight of nuclear power plants is a less than rigorous "patchwork" of mandatory and voluntary provisions. Some critical safety components are regulated, but others are left to voluntary action by the nuclear industry and the companies that operate the plants.

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Gilles, Nanette

From: Apostolakis, George
Sent: Tuesday, July 26, 2011 2:45 PM
To: Baggett, Steven; Biggins, James; Cunningham, Mark; Davis, Roger; Gilles, Nanette; Lui, Christiana; Reckley, William; Sosa, Belkys
Subject: FW: INSAG Report on the Fukushima Accident
Attachments: Report 7-26-11.pdf

-----Original Message-----
From: Richard Meserve [mailto:rmeserve@carnegiescience.edu]
Sent: Tuesday, July 26, 2011 1:37 PM
To: Jaczko, Gregory; Ostendorff, William; Svinicki, Kristine; Apostolakis, George; Magwood, William
Cc: Doane, Margaret; Henderson, Karen
Subject: INSAG Report on the Fukushima Accident

Ladies and Gentlemen --

As you may know, INSAG was asked by Director General Amano to prepare a report that would provide recommendations for action by the IAEA in connection with the Fukushima accident. I attach a copy of the report that I transmitted to him today.

It is my understanding that the DG will use the INSAG report and a report that the IAEA staff are preparing based on the June Ministerial
in the development of an "Action Plan." That plan will then be used in
consultations with Member States, in anticipation of the presentation of the Action Plan for approval at the Board of Governors meeting in September.

Best regards.

Dick

--
Richard A. Meserve, President
Carnegie Institution
1530 P St., NW
Washington, DC 20005
202-387-6404
www.carnegiescience.edu

CARNEGIE
INSTITUTION FOR
SCIENCE

July 26, 2011

OFFICE OF THE PRESIDENT

Richard A. Meserve
rmeserve@ciw.edu

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202 387 8092

www.ciw.edu

Director General Yukiya Amano
International Atomic Energy Agency
Wagramer Strasse 5
A-1400 Vienna
AUSTRIA

Re: The Fukushima Accident

Dear Director General Amano:

I am writing on behalf of the International Nuclear Safety Group ("INSAG") in response to your letter of July 5, 2011. This letter report is intended to respond to your request for INSAG recommendations to guide future actions related to the Fukushima accident. It will constitute INSAG's annual safety-assessment letter for 2011.

I understand that the IAEA staff is preparing a report discussing the Fukushima accident, the Ministerial Conference of June 20-24, and various conclusions and recommendations drawn from the deliberations at the Conference. Rather than duplicate the staff's effort, I shall set out certain recommendations reflecting INSAG's insights. This letter report is intended to supplement the staff's effort. It will draw on information presented at the Ministerial Conference, our knowledge of various other efforts to analyze the accident, and the experience of INSAG members.

I should emphasize at the outset that this letter can constitute only an early effort to draw lessons from the Fukushima accident. At this stage, the world community has only a preliminary understanding of the accident and I anticipate that an extended period will be necessary before full understanding is achieved. In this connection, it is worth noting that a complete understanding of the Three Mile Island accident required an assessment of the condition of the core that was not available until six years after the accident. I anticipate that future reports by INSAG and others to extend and elaborate the lessons from the Fukushima accident will be appropriate as more is known. *All the lessons that should be drawn from the Fukushima accident cannot yet be known and thus aggressive efforts to learn from the accident should continue. Nonetheless, it is worth taking stock of the accident so that safety vulnerabilities that are now apparent can be addressed promptly.*

In Part I of this letter, I shall describe the responsibilities for ensuring safety. In Part II, I shall turn to certain of the substantive issues that arise from the Fukushima accident. Then, in Part III, I shall outline some INSAG recommendations, focusing on recommendations directed at the IAEA and the Member States.

I.

There is a hierarchy of responsibility for ensuring nuclear safety. The prime responsibility for safety rests with the reactor operator; the operator controls what happens in the plant and, as a result, can best assure continuing safe performance. The operator must have the engineering, financial, and management capability to ensure not only that the plant is built and operated in a safe fashion, but also that it operates with safety as the highest priority. In turn, a national nuclear safety regulator undertakes the reinforcement and policing of the operator, defining the operator's responsibilities and seeking to ensure that those responsibilities are being met. Operators and national regulators play the essential roles in ensuring safety.

There is an important backstop to the operator and regulator: the global nuclear safety framework. That framework is a collective international enterprise that seeks to define a level of performance expected of all operators and regulators, to monitor their performance, and to build their competence and capability. This overall framework has grown and developed in an *ad hoc* fashion over many years. It is made up of several components: intergovernmental organizations such as the IAEA and the Nuclear Energy Agency ("NEA"); multinational networks among regulators, including the International Nuclear Regulators Association and the Western European Nuclear Regulators Association; multinational networks among operators, the most important of which is the World Association of Nuclear Operators ("WANO"); the international nuclear industry, including vendors and architect-engineering firms; multinational networks among scientists and engineers, fostered by scientific and engineering societies; standard development organizations; and nongovernmental organizations and the international press. A web of international conventions, international safety standards, codes of conduct, joint projects, and international conferences and workshops holds the system together. They constitute the "glue" that connects the global enterprises to the national programs. See generally *Strengthening the Global Nuclear Safety Regime* (2006) (INSAG-21).

Every participant in this overall framework has the responsibility after the Fukushima accident to determine changes that should be made in its activities in order to address the safety vulnerabilities that the accident has revealed. The chief responsibility to identify necessary changes rests with operators and national regulators, but all have important roles to play.

II.

The IAEA fact-finding mission to Japan and the Ministerial Conference provided considerable information about the Fukushima accident. Although much remains to be learned, the Fukushima event revealed a variety of areas that warrant further scrutiny by those involved in nuclear safety. We note the following items not as a criticism of Japan, but as an identification of possible vulnerabilities that should be of concern to all those engaged in the nuclear enterprise.

1. Regulatory Structure. The nuclear regulator must have independence, legal authority, competence, and adequate human and financial resources to fulfill its responsibilities. See *Fundamental Safety Principles*, 3.10 (2006) (SF-1). The regulator should ensure that any significant safety deficiency is promptly addressed by the operator through design or procedural improvements. This obligation extends to insights that are derived from events and initiatives that occur outside of the regulator's home country. Every country should undertake an examination of these matters to ensure that an effective and appropriate structure for ensuring safety is in place.

2. Chain of Command. There needs to be clear and unambiguous definition of responsibilities within the management structure of the operator, the regulator, and the government more generally in the event of an accident. The objective is to ensure that there is a pre-defined command-and-control system to ensure that necessary accident management decisions can be taken promptly at the proper operational level. It is important to have a chain of command that can react swiftly to an accident and thereby minimize the overall consequences for society. Of course, responsibility and competence must go together.

3. Extreme Events. The Fukushima operators were confronted with a tsunami that far exceeded the design basis for the plant. One obvious response to the Fukushima accident involves the evaluation of extreme events – earthquakes, tsunamis, hurricanes, typhoons, floods, and the like – and of the adequacy of the capacity to deal with them. There may be the need to guard against extreme natural hazards of an intensity and frequency larger than those considered in the original nuclear power plant design. See Letter from R.A. Meserve to M. ElBaradei (Aug. 25, 2008) (2008 INSAG Safety Assessment Letter).

4. Severe Accidents. Nuclear power plants are designed with the capacity to respond to certain "design basis accidents" – accidents reflecting expected operational occurrences and certain postulated accidents, such as a loss-of-coolant accident involving a major pipe break. These events are used to establish the functions and capacities of safety-related plant systems, structures,

and components. Accidents outside the scope of the plant's design basis are termed "beyond-design-basis" events; if the plant is unable to cope with such events without significant damage to the reactor core, these events may progress to become "severe accidents." Because of the potential for the release of radioactivity from the plant once the core is damaged, these events represent the primary source of risk to the public from the operation of nuclear power plants. The Fukushima accident was a beyond-design-basis accident because the plant was threatened in ways that were unanticipated in the design, and it became a severe accident when the operator was unable to mitigate the consequences of the event prior to core damage in the three reactors that were operating at the time of the earthquake. The event reinforces the need for defense against severe accidents by reducing the likelihood of such events, by preparing the plants to respond without significant damage, and by limiting the consequences of a severe accident if one should occur. A recent INSAG report on the integration of the results of Probabilistic Safety Assessments and deterministic defense-in-depth considerations should be helpful in this respect. See *A Framework for An Integrated Risk-Informed Decision-Making Process* (2011) (INSAG-25).

5. Station Blackout. The various systems that were intended to provide core cooling at the Fukushima plant either failed or ultimately were unavailable, largely as a result of the loss of all emergency AC power. The accident shows that emphasis should be placed on assuring the availability of off-site power to the extent possible through redundancy in power supply lines and switchyard facilities, and on providing emergency diesel generators that are not vulnerable to extreme events. Consistent with the philosophy of defense in depth, there also is a need for assurance of the ability to cope with a station blackout for an extended period, including both on-site coping capacity and the ability to marshal off-site resources promptly. The backup power supply should be able to provide support of key important safety functions, including the cooling of the core and the inventory of spent fuel in pools, for several days of blackout.

6. Loss of Heat Sink. As a result of the tsunami, the Fukushima units lost the capacity to release the heat being produced by the cores of units 1-3 to the heat sink (the ocean). The event reinforces the need not only to evaluate the capacity to restore an ultimate heat sink promptly under accident conditions, but also to include in accident planning consideration of alternative means for providing an ultimate heat sink for an extended period in the event that normal and safety-related heat transport systems are unavailable.

7. Explosive gases. The reactor buildings at the Fukushima Daiichi plant were destroyed by the accumulation of hydrogen inside the buildings and its subsequent explosion. The accident should prompt a careful examination of the means to prevent the buildup of dangerous gases or to mitigate their capability to cause damage to key plant structures.

8. Spent Fuel Pools. The Japanese confronted considerable challenges in maintaining the water inventory in the spent fuel pools. Special examination is warranted to ensure that there are diverse and redundant means to monitor water temperature and level and to ensure the maintenance of water inventory in order to avoid a release from a spent fuel pool.

9. Emergency Planning. The Fukushima event reinforces the reality that the unexpected can occasionally occur. The event reinforces the importance of having an integrated emergency response capability that is in place at and in the area surrounding the plant site, at the national level, and at the international level. The emergency response plans should not assume the availability of infrastructure, such as communications systems, that could be unavailable as a result of an extreme event. Moreover, the Fukushima accident reveals that problems at one unit could affect the capacity to respond at the other units. A thorough review of emergency planning is warranted to ensure that there are reasonable response strategies for such circumstances. Careful training and realistic exercises should be conducted to verify the capacity to implement the strategies.

No doubt, many other issues will emerge as a fuller understanding of the Fukushima accident is obtained.

III.

Although, as noted above, all the participants in the nuclear enterprise have responsibilities for review of these matters and for the implementation of necessary responses, I know that you are particularly interested in actions that the IAEA and its Member States should undertake. Many of the items identified here were raised in your address to the Ministerial Conference and in the Chairmen's Summaries arising from that Conference.

1. Safety standards. IAEA safety standards provide important guidance for national regulatory requirements and serve as the basis for IAEA peer reviews. As a result, the IAEA safety standards serve as the common reference around the globe for all those involved in the nuclear enterprise. Because of the singular importance of the standards, the IAEA should seek to assess the Fukushima accident to determine whether it reveals deficiencies in the existing standards or rather in their implementation. As necessary, the IAEA should update the standards to incorporate the lessons learned from the accident. (Indeed, I understand that exactly this task will be undertaken the IAEA's Commission on Safety Standards.) We anticipate that assessment of the standards might cover many of the items identified above. The Member States should assure that their regulatory requirements are modified to reflect enhancements in the international standards.

As part of this process, it should be noted that the strength and validity of the IAEA standards is ensured by careful and methodical analysis by competent international safety experts and the development of consensus. We encourage involvement in the development of standards by all relevant parties, including not only experts from regulatory bodies, but also experts from vendors, manufacturers, operators, and research organizations, as appropriate.

2. Peer Review Services. The IAEA's various peer-review services provide an important means to enhance safety by revealing vulnerabilities that might not otherwise be apparent and by encouraging continuous improvement. It is expected that the Fukushima accident will provide a wealth of important information that should be embodied in the peer-review services. There are several aspects of the peer-review system that could be strengthened:

- All countries should be strongly encouraged to obtain the benefit of the variety of peer-review services on a periodic and regular basis. There should be follow-up missions to assess the adequacy of the responses to issues that are raised by earlier missions.

- Transparency with regard to the results of the peer-review missions, the response to them, and the follow-up missions should become the norm. The availability of these assessments is an important element in ensuring public confidence. It would be appropriate, in any event, to provide information about the use of the peer-review services by Member States, as well as the identification of those who have not participated.

- Many countries have undertaken an immediate review of the capability to respond to extreme and/or beyond-design-basis events and loss of safety systems and of the adequacy of the emergency response arrangements. (All countries should be encouraged to do so.) The IAEA should seek to assemble the broadly applicable lessons that can be derived from these efforts and incorporate them in its review services, as appropriate. The IAEA has an important role to play in nurturing the exchange of information and in offering assistance at the request of a Member State.

- The IAEA's mission to evaluate a nation's regulatory program (IRRS) includes a module for "regulations and guides." Review under this module might appropriately focus on an assessment of the consistency between the national regulations and the IAEA safety standards. The national regulators should prepare for an IRRS review by conducting a self assessment of consistency.

- Design review missions should become a regular practice in all Member States. They may be particularly appropriate in connection with periodic safety reviews or consideration of lifetime extension by national regulators. In order to enable a deep review, the efforts might focus on certain topical areas of particular importance to a given plant, such as protection from external hazards, diversity of means to transfer heat to a heat sink, or provision of means to protect reactor containment after a core meltdown.

3. International Emergency Preparedness and Response. Although the national operator and regulator each have different and special responsibilities for response to an accident, the IAEA can play an important role in facilitating their response and in helping to marshal international assistance. There are several elements of the IAEA's capability that should be strengthened:

- The Fukushima accident revealed a hunger for information about the accident by numerous regulators and other institutions. Unfortunately, much of the information of interest was simply not available, with the result that at times speculation substituted for fact. Although it would likely not be possible for the IAEA to provide information during the course of an accident that requires information about the detailed plant design or of modifications to the plant during its life, the IAEA could play a stronger role as a clearinghouse for information. It might be possible, for example, for the IAEA to provide some analyses of the progress of the accident, the estimation of the source term, and the projected radiological impacts on affected populations. In order to accomplish this role, the IAEA might have to augment its staff temporarily by making pre-accident arrangements for assistance from international experts with the necessary technical knowledge.

- The IAEA could play a stronger role in the future in coordinating the international emergency response. Many countries sought to help Japan, but there is a need to strengthen the means to ensure that assistance of the right type is made available promptly. The framework for such a system is in place through the IAEA's Response and Assistance Network ("RANET"), but it could be augmented. It is appropriate to follow up on the recommendations and conclusions of the plan to strengthen RANET that was prepared in 2009. The network would be enhanced if more Member States would register their special capabilities with RANET and if regional coverage were expanded.

- The International Nuclear Event Scale ("INES") did not serve the purpose of providing a simple and intelligible assessment of the severity of the Fukushima accident. It should be reviewed and possibly revised.

4. International Conventions. There are a variety of international conventions that bear directly on the response and evaluation of nuclear accidents: the Convention on Nuclear Safety (CNS), the Convention on Early Notification of a Nuclear Accident, and the Convention on Assistance in the Case of a Nuclear Accident. Although the various responses to the Fukushima accident described elsewhere in this letter should not be delayed, a longer-term effort should involve the evaluation of these conventions in light of the events at the Fukushima accident to determine if any modifications or amendments are appropriate. This opportunity will arise at a special meeting of the parties to the CNS to be held in 2012 to discuss the Fukushima accident. Because the amendment of a convention is a protracted and difficult process, efforts should also be made to improve the effectiveness of the conventions within the scope of their current terms. There has been criticism, for example, that the recent review meetings of the CNS no longer are as productive as the initial meetings. Means should be found to revitalize the review process by providing more focus to the review meetings. Perhaps the observations from peer-review missions to a given country could be the foundation of the review meeting for that country.

5. International Safety Research. The underlying technical phenomena associated with the Fukushima accident, including such matters as fuel and system performance, hydrogen generation, and behavior of the spent fuel in the pools, should be the focus of research programs. International cooperation on such research should be pursued through the existing NEA framework. The IAEA should seek to ensure that the results are reflected in its safety programs and that all countries benefit.

6. Remediation. The Japanese will confront a major challenge in remediating the lands that were contaminated by the Fukushima accident. The IAEA can play a role in marshaling international expertise to assist in the effort and, in turn, the IAEA should ensure that the lessons that are learned from the remediation are made available to the international community.

7. Other Matters. There are a variety of matters that, while not directly related to the Fukushima accident, warrant aggressive action by the IAEA. The Fukushima accident reinforces the broader reality that continued work across the spectrum of activities that enable safety is warranted.

- New entrant countries. It is noteworthy that the three major nuclear accidents – Three Mile Island, Chernobyl, and Fukushima – occurred in technically sophisticated countries with advanced nuclear power

programs. The lesson to be learned from this fact is that ensuring nuclear safety requires hard and dedicated work even in advanced countries. The challenge no doubt is greater in those countries without an extensive background in similarly sophisticated technology. But, as you know, there are many countries without experience with nuclear power that have launched programs to construct a plant or are advancing in that direction. There should be aggressive efforts by the IAEA – and by all others involved in the nuclear enterprise – to ensure that countries moving ahead with nuclear construction can be successful in ensuring safety. The IAEA should reach out to these countries to provide both the education about the necessary infrastructure that must be established and the services to monitor and assist their progress in complying with international standards. Vendors and the regulatory organizations in the vendors' home countries also have particularly important roles to play. Our thoughts concerning actions to respond to this important issue are explained more fully in my correspondence of last year. See Letter from R.A. Meserve to Y. Amano (Aug. 25, 2010) (2010 INSAG Safety Assessment Letter). See also *National Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles* (2008) (INSAG-22).

- Operating Experience. Those who do not learn from the past are condemned to repeat it. The operating experience from existing plants can provide important lessons as to how to avoid accidents from which all should benefit. The operational feedback provided by WANO is very useful in this respect, but the content of this system is confidential and is available only to operators. There thus needs to be an effective system to provide operating experience feedback to regulators and others that is drawn from enhanced communication among the IAEA, operators, regulators, WANO, and no doubt others. This can best be accomplished through enhancement of the Incident Reporting System ("IRS") maintained by the IAEA and the NEA, as well as through topical reports on measures that should be considered for enhancing safety on the basis of lessons learned. INSAG has published a report that outlines the changes that we believe are required. *See Improving the International System for Operating Experience Feedback (OEF)* (2008) (INSAG-23). Although the need to enhance the system for operational experience feedback has been discussed in recent years, there is little apparent progress in reducing risks and enhancing safety on the basis of lessons from other countries' experience. This matter deserves increased attention.

* * *

Let me close by noting that the IAEA is the central international body dedicated to improving nuclear safety. As the Fukushima accident has reinforced, this mission is of singular importance. The world was riveted by the events in Fukushima, reflecting the public expectation that high levels of safety must be achieved everywhere. The IAEA should play a central role in meeting this need.

Only about 9 percent of the most recent IAEA regular budget is allocated to safety and security. Although I do not dispute the importance of the various activities pursued by the IAEA, it is apparent that the staffing and budget for safety may need to grow significantly to meet the expanded needs that the IAEA must satisfy. In this connection, it appropriate to note that the cost increase associated with the IAEA's safety work is likely to be only a small fraction of the costs associated with a severe accident. Let me add, growth is necessary not only to allow a timely and effective response to the lessons from Fukushima, but also to reflect the need for substantial international assistance to enable the new entrant countries to succeed in their first application of nuclear power. Of course, any increase in the budget allocation for safety must be accompanied by a commitment by the IAEA to deploy those resources efficiently and effectively.

I hope that this letter is helpful to you. Please feel free to contact me if I can provide any further input or assistance.

Best regards.

Very truly yours,

Richard A. Meserve

cc: INSAG Members
Denis Flory

Sosa, Belkys

From: Powell, Amy
Sent: Wednesday, July 27, 2011 2:35 PM
To: Batkin, Joshua; Bubar, Patrice; Sharkey, Jeffry; Sosa, Belkys; Nieh, Ho
Cc: Castleman, Patrick; Coggins, Angela; Hipschman, Thomas; Gilles, Nanette; Orders, William; Franovich, Mike; Schmidt, Rebecca; Vietti-Cook, Annette; Rothschild, Trip
Subject: Yesterday's floor speech by Sen Kirk

Hi all –

Per a request at today's Chiefs of Staff meeting, below my "signature" is the text of Sen. Kirk's floor speech regarding the Task Force and its recommendations.

Amy

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

Mr. President, this past Sunday, an editorial in "The New York Times" entitled "In The Wake Of Fukushima" noted that if nuclear is to have a future in this conference, Americans should have confidence in the industry and regulators are learning lessons from Fukushima and are taking all steps necessary to ensure safety. Following the accident at the Fukushima plant in march, it's clear that maintaining America's confidence in the safety of our nuclear reactors is paramount. the disaster at Fukushima should not lead to a freeze of the nuclear industry. Instead, it should be an opportunity to upgrade the safety of our nuclear fleet. Both industry and the U.S. Nuclear Regulatory Commission assure us that currently there is no immediate threat to the operation of our nuclear plants. Nuclear power is especially important to my home state of Illinois, where nearly half of all electricity in the state is nuclear. With 11 of 104 nuclear power plants and stations in our state, we have more reactors than any other state in the union. In the mere term, it's my hope that nuclear regulatories and the industry will take actions necessary to increase safety measures and integrate emergency operating procedures. furthermore, nuclear plants should swiftly implement sensible measures to increase flood protections, enhance containment venting ca capabilities, install remote monitoring controls of spent fuel pool conditions, and upgrade the ability to cope and maintain operations by a single station sustained for initially eight hours and eventually up to 72 hours, utilizing preplanned and prestaged resources. Now, moving forward, one of our top priorities should be enhancing flood protection at reactors. obviously reactors for their cooling need to be near large bodies of water, subject to flood. Fukushima highlighted the need to take additional protections to guarantee that current backup pumps and generators are also protected against flood or other seismic events. The recent flooding on the Missouri River is a demonstration of the need for such enhancements. Although flood barriers and procedures have so far protected the Fort Calhoun nuclear plant in Nebraska, this is not the time to look away from making further efforts on protecting reactors from

floods. One of the ringing lessons of the Fukushima disaster is the need for enhanced capabilities for nuclear operators to cope with prolonged power outages. Every U. S. nuclear plant should be able to cope with a prolonged loss of power for at least eight hours for an initial period and eventually 72 hours using only the resources on site so that plant operators can utilize preplanned and prestaged equipment and muster other resources, if necessary. We should be prepared for simultaneous events at multiple reactors on site and should be able to maintain key power functions in the face of varying circumstances, including debilitated infrastructure, a lack of communication, and especially the loss of on-site power. It's clear that operators' capability to cope with a prolonged loss of power was critical at Fukushima. We know that the tsunami hit the Fukushima Diachi plant and wiped out all at fitting that power and backup power necessary to provide resources to the cooling pumps. This eventually caused overheating in both reactor vessels and cooling ponds. The ability to perform these critical functions and to monitor them, providing power to fans and pumps and to remotely open and close vents and valves, the inability of the Japanese to perform these functions caused them to lose control of key areas or to maintain cooling to critical spent fuel ponds and reactor vessels. The Japanese also were unable to remotely monitor conditions, especially in their spent fuel pools, and struggled continuously to pump enough water into their reactors. Operators need to have proper instrumentation at far remote locations so that they can continue to understand what is happening in reactors and cooling ponds if an event occurs. Furthermore, we need to install proper venting upgrades on all reactors with the Mark 2 containment design. This is an important step in preventing any kind of overpressurization in reducing risk of operations that we saw so clearly at Fukushima. Now, in the United States, there are 23 reactors with the Mark 1 containment design. We have known since 1989 that there are flaws with the pressure containment system of the original mark 1 designed boiling water reactor as a precaution, industry upgraded the mark 1 containments with hardened vents to protect against excess active pressure in the containment – excessive pressure in the containment. According to the NRC's very recent Task Force 90-day report, which examined the safety of nuclear power plants, the hardened vents are not universally installed on the Mark 2 containments inside the United States. The Task Force noted further that because the Mark 2 containments are only 25% larger than the volume of the Mark 1, it's conceivable that the mark 2 containments under a similar situation would suffer the same consequences as units 1-4 at Fukushima. We should install hardened vents on all Mark 2 containment reactors and not allow any more time to pass before making deliberate improvements to address these safety concerns. Now, as we press forward with nuclear power generation, I believe that the NRC should also update our emergency planning zones. This is the evacuation zone that's preplanned around every nuclear power plant. It seems prudent now in the light of the experience at Fukushima that we should expand the emergency planning zone to the Japanese radius of 20 kilometers, or 12.5 miles, around each nuclear reactor. These EPZ's should also be updated with the latest 2010 census data of the number of Americans residing around these and the NRC should require enough radiation dose medication to handle at least two full EPZ evacuations, if necessary.
we also know that the spent fuel pools posed a serious threat

to the safety of the site. Throughout the crisis, Fukushima crews struggled to maintain water levels at the spent fuel pools to prevent an escape of uncontained radiation environment. For those of us that know a little bit about reactors, this was a surprise because normally we are totally focused on what is happening inside the reactor, but at Fukushima, as much attention had to be paid on overheating in the spent fuel ponds. This warning should serve as a beginning of an effort for us to relook at the issue of spent fuel in the United States, especially spent fuel which is stored near our drinking water sources. We all know that 96% of all the freshwater in the united states is in the great lakes, and I am concerned that we store approximately 1,000 tons of highly radioactive spent nuclear fuel just 200 yards from the Lake Michigan shoreline at the now-defunct Zion nuclear reactor. Any proposal to stop the permanent disposal of nuclear waste in Nevada is a proposal to continue storing highly radioactive nuclear fuel right next to America's source of 96% of its freshwater. I believe that we should now continue to reinvigorate the process of building the Yucca Mountain facility. Any proposal to not build yucca is a proposal to build a clear and present long-term danger to the environmental future of the Great Lakes. The bottom line is that we should not let the lessons learned from the Fukushima disaster become a forgotten story, that the NRC Task Force and its 90-day report issued after the Fukushima disaster is a serious document that now should lead not just to further studies and consultant reports but comprehensive action like hardened vents, like making sure we have remote monitoring of spent fuel ponds, that all reactors be able to operate first eight and then 72 hours without outside power and that we take the other measures to upgrade our safety like expanding the EPZ.'s. tomorrow I will be testifying before the Nuclear Regulatory Commission and as the junior senator for the State of Illinois, the most nuclear state in America, I carry a strong message that nuclear power has a strong future in the United States but one that should be going forward in light of the lessons of Fukushima. And with that, Mr. President, I yield the floor.

Gilles, Nanette

From: Gilles, Nanette
Sent: Monday, August 01, 2011 3:44 PM
To: Apostolakis, George
Cc: Sosa, Belkys; Davis, Roger
Subject: BWR Mark II Containments

Commisisoner – Here is what the Task Force report says about Mark II containments:

In BWRs with a Mark II containment design, the containment volume could be approximately 25 percent larger than the volume of Mark I containments. In the resolution of GSI157, "Containment Performance," the staff concluded that that the need for hardened vents at BWRs with Mark II containments should be evaluated on a plant-specific basis through the IPE program. Eight BWR units in the United States have Mark II containment designs. Three of these units have installed hardened vents, and the remaining five units at three sites have not installed hardened vents. [p. 40, 3rd ¶]

[Fukushima Daiichi] Units 1, 2, 3, and 4 use the Mark I containment design; however, because Mark II containment designs are only slightly larger in volume than Mark I containment designs, it can reasonably be concluded that a Mark II under similar circumstances would have suffered similar consequences. [p.40, 4th ¶]

Ensuring that BWR Mark I and Mark II containments have reliable hardened venting capability would significantly enhance the capability of those BWRs to mitigate serious beyond-design-basis accidents. A reliable venting system could be designed to be independent of ac power and to operate with limited operator actions from the control room. Alternatively, a reliable venting capability could be provided through a passive containment venting design, such as rupture disks with ac-independent isolation valves to reestablish containment following rupture of the disk. The Task Force concludes that the addition or confirmation of a reliable hardened wetwell vent in BWR facilities with Mark I and Mark II containment designs would have a significantly safety benefit. [p. 41, 2nd ¶]

Nan

Statement of
George Apostolakis, Commissioner
United States Nuclear Regulatory Commission
before the
Committee on Environment and Public Works
and the
Clean Air and Nuclear Safety Subcommittee
United States Senate
August 2, 2011

Chairman Boxer, Ranking Member Inhofe, Chairman Carper, Ranking Member Barrasso, and members of the committee, good morning. I appreciate the opportunity to appear before you today.

My views regarding the way forward with the Near-Term Task Force recommendations are summarized as follows:

1. It is important to bear in mind the significant Task Force conclusion that the current regulatory system has served the Commission and the public well and that a sequence of events like those that occurred in Fukushima is unlikely to occur in the United States.
2. Many people have referred to the events at Fukushima as unthinkable or unforeseen and imply that we should focus on protecting nuclear plants from unimaginable events. However, there is growing evidence that the historical record of tsunamis had not been used properly to determine the design basis at Fukushima Daiichi and, consequently, the protection of the plants was not sufficient. In addition, the location of safety-significant equipment was less than optimal with respect to protection against flooding. The accident was not of extremely low probability, i.e., it was not "unthinkable" or "unforeseen." These observations suggest that we

should be mindful of striking a proper balance between confirming the correctness of the design basis and expanding the design basis of U.S. plants.

3. The timely disposition by the Commission of the Near-Term Task Force recommendations is important. It is also important to do this in an open and transparent manner. Three months should be sufficient time to achieve these objectives.
4. Our process for reaching decisions should be methodical and systematic. The Three Mile Island experience is relevant here. As the Task Force states, some of the actions taken by the NRC after TMI were not subjected to a structured review. Subsequently, some of the resulting requirements were found not to be of substantial safety benefit and were removed.
5. With these observations in mind, I believe that the Commission's deliberations would benefit from an evaluation of the Task Force recommendations by NRC management, the views of external stakeholders, and an independent evaluation by the Advisory Committee on Reactor Safeguards. These reviews may, in fact, result in additional or different recommendations.

I will be working with my fellow Commissioners to reach a timely resolution of the lessons learned from Fukushima.

Thank you.

Davis, Roger

From: Reuters_News@reuters.com
Sent: Wednesday, August 03, 2011 3:51 PM
To: Baggett, Steven; Davis, Roger; Lui, Christiana; Gilles, Nanette; Sosa, Belkys
Cc: Apostolakis, George
Subject: Reuters.com - Fukushima disaster not "unforeseen"-NRC commissioner

George Apostolakis (George.Apostolakis@nrc.gov) has sent you this article.

Personal Message:

Reuters.com - Fukushima disaster not "unforeseen"-NRC commissioner
http://www.reuters.com/article/email/idUSN1E77211Y20110803

Wed Aug 3, 2011 3:17pm EDT

- Japan nuclear disaster not "unthinkable"-Apostolakis
- Fukushima not designed to withstand historical tsunamis
- "We have time to think and be methodical"
- Wants senior staff to evaluate options in 45 days
- NRC could still meet Chairman Jaczko's 90-day goal

By Roberta Rampton

WASHINGTON, Aug 3 (Reuters) - Japan's nuclear disaster was not the kind of "unforeseen" event that would require a radical overhaul of safety rules for U.S. plants, a commissioner at the U.S. nuclear regulatory agency said on Wednesday.

Emerging evidence shows that a tsunami like the one that overwhelmed the Fukushima Daiichi plant in March could happen once every 1,000 years or less, said George Apostolakis, one of three Democrats on the five-member Nuclear Regulatory Commission.

That kind of frequency would be unacceptable for U.S. plants not to be prepared for and it showed the plant was not adequately designed to protect against events that were within the realm of probability, Apostolakis said.

"This focus on the unthinkable is really misplaced. It was not unthinkable at all," Apostolakis said in a speech at the Bipartisan Policy Center.

He said not enough people have yet acknowledged the issue that the plant should been better secured. "This is the kind of secret that everybody knows but nobody wants to say anything about."

The U.S. regulator should now reconfirm that the country's fleet of 104 nuclear reactors owned by some of the country's biggest utilities are designed to withstand disasters within historical probabilities. But the NRC would have had a much bigger task if Fukushima's disaster truly was "unthinkable," Apostolakis said.

"If it was really unthinkable, there would be great urgency, it seems to me, to really try to think about these kind of unlikely events and how we can protect the plants," he said.

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FACTBOX-What's in the task force report? [ID:nN1E76C176]
REPORT-Engineers knew tsunami risk [ID:nL3E7ET2D1]
Q+A-What's going on at Fukushima? [ID:nL3E7J115U]
TAKE A LOOK-US maps out nuclear reforms [ID:nNUKEUSA]

^^>

"WE HAVE TIME TO THINK AND BE METHODICAL"

A task force of six senior NRC staff examining lessons from Fukushima said that there is no imminent risk that a similar disaster could unfold in the United States.

"That means we have time to think and be methodical," Apostolakis said.

Last month, the task force released a report with a series of recommendations, some of which would force plants to plan for catastrophes beyond what they were originally designed to withstand, potentially adding millions in costs for operators like Exelon (EXC.N), Entergy (ETR.N), and PG&E (PCG.N).

The NRC has not yet decided how to move forward.

Chairman Gregory Jaczko wants commissioners to rule on each task force recommendation within 90 days, with a goal for completing and implementing new rules within five years -- an expedited timetable for the agency.

Jaczko has not formally voted on how to move forward. But the four other commissioners including Apostolakis have advocated an alternate approach.

The commissioners said they want top NRC operations staff to develop a schedule within 45 days to evaluate the task force ideas and gather input from the public and industry.

[ID:nN1E76R0IJ]

"There is a systematic way of processing things through the agency," Apostolakis said.

"It's the normal way the commission makes decisions," he told reporters.

Under this approach, Apostolakis said the NRC could still make key decisions in 90 days, as advocated by Jaczko.

(Reporting by Roberta Rampton; Editing by Lisa Shumaker)

Comments (3)

JackTruth wrote:

I am a Professional Geotechnical Engineer. The tsunami that destroyed the Fukushima nuclear power plant was predictable, frequent and guaranteed. The record of previous events was easily checked by local geology and subsurface investigation. The Japanese failed to meet nature's requirements. The resulting nuclear disaster was due entirely to human folly. Putting a nuclear plant near the tectonic plate ring of fire was the ultimate in arrogance, stupidity and corruption.

Aug 24 2011 3:38pm EDT Report as abuse

Observer0 wrote:

[...potentially adding millions in costs for operators like Exelon (EXC.N), Entergy (ETR.N), and PG&E (PCG.N).]

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Please complete "the rest of the story" (i.e., and potentially adding significantly to electric power costs to consumers). Companies don't generate monies out of thin air; their monies come from customers.

Report as abuse

voltscommissar wrote:

If the NRC task force of six really said "there is no imminint risk" then they should all resign or be sacked. The risks may be very small, but they are constant and enduring! This is probability theory 101. Any spent fuel pool can be hit by a terror attack or a meteorite at any time, but the risk is there constantly. Now that we have spent fuel pools littering the landscape, we really rely on "luck" or in other words we can only sleep at night if we suppress conscious thought of a direct hit by a terrorist or meteorite.

Report as abuse

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Protecting People and the Environment

Evolving Nuclear Technology and Regulation: Lessons Learned from Fukushima

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

Bipartisan Policy Center

August 3, 2011

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Discussion Topics

- Defense in Depth
- Design Basis & Beyond-Design-Basis Accidents
- Insights from the Fukushima Daiichi Accident
- Risk-Informed Performance-Based Regulatory Approach

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The Pre-PRA Era

- Management of (unquantified at the time) uncertainty was always a concern.
- Defense-in-depth and safety margins became embedded in the regulations.
- "Defense-in-Depth is an element of the NRC's safety philosophy that employs successive compensatory measures to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility." [Commission's White Paper, February 1999]

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Major Elements of Defense in Depth

- Accident Prevention
- Accident Mitigation
- Emergency Planning

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Accident Terminology

- *Design Basis Accidents* are postulated accidents that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to assure public health and safety
- *Beyond-Design-Basis Accidents* are accidents involving multiple failures following accident initiation
- PRAs identify beyond-design-basis accidents

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A Major DBA: Loss-of-Coolant Accident (LOCA)

- An Emergency Core Cooling System (ECCS) must be designed to withstand the following postulated LOCA:
  - a double-ended break of the largest reactor coolant line,
  - the concurrent loss of offsite power,
  - and a single failure of an active ECCS component in the worst possible place.

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Probabilistic Risk Assessment

- PRA is a structured analytical process that provides both qualitative insights and quantitative estimates of risk.

- PRA answers the following questions:
  1) What can go wrong?
  2) How likely is it?
  3) What are the consequences?

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Reactor Safety Study (WASH-1400, 1975)

Prior Beliefs:

1. Protect against large LOCA.
2. CDF is low (about once every 100 million years, 10^{-8} per reactor year).
3. Consequences of accidents would be disastrous.

Major Findings

1. Dominant contributors: Small LOCAs and Transients.
2. CDF higher than earlier believed (best estimate: 5×10^{-5}, once every 20,000 years; upper bound: 3×10^{-4} per reactor year, once every 3,333 years).
3. Consequences significantly smaller.
4. Support systems and operator actions very important.

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Regulatory Treatment

- ***Design Basis Accidents*:**
  - Controlled through specific regulations and the General Design Criteria
  - Evaluated using conservative codes and subjected to surveillance, inspection, and maintenance requirements
- ***Beyond-Design-Basis Accidents*:**
  - Specific regulations (e.g., station blackout, large fires and explosions)
  - Voluntary industry initiatives (e.g., severe accident features, strategies, and guidelines)

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Inspection Findings

- Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"
  - Some deficiencies were identified that would have caused a single strategy to be compromised or fail
  - No functions were compromised that would have resulted in damage to the fuel elements or containment
  - Observations indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events

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Inspection Findings

- Temporary Instruction 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)"
  - Confirmed that every site has SAMG
  - Revealed inconsistent implementation
    - ✓ Procedure availability and control
    - ✓ Plant configuration control
    - ✓ Training and exercises

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Near-Term Task Force

- Commission Direction for Near-Term Review
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
- Task Force Conclusions
  - Similar sequence of events in the U.S. is unlikely
  - Existing mitigation measures could reduce the likelihood of core damage and radiological releases
  - No imminent risk from continued operation and licensing activities

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Task Force Recommendations (1)

- 12 overarching recommendations
- Improvements to regulatory framework
- Reevaluate design-basis seismic and flooding protection
- Evaluate capability to prevent or mitigate seismically induced fires and internal floods
- Strengthen Station Blackout (SBO) mitigation capability
- Require reliable hardened vent designs in BWR Mark I and Mark II plants
- Identify insights about hydrogen control and mitigation

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Task Force Recommendations (2)

- Enhance spent fuel pool makeup capability and instrumentation
- Strengthen and integrate onsite emergency response capabilities
- Require emergency plans to address prolonged SBO and multiunit events
- Pursue additional EP topics related to multiunit events and prolonged SBO, as part of the NRC's longer-term review
- Pursue EP topics related to decision making, radiation monitoring, and public education, as part of the NRC's longer-term review
- Strengthen regulatory oversight of licensee safety performance by focusing more attention on defense-in-depth requirements

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My Views on Fukushima Insights

- Significant conclusion: The current regulatory system has served us well and a sequence of events like those that occurred in Fukushima is unlikely to occur in the U.S.
- The accident was not of extremely low probability, i.e., it was not "unthinkable".
- Timely disposition by the Commission of the Task Force recommendations is important.
- Our process for reaching decisions should be methodical and systematic (remember TMI).
- Commission's deliberations would benefit from an evaluation of the Task Force recommendations by NRC management, the views of external stakeholders, and an independent evaluation by the Advisory Committee on Reactor Safeguards.
- Additional recommendations may be offered.

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Another Initiative

- Task Force for Assessment of Options for a More Holistic Risk-Informed, Performance-Based Regulatory Approach formed in February 2011
- Task Force charter is to develop a strategic vision and options for adopting a more comprehensive and holistic risk-informed, performance-based regulatory approach for reactors, materials, waste, fuel cycle, and transportation that would continue to ensure the safe and secure use of nuclear material
- Final report in Spring 2012
- Seeking broad stakeholder input

Gilles, Nanette

From: Gilles, Nanette
Sent: Thursday, August 04, 2011 11:48 AM
To: Sosa, Belkys; Bowman, Gregory
Subject: RE: Reminder: Lessons Learned from Fukushima
Attachments: Bipartisan Policy Center 3Aug11.pptx

Greg – Regarding yesterday's meeting at the Bipartisan Policy Center, I've attached the Commissioner's slides for you. These were essentially the same slides he used for the INPO SNPM class presentation on Monday. Yesterday's meeting was hosted by former Senator Pete Domenici. The Commissioner was the keynote speaker and he was followed by a panel discussion. The panel was moderated by former Asst. Secretary for Nuclear Energy Pete Miller. Panel members included Chip Pardee from Exelon, Tom Cochran from NRDC, Mike Corradini from U of WI and ACRS, & Jim Ferland from Westinghouse. The panel members did not have slides.

In general, the meeting went very well. As you can imagine, there were some different viewpoints with regard to what the NRC should do with the Task Force recommendations and on other issues not addressed by the Task Force (e.g., EPZ). During his presentation, the Commissioner answered questions about:

(1) the recent PRMs submitted by NRDC that would implement all of the Task Force recommendations for orders and rulemaking (whether this was the most expeditious way to implement the recommendations). He said it was one way, but not his preferred way (which was to get senior management input and disposition them in 90 days).
(2) Whether the NRC was going to take hydrogen control more seriously and issue regulations (because this was a voting matter before the Commission, he didn't express an opinion)
(3) When the NRC will get thorough and complete analysis of the Fukushima accident. The Commission said he could take up to a year before we really know what happened.

Following the event, the Commissioner was interviewed by a number of reporters. If you haven't already seen those articles, here are some links:

http://eenews.net/Greenwire/2011/08/03/archive/11?terms=apostolakis

http://www.reuters.com/article/2011/08/03/usa-nuclear-apostolakis-idUSN1E77211Y20110803

Nan

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Sosa, Belkys
Sent: Monday, August 01, 2011 3:49 PM
To: Bowman, Gregory
Cc: Gilles, Nanette
Subject: RE: Reminder: Lessons Learned from Fukushima

Greg, both Nan and I are planning to attend. Please close the loop with Nan regarding feedback following the event. Thanks, Belkys

From: Bowman, Gregory
Sent: Monday, August 01, 2011 3:47 PM
To: Sosa, Belkys
: Gilles, Nanette
ubject: FW: Reminder: Lessons Learned from Fukushima

Belkys,

Marty asked that I check with you to see if you or someone else from your office will be attending the August 3 meeting with Commissioner Apostolakis on Fukushima. If so, would you be willing to provide us some feedback on how it goes?

Greg

From: Bipartisan Policy Center [mailto:email@bipartisanpolicycenteremail.org]
Sent: Monday, August 01, 2011 3:00 PM
To: Leeds, Eric
Subject: Reminder: Lessons Learned from Fukushima

To view this email as a web page, go here.

BIPARTISAN POLICY CENTER

The Bipartisan Policy Center (BPC)
Invites you to a breakfast discussion

Evolving Nuclear Technology and Regulation: Lessons Learned from Fukushima

Wednesday, August 3, 2011
9:00AM-10:30AM
Breakfast available at 8:30AM

Click here to register.

Opening statement from

Senator Pete Domenici
BPC Senior Fellow
Co-chairman, BPC Nuclear Initiative

Keynote Address

The Honorable George Apostolakis
Commissioner, U.S. Nuclear Regulatory Commission

Panel discussion moderated by

Warren "Pete" Miller, Ph.D.
Co-chairman, BPC Nuclear Initiative
Former Assistant Secretary for Nuclear Energy, DOE

Featuring

Tom Cochran
Senior Scientist Consultant, Nuclear Program
Natural Resources Defense Council

Michael Corradini, Ph.D.
Director, Wisconsin Institute of Nuclear Systems
University of Wisconsin

Jim Ferland
President, Americas
Westinghouse Electric Company

Charles "Chip" Pardee
Chief Operating Officer
Exelon Generation

Bipartisan Policy Center
1225 Eye St NW, Suite 1000
Washington, DC

Click here to register.

Click here for a detailed agenda.

As the events surrounding the Fukushima Dai-ichi incident become clearer, efforts are underway at the Nuclear Regulatory Commission, within industry, and among other stakeholders to glean and apply the lessons learned. Join the BPC for a discussion with policymakers and experts on the potential ramifications of the Fukushima incident and how new insights may be incorporated into U.S. regulations and operations.

Founded in 2007 by former Senate Majority Leaders Howard Baker, Tom Daschle, Bob Dole and George Mitchell, the Bipartisan Policy Center (BPC) is a non-profit organization that drives principled solutions through rigorous analysis, reasoned negotiation, and respectful dialogue. With projects in multiple issue areas, the BPC combines politically-balanced policymaking with strong, proactive advocacy and outreach. For more information, please visit our website: http://www.bipartisanpolicy.org/.

This email was sent to: **eric.leeds@nrc.gov**

This email was sent by: Bipartisan Policy Center
1225 Eye Street NW, Suite 1000 Washington, DC, 20005, 202-204-2400 Facsimile: 202-637-9220

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Evolving Nuclear Technology and Regulation: Lessons Learned from Fukushima

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov

Bipartisan Policy Center

August 3, 2011

U.S.NRC
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Discussion Topics

- Defense in Depth
- Design Basis & Beyond-Design-Basis Accidents
- Insights from the Fukushima Daiichi Accident
- Risk-Informed Performance-Based Regulatory Approach

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The Pre-PRA Era

- Management of (unquantified at the time) uncertainty was always a concern.
- Defense-in-depth and safety margins became embedded in the regulations.
- "Defense-in-Depth is an element of the NRC's safety philosophy that employs successive compensatory measures to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility." [Commission's White Paper, February 1999]

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Major Elements of Defense in Depth

- Accident Prevention
- Accident Mitigation
- Emergency Planning

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Accident Terminology

- *Design Basis Accidents* are postulated accidents that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to assure public health and safety
- *Beyond-Design-Basis Accidents* are accidents involving multiple failures following accident initiation
- PRAs identify beyond-design-basis accidents

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A Major DBA: Loss-of-Coolant Accident (LOCA)

- An Emergency Core Cooling System (ECCS) must be designed to withstand the following postulated LOCA:
  - a double-ended break of the largest reactor coolant line,
  - the concurrent loss of offsite power,
  - and a single failure of an active ECCS component in the worst possible place.

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Probabilistic Risk Assessment

- PRA is a structured analytical process that provides both qualitative insights and quantitative estimates of risk.

- PRA answers the following questions:
  1) What can go wrong?
  2) How likely is it?
  3) What are the consequences?

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Reactor Safety Study (WASH-1400, 1975)

Prior Beliefs:

1. Protect against large LOCA.
2. CDF is low (about once every 100 million years, 10^{-8} per reactor year).
3. Consequences of accidents would be disastrous.

Major Findings

1. Dominant contributors: Small LOCAs and Transients.
2. CDF higher than earlier believed (best estimate: $5x10^{-5}$, once every 20,000 years; upper bound: $3x10^{-4}$ per reactor year, once every 3,333 years).
3. Consequences significantly smaller.
4. Support systems and operator actions very important.

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Regulatory Treatment

- ***Design Basis Accidents*:**
  - Controlled through specific regulations and the General Design Criteria
  - Evaluated using conservative codes and subjected to surveillance, inspection, and maintenance requirements
- ***Beyond-Design-Basis Accidents*:**
  - Specific regulations (e.g., station blackout, large fires and explosions)
  - Voluntary industry initiatives (e.g., severe accident features, strategies, and guidelines)

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Inspection Findings

- Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"
  - Some deficiencies were identified that would have caused a single strategy to be compromised or fail
  - No functions were compromised that would have resulted in damage to the fuel elements or containment
  - Observations indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events

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Inspection Findings

- Temporary Instruction 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)"
  - Confirmed that every site has SAMG
  - Revealed inconsistent implementation
    - ✓ Procedure availability and control
    - ✓ Plant configuration control
    - ✓ Training and exercises

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Near-Term Task Force

- Commission Direction for Near-Term Review
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
- Task Force Conclusions
  - Similar sequence of events in the U.S. is unlikely
  - Existing mitigation measures could reduce the likelihood of core damage and radiological releases
  - No imminent risk from continued operation and licensing activities

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Task Force Recommendations (1)

- 12 overarching recommendations
- Improvements to regulatory framework
- Reevaluate design-basis seismic and flooding protection
- Evaluate capability to prevent or mitigate seismically induced fires and internal floods
- Strengthen Station Blackout (SBO) mitigation capability
- Require reliable hardened vent designs in BWR Mark I and Mark II plants
- Identify insights about hydrogen control and mitigation

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Task Force Recommendations (2)

- Enhance spent fuel pool makeup capability and instrumentation
- Strengthen and integrate onsite emergency response capabilities
- Require emergency plans to address prolonged SBO and multiunit events
- Pursue additional EP topics related to multiunit events and prolonged SBO, as part of the NRC's longer-term review
- Pursue EP topics related to decision making, radiation monitoring, and public education, as part of the NRC's longer-term review
- Strengthen regulatory oversight of licensee safety performance by focusing more attention on defense-in-depth requirements

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My Views on Fukushima Insights

- Significant conclusion: The current regulatory system has served us well and a sequence of events like those that occurred in Fukushima is unlikely to occur in the U.S.
- The accident was not of extremely low probability, i.e., it was not "unthinkable".
- Timely disposition by the Commission of the Task Force recommendations is important.
- Our process for reaching decisions should be methodical and systematic (remember TMI).
- Commission's deliberations would benefit from an evaluation of the Task Force recommendations by NRC management, the views of external stakeholders, and an independent evaluation by the Advisory Committee on Reactor Safeguards.
- Additional recommendations may be offered.

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Another Initiative

- Task Force for Assessment of Options for a More Holistic Risk-Informed, Performance-Based Regulatory Approach formed in February 2011
- Task Force charter is to develop a strategic vision and options for adopting a more comprehensive and holistic risk-informed, performance-based regulatory approach for reactors, materials, waste, fuel cycle, and transportation that would continue to ensure the safe and secure use of nuclear material
- Final report in Spring 2012
- Seeking broad stakeholder input

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

COMMISSIONER

August 5, 2011

The Honorable James M. Inhofe
United States Senate
Ranking Member, Committee on
Environment and Public Works
Washington, DC 20510-6175

Dear Senator Inhofe:

I am responding to your letter of July 8, 2011, regarding a comparison of U.S. regulatory requirements with those in Japan in the context of the Commission's follow-up to the accident at the Fukushima Dai-ichi nuclear power plants.

As you know, the Commission formed a Near-Term Task Force to conduct a review of NRC processes and regulations to determine whether the agency should make improvements to its regulatory system in light of the accident at Fukushima Dai-ichi. The Task Force submitted its report to the Commission on July 12th. On July 19th, Task Force members presented their recommendations to the Commission in a public meeting. At present, the Commission is deliberating on the path forward. My focus is on the timely disposition of these recommendations and any others that may be presented to the Commission in the near term.

In your letter, you state that a systematic and methodical comparison of U.S. regulatory requirements with those in Japan is essential and can be accomplished in the near term. As you mention, the Commission did direct the staff, as part of the NRC's longer term review, to perform a comparison between NRC requirements for station blackout and the corresponding Japanese regulatory requirements. The Commission also directed the staff to be mindful of the potential impact of requesting relevant information from the Japanese regulator given that the event is still ongoing.

I also recognize the value of understanding the differences in the two regulatory approaches. An example of this is in my statement before the Committee on Environment and Public Works on August 2, 2011, regarding the assessment of the tsunami threat at Fukushima Dai-ichi, a subject you also mention in your letter. In addition, I have concerns about the Japanese regulatory approach for protection from floods.

Because a comparison between U.S. regulatory requirements with those in Japan has not been done to date, I do not have sufficient information to answer all of the specific questions posed in your letter. Differences in regulatory requirements could be a factor in the ultimate adoption of lessons learned. I intend to keep the above considerations in mind during the ongoing deliberations.

Sincerely,

George Apostolakis

July 8, 2011

The Honorable George Apostolakis
Commissioner
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Commissioner Apostolakis:

A nuclear accident in Japan should not be automatically viewed as an indictment of U.S. institutional structures and nuclear safety requirements. Reconstructing a detailed sequence of events and the technological aspects of the Fukushima accident will take some time to be thoroughly examined and understood. However, I believe that a comparison of U.S. regulatory requirements with those in Japan is essential and can be accomplished in the near term. A regulatory comparison should not be an effort to criticize the Japanese regulatory framework. Rather it should be rooted in an acknowledgement that our regulatory systems and culture are fundamentally different, most notably with the establishment in the U.S. of an independent agency early in the industry's history whose sole focus is to regulate the safe use of nuclear materials.

A systematic and methodical regulatory comparison should determine if there are differences that either indicate necessary safety enhancements or provide added confidence that our nuclear safety regime appropriately reflects lessons learned from past accidents and provides adequate protection of public health and safety. The absence of such a review would diminish the credibility of any new regulatory requirements since there would be no clear basis for assessing whether the recommended changes accurately and adequately address actual problems highlighted by the Fukushima accident.

I am concerned that the Nuclear Regulatory Commission's efforts in this area are inadequate. The Commission's March 23 memo directing the staff to establish a task force fails to mention a comparison of US regulations with Japanese requirements. It appears it was not until June 8th that the staff was directed to make such an evaluation and that direction was limited to station blackouts and given a very low emphasis. Information is emerging from the International Atomic Energy Agency (IAEA), the Japanese Government, the media, and other sources that indicate differences may exist between US and Japanese regulatory institutions and requirements that are relevant and should be evaluated:

a. The IAEA observed and the Japanese Government acknowledged that they underestimated the magnitude of a tsunami for which the Fukushima Daiichi plant was at risk. What method was used for that estimation and how does it compare to methods used by the NRC?

b. The NRC has strict design, maintenance, and testing requirements in place to ensure the operability of emergency diesel generators when needed. These requirements begin with locating multiple, redundant diesel generators, their fuel tanks, and electrical equipment within robust structures designed to withstand hurricanes, earthquakes, tornados, floods and other phenomena. Each generator is strictly maintained and required to be tested weekly or monthly to ensure it will get up to speed in less than 10 seconds when called on, resulting in a 97% reliability rate. How do these requirements compare with the Japanese requirements in place at the time of the Fukushima accident?

c. U.S. reactor operators are not only empowered but required to take all necessary actions to protect the public. In the wake of the Fukushima accident, there are several press articles about corporate and government officials influencing decision-making about plant operations during the emergency at Fukushima. How do these different approaches impact efforts to respond in an emergency situation?

d. The Three Mile Island accident raised awareness in the U.S. of the vital importance of operator training. As a result, the NRC, the Institute of Nuclear Power Operations, and the nuclear industry have invested heavily and continuously in operator training, including licensing by the NRC, rigorous standardized training programs, and site-specific simulators at every plant. How does the Japanese training regime compare and how might those differences impact how operators might respond in an emergency?

e. At the time of the Fukushima accident, did the Japanese have anything comparable to our nuclear industry's Severe Accident Management Guidelines?

These are a few areas, and there are surely others, where comparison and analysis need not wait until there is complete understanding of the technical details of the full event. I suggest you and your colleagues promptly work together to provide direction to the staff to develop a charter for a rapid-response study in these and other closely related areas with consideration given to specific design and beyond design basis requirements. I would ask that this comparison and analysis be accomplished with all deliberate speed.

Lastly, the NRC's Efficiency Principle of Good Regulation states: "Regulatory activities should be consistent with the degree of risk reduction they achieve." I hope this statement will inform your perspective as you proceed to consider any potential regulatory changes in response to the Fukushima accident.

Sincerely,

James M. Inhofe
Ranking Member
Committee on Environment and Public Works

CC: Chairman Gregory Jaczko
Cmsr. Kristine Svinicki
Cmsr. William Magwood
Cmsr. William Ostendorff

August 5, 2011

The Honorable James M. Inhofe
United States Senate
Ranking Member, Committee on
Environment and Public Works
Washington, DC 20510-6175

Dear Senator Inhofe:

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As you know, the Commission formed a Near-Term Task Force to conduct a review of NRC processes and regulations to determine whether the agency should make improvements to its regulatory system in light of the accident at Fukushima Dai-ichi. The Task Force submitted its report to the Commission on July 12th. On July 19th, Task Force members presented their recommendations to the Commission in a public meeting. At present, the Commission is deliberating on the path forward. My focus is on the timely disposition of these recommendations and any others that may be presented to the Commission in the near term.

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Because a comparison between U.S. regulatory requirements with those in Japan has not been done to date, I do not have sufficient information to answer all of the specific questions posed in your letter. Differences in regulatory requirements could be a factor in the ultimate adoption of lessons learned. I intend to keep the above considerations in mind during the ongoing deliberations.

Sincerely,

George Apostolakis

Davis, Roger

From: Davis, Roger
Sent: Thursday, August 11, 2011 9:20 AM
To: Gilles, Nanette; Baggett, Steven; Sosa, Belkys
Subject: FW: Supplemental Comments by NC WARN - Shearon Harris
Attachments: 8-10-11 Supplemental Comments by NC WARN.pdf

FYI. We appear to be getting today a # of new filings in supplemental to the petitions to suspend proceedings. I will pass on one or two FYI. As reflected in NRC in the News Today, LA Times today says there will be 25 legal challenges mounted today.

From: Docket, Hearing
Sent: Thursday, August 11, 2011 8:54 AM
To: Bates, Andrew; Ammon, Bernice; Biggins, James; Bupp, Margaret; Carson, Cecilia; Clark, Lisa; Coggins, Angela; Cordes, John; Davis, Roger; Docket, Hearing; Frye, Roland; Hart, Ken; Krause, Emily; McIntyre, David; Monninger, John; Nieh, Ho; OCAAMAIL Resource; OPA Resource; Poole, Brooke; Reddick, Darani; Sexton, Kimberly; Spicer, Susan; Temp, WCO; Temp, WDM; Vietti-Cook, Annette
Cc: Julian, Emile; Giitter, Rebecca; Lewis, Linda; Greathead, Nancy; Pierpoint, Christine; Ngbea, Evangeline
Subject: Supplemental Comments by NC WARN - Shearon Harris

Attached are **"Supplemental Comments by NC WARN in Support of Emergency Petition regarding NEPA Requirement to Address Safety and Environmental Implications of the Fukushima Task Force Report" submitted by John Runkle** - received via EIE– Shearon Harris.

ACTION OFFICE: **OCAA** ACTION: **APPROPRIATE**

Evangeline S. Ngbea
Rulemakings and Adjudications Staff
Office of the Secretary

Baggett, Steven

From: Burnell, Scott
Sent: Tuesday, August 16, 2011 3:11 PM
To: Jon Palfreman
Cc: Kate McMahon; Brenner, Eliot
Subject: RE: Frontline Interview 8/25

Jon;

Thanks very much. Looking forward to seeing you next week.

Scott

From: Jon Palfreman [mailto:jpalfreman@pfgmedia.com]
Sent: Tuesday, August 16, 2011 2:02 PM
To: Burnell, Scott
Cc: Kate McMahon
Subject: Re: Frontline Interview 8/25

Scott...it will be a two camera interview, with Miles O'Brien as correspondent.

I am aware that Dr Apostolakis will be expressing his own opinions and not speaking for the agency.

The basic objective is to discuss the issues raised by and lessons learned from the Fukushima Daiichi accident and of course to talk about the recommendations of the NRC Task Force.
This is a great opportunity to engage the audience with some of the nuclear safety issues raised by this nuclear disaster. This was a beyond design basis natural disaster, one in which a plant proved highly vulnerable to common cause failure. The earthquake/tsunami led to a prolonged Station Blackout, where onsite and offsite power vanished virtually simultaneously. This rapidly progressed into a severe accident with multiple hydrogen explosions.... an accident that released radiation into the environment causing considerable social and economic disruption. Our audience will want to understand what nuclear safety enhancements are being considered in the US to protect against and mitigate such an event happening here.

One issue, of course, is how adequately the NRCs patchwork of rules, and mandatory and voluntary guidelines deals with such low probability high consequence events.

Look forward to seeing you on August 25. My colleague Kate McMahon will be in touch with you and Brenda Akstulewicz to confirm the details.

best,

Jon
On Aug 15, 2011, at 11:32 AM, Burnell, Scott wrote:

Hi Jon;

Have you had the chance to firm up the questions and/or specific topics for next week? Thanks.

Scott

-----Original Message-----
From: Burnell, Scott
Sent: Tuesday, August 02, 2011 11:35 AM

To: Jon Palfreman
Cc: Brenner, Eliot
Subject: RE: Hi

Hi Jon;

I'll double-check with the Commissioner's staff on that particular time. Please keep in mind that if the Commission is still considering the task force recommendations on the 25th, Commissioner Apostolakis might not be able to have an in-depth conversation on the subject.

Scott

-----Original Message-----
From: Jon Palfreman [mailto:jpalfreman@pfgmedia.com]
Sent: Tuesday, August 02, 2011 11:21 AM
To: Burnell, Scott
Subject: Hi

Scott, regarding the interview with Commissioner Apostolakis on August 25, we would like the slot beginning at 3.00 pm if possible and we will be likely using a room in the Marriott across the street.
Regarding questions, the focus will be on lessons learned from Fukushima and proposals to enhance nuclear safety in US nuclear plants.

Best,

Jon

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

August 18, 2011

The Honorable Barbara Boxer
Chairman, Committee on
Environment and Public Works
United States Senate
Washington, DC 20510

The Honorable James M. Inhofe
Ranking Member, Committee on
Environment and Public Works
United States Senate
Washington, DC 20510-6175

Dear Senators Boxer and Inhofe:

I am responding to your letter of August 3, 2011, which contained questions submitted by Senator Inhofe related to the June 16, 2011 hearing before the Committee on Environment and Public Works. The subject of the hearing was the Nuclear Regulatory Commission's preliminary results of the nuclear safety review following the accident at the Fukushima Dai-ichi nuclear power plants in Japan. My responses to Senator Inhofe's questions are enclosed.

Sincerely,

George Apostolakis

Enclosure: as stated

Environment and Public Works Committee Hearing
June 16, 2011
Follow-Up Questions for Written Submission

Questions for Apostolakis

Senator James M. Inhofe

1. Do you believe the Commission would benefit from greater involvement of the ACRS on the NRC's longer term review rather than merely reviewing the staff's final product? If not, why not?

Yes, I believe that the staff should engage the ACRS early on in its review of substantive safety issues being pursued as part of the NRC's longer term review. In addition, the ACRS, on its own initiative, may conduct reviews of specific generic matters or nuclear facility safety-related items.

2. Please describe the processes the NRC uses to revise its regulatory requirements following new information or world events. Notwithstanding the seriousness of the events in Japan, there doesn't seem to be a reason to alter the Commission's normal processes to take account of any lessons learned from the events in Japan given the repeated assurances that U.S. plants are operating safely. Do you agree? If not, why not?

The NRC uses rulemaking or orders to impose new or modified regulatory requirements. The NRC may also institute a proceeding to modify, revoke, or suspend a license. In addition, the NRC may also request that licensees provide information to determine whether or not a license should be modified, suspended or revoked. New requirements may be subject to the change processes outlined in 10 C.F.R. 50.109, 52.98, and 52.63. As is often the case with significant new information presented to the NRC, there are policy issues to be decided by the Commission with regard to the lessons learned from the events in Japan (e.g., whether to initiate rulemaking or to authorize issuance of Orders to U.S. operating nuclear power licensees). Once those policy decisions are made by the Commission, the NRC staff should be able to use its normal processes to implement the Commission's decisions.

3. Do the Commission's regulations provide a mechanism for applying lessons learned from Japan to COLs or certified designs already issued? Is there any material difference in NRC's ability to apply those lessons to COLs or certified designs as opposed to plants that are currently licensed and operating?

Yes, NRC regulations provide mechanisms for imposing new requirements on COLs or certified designs already issued subject to the provision in 10 C.F.R. 50.109, 52.98, and 52.63. Although there is some variation in the criteria for imposing new requirements on a certified design, a COL holder, and the holder of a current operating license, there is no material difference in the NRC's ability to impose new requirements that are necessary to protect public health and safety.

4. Given NRC's authority to apply lessons learned from Japan to the operating fleet, and the state of the art review the COL and design certification applications have undergone, it doesn't make any sense to delay the licensing process on these applications during the review of the Japan situation. Do you agree? If not, why not?

Currently before the Commission is an "Emergency Petition to Suspend All Pending Reactor Licensing Decisions and Related Rulemaking Decisions" pending investigation of the lessons learned from the Fukushima Daiichi nuclear power station event. A central point of the petitions is a request to hold in abeyance (among other things) certain COL licensing reviews, associated adjudicatory proceedings, and ongoing design certification rulemakings pending resolution of Fukushima lessons learned. As this petition and related filings are currently under consideration by the Commission in its adjudicatory capacity, I should not comment on your question at this time.

United States Senate

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
WASHINGTON, DC 20510-6175

August 3, 2011

The Honorable George Apostolakis
Commissioner
Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Commissioner Apostolakis:

Thank you for appearing before the Committee on Environment and Public Works on June 16, 2011 at the oversight hearing regarding the Nuclear Regulatory Commission's preliminary results of the nuclear safety review in the United States following the emergency at the Fukushima Daiichi Power Plant in Japan. We appreciate your testimony, and we know that your input will prove valuable as we continue our work on this important topic.

Enclosed are questions that have been submitted by Senator Inhofe for the hearing record. Please submit your answers to these questions by COB August 18, 2011 to the attention of Katie Lee, Senate Committee on Environment and Public Works, 410 Dirksen Senate Office Building, Washington, D.C. 20510. In addition, please provide the Committee with a copy of your answers via electronic mail to Katie_Lee@epw.senate.gov. To facilitate the publication of the record, please reproduce the questions with your responses.

Again, thank you for your assistance. Please contact Kathy Dedrick of the Majority Staff at (202) 224-8832, or Annie Caputo of the Minority Staff at (202) 224-6176 with any questions you may have. We look forward to reviewing your answers.

Sincerely,

Barbara Boxer
Chairman

James M. Inhofe
Ranking Member

Environment and Public Works Committee Hearing
June 16, 2011
Follow-Up Questions for Written Submission

Questions for Apostolakis

Senator James M. Inhofe

1. Do you believe the Commission would benefit from greater involvement of the ACRS on the NRC's longer term review rather than merely reviewing the staff's final product? If not, why not?

2. Please describe the processes the NRC uses to revise its regulatory requirements following new information or world events. Notwithstanding the seriousness of the events in Japan, there doesn't seem to be a reason to alter the Commission's normal processes to take account of any lessons learned from the events in Japan given the repeated assurances that U.S. plants are operating safely. Do you agree? If not, why not?

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4. Given NRC's authority to apply lessons learned from Japan to the operating fleet, and the state of the art review the COL and design certification applications have undergone, it doesn't make any sense to delay the licensing process on these applications during the review of the Japan situation. Do you agree? If not, why not?

Apostolakis, George

m: Apostolakis, George
: Friday, August 19, 2011 10:15 AM
: Beasley, Benjamin; Sosa, Belkys; Davis, Roger; Gilles, Nanette; Baggett, Steven
Subject: Chairman

I just talked to him.

I told him I was pleased with his statement in the OPA announcement regarding the Japan Task Force. He was pleased that I was pleased.

Call me if you want to discuss.

GA

Apostolakis, George

~~NOT FOR PUBLIC DISCLOSURE~~

m: Apostolakis, George
t: Monday, August 22, 2011 1:30 PM
: Blake, Kathleen
Subject: Re: Paper

I cannot open the attachment. Could you send in pdf?

George Apostolakis
Commissioner, US NRC
Blackberry (b)(6)

From: Blake, Kathleen
To: Apostolakis, George; Baggett, Steven
Sent: Mon Aug 22 12:42:15 2011
Subject: RE: Paper

For your airport reading. kb

Administrative Assistant
to Commissioner Apostolakis
. Nuclear Regulatory Commission
55 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: Apostolakis, George
Sent: Monday, August 22, 2011 11:53 AM
To: Rhodes, Bebbie; Blake, Kathleen; Baggett, Steven
Subject: RE: Paper

Yes, this is it. Thank you very much.

Commissioner George Apostolakis
US Nuclear Regulatory Commission
One White Flint North, MS O16 G4
11555 Rockville Pike
Rockville, MD 20852

(301) 415-1810

~~NOT FOR PUBLIC DISCLOSURE~~

m: Rhodes, Bebbie
nt: Monday, August 22, 2011 11:31 AM
To: Blake, Kathleen; Apostolakis, George; Baggett, Steven
Subject: RE: Paper

Hi Kathleen,

~~NOT FOR PUBLIC DISCLOSURE~~

[illegible]he title of the document "Development of a Probabilistic Tsunami Hazard Analysis in Japan?" If so, we have [illegible]nt copy of the ICONE 2006 proceedings in the Library. I will leave the ICONE proceeding at the Library's Reference Desk for someone from your office to copy the paper.

Let me know if this is not the paper you need.

Thanks so much,

Bebbie

From: Blake, Kathleen
Sent: Monday, August 22, 2011 11:23 AM
To: Apostolakis, George; Baggett, Steven
Cc: Rhodes, Bebbie
Subject: RE: Paper

Sure – I have a contact in the library that could help.

Bebbie: Could you find the below doc for Cmr Apostolakis? kb

Kathleen [illegible] Blake
Administrative Assistant
to Commissioner Apostolakis
[illegible]. Nuclear Regulatory Commission
[illegible]5 Rockville Pike
[illegible]ckville, Maryland 20852
301-415-1810

From: Apostolakis, George
Sent: Monday, August 22, 2011 11:06 AM
To: Baggett, Steven
Cc: Blake, Kathleen
Subject: Paper

I am looking for a paper authored (or, co-authored) by Sakai that is in the proceedings of the 2006 ICONE conference. Could our library find it for me? Thanks.

~~NOT FOR PUBLIC DISCLOSURE~~

Gilles, Nanette

From: Gilles, Nanette
Sent: Thursday, August 25, 2011 8:42 AM
To: Baggett, Steven
Subject: Re: 8/24 RX TA meeting summary

Thanks, Steve.

Sent from my NRC Blackberry

NOT FOR PUBLIC DISCLOSURE

From: Baggett, Steven
To: Gilles, Nanette
Sent: Thu Aug 25 08:17:55 2011
Subject: 8/24 RX TA meeting summary

Nan,

You called into the North Anna brief. No other issues, although I did cut out a bit early to attend another meeting.

Fukushima update:

- Recap no update last week due to Japan's national week of honoring the dead.
- Unit 3 due to concerns about feed water pipe's leaking, TEPCO will be switching over to a core spray system. They are concerned about the effect of thermal shock on the crud and that could result in another release of radioactive material.
- Surry (sp?) system is running well. TEPCO plans to run both water treatment systems. TEPCO noted water treatment is limited due to lack of sufficient desalination equipment. TEPCO is working to resolve the issue.
- TEPCO will be install 100 – 100 metric ton single wall carbon steel tanks to hold waste water. Baggett estimate each tank will hold about 26,500 gallons of water. Seem they are following the US lead and creating a Hanford like site
- TEPCO concerned that the volume of water pumped in and the volume of water pumped out indicate that there is ground water leakage into the turbine building.
- Gov't of Japan committed to continue to work with NRC after the Japan regulator reorganization.
- Khan will visit Fukushima Friday 8/26 to apologize to the local government, announce a 3 kilometer no habitation zone (circular) but they are keeping the 20 KM zone at this time. Khan is expected to announce his resignation that day as well.
- DOS plans to issued the travel advisor shortly. NRC staff is ok with the content and it has more alignment aligns with Japan gov't guidance.

Lastly, the Skeen team has been assigned additional staffing and the responsibility to respond as directed by the Commission to the 21 and 45 day Japan event. New org chart in your inbox.

Steve

NOT FOR PUBLIC DISCLOSURE

Gilles, Nanette

From: Gilles, Nanette
Sent: Friday, September 09, 2011 3:28 PM
To: Holahan, Gary
Subject: Questions for JNES Seismic Expert

Gary – Here are some questions from the Commissioner for your discussions with the seismic expert from JNES next week:

1. What kind of PRA did TEPCO have for Fukushima Dai-ichi?
2. Did they do a flooding PRA?
3. Are Japanese utilities required to do a PRA?
4. Did TEPCO consider SBO?
5. Why was the tsunami underestimated?

Now I'm realizing that none of the questions are related to seismic issues. Hmm. Nevertheless, this is what he asked me to pass on.

Nan

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

Gilles, Nanette

om: Gilles, Nanette
nt: Wednesday, September 14, 2011 6:22 PM
To: Baggett, Steven; Sosa, Belkys
Subject: RE: GBJ Japan vote - FYI

Thanks, Steve.

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

From: Baggett, Steven
Sent: Wednesday, September 14, 2011 4:40 PM
To: Gilles, Nanette; Sosa, Belkys
Subject: GBJ Japan vote - FYI

Nan,

Mike Marshal said GBJ will be voting soon with approved and a few comments on the vote sheet itself.

eve

Davis, Roger

m: Apostolakis, George
t: Thursday, September 15, 2011 5:05 PM
o: Sosa, Belkys; Gilles, Nanette; Davis, Roger
Subject: FW: Science Magazine on Fukushima
Attachments: Science Magainze - Preventing the next Fukushima- 09-01-11.pdf

Commissioner George Apostolakis
US Nuclear Regulatory Commission
One White Flint North, MS O16 G4
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NUCLEAR SAFETY

Preventing the Next Fukushima

Weak authority and largely voluntary standards limit global institutions' impact on nuclear safety and security.

Matthew Bunn* and Olli Heinonen

While this year's disaster at Japan's Fukushima Dai'ichi plant, the worst since Chernobyl in 1986, was caused by the one-two punch of a huge earthquake followed by an immense tsunami—a disaster unlikely to occur in many locations—it revealed technical and institutional weaknesses that must be fixed around the world. If nuclear power is to grow on the scale required to be a significant part of the solution to global climate disruption or scarcity of fossil fuels, major steps are needed to rebuild confidence that nuclear facilities will be safe from accidents and secure against attacks (*1*).

It is too soon to draw all the lessons from the Fukushima disaster. But it is clear that the reactors' abilities to maintain cooling in the event of a prolonged loss of power and to vent dangerous gas buildups were insufficient, as were the operators' ability to respond to large-scale emergencies and the regulators' degree of independence from the nuclear industry (*2*). Operators and regulators around the world are reviewing their nuclear safety measures and responding to heightened public concerns. Governments' conclusions have ranged from China's plan to continue its massive nuclear construction effort to Germany's decision to phase out all nuclear energy by 2022.

But how are global institutions responding? The Chernobyl accident led to much of the current global nuclear safety regime, such as the Convention on Nuclear Safety (CNS) and other safety and liability treaties; an expanded safety program at the International Atomic Energy Agency (IAEA), including nonbinding safety standards and safety peer reviews carried out when states ask for them; and industry efforts such as the World Association of Nuclear Operators (WANO) that exchanges best practices and carries out peer reviews (*3*). But these institutions still leave primarily to each country the decisions about what nuclear safety and security measures to take, with only broad and largely voluntary international standards in place and weak authority for global institutions like the IAEA. Will Fukushima lead to new action to strengthen the global nuclear safety and security system?

So far, the signs are not promising. With competing proposals from several countries, little understanding of which ideas would help, and a lack of sustained leadership focused on building support for key initiatives beforehand, little consensus emerged at June's IAEA ministerial meeting, although the ministers directed the agency to prepare a suggested action plan. That plan, a 22 September United Nations conference on nuclear safety and natural disasters; reviews of the CNS; and the ongoing WANO effort to find ways to strengthen its operations all represent opportunities for progress.

Over the long term, new reactor designs with greater reliance on "inherent" safety measures, e.g., not requiring active pumps and valves to maintain safe operation, may reduce risks. But for the next few decades, most nuclear energy will be generated by the hundreds of reactors that already exist and those that will be built with existing designs. Hence, the near-term focus should be on upgrading safety and security for existing and planned facilities and building institutional approaches that can find and fix the facilities that pose the highest risks. We propose actions in six areas.

Higher Safety Standards

More stringent national regulations and international safety standards are needed, covering several issues. Reactor operators should be required to be better prepared for disasters such as floods and earthquakes, as well as for any events that cause a prolonged loss of electrical power, the key factor that led to the Fukushima disaster. These are the kinds of issues addressed in the "stress tests" the European Union is conducting and that regulators in other countries are pursuing.

The Fukushima earthquake and tsunami were both larger than the "design basis" Japanese plants were required to protect against, as was a 2007 earthquake near the Kashiwazaki-Kariwa nuclear plant. All regulators should reassess whether design bases reflect the spectrum of plausible disasters, requiring safety backfits where necessary, and should also require operators to plan responses to events beyond plants' design bases.

Operators should be required to install filtered vents, as some countries have done, which could greatly reduce the amount of radiation released if a dangerous pressure buildup in a reactor forces operators to vent gases, as occurred at Fukushima (*4*). Operators should also be required to put in place measures to prevent spent fuel from melting or burning if a spent fuel pool drains, such as installing survivable systems to spray the fuel in the pool with water. Ultimately, much of the fuel now stored in spent fuel pools should be moved to safer dry casks (*5*).

Institutionally, regulators must be wholly independent of those they regulate and have the authority, resources, expertise, and culture to be effective. For example, Japan has decided to separate its regulator from the ministry responsible for nuclear power.

The IAEA should recommend that states require steps such as these. The United States and other countries operating and exporting nuclear reactors, along with industry groups such as WANO, should press for these steps to be taken, in the interest of both public safety and the future of nuclear energy.

Higher Security Standards

There is a need for more stringent standards for protecting nuclear facilities against terrorist sabotage—a step both al Qaeda and Chechen terrorists have considered. Terrorists have also sought materials to make a crude nuclear bomb (*6*). Nuclear safety and security measures are in many ways mutually reinforcing (although they can sometimes conflict, as when safety might call for rapid emergency evacuation, whereas security might call for checking those who leave). A nuclear facility cannot be considered safe, in the sense of posing little risk to humans and the environment, unless it is also secure (*7*).

Yet today, security in place at many nuclear sites around the world is weak, and the IAEA security recommendations are much less specific than the agency's safety standards. Nuclear security, ignored at the June IAEA ministerial and in the EU stress tests, must be a fundamental part of the follow-up to Fukushima. States should adopt rules and practices that ensure that weapons-usable nuclear materials and major nuclear facilities, not just power reactors, are effectively protected

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THREATS WORSE Nuclear FIGHT MELT

against all plausible terrorist threats. The IAEA should issue recommendations to prevent a "security Fukushima," and the IAEA and the World Institute for Nuclear Security (WINS), the key operatrors' organization focused on security, should work with operators to ensure that nuclear security best practices are shared and implemented. Progress on these steps could build support for further action at the March 2012 nuclear security summit in Seoul.

Stronger Emergency Response

Nuclear operators and the institutions around them, e.g., local police, fire, and emergency departments, must put in place more effective emergency response plans and conduct regular and realistic exercises to make sure all the key players know what to do in a crisis. Operators should have redundant instrumentation and backup control centers, in case a reactor control room stops functioning (as also occurred at Fukushima). IAEA standards should call for each of these steps.

The IAEA response to the Fukushima crisis was often too little, too late, in sharp contrast, for example, to the World Health Organization's ability to respond quickly to disease outbreaks. The IAEA emergency response—from providing reliable independent information and analysis to helping the affected state—needs radical improvement.

Although difficult issues of responsibility and liability would have to be addressed, the industry should pursue the recommendation by James Ellis, president and CEO of the Institute of Nuclear Power Operations (INPO), who called for creation of an international emergency response team "with pre-staged equipment that is interoperable both domestically and internationally" (*8*). Such a team should probably be managed by the industry itself, with its capacity for rapid decision.

Strengthened and Expanded Peer Reviews

Every country operating major nuclear facilities should ask for an international team to review its nuclear safety and security arrangements. Reviews to check compliance with inadequate standards are not enough; these reviews should be based on the more stringent safety and security standards just described. WANO and the IAEA already provide safety peer reviews, using somewhat different approaches. But WANO reviews are organized by the industry and are kept confidential, whereas most reactors have never had a more transparent IAEA safety review or any international review of their security measures. The IAEA might select only a fraction of facilities for on-site reviews initially, to conserve resources (although WANO plans safety reviews at all reactors every few years), but the possibility of being selected would encourage other operators to upgrade standards.

Such reviews could help rebuild public confidence (as an IAEA review did after the 2007 earthquake at the Kashiwazaki-Kariwa plant) and identify issues that may have been overlooked. The largest nuclear operating and exporting countries should offer to accept such reviews at their civilian facilities and should work to convince others to do the same.

Legally Binding Requirements

Given the international consequences of a major release, there is a strong case to be made for more stringent global requirements, although states will insist on ultimate control over nuclear safety and security decisions. Treaties governing nuclear safety and security, such as the CNS and the Convention on the Physical Protection of Nuclear Materials and Facilities (with its 2005 amendment), express broad goals but include few specific requirements. States should negotiate specific, binding standards for both safety and security, although this is not likely to happen quickly, given the current lack of consensus (*3*, *9*). As Ellis put it, the world needs to find "the sweet spot between national sovereignty and international accountability" (*8*).

Expanded International Cooperation

There is a clear need for expanded international nuclear safety and security cooperation. The fact that the disaster revealed a range of inadequacies in nuclear safety in Japan, one of the world's wealthiest countries and among those with the longest experience in using nuclear energy, highlights the stringent demands for political and institutional stability, regulatory effectiveness, and sustained organizational excellence that today's nuclear technologies impose. Some nuclear countries, or countries now planning their first plant, struggle with regulatory ineffectiveness, corruption, and political instability. The IAEA, states and companies selling nuclear power facilities, and nongovernmental organizations must work together to help these countries put in place and sustain effective safety and security measures.

A Safer, More Secure Nuclear Future

A central lesson of Fukushima is that judgments that some events are so unlikely that they can be ignored may prove to be wrong. For example, new knowledge of the magnitude of historical tsunamis was not adequately incorporated into tsunami-protection rules, including rules for nuclear power plants (*10*). Ultimately, the goal must be a change in thinking and organizational priorities, to focus on achieving the highest practicable levels of nuclear safety and security, even when the risks being addressed seem small. Given large uncertainties, cost-benefit analysis should not always be the driver: Wherever low-cost steps could help protect against potential catastrophes, those steps should be taken, even if the dangers they protect against are thought to be very unlikely. Operators and regulators must assess regularly whether their organizational cultures focus sufficiently on safety and security. While much attention has been paid to power plants, safety and security of all nuclear installations that pose a risk of large radioactive releases should be reviewed. Much now depends on bold leadership from IAEA Director-General Yukiya Amano and the leaders of major states operating and exporting nuclear plants.

References and Notes

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5. National Research Council, *Safety and Security of Commercial Spent Nuclear Fuel Storage* (National Academies Press, Washington, DC, 2006).
6. M. Bunn, *Securing the Bomb 2010: Securing All Nuclear Materials in Four Years* (Harvard Univ. and the Nuclear Threat Initiative, Cambridge, MA, 2010).
7. International Nuclear Safety Group, *The Interface Between Safety and Security at Nuclear Power Plants* (INSAG-24, IAEA, Vienna, 2010).
8. Nuclear Energy Institute, News Release, "INPO Chief Proposes Global Nuclear Response Group," 12 May 2011.
9. Commission of Eminent Persons, *Reinforcing the Global Nuclear Order for Peace and Prosperity: The Role of the IAEA to 2020 and Beyond* (IAEA, Vienna, 2008).
10. D. Normile, *Science* 332, 22 (2011).

10.1126/science.1209668

Managing Uncertainties in the Regulation and Licensing of Nuclear Facilities

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U.S. Nuclear Regulatory Commission
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University of Wisconsin
20 September 2011

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The Pre-PRA Era

- Management of (unquantified at the time) uncertainty was always a concern.
- Defense-in-depth and safety margins became embedded in the regulations.
- "Defense-in-Depth is an element of the NRC's safety philosophy that employs successive compensatory measures to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility." [Commission's White Paper, February 1999]
- *Design Basis Accidents* are postulated accidents that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to assure public health and safety.

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The Single-Failure Criterion

- "Fluid and electric systems are considered to be designed against an assumed single failure if neither (1) a single failure of any active component (assuming passive components function properly) nor (2) a single failure of a passive component (assuming active components function properly), results in a loss of the capability of the system to perform its safety functions."

- The intent is to achieve high reliability (probability of success) without quantifying it.

- Looking for the worst possible single failure leads to better system understanding.

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Design Basis Accidents

- A DBA is a postulated accident that a facility is designed and built to withstand without exceeding the offsite exposure guidelines of the NRC's siting regulation.
- They are very unlikely events.
- They protect against "unknown unknowns."

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Emergency Core Cooling System

- An ECCS must be designed to withstand the following postulated Loss-of-Coolant Accident:
  - a double-ended break of the largest reactor coolant line,
  - the concurrent loss of offsite power, and
  - a single failure of an active ECCS component in the worst possible place.

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Technological Risk Assessment (Reactors)

- Study the system as an integrated *socio-technical* system.

<u>Probabilistic Risk Assessment (PRA) supports Risk Management by answering the questions:</u>

- What can go wrong? (accident sequences or scenarios)
- How likely are these scenarios?
- What are their consequences?
- Which systems and components contribute the most to risk?

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Reactor Safety Study (WASH-1400; 1975)

Prior Beliefs:

1. Protect against large LOCA.
2. CDF is low (about once every 100 million reactor years).
3. Consequences of accidents would be disastrous.

Major Findings

1. Dominant contributors: Small LOCAs and Transients.
2. CDF higher than earlier believed (best estimate: 5×10^{-5}, once every 20,000 years; upper bound: 3×10^{-4} per reactor year, once every 3,333 years).
3. Consequences significantly smaller.
4. Support systems and operator actions very important.

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At Power Level I Results

CDF = 4.5×10^{-5} / yr

Initiator Contribution to CDF Total:

- ✓ Internal Events.....56%
- ✓ External Events 44%
  - ➢ Seismic Events 24%
  - ➢ Fires 18%
  - ➢ Other 2%

K. Kiper, MIT Presentation, 2008

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Level I Results

- **Functional Sequences**

➢ Station Blackout/Seal LOCA	45%
➢ Loss of Support Systems/Seal LOCA	29%
➢ Loss of Feedwater/Feed & Bleed	12%
➢ LOCA - Injection/Recirculation Failure	7%
➢ ATWS - No Long Term Reactivity Control	6%
➢ ATWS - Reactor Vessel Overpressurization	2%

K. Kiper, MIT Presentation, 2008

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Quantitative Health Objectives (QHOs) (August, 1986)

Early and latent cancer mortality risks to an individual living near the plant should not exceed 0.1 percent of the background accident or cancer mortality risk, approximately 5×10^{-7}/year for early death and 2×10^{-6}/year for death from cancer.

- The prompt fatality goal applies to an average individual living in the region between the site boundary and 1 mile beyond this boundary.
- The latent cancer fatality goal applies to an average individual living in the region between the site boundary and 10 miles beyond this boundary.

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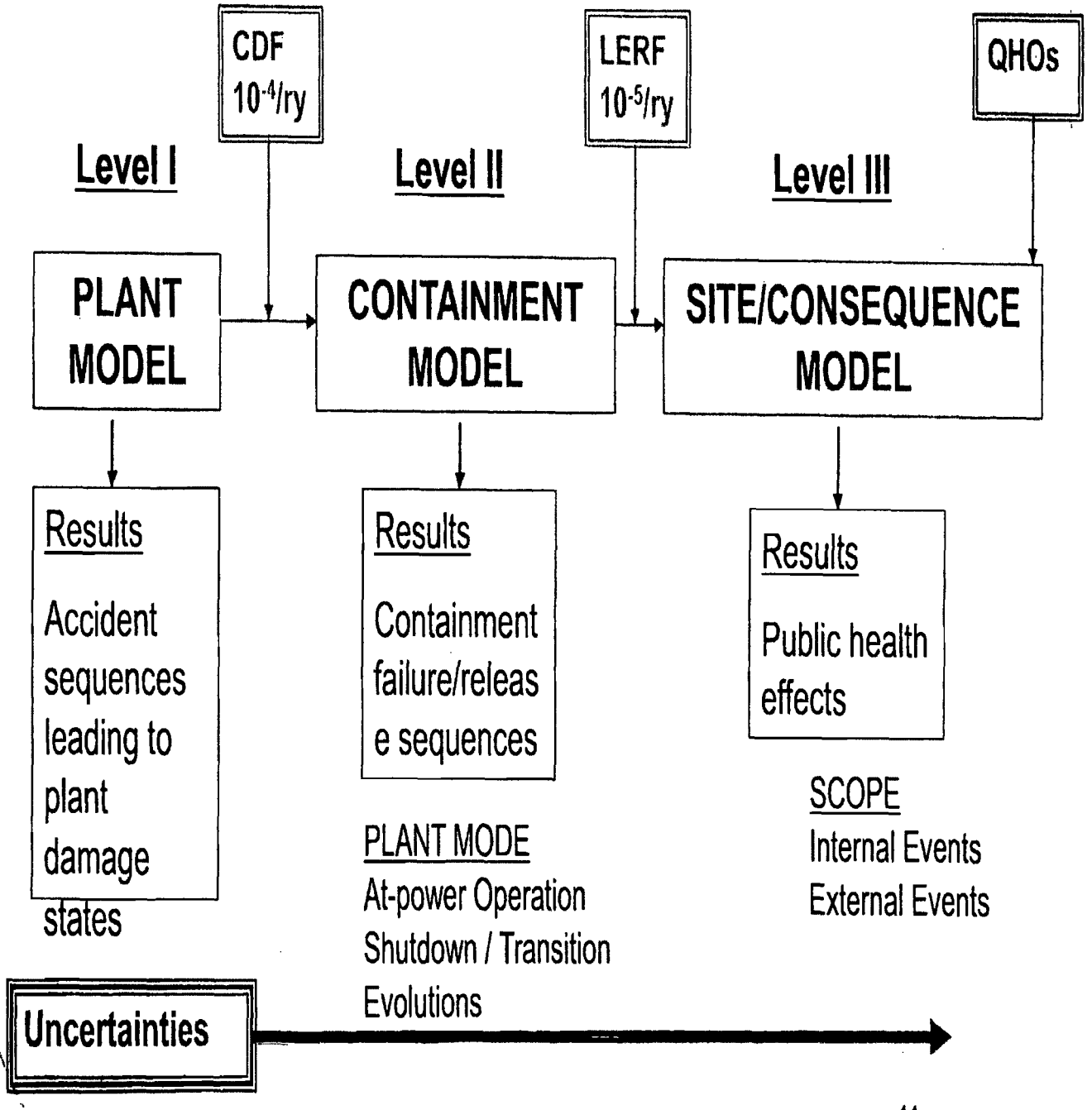
PRA Model Overview



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PRA Policy Statement (1995)

- The use of PRA should be increased to the extent supported by the state of the art and data and in a manner that complements the defense-in-depth philosophy.
- PRA should be used to reduce unnecessary conservatisms associated with current regulatory requirements.

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Risk-Informed Changes to the Licensing Basis (RG 1.174; 1998)

Comply with Regulations

Maintain Defense-in-Depth Philosophy

Maintain Safety Margins

Integrated Decision Making

Risk Decrease, Neutral, or Small Increase

Monitor Performance

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ASME BPVC Section XI Requirements

- Class 1 piping systems: 25% welds examined every 10-year interval
- Class 2 piping systems: 7.5% welds examined every 10-year interval
- Class 3 piping systems: Only pressure test for leakage every 10-year interval

- Failures are occurring at locations where unanticipated and unusual operating conditions have developed, such as, thermal stratification in sloping pipe systems (e.g., the pressurizer surge line), flow-assisted corrosion, and stress corrosion cracking.

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Risk Evaluation Matrix

CONSEQUENCE CATEGORY
(Safety Significance)

DEGRADATION CATEGORY (Pipe Rupture Potential)	NONE	LOW	MEDIUM	HIGH
HIGH	LOW (Cat. 7)	MEDIUM (Cat. 5)	HIGH (Cat. 3)	HIGH (Cat. 1)
MEDIUM	LOW (Cat. 7)	LOW (Cat. 6)	MEDIUM (Cat. 5)	HIGH (Cat. 2)
LOW	LOW (Cat. 7)	LOW (Cat. 7)	LOW (Cat. 6)	MEDIUM (Cat. 4)

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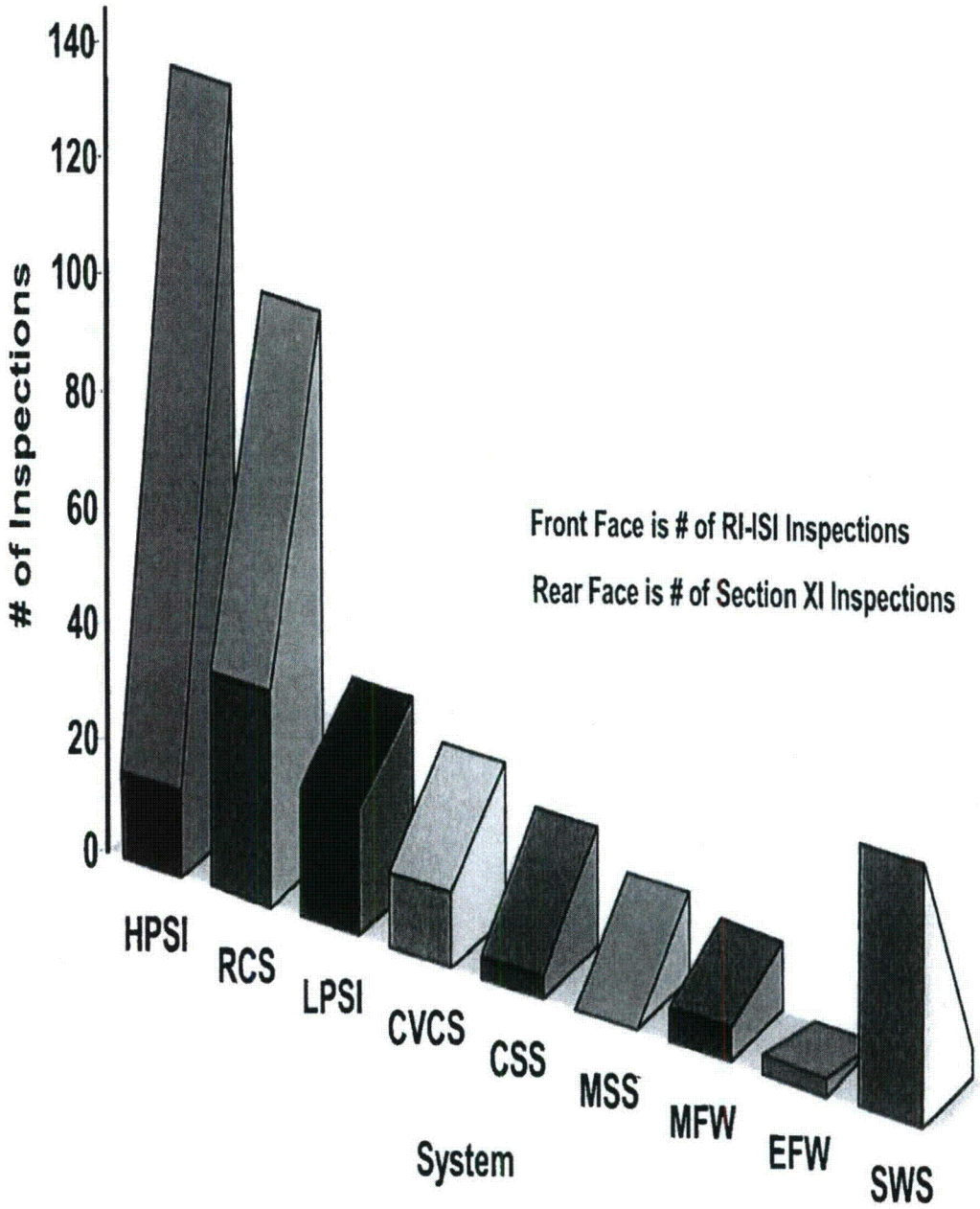
Number of Inspections Before and After



V. Dimitrijevic, MIT Lecture, 2008

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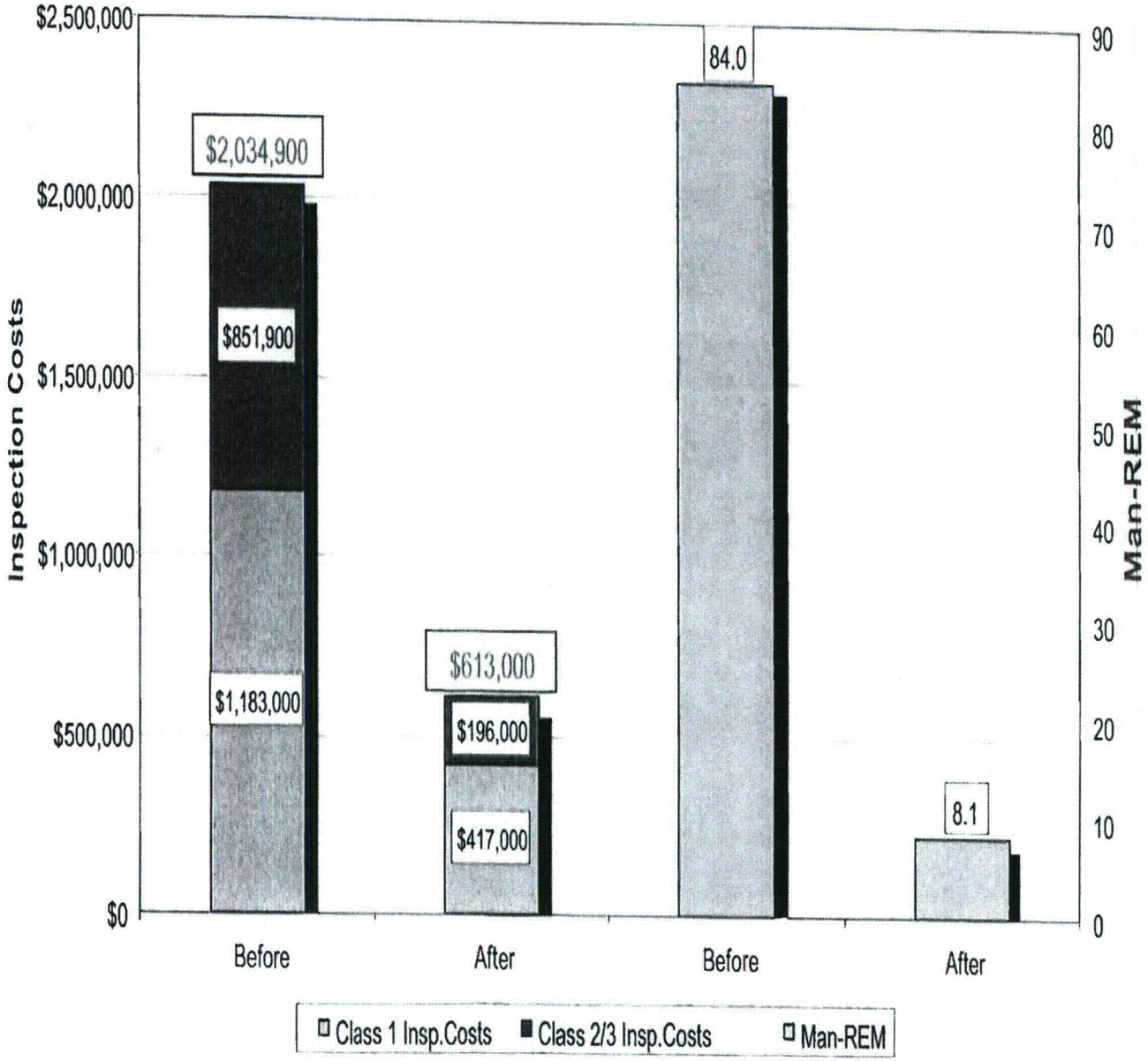
Cost and Man-Rem Savings



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A More Holistic Risk-Informed, Performance-Based Regulatory Approach

- Task Force for Assessment of Options formed in February 2011
- Task Force charter is to develop a strategic vision and options for adopting a more comprehensive and holistic risk-informed, performance-based regulatory approach for reactors, materials, waste, fuel cycle, and transportation that would continue to ensure the safe and secure use of nuclear material
- Final report in Spring 2012
- Seeking broad stakeholder input

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Atomic Energy Act

Ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment

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Objective

Ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment

Manage the risks from the use of byproduct, source and special nuclear materials through appropriate regulatory controls and oversight

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Risk Management Goal

Ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment

Manage the risks from the use of byproduct, source and special nuclear materials through appropriate regulatory controls and oversight

Defense-in-depth protections are provided to:

(1) Establish appropriate barriers to prevent, contain, and mitigate possible releases of radioactive material according to the hazard present and the associated uncertainties; and

(2) Ensure that the risks from events that degrade or challenge the established barriers are maintained acceptably low

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Ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment

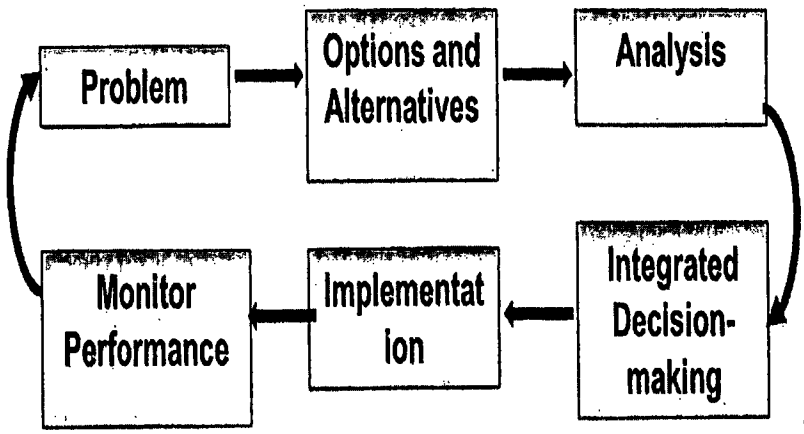
Manage the risks from the use of byproduct, source and special nuclear materials through appropriate regulatory controls and oversight

Defense in depth protections are provided to:

(1) Establish appropriate barriers to prevent, contain, and mitigate possible releases of radioactive material according to the hazard present and the associated uncertainties; and

(2) Ensure that the risks from events that degrade or challenge the established barriers are maintained acceptably low

Use a disciplined process to make decisions regarding appropriate defense-in-depth protections



22

Atomic Energy Act

Ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment

Objective

Manage the risks from the use of byproduct, source and special nuclear materials through appropriate regulatory controls and oversight

Risk Management Goal

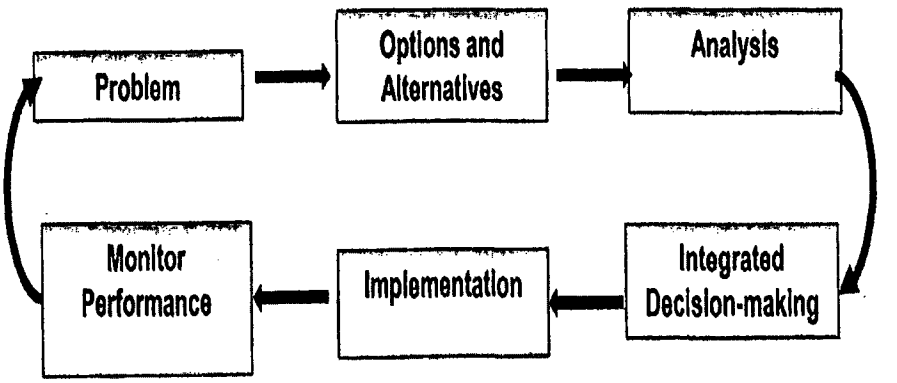
Defense-in-depth protections are provided to:

(1) Establish appropriate barriers to prevent, contain, and mitigate possible releases of radioactive material according to the hazard present and the associated uncertainties; and

(2) Ensure that the risks from events that degrade or challenge the established barriers are maintained acceptably low

Risk Management Process

Use a disciplined, risk management process to identify and evaluate issues and make decisions regarding appropriate defense-in-depth protections



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Fukushima: Near-Term Task Force

- Commission Direction for Near-Term Review
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
- Task Force Conclusions
  - Similar sequence of events in the U.S. is unlikely
  - Existing mitigation measures could reduce the likelihood of core damage and radiological releases
  - No imminent risk from continued operation and licensing activities

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Task Force Recommendations (1)

- 12 overarching recommendations
- Improvements to regulatory framework
- Reevaluate design-basis seismic and flooding protection
- Evaluate capability to prevent or mitigate seismically induced fires and internal floods
- Strengthen Station Blackout (SBO) mitigation capability
- Require reliable hardened vent designs in BWR Mark I and Mark II plants
- Identify insights about hydrogen control and mitigation

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Task Force Recommendations (2)

- Enhance spent fuel pool makeup capability and instrumentation
- Strengthen and integrate onsite emergency response capabilities
- Require emergency plans to address prolonged SBO and multiunit events
- Pursue additional EP topics related to multiunit events and prolonged SBO, as part of the NRC's longer-term review
- Pursue EP topics related to decision making, radiation monitoring, and public education, as part of the NRC's longer-term review
- Strengthen regulatory oversight of licensee safety performance by focusing more attention on defense-in-depth requirements

Davis, Roger

m: Davis, Roger
nt: Wednesday, September 21, 2011 11:32 AM
To: Apostolakis, George; Sosa, Belkys; Baggett, Steven; Gilles, Nanette
Subject: Chief of Staff metting

Items discussed today:

-Late Oct./early Nov. voting paper on budget items: (1) 2012 current estimate (reactor page example provided today); (2) 2012 shortfall; (3) Japan impacts. Response will be needed 11/19. EDO staff and Neha attended. TA brief for next week. KLS and WDM office still want the briefing.

-AP1000 paper not expected to be ready until 10/26

-TVA delaying SMR construction permit application until 2013 (funding & Fukushima)

-Press release on scheduling note today

-Materials Assistants' interest in info meeting with DHS on chemical security regulation/MOU - Josh wants to discuss again this week)

-Patty – should leitter from Jean Mott Oxford (Tracking System # 110512) re Calloway concerns and adequacy of prior answers be assigned to EDO for chariman's signature

xpect walk-around re USEC issue

Roger K. Davis
Legal Counsel
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
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Rockville, Maryland 20852
301-415-1762

Baggett, Steven

From: Sosa, Belkys
Sent: Monday, September 26, 2011 5:07 PM
To: Baggett, Steven; Apostolakis, George
Cc: Blake, Kathleen
Subject: FW: Question for October 4th and one more on Halden

Refer to the following questions...

From: Afshar-Tous, Mugeh
Sent: Monday, September 26, 2011 9:39 AM
To: Sosa, Belkys
Subject: Question for October 4th and one more on Halden

Hi Belkys - a few questions:

1) The U.S. Embassy in Oslo is asking if someone (I think it will be the Science Officer) from the Embassy can accompany us to the meeting with the regulator (NRPA) on Tuesday, October 4th. NRPA welcomes U.S. Embassy staff. I am just making sure that Commissioner Apostolakis doesn't have any objections.

2) Dr. Harbitz (NRPA) is suggesting the following discussions:

The NRPA - mandate and responsibilities
The NRC - mandate and responsibilities
Emergency preparedness and response to the accident at the Fukushima NPP
Recent bilateral nuclear safety activities in Russia, future challenges
Recent nuclear safety projects in Bulgaria and Romania - trilateral co-operation between the respective countries, IAEA and Norway.

Does the Commissioner agree with the topics, specially the NRC – Mandate and responsibilities? Which is lead by him.

3) Also, for the 4th the NRPA is inviting us to a small luncheon meal. Please let me know if that is ok or does the Commissioner prefer to eat before the meeting. I have to confirm.

4) For our meeting at Halden, on October 1st, does the Commissioner or you have any dietary restrictions? They are offering fish. I am told that we are eating at the Halden club, and we have to let them know in advance.

Thanks.
Mugeh

Sosa, Belkys ~~NOT FOR PUBLIC DISCLOSURE~~

m: Gilles, Nanette
nt: Tuesday, October 04, 2011 11:32 AM
o: Sosa, Belkys; Baggett, Steven; Davis, Roger
Subject: EA Meeting Summary

It was a quick meeting. Here is a summary:

- Beginning to see focus on the National Level Exercise 2012, which will have a cyber security focus
- GOJ has lifted the travel restriction is the 20-30 km area outside Fukushima
- State Dept. has not yet lifted the advisory for the U.S. 50-mile restriction. Josh said we don't know why.
- CR was approved through 11/18 today.
- We are gearing up for the IRRS meeting in late October
- Talk is beginning around the upcoming G8 summit
- Supreme Court has asked DOJ for its views on whether the Court should hear a cased related to Rocky Flats site and Price Anderson Act. Involves issues of land contamination, etc., that NRC would be interested in. DOJ likely to ask NRC for its views.
- NRC collected over 99% of its fees for last year.
- We received a letter from B&W Lynchburg saying that the physical protection assessment they were supposed to have completed by Dec. 2011 will not be done until Spring 2012. Staff is apparently OK with this.
- Josh reminded other offices that response needed on early release of Japan 45-day paper.
- John Szabo announced he is retiring in Jan. 2012.

nette V. Gilles
echnical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

~~NOT FOR PUBLIC DISCLOSURE~~

Davis, Roger

From: Gilles, Nanette
Sent: Tuesday, October 04, 2011 9:36 AM
To: Apostolakis, George; Sosa, Belkys
Cc: Davis, Roger; Baggett, Steven
Subject: 45-day SECY Paper
Attachments: SECY-11-0137-45-day Paper.docx; SECY-11-0137enclosure.docx

Commissioner/Belkys – Here is the final, signed version of the 45-day SECY paper.
Nan

Nanette V. Gilles
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-1180
Email: nanette.gilles@nrc.gov

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Nuclear Regulatory Commission Mandate and Responsibilities

Commissioner George Apostolakis

U.S. Nuclear Regulatory Commission

Norwegian Radiation Protection Authority

October 4, 2011

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NRC's Legislative Mandate

- Atomic Energy Act (1954) as amended
  - "Assure the adequate protection of public health and safety and the promotion of the common defense and security."
- National Environmental Policy Act (1969) as amended
  - "...to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."

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The Agency

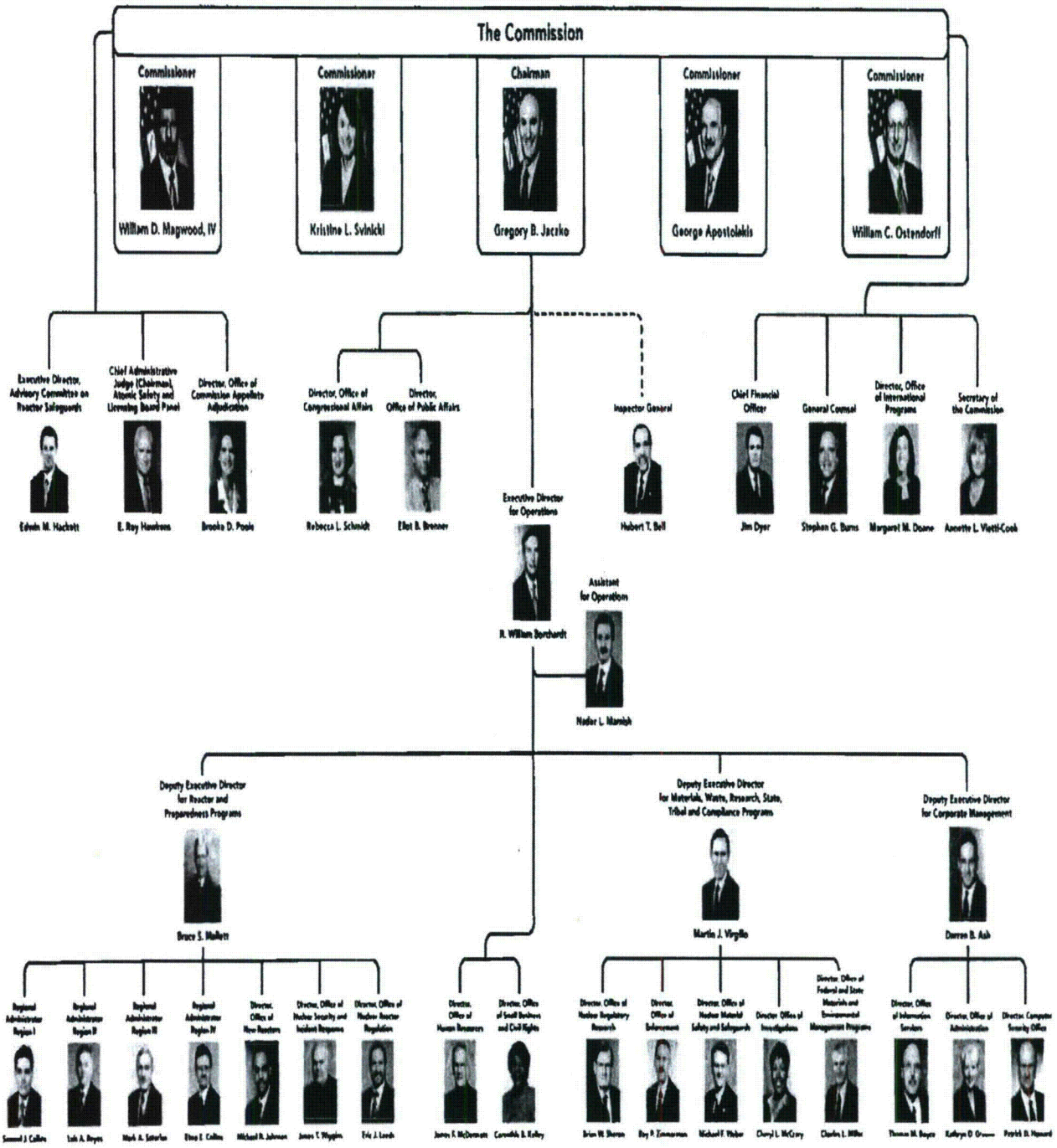
- The U.S. Nuclear Regulatory Commission regulates the civilian use of nuclear materials and facilities to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment.

- It is an independent agency within the Executive Branch.

- It consists of five Commissioners, appointed by the President and confirmed by the Senate, who serve staggered 5-year terms. The President designates the Chairman.

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

U.S. Nuclear Regulatory Commission



U.S.NRC
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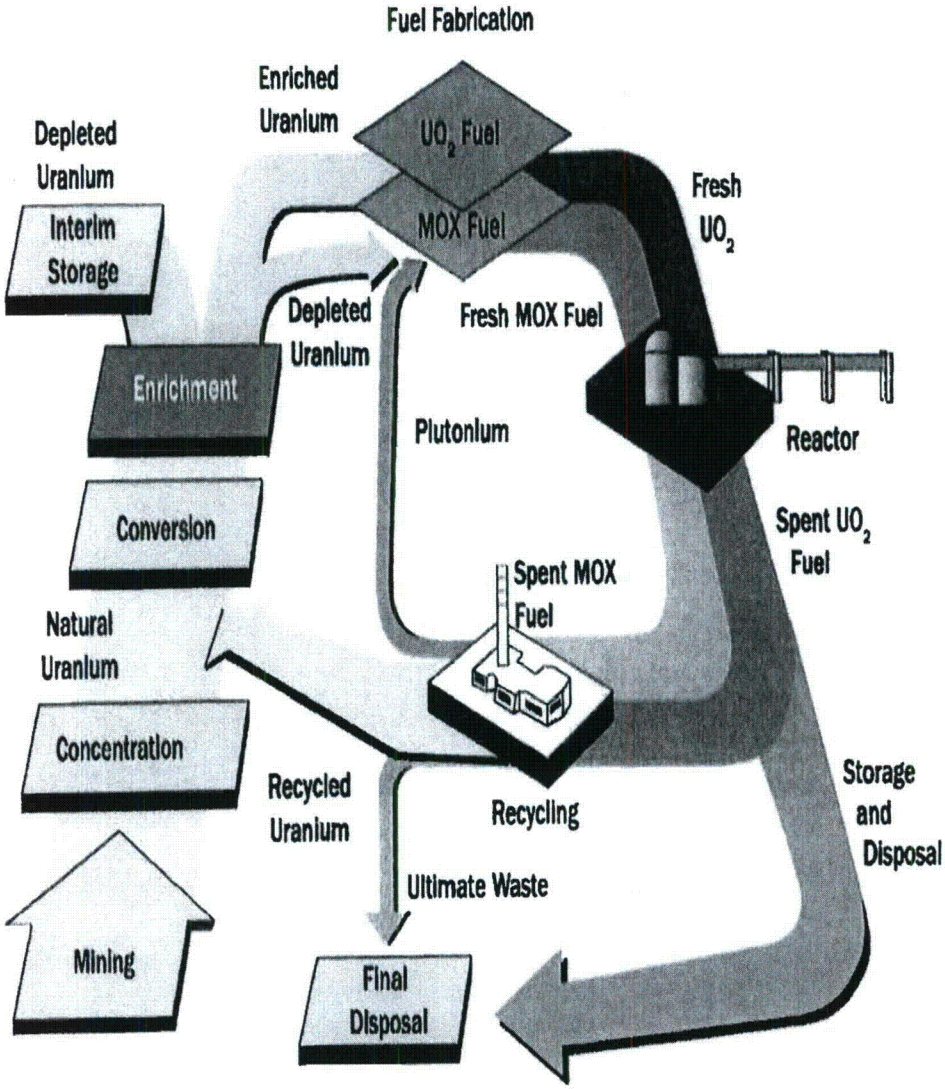
The Nuclear Fuel Cycle



Source: U.S. Nuclear Regulatory Commission

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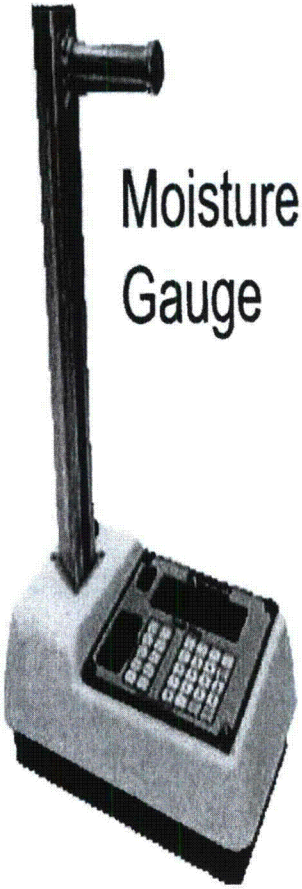
Research and Test Reactors

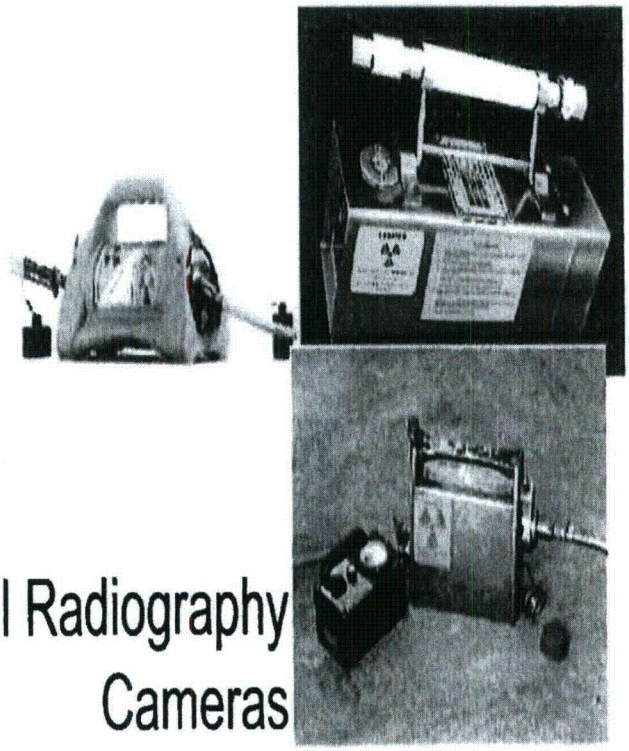
- 32 Sites
- Licensing:
  - Renewals; power increases; technical specification changes; environmental aspects, medical isotope production
  - Design review of Navy reactors
  - New Moly-99 production facilities in 2014

- Oversight:
  - Training and qualifications and Operator License Exams
  - Inspections

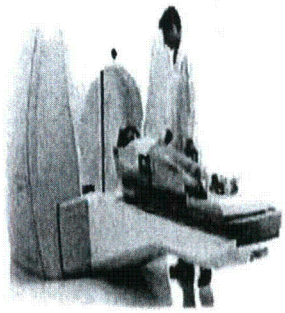
Industrial, Commercial and Medical Uses



Moisture Density Gauge



Industrial Radiography Cameras



Gamma Knife

Exit signs and smoke detectors

New Reactor Applicants

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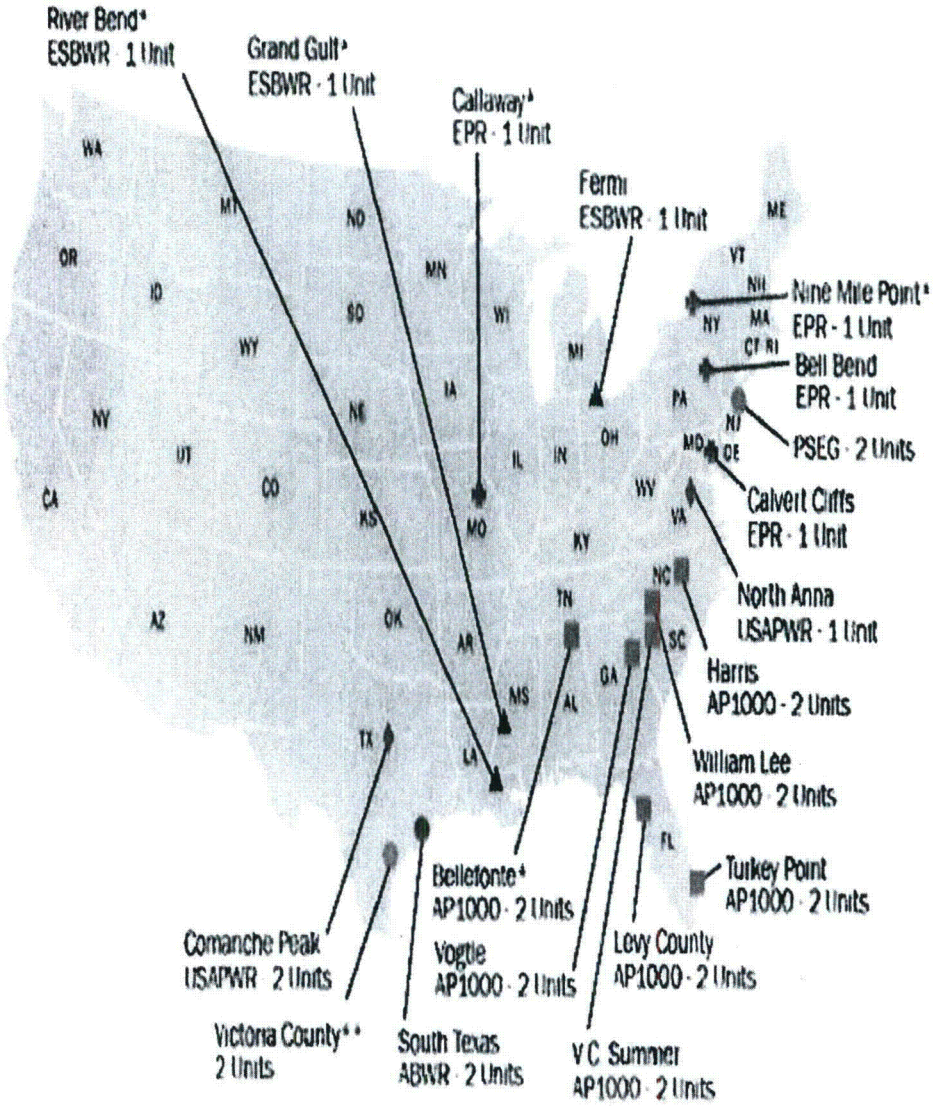

● ABWR ■ AP1000 ✚ EPR ▲ ESBWR ♦ USAPWR ▽ Design/Units - TBA ⬢ ESP

*Review Suspended by Applicant

** COL Application Amended by Applicant to ESP on 03/25/2010

Operating Reactors

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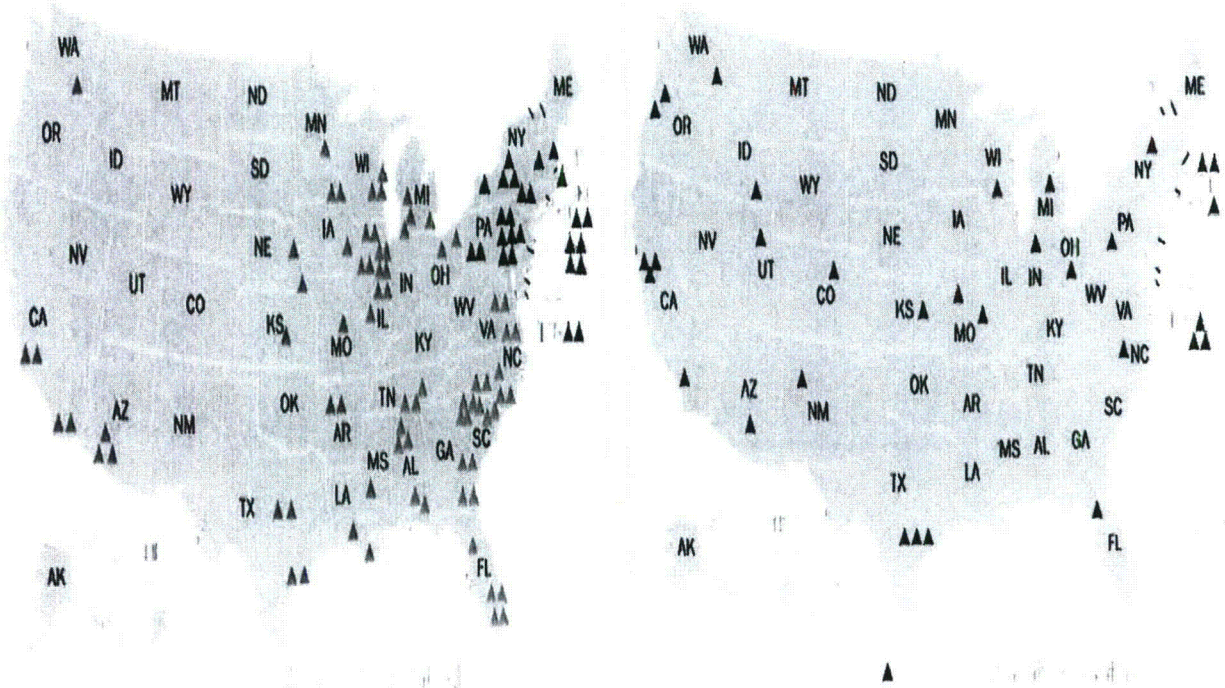

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NRC Response to Fukushima

- Initial NRC response coordinated through Headquarters Operations Center
- Revolving teams of NRC officials with appropriate expertise were deployed to Japan the day after the event
- NRC played a key role in coordinated U.S. response to the event

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NRC Response to Fukushima
Regulatory Actions (1)

- Temporary Instruction 2515/183, "Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event"
  - Observations "indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events"
  - However, "no functions were compromised that would have resulted in damage to the fuel elements or containment"
- NRC Bulletin 2011-01, "Mitigating Strategies"
  - Confirm mitigative strategy equipment is in place and available
  - Provide information on:
    - ✓ Equipment maintenance, testing, & availability controls
    - ✓ Coordination with local emergency response organizations

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NRC Response to Fukushima Regulatory Actions (2)

- Temporary Instruction 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)"
  - To determine that the SAMGs are available and assess how they are being implemented
  - To determine the nature and extent of licensee implementation of SAMG training and exercises

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NRC Response to Fukushima Task Force

- **Near-Term Review**
  - Conduct methodical and systematic review of relevant NRC regulatory requirements, programs, and processes
  - Recommend whether the agency should make near-term improvements to our regulatory system
  - Recommend content, structure, and estimated resource impact for longer-term review
  - Report to Commission after 30, 60, & 90 days

- **Current Assessment**
  - To date the task force has not identified any issues that undermine our confidence in the continued safety and emergency planning of U.S. plants
  - Task force review likely to recommend actions to enhance safety and preparedness

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Task Force Areas of Focus

- Protection from design basis natural phenomena
- Consideration of beyond design basis natural phenomena
- Mitigation for long-term SBO
  - Including multiple unit events
- Emergency preparedness
- NRC programs

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Task Force Recommendations (1)

- 12 overarching recommendations
- Improvements to regulatory framework
- Reevaluate design-basis seismic and flooding protection
- Evaluate capability to prevent or mitigate seismically induced fires and internal floods
- Strengthen Station Blackout (SBO) mitigation capability
- Require reliable hardened vent designs in BWR Mark I and Mark II plants
- Identify insights about hydrogen control and mitigation

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Task Force Recommendations (2)

- Enhance spent fuel pool makeup capability and instrumentation
- Strengthen and integrate onsite emergency response capabilities
- Require emergency plans to address prolonged SBO and multiunit events
- Pursue additional EP topics related to multiunit events and prolonged SBO, as part of the NRC's longer-term review
- Pursue EP topics related to decision making, radiation monitoring, and public education, as part of the NRC's longer-term review
- Strengthen regulatory oversight of licensee safety performance by focusing more attention on defense-in-depth requirements

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NRC Response to Fukushima Task Force

- Longer-Term Review (9 months)
  - Specific information on sequence of events and equipment status
  - Evaluate policy issues & potential interagency issues
  - Lessons learned for facilities other than operating reactors
  - Receive input and interact with all key stakeholders
  - Report within six months after beginning of long-term effort
  - Advisory Committee on Reactor Safeguards to review final long-term report and provide letter report to the Commission

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My Views on Fukushima Insights

- Significant conclusion: The current regulatory system has served us well and a sequence of events like those that occurred in Fukushima is unlikely to occur in the U.S.
- The accident was not of extremely low probability, i.e., it was not "unthinkable".
- Timely disposition by the Commission of the Task Force recommendations is important.
- Our process for reaching decisions should be methodical and systematic (remember TMI).
- Commission's deliberations would benefit from an evaluation of the Task Force recommendations by NRC management, the views of external stakeholders, and an independent evaluation by the Advisory Committee on Reactor Safeguards.
- Additional recommendations may be offered.

Sosa, Belkys

om: Blake, Kathleen
nt: Tuesday, October 04, 2011 11:05 AM
o: Sosa, Belkys
Subject: FW: Last Chance To RSVP! Markey & Jaczko Confirmed For Tomorrow's U.S. Nuclear Policy Discussion

Kathleen M. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: CMRAPOSTOLAKIS Resource
Sent: Tuesday, October 04, 2011 11:04 AM
To: Blake, Kathleen
Subject: FW: Last Chance To RSVP! Markey & Jaczko Confirmed For Tomorrow's U.S. Nuclear Policy Discussion

om: National Journal LIVE [mailto:rsvp@nationaljournal.com]
ent: Tuesday, October 04, 2011 10:55 AM
To: CMRAPOSTOLAKIS Resource
Subject: Last Chance To RSVP! Markey & Jaczko Confirmed For Tomorrow's U.S. Nuclear Policy Discussion

FEATURE INTERVIEWS WITH:
Gregory B. Jaczko, Chairman, U.S. Nuclear Regulatory Commission
Rep. Ed Markey, Member, House Energy & Commerce Committee (D-MA)

NATIONAL JOURNAL LIVE POLICY SUMMIT

LESSONS FROM JAPAN
Global Implications of Nuclear Disaster

As we approach the seven month anniversary of the Great East Japan earthquake and tsunami and the ensuing nuclear crisis, Americans still question what happened, why, and what an event of this magnitude means for U.S. nuclear policy and our relative state of preparedness.

National Journal will convene experts to discuss the latest on the current nuclear situation, the U.S. government's efforts to assist Japan, and the public health and economic lessons learned as a result of the disaster.

RSVP: njsummit100511.eventbrite.com

FEATURE INTERVIEWS:
Gregory B. Jaczko, Chairman, U.S. Nuclear Regulatory Commission
Rep. Ed Markey, Member, House Energy & Commerce Committee (D-MA)

MODERATED BY:
James Kitfield, Senior Correspondent, National Journal

PANEL:

- Richard W. Caperton, Senior Policy Analyst, Energy Opportunity, Center for American Progress
- Allison Macfarlane, Associate Professor of Environmental Science and Policy, George Mason University

Wednesday, October 5, 2011
8:00 AM Registration
8:30 – 10:30 AM Program

National Press Club
First Amendment Room
529 14th Street NW
Washington DC

RSVP: njsummit100511.eventbrite.com

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600 New Hampshire Avenue NW, Washington, DC 20037

Sosa, Belkys

From: Baggett, Steven
Sent: Wednesday, October 05, 2011 8:03 AM
To: Apostolakis, George; Sosa, Belkys
Subject: a few items for your awareness. I did not include clips noting the upcoming Commission hearings.

Nuclear News Flashes Summary Tuesday, Oct 04, 2011

*** NRC will not finish the safety review of Detroit Edison's application for a combined construction permit-operating license for a new unit at its Fermi plant until May 2013, eight months later than previously scheduled. Completion of the safety review has been delayed by the need for site-specific soil properties analyses.

*** IAEA plans to send an international expert mission to Japan October 7-15 to help the country plan its remediation of areas away from the Fukushima I nuclear power plant. The mission is a follow-up to the fact finding mission the IAEA held May 24-June 2, it said. As with
the first mission, this follow-up is being done at the Japanese government's request.

Other Stuff:

Over the objections of some environmental groups, the Energy Department has made final rule changes that give the agency far greater leeway to avoid detailed environmental reviews in conducting, hosting or funding a wide range of energy infrastructure and research projects, including certain power plants, power lines, natural gas pipelines, renewable energy projects, carbon dioxide injection wells, nuclear material tests, cleanup operations and nanoscale and bio-engineering facilities.

The Nuclear Regulatory Commission established a YouTube channel last month. It has a Twitter account, and since January it has had a blog. On Tuesday it took the next step: the chairman, Gregory B. Jaczko, hosted an online session with more than 50 bloggers, most of them pro-nuclear. He is supposed to do it again on Thursday, with anti-nuclear bloggers.

The International Commission on Radiological Protection (ICRP) will hold its Symposium on the International System of Radiological Protection in Rockville, Md., on Oct. 24-26.
The symposium is being held in conjunction with the joint meeting of ICRP's main Commission and committees, and is sponsored in part by the NRC's Office of Nuclear Regulatory Research. NRC Commissioner Kristine L. Svinicki will deliver a welcoming address on Oct. 24.

Canadian nuclear regulators have determined the Chalk River NRU plant, "world's oldest operating nuclear reactor can run until at least 2016 without compromising safety." The "federal operating permit for the sprawling Chalk River nuclear complex two hours northwest of Ottawa, including the 53-year-old National Research Universal (NRU) medical isotope reactor, expires Oct. 31." The Canadian Nuclear Safety Commission is considering whether to grant a five-year extension to the reactors operating license, and is doing so "against the backdrop of Japan's Fukushima reactor disaster." One "crucial consideration is the operational health of the NRU research reactor, which sprang a heavy-water leak in 2009 that led to a 15-month, $70-million shutdown and a global shortage of medical isotopes.

Sosa, Belkys

From: Baggett, Steven
Sent: Wednesday, October 05, 2011 11:07 AM
To: Gilles, Nanette; Davis, Roger; Sosa, Belkys; Apostolakis, George; Blake, Kathleen; Lui, Christiana; Savoy, Carmel
Subject: October 5 EA Meeting Summary

All, a very short meeting.

No morning meeting as the Chairman was attending the National Journal Policy Summit: Lessons from Japan: Global Implications of Nuclear Disaster and the NRC Senior Management meeting

Some concerned expressed that the current procedures for submitting slides for Commission Briefings may not be adequate for Commission Hearings, ie need more than 5 days.

SECY is working to conduct affirmation for Diablo Canyon and Shieldalloy on 10/12

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Gilles, Nanette

From: Apostolakis, George
Sent: Friday, October 07, 2011 7:11 PM
To: Gilles, Nanette
Subject: FW: FW: 10.2

From: Harold.Ray@sce.com [mailto:Harold.Ray@sce.com]
Sent: Friday, October 07, 2011 6:04 PM
To: Apostolakis, George
Subject: Re: FW: 10.2

George: Related to our discussion today, provided below is some of the NTTF report discussion that is relevant:

1. (pg. 47) "As stated in the Westinghouse SAMG documentation, 'the SAMG is designed to fill the void between the EOPs and the E-Plan.' While implementing SAMGs, the accident command and control functions shift to the TSC and typically to the emergency coordinator or shift technical advisor or both... Since the SAMGs are voluntary and targeted to the technical support staff, the formal training and licensing of plant operators does not address them."

2. (pgs. 47-48) "(As a result of 9/11, requirements were established which) have led to the development of EDMGs at all U.S. nuclear power plants. The guidelines and strategies included in the EDMGs are NRC requirements... (However, as stated in NEI 06-12) 'the initial EDMGs are not a type of emergency operating procedures, nor are they intended to be a replacement for EOPs. They are, in fact, intended to be used when the normal command and control structure is disabled and the use of EOPs is not feasible.' In terms of command and control, either control room, plant, TSC, or EOF staff could make EDMG decisions. The EDMGs do not play a large role in the formal training and licensing of plant operators."

3. (pg. 48) "(At the request of the NTTF) inspectors collected information on the initial implementation, ongoing training and maintenance of the SAMGs... The inspectors observed inconsistent implementation of SAMGs and attributed this to the voluntary nature of this (9/11) initiative."

4. (pg. 54) "Currently, during a General Emergency, the licensee's emergency director assigned with the authority to lead the licensee response is located in the EOF. An emergency director in the TSC remains in command of the technical assessment and damage control aspects of the response. During a multiunit event, the lead TSC official would be in the best position to address the triage and prioritization of resource requirements for each unit."

Notice in 4 above the references to emergency directors in both the EOF and the TSC. SECY-11-0124 states, "The staff recommends that the NRC, as a near-term action, undertake regulatory action to resolve NTTF Recommendations 8.1, 8.2, 8.3 and 8.4: Issue an advanced notice of proposed rulemaking to engage stakeholders in rulemaking activities associated with the methodology for integration of onsite emergency response processes, procedures, training and exercises. Interact with stakeholders to modify the EOP generic technical guidelines in order to include guidance for SAMGs and EDMGs in an integrated manner and to clarify command and control issues as appropriate."

It is very difficult to define what long term recommendation 10.2 requires that is in addition to the near-term action above. Whatever it is, if anything, it would seem like it should be done as part of the response to Recommendation 8. Regards, Harold

From: "Apostolakis, George" <George.Apostolakis@nrc.gov>
To: "Harold Ray (Harold.Ray@sce.com)" <Harold.Ray@sce.com>, "reason@psy.man.ac.uk" <reason@psy.man.ac.uk>
Date: 10/07/2011 10:00 AM
Subject: FW: 10.2

NOT FOR PUBLIC DISCLOSURE

m: Apostolakis, George
nt: Friday, October 07, 2011 12:28 PM
To: Harold Ray (Harold.Ray@sce.con)
Subject: 10.2

Harold:

I've looked at recommendation 10.2. I'd like to discuss it with you. Please either call me (301-415-1810) or come to my office any time after 2:00pm.

Thanks.

Commissioner George Apostolakis
US Nuclear Regulatory Commission
One White Flint North, MS O16 G4
11555 Rockville Pike
Rockville, MD 20852

(301) 415-1810

Gilles, Nanette ~~NOT FOR PUBLIC DISCLOSURE~~

From: Sosa, Belkys
Sent: Thursday, October 13, 2011 4:27 PM
To: Gilles, Nanette; Apostolakis, George; Davis, Roger; Baggett, Steven
Subject: FYI: ACRS Committee Letter
Attachments: FINAL Fukushima ACRS Review.pdf

Importance: High

fyi

From: Hackett, Edwin
Sent: Thursday, October 13, 2011 4:22 PM
To: Nieh, Ho; Bubar, Patrice; Sosa, Belkys; Sharkey, Jeffry; Marshall, Michael
Subject: FW: ACRS Committee Letter
Importance: High

FYI – Initial ACRS Letter on Fukushima. I thought you all would like to see it ASAP.

Ed

From: Meador, Sherry
Sent: Thursday, October 13, 2011 4:19 PM
To: Bellinger, Alesha; Berrios, Ilka; Brown, Christopher; Antonescu, Christina; Davis, Desiree; Widmayer, Derek; Dias, Antonio; Diaz-Sanabria, Yoira; Shukla, Girija; Hackett, Edwin; Nourbakhsh, Hossein; Howard, Kent; Delgado, Jessie; Lai, [illegible]hn; Banerjee, Maitri; Wen, Peter; Santos, Cayetano; Wang, Weidong; Weaver, Kathy; Bates, Andrew; Champ, Billie; [illegible]yton, Kathleen; RidsEdoMailCenter Resource; RidsFsmeOd Resource; Jaegers, Cathy; Lewis, Antoinette; Lien, Peter; [illegible]ike, Linda; RidsNmssOd Resource; RidsNroOd Resource; RidsNrrPMAAdams Resource; RidsNsirOd Resource; RidsOcaMailCenter Resource; RidsOcaaMailCenter Resource; RidsOgcMailCenter Resource; RidsOigMailCenter Resource; RidsOpaMail Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource; RidsResOd Resource; Rini, Brett; RidsSecyMailCenter Resource; Shea, Pamela; Wright, Darlene
Subject: ACRS Committee Letter
Importance: High

Letter to the Honorable Gregory B. Jaczko, NRC Chairman, from Said Abdel-Khalik, ACRS Chairman, dated October 13, 2011, Subject: Initial ACRS Review of: (1) the NRC Near-Term Task Force Report on Fukushima and (2) Staff's Recommended Actions to be Taken Without Delay

ML11284A136

Sherry

Sherry Meador
Management Analyst
US Nuclear Regulatory Commission
Tel. 301-415-7360
Fax 301-415-5589

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Baggett, Steven

From: Sosa, Belkys
nt: Thursday, October 13, 2011 10:58 AM
: Weber, Michael
Cc: Baggett, Steven; Gilles, Nanette; Davis, Roger; Apostolakis, George
Subject: RE: FYI - PETRANGELO'S PRESENTATION TO LOCAL ANS CHAPTER

Mike, thanks for the info. - Belkys

From: Weber, Michael
Sent: Thursday, October 13, 2011 9:15 AM
To: Apostolakis, George
Cc: Sosa, Belkys
Subject: FYI - PETRANGELO'S PRESENTATION TO LOCAL ANS CHAPTER

Good morning, Commissioner. Given that you are the guest speaker at the next meeting of the Washington ANS Chapter in mid-November, I am sharing with you my summary of Tony Petrangelo's (NEI) presentation to the chapter meeting last evening. Chapter leadership emphasized that your presentation will be on the actions being taken by the NRC in response to lessons learned from Fukushima-Daiichi. Tony focused his presentation on the Way Forward following Fukushima. In short, Tony was very complimentary of the NRC and observed that NRC "got it right" regarding the Near-Term Task Force Report and the staff's recommendations for how to proceed with the Tier I enhancements based on the lessons learned from Fukushima.

Tony began his presentation by commenting about the lessons the nuclear industry learned from the Deepwater Horizon accident in the Gulf. He commented that an accident like that would "finish" the nuclear industry in the U.S., if had occurred at a nuclear plant. In response, EPRI, INPO, and NEI decided to collaborate to enhance the level of dustry preparedness to respond to a nuclear emergency in the U.S. Industry had conducted an initial exercise in October 2010 and had planned a follow-on exercise in May 2011. This follow-on exercise never occurred because they had the opportunity to respond for real to the nuclear emergency at Fukushima-Daiichi. Tony also noted that 2011 has been a trying year for nuclear power in the U.S., even without Fukushima – tornadoes, floods, earthquakes, hurricanes, and tropical storms – each of which have demonstrated the ability of the nuclear power plants to remain safe and secure despite significant natural events.

Following his introduction, Tony briefly reviewed how the industry has responded to the Fukushima accident, including the structure, guiding principles, goals, and organization of the way forward. He succinctly summarized the NRC's Near-Term Task Force and commented that this was an "impossible job," but the NTTF accomplished the report and recommendations in an outstanding manner. He then briefly reviewed the latest recommendations to the Commission from the staff in the 45-day report and stated that the industry largely agrees with the staff's recommendations. He ended his presentation by summarizing the most recent public opinion polls that show a majority of Americans continue to support reliance on nuclear power to meet the Nation's energy needs, provided the plants are safe. He also discussed how NEI has shifted key messages in advertisements back to an emphasis on safety and featuring workers at the plants. In the last several years preceding March 2011, NEI had placed more emphasis in its advertisements on the use of nuclear energy to meet energy needs in a sustainable and environmentally friendly manner.

In the questions and answers that followed (about 45 minutes after a 30 minute presentation), several of the questions focused on how long will it take to implement the enhancements with some impatience for rulemakings that may last 4-5 years. Tony used these answers to emphasize the importance of not distracting operators from safe operation of the plants and of avoiding enhancements that inadvertently weaken, rather than strengthen, safety.

In sum, his presentation was positive and well received.

Regards,

Mike

chael Weber
Deputy Executive Director for Materials, Waste, Research,
State, Tribal, and Compliance Programs
U.S. Nuclear Regulatory Commission

301-415-1705
Mail Stop O16E15

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Sosa, Belkys
Sent: Thursday, October 20, 2011 6:32 PM
To: Apostolakis, George; Davis, Roger
Subject: RE: [Invitation] Photo Exhibit Opening
Attachments: image001.png; image002.png

I recommend you go as a sign of good will. On the other hand it is right before the Nov 3rd hearing...

From: Apostolakis, George
Sent: Thursday, October 20, 2011 6:28 PM
To: Sosa, Belkys; Davis, Roger
Subject: FW: [Invitation] Photo Exhibit Opening

NOT FOR PUBLIC DISCLOSURE

Any advice?

From: DEMARS JEFF [mailto:jeff.demars@ws.mofa.go.jp]
Sent: Thursday, October 20, 2011 5:45 PM
To: Apostolakis, George
Subject: [Invitation] Photo Exhibit Opening

Dear Sir/Madam,

We are pleased to extend an invitation to you for the opening of a photo exhibition titled "Moving Forward: Life after the Great East Japan Earthquake," taking place at 5 pm, Tuesday, November 1, at the Japan Information and Culture Center (JICC), Embassy of Japan, located at 1150 18th Street, NW, Washington, DC.

This exhibition in Washington, DC, co-presented by Tohoku regional newspaper The Kahoku Shimpo, the UCLA Paul I. and Hisako Terasaki Center for Japanese Studies, and the Embassy of Japan, uses photojournalism to document the lives and stories of people affected by the disaster, illuminating the continuing efforts of a nation as it moves forward toward recovery. At the opening on November 1, Ambassador Ichiro Fujisaki, Mr. Yoshihisa Nishikawa, Executive Director (Editorial) of The Kahoku Shimpo, and Professor Hitoshi Abe, Director of the UCLA Terasaki Center, will be present to speak.

We would like to invite you to see these photographs documenting the progress that has been made in the region.

Please let us know if you can attend the opening by calling or sending an email to my colleague Jeff DeMars at 202-238-6947, jeff.demars@ws.mofa.go.jp.

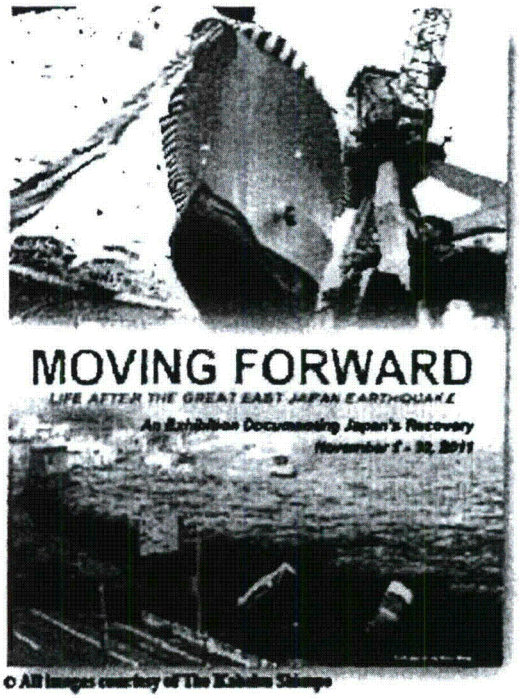
Please also note that the exhibition will continue until the end of November. We would appreciate it if you could visit with your colleagues sometime.

Sincerely,

Izumi Seki

Director, JICC
Counsellor, Embassy of Japan

The Kahoku Shimpo, UCLA Paul I. and Hisako Terasaki Center for Japanese Studies and the Embassy of Japan present



© All images courtesy of The Kahoku Shimpo

MOVING FORWARD:

Life After the Great East Japan Earthquake

An Exhibition Documenting Japan's Recovery

Opening Tuesday, Nov.1st at 5:00 pm

At the Japan Information and Culture Center (JICC)
1150 18th Street NW, Washington, D.C.

In remembrance of the victims and with continued support for the survivors of the Great East Japan Earthquake and tsunami, local Tohoku region newspaper The Kahoku Shimpo and the UCLA Paul I. and Hisako Terasaki Center for Japanese Studies have come together with the Embassy of Japan to present an exhibition that uses photojournalism to document the lives and stories of those affected, illuminating the continuing efforts of a nation as it moves forward toward recovery.

To commemorate the opening of the exhibition, Ambassador Ichiro Fujisaki, Mr. Yoshihisa Nishikawa, Executive Director (Editorial) of The Kahoku Shimpo, and Professor Hitoshi Abe, Director of the UCLA Terasaki Center will be present to speak. Please note that spaces for the opening event are limited and registration is required.

The JICC will also be offering the first hour of parking at 1800 M St. Parking Garage (entrance on 18th St.) for free for this opening event. Don't forget to bring you parking ticket to the JICC for validation.

Register now!

After Washington, DC, the exhibit will travel to the following locations, presented by The Kahoku Shimpo and UCLA Paul I. and Hisako Terasaki Center for Japanese Studies:

Chicago: 1/15-2/20, 2012 at Chicago University's Rockefeller Memorial Chapel
Los Angeles: 3/7-4/15, 2012 at the UCLA's Fowler Museum
New York and Boston: Currently in planning phase.

For further information, please visit www.international.ucla.edu/japan.

Hosting Organizations for the Washington D.C. Exhibit:

Japan Information & Culture Center

UCLA Paul I. and Hisako Terasaki Center for Japanese Studies

河北新報社
THE KAHOKU SHIMPO

Supporting Organization:

U.S.-JAPAN COUNCIL

Special thanks to:
Tohoku Gakuin University Volunteer Station Translation Project Team, Mari Ishida, Timothy Unverzagt Goddard, and Saran Oki

Sosa, Belkys

om: 7Consulting [7consulting@mlc.vigicorp.fr]
nt: Thursday, October 20, 2011 10:45 AM
: Sosa, Belkys
Subject: Eurosafe 2011

Dear Madam, Dear Sir,

This year, the EUROSAFE Forum will take place in Paris at Maison Internationale - Cité Internationale Universitaire on 7 and 8 November 2011. It is co-organised by IRSN (Institut de Radioprotection et de Sûreté Nucléaire), GRS (Gesellschaft für Anlagen- und Reaktorsicherheit) and Bel V.
The Forum will focus on **"Nuclear Safety: New Challenges, Gained Experience and Public Expectations" in the light of the Fukushima NPS accident**.

The topic will be considered from the point of view of Japanese safety authorities, of a regulator, of an international organisation, a utility and a Technical Safety Organisation (TSO). The lectures will be completed by a round table discussion on **"Operate safely on the long term: how safe and how long?"** with six international experts. The forum will give the opportunity for discussion to experts from TSOs, research institutes, safety authorities, utilities, industries, public authorities, public associations and international organisations.

The first part of the second day will be devoted to common ETSON and/or EUROSAFE presentations of the Fukushima accident.

The second part of this day will present the latest work carried out by ETSON and Eurosafe members through three seminars (nuclear safety research and safety assessment, radiation protection and environment, nuclear material and nuclear facilities security), a workshop on safety experience feedback on nuclear installations others than NPP and a poster exhibition.

It is our sincere hope that you will attend to contribute to the debates of this Forum and help to progress towards more convergence in technical nuclear safety practices with a view to a high level of safety in nuclear facilities. The attached programme contains all the information you need about the schedule, content and organisation of the Forum.

We should be grateful if you could register online http://registration.net-resa.com/site/600/eurosafe before **the October 27, 2011** to enable us to make arrangements in good time for your stay in Paris.

We look forward to welcoming you to the EUROSAFE Forum 2011.

rs sincerely,

F.-P. Weiß

Jacques Repussard
Directeur général
de l'IRSN

Frank-Peter Weiss
Directeur technique et
scientifique de la GRS

Benoît De Boeck
Directeur général
de Bel V

Baggett, Steven

From: Blake, Kathleen
Sent: Friday, October 21, 2011 12:35 PM
To: EDOBriefingPkgRequest Resource
Cc: Wittick, Susan; Sargent, Kimberly; Baggett, Steven
Subject: Action - Background for Courtesy Visit on November 1, 2011 with NEI
Attachments: Commissioner & OEDO Drop-ins - November 1, 2011

Cathy:

Please ask staff to prepare a briefing package for Commissioner Apostolakis' courtesy visit that has been scheduled for:

DATE: November 1, 2011

TIME: 1:30 p.m.

LOCATION: Worked with Rochelle Bavol in SECY to reserve the 18th floor conference room for the afternoon.

ORGANIZATION: NEI

SUBJECT MATTER:

Topics of Discussion
Fuel Cycle Oversight Process
Prioritization of Regulatory Initiatives
10 CFR Part 40 Rulemaking
Post Fukushima Industry Efforts

ATTENDEES, TITLES:

Industry Participant	Company	Title
Jennifer K. Wheeler	Nuclear Fuel Services, Inc.	Licensing and Integrated Safety Analysis Manager
Michael L. Boren	USEC, Paducah Gaseous Diffusion Plant	Regulatory Compliance and Nuclear Safety Manager
Robert Link	AREVA NP Inc., Richland Fuel Manufacturing Facility	Manager of Environmental, Health, Safety, and Licensing
Douglas A. Yates	Shaw AREVA MOX Services	Advisory Engineer - Licensing
John J. Miller	International Isotopes Inc.	Radiation Safety Officer
David L. Spangler	Babcock and Wilcox, Nuclear Operations Group	Manager, Nuclear Safety and Licensing
Michael E. Greeno	Honeywell International Inc., Metropolis Works Plant	Regulatory Compliance Manager

Larry V. Parscale	Honeywell International Inc., Metropolis Works Plant	Regulatory Affairs Project Manager
Scott P. Murray	GE Hitachi Nuclear Energy, Global Nuclear Fuel – Americas, LLC	Manager, Licensing and Liabilities
Janet R. Schlueter	Nuclear Energy Institute	Director, Fuel & Materials Safety
Andrew N. Mauer	Nuclear Energy Institute	Senior Project Manager, Fuel & Materials Safety

CONTACT: Andrew N. Mauer
Senior Project Manager
Fuel and Materials Safety

Nuclear Energy Institute
1776 I Street, N.W., Suite 400
Washington, D.C. 20006

T: 202.739.8018
F: 202.533.0157
E: anm@nei.org

FURTHER INFORMATION:
* TA(s) and Coordinators have been notified of visit.
* 2 copies of briefing package is requested from staff.

CM/GA Contact: Kathleen Blake 415-1810

Thank you.

Kathleen M. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

Sosa, Belkys ~~NOT FOR PUBLIC DISCLOSURE~~

From: Sosa, Belkys
Sent: Thursday, September 01, 2011 9:42 AM
To: Blake, Kathleen
Subject: Re: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

Categories: Red Category

No action

Sent from an NRC Blackberry
Belkys Sosa
(b)(6)

From: Blake, Kathleen
To: Sosa, Belkys
Sent: Thu Sep 01 09:22:23 2011
Subject: FW: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

Kathleen H. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: CMRAPOSTOLAKIS Resource
Sent: Wednesday, August 31, 2011 6:04 PM
To: Blake, Kathleen
Subject: FW: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

From: (b)(6)
Sent: Wednesday, August 31, 2011 4:41 PM
To: Gallagher, Carol; Hannah, Roger; Ledford, Joey
Cc: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMROSTENDORFF Resource; CMRMAGWOOD Resource
Subject: FW: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

Dear Mr. Ledford and Mr. Hannah,

Sosa, Belkys

From: Blake, Kathleen
Sent: Thursday, September 01, 2011 9:20 AM
To: Sosa, Belkys
Subject: FW: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report
Attachments: image001.gif; image002.png; image003.png; image004.jpg; image005.jpg

Fyi - kb

Kathleen M. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: CMRAPOSTOLAKIS Resource
Sent: Thursday, September 01, 2011 8:00 AM
To: Blake, Kathleen
Subject: FW: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

From: (b)(6)
Sent: Thursday, September 01, 2011 7:57 AM
To: Rakovan, Lance; carol.gallagher@nrc.com; OPA Resource; OPA1 RESOURCE; OPA2 Resource; Resource, OPA3; OPA4 Resource
Cc: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMROSTENDORFF Resource; CMRMAGWOOD Resource
Subject: RE: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

Thanks for the information.

Robert H. Smith

From: Rakovan, Lance [mailto:Lance.Rakovan@nrc.gov]
Sent: Thursday, September 01, 2011 7:43 AM
To: (b)(6) carol.gallagher@nrc.com; OPA Resource; OPA1 RESOURCE; OPA2 Resource; Resource, OPA3; OPA4 Resource
Cc: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMROSTENDORFF Resource; CMRMAGWOOD Resource
Subject: RE: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

The webcast is already available at: http://video.nrc.gov/

You can find the slides for the meeting in our Agencywide Documents Access and Management System (ADAMS) under ML112430111.

If you have any additional questions, please let me know.

Lance J Rakovan
Senior Communications Specialist
Office of the Executive Director for Operations
US Nuclear Regulatory Commission
Washington, DC 20555
(301) 415-2589
(301) 415-2700 fax
lance.rakovan@nrc.gov

U.S.NRC

please consider the environment before printing this email

From: (b)(6)
Sent: Wednesday, August 31, 2011 4:29 PM
To: carol.gallagher@nrc.com; Rakovan, Lance; OPA Resource; OPA1 RESOURCE; OPA2 Resource; Resource, OPA3; OPA4 Resource
Cc: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMROSTENDORFF Resource;

CMRMAGWOOD Resource
Subject: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

Dear Ms. Gallagher,

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I had some internet connection issues at the end of the hearing therefore I have to listen to the end of the hearing when it is available.

I am looking forward to the specific proposals that come out of these hearings with regard to any new orders and rule changes that are going to be made. It is still my understanding that an order would move more quickly than a new rule.

Thanks,

Robert H. Smith

August 23, 2011

MEMORANDUM TO: David L. Skeen, Director
Japan Lessons-Learned Project Directorate

SUBJECT: CATEGORY 2 PUBLIC MEETING TO SOLICIT COMMENTS ON NEAR-TERM TASK FORCE REPORT

this telecopied information is strictly prohibited, and the documents should be returned. In this regard, if you received this telecopy in error, please contact the sender by reply E-mail and destroy all copies of the original.

From: (b)(6)
Sent: Tuesday, August 16, 2011 12:53 PM
To: 'OPA Resource'; 'OPA1.Resource@nrc.gov'; 'OPA3.Resource@nrc.gov'; 'OPA4.Resource@nrc.gov'; 'Chairman@nrc.gov'; 'CMRSVINICKI@nrc.gov'; 'CMRAPOSTOLAKIS@nrc.gov'; 'CMRMAGWOOD@nrc.gov'; 'CMROSTENDORFF@nrc.gov'
Subject: RE: NRC Japan Task Force Meeting Update 8/16/2011 8:30AM to 12:00PM

To whom it may concern:

Since most of the hearing was muted for the presentation I felt that I can send an email regarding my comments about the hearing.

Please send a copy of this to the following:

Dr. Charles Miller

Amy Cubbage

Daniel Dorman

ck Grobe

Gary Holahan

Nathan Sanfilippo

Thanks for sending me the teleconference number with regard to this meeting on enhancing reactor safety.

The meeting today was informative on the current process of how the NRC will be instituting orders and/or rules to address these safety issues in the future. It is my understanding from the meeting that an order can be instituted much more quickly than a rule. I also understand that a lot of the rules were from the 1970's and might have not been changed. Is this the case?

I understand the talk about the differences with the demographics of Japan (Tsunami's) and the United States in which only the Northwest Coast might have exposure to this type of issue.

I was specifically interested in the section with regard to providing the backup up power at the plant. Based upon the conversation in the meeting today it discussed the 72 hour timeframe for backup up power before an outside hookup can be installed to provide full power to the plant. Will the NRC issue guidelines with regard to this timeframe? Will this be through an order or rulemaking? I understand that the 72 hour timeframe can even become a 0 hour timeframe depending on the events that occur at the site.

pending on the Safety backup systems and the events that occur at the plants there might be a need for a much oner approach to providing backup power and/or pumps to keep the core reactors and the spent fuel pools cool if

they have a loss of their regular A/C power and/or backup up power capability. This might change the scope of the required backup hour timeframe that would be needed in order to keep the plant cool.

ere was talk in the meeting with regard to possibility elevating the switch gear at the site to protect the switch gear om flooding but there was a concern that a seismic event might have an impact on this type of equipment. Is this the distribution hookup into the plant that would be able to supply the power to keep the pumps running? What would happen if a set of pumps at one reactor was not working due to a seismic event? Is there parallel piping installed at a multiple reactor setup to potentially be utilized to provide switching in order to maybe use the pumps from another reactor. Do the current reactors have only one set of pumps to run the cooling at one reactor or do they have redundant pumps to be able to be used to provide an additional layer of backup pump capability? If there is a multiple reactor site and one set of pumps at another reactor is damaged due to a seismic event then what would be the backup plan to make sure that there would be pumping capability in order to keep one of the reactors cool?

What specific types of portable solutions are actually being discussed? Was this meeting just the beginning of the discussions on what the types of portable backup solutions might be required or made available to use for the reactor and/or spent fuel pools have a sudden loss of power (regular A/C power supply and/or loss of their backup generators (Station Black out Diesels)? There was talk of a DC power versus A/C power solutions. I do not recall if there was talk about a cooling tower set up at the plant. I think that some of the specifications related to this are the 72 hour timeframe to provide water to the reactor to keep it cool.

I am not sure if this is accurate but I thought I would ask these questions since I think that there was one reactor in Japan that had this type of set up and it was compromised by the tsunami. What would be the portable backup plan for this type of issue? We have to be careful here since a seismic event might require that the backup up power timeframe might have to be reduced to zero based upon the actual events at the plant and/or spent fuel pools.

ill these recommendations be legislated through the order process or rule making as discussed in the meeting?

. nis is very important since based upon the discussions it was indicated that the rule making process could take up to 2 to 3 years. I would think that technology changes might have an impact on a rule that might take up to 2 to 3 years to complete.

I would be very interested to talk about the specific portable solutions that might be implemented. Since this meeting was a broad based meeting I am looking forward to hearing about the specific solutions that might be proposed.

I have sent my previous emails to provide a suggestion of dealing with this type of issue. I think that an elevated type of setup if it can be secured would work for the flood scenario but might be subject to a seismic event.

I think that this can be addressed by bringing a backup power solution to the plant that would be able to be hooked up into the distribution system at the plant if it remains intact after the event or providing a full portable pump/power solution to potentially deal a event specific type of event. For example:

Any plant located with ocean access might be able to utilize a ship with portable power setup to provide power to the plant after the flood event.

Any plant located inland that is subjected to a flood situation would be able to utilize a boat/ship type of setup to provide power to the plant after the flood event. I noticed that submersible pumps were used at the Japan plants based upon certain news reports. Were these effective? If this were effective then a potable power solution would work with ese pumps to either supply fresh water or in extreme cases sea water if possible to keep the reactor and/or spent fuel ol cool.

Any plant without a flood event and has either a seismic event or event (hurricane, tornado) that causes damage to the pumps/ability to supply power has another portable pump solution that might include the ability to bring another

portable pump/power solution via truck [illegible] power can be supplied until full power is restored to the plant. If the submersible pumps below were effective then these can be utilized to keep the reactor and/or spent fuel pools [illegible]ol as well.

[illegible]m fully aware that there are multiple scenarios to take a look at with regard what type of safety solutions would work.

I am looking forward to hearing about the specific solutions that are going to be put into place and what the timeframe would be to put these orders and/or rules into place. Based upon what I have heard at the meeting it appears that the order route might be the quickest route to go.

If there are future hearings with regard to the specific solutions then please let me know.

I am sure that a portable power/pump solution would work. This can be either boat/ship based for plants that are located near the ocean or are surrounded by flood waters. For land based type of events I am sure that portable power could be brought in by truck etc. to provide portable backup power and/or pumps as well.

Is there going to be any meeting(s) regarding the flood scenario with the Nebraska plant? There has been limited news reporting regarding this issue.

The reason why I wanted to hear the meeting is to gear up for issues that might surface in a rate recovery proceeding for a Utility with regard to additional cost recovery that might be required to incorporate any new safety features that are finally decided by the Commission and the NRC. So far there has been no talk about the specifics with regard to cost estimates. This is understood since there has been no specific talk about the actual solutions that might be proposed.

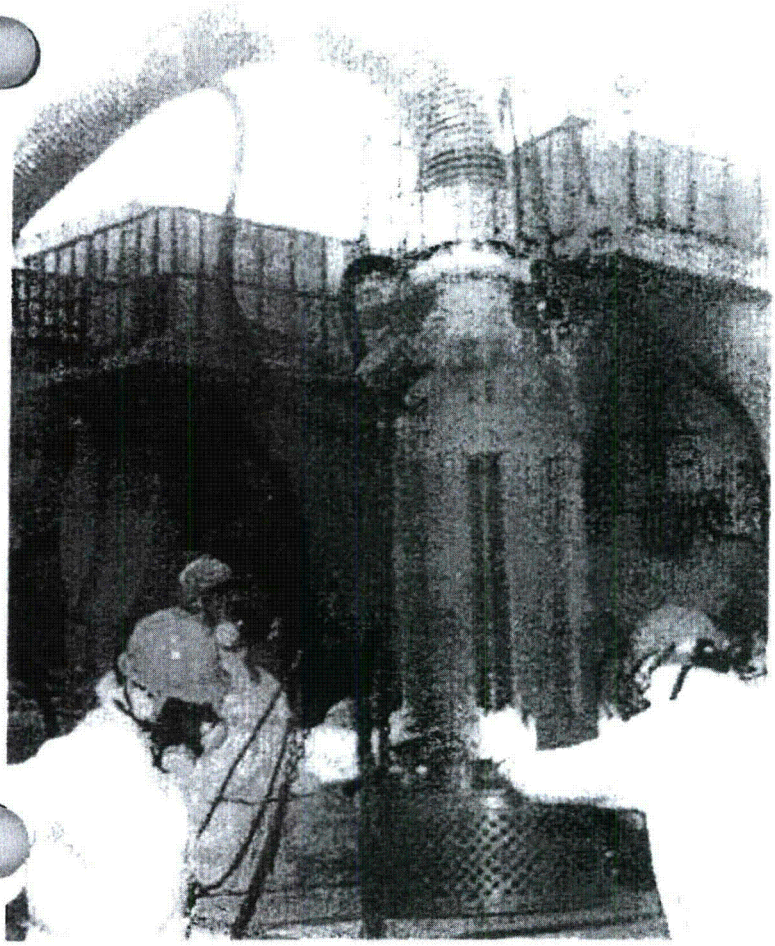
[illegible]anyone has any information with regard to the specific solutions please let me know.

I have a copy of the recommendation study that has been completed from the NRC web site.

Again I thank you for providing me the opportunity to participate in the hearing today.

Thanks,

Robert H. Smith



From: OPA Resource [mailto:OPA.Resource@nrc.gov]
Sent: Friday, August 12, 2011 1:12 PM
To (b)(6)
Subject: RE: NRC Japan Task Force Meeting Update 8/16/2011 8:30AM to 12:00PM

r. Smith:

For the meeting on August 16, a telephone bridge line will be available:

866-822-3032
Pass Code (b)(6)

~~NOT FOR PUBLIC DISCLOSURE~~

From: (b)(6)
Sent: Friday, August 12, 2011 8:40 AM
To: OPA Resource; OPA1 RESOURCE; Resource, OPA3; OPA4 Resource
Cc: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMRMAGWOOD Resource; CMROSTENDORFF Resource
Subject: FW: NRC Japan Task Force Meeting Update 8/16/2011 8:30AM to 12:00PM

To whom it may concern:

Will this conference be available on a web cast and/or teleconference?

Thanks,

Robert H. Smith

From: RSmith (b)(6)
Sent: Thursday, August 11, 2011 1:46 PM
To: 'OPA.Resource@nrc.gov'
Subject: NRC Japan Task Force Meeting Update 8/16/2011 8:30AM to 12:00PM

To whom it may concern:

Will this meeting be web cast/teleconferenced for the outside public? Do we have the web link or teleconference number to be able to hear the meeting?

Thanks,

Robert H. Smith

NOT FOR PUBLIC DISCLOSURE

~~NOT FOR PUBLIC DISCLOSURE~~

NRC NEWS

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

August 11, 2011

MEDIA ADVISORY

NRC JAPAN TASK FORCE MEETING UPDATE

The NRC's Near-Term Task Force that reviewed lessons learned from the Fukushima Dai-ichi accident will discuss its recent report with the Fukushima Subcommittee of the Advisory Committee on Reactor Safeguards on Tuesday, Aug. 16, from 8:30 a.m. – noon. The meeting will take place in Room T2-B1, Two White Flint North, 11545 Rockville Pike, Rockville, Md. An earlier NRC press release provided an incorrect date.

~~NOT FO~~

Sosa, Belkys

om: Blake, Kathleen
ent: Thursday, September 01, 2011 9:22 AM
o: Sosa, Belkys
Subject: FW: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report
Attachments: image001.png; image002.png; image003.jpg; image004.jpg

Categories: Red Category

Kathleen H. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

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From: (b)(6)
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To: Gallagher, Carol; Hannah, Roger; Ledford, Joey
Cc: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMROSTENDORFF Resource; CMRMAGWOOD Resource
Subject: FW: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

Dear Mr. Ledford and Mr. Hannah,

The OPA2.resource@nrc.gov has sent me an undeliverable. I have been told that this issue was going to be fixed. Is this the case?

Thanks,

bert H. Smith

From: postmaster@nrc.gov [mailto:postmaster@nrc.gov]
Sent: Wednesday, August 31, 2011 4:29 PM
To: (b)(6)
Subject: Undeliverable: Category 2 Public Meeting to Solicit Comments On Near-Term Task Force Report

Delivery has failed to these recipients or distribution lists:

OPA2
Your message wasn't delivered because of security policies. Microsoft Exchange will not try to redeliver this message for you. Please provide the following diagnostic text to your system administrator.

[illegible]

Diagnostic information for administrators:

Generating server: nrc.gov

OPA1@nrc.gov
#550 5.7.1 RESOLVER.RST.AuthRequired; authentication required ##

Original message headers:

[illegible]

NOT FOR PUBLIC DISCLOSURE

From: RSmith (b)(6)
Sent: Wednesday, August 31, 2011 4:29 PM
To: 'carol.gallagher@nrc.com'; 'lance.rakovan@nrc.gov'; 'OPA Resource'; 'OPA1.Resource@nrc.gov'; 'OPA2.Resource@nrc.gov'; 'OPA3.Resource@nrc.gov'; 'OPA4.Resource@nrc.gov'
Cc: 'Chairman@nrc.gov'; 'CMRSVINICKI@nrc.gov'; 'CMRAPOSTOLAKIS@nrc.gov'; 'CMROSTENDORFF@nrc.gov'; 'CMRMAGWOOD@nrc.gov'
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Thanks,

Robert H. Smith

~~NOT FOR PUBLIC DISCLOSURE~~

August 23, 2011

MEMORANDUM TO: David L. Skeen, Director
Japan Lessons-Learned Project Directorate

SUBJECT: CATEGORY 2 PUBLIC MEETING TO SOLICIT COMMENTS ON NEAR-TERM TASK FORCE REPORT

From: RSmith [(b)(6)]
Sent: Tuesday, August 16, 2011 12:53 PM
To: 'OPA Resource'; 'OPA1.Resource@nrc.gov'; 'OPA3.Resource@nrc.gov'; 'OPA4.Resource@nrc.gov'; 'Chairman@nrc.gov'; 'CMRSVINICKI@nrc.gov'; 'CMRAPOSTOLAKIS@nrc.gov'; 'CMRMAGWOOD@nrc.gov'; 'CMROSTENDORFF@nrc.gov'
Subject: RE: NRC Japan Task Force Meeting Update 8/16/2011 8:30AM to 12:00PM

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Charles Miller

Amy Cubbage

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Daniel Dorman

Jack Grobe

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ry Holahan

athan Sanfilippo

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Will these recommendations be legislated through the order process or rule making as discussed in the meeting?

NOT FOR PUBLIC DISCLOSURE

This is very important since based upon the discussions it was indicated that the rule making process could take up to 2 to 3 years. I would think that technology changes might have an impact on a rule that might take up to 2 to 3 years to complete.

I would be very interested to talk about the specific portable solutions that might be implemented. Since this meeting was a broad based meeting I am looking forward to hearing about the specific solutions that might be proposed.

I have sent my previous emails to provide a suggestion of dealing with this type of issue. I think that an elevated type of setup if it can be secured would work for the flood scenario but might be subject to a seismic event.

I think that this can be addressed by bringing a backup power solution to the plant that would be able to be hooked up into the distribution system at the plant if it remains intact after the event or providing a full portable pump/power solution to potentially deal a event specific type of event. For example:

Any plant located with ocean access might be able to utilize a ship with portable power setup to provide power to the plant after the flood event.

Any plant located inland that is subjected to a flood situation would be able to utilize a boat/ship type of setup to provide power to the plant after the flood event. I noticed that submersible pumps were used at the Japan plants based upon certain news reports. Were these effective? If this were effective then a potable power solution would work with these pumps to either supply fresh water or in extreme cases sea water if possible to keep the reactor and/or spent fuel pool cool.

Any plant without a flood event and has either a seismic event or event (hurricane, tornado) that causes damage to the pumps/ability to supply power has another portable pump solution that might include the ability to bring another portable pump/power solution via truck etc. so that the power can be supplied until full power is restored to the plant. If the submersible pumps below were effective then these can be utilized to keep the reactor and/or spent fuel pools cool as well.

I am fully aware that there are multiple scenarios to take a look at with regard what type of safety solutions would work.

I am looking forward to hearing about the specific solutions that are going to be put into place and what the timeframe would be to put these orders and/or rules into place. Based upon what I have heard at the meeting it appears that the order route might be the quickest route to go.

If there are future hearings with regard to the specific solutions then please let me know.

I am sure that a portable power/pump solution would work. This can be either boat/ship based for plants that are located near the ocean or are surrounded by flood waters. For land based type of events I am sure that portable power could be brought in by truck etc. to provide portable backup power and/or pumps as well.

Is there going to be any meeting(s) regarding the flood scenario with the Nebraska plant? There has been limited news reporting regarding this issue.

The reason why I wanted to hear the meeting is to gear up for issues that might surface in a rate recovery proceeding for a Utility with regard to additional cost recovery that might be required to incorporate any new safety features that are finally decided by the Commission and the NRC. So far there has been no talk about the specifics with regard to cost estimates. This is understood since there has been no specific talk about the actual solutions that might be proposed.

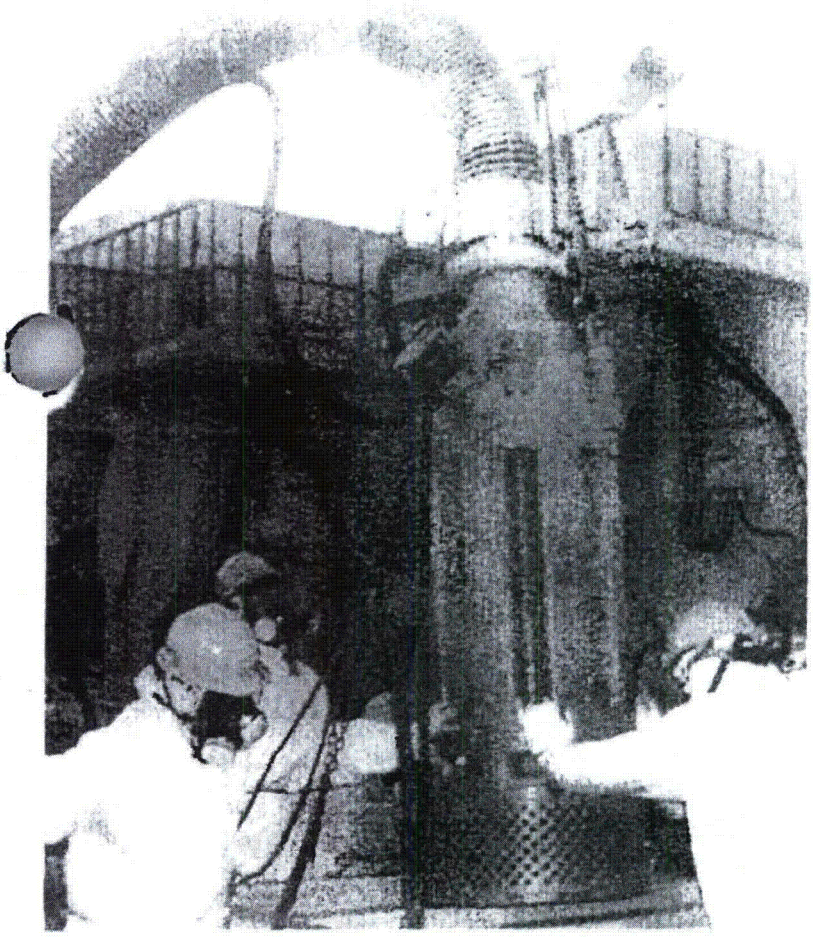
If anyone has any information with regard to the specific solutions please let me know.

I have a copy of the recommendation study that has been completed from the NRC web site.

ain I thank you for providing me the opportunity to participate in the hearing today.

anks,

Robert H. Smith



Confidentiality Statement

NOT FOR PUBLIC DISCLOSURE

From: OPA Resource [mailto:OPA.Resource@nrc.gov]
Sent: Friday, August 12, 2011 1:12 PM
To: (b)(6)
Subject: RE: NRC Japan Task Force Meeting Update 8/16/2011 8:30AM to 12:00PM

Mr. Smith,

For the meeting on August 16, a telephone bridge line will be available:

866-822-3032
Pass Code (b)(6)

From: (b)(6)
Sent: Friday, August 12, 2011 8:40 AM
To: OPA Resource; OPA1 RESOURCE; Resource, OPA3; OPA4 Resource
Cc: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMRMAGWOOD Resource; CMROSTENDORFF Resource
Subject: FW: NRC Japan Task Force Meeting Update 8/16/2011 8:30AM to 12:00PM

To whom it may concern:

Will this conference be available on a web cast and/or teleconference?

Thanks,

Robert H. Smith

~~**Confidentiality Statement**~~

~~The documents accompanying this telecopy transmission contain information which is confidential and/or legally privileged. The information is intended only for the use of the individual or entity named on this transmission sheet. If you are not the intended recipient, you are hereby notified that any disclosure, copying, distribution or the taking of any action in reliance on the contents of this telecopied information is strictly prohibited, and the documents should be returned. In this regard, if you received this telecopy in error, please contact the sender by reply E-mail and destroy all copies of the original.~~

From: RSmith (b)(6)
Sent: Thursday, August 11, 2011 1:46 PM
To: 'OPA.Resource@nrc.gov'
Subject: NRC Japan Task Force Meeting Update 8/16/2011 8:30AM to 12:00PM

NOT FOR PUBLIC DISCLOSURE

To whom it may concern: ~~NOT FOR PUBLIC DISCLOSURE~~

Will this meeting be web cast/teleconferenced for the outside public? Do we have the web link or teleconference number to be able to hear the meeting?

Thanks,

Robert H. Smith

NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION

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

August 11, 2011

*****MEDIA ADVISORY*****

NRC JAPAN TASK FORCE MEETING UPDATE

The NRC's Near-Term Task Force that reviewed lessons learned from the Fukushima Dai-ichi accident will discuss its recent report with the Fukushima Subcommittee of the Advisory Committee on Reactor Safeguards on Tuesday, Aug. 16, from 8:30 a.m. – noon. The meeting will take place in Room T2-B1, Two White Flint North, 11545 Rockville Pike, Rockville, Md. An earlier NRC press release provided an incorrect date.

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Sosa, Belkys
nt: Wednesday, October 12, 2011 10:38 AM
: Blake, Kathleen
ubject: RE: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report
Attachments: image001.png; image002.png

No action

From: Blake, Kathleen
Sent: Wednesday, October 12, 2011 9:57 AM
To: Sosa, Belkys
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

Kathleen H. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
1-415-1810

From: CMRAPOSTOLAKIS Resource
Sent: Tuesday, October 11, 2011 5:57 PM
To: Blake, Kathleen
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

From: (b)(6)
Sent: Tuesday, October 11, 2011 4:51 PM
To: Rakovan, Lance; Gallagher, Carol; OPA Resource; OPA1 RESOURCE; OPA2 Resource; Resource, OPA3; OPA4 Resource; Gallagher, Carol; Hannah, Roger; Ledford, Joey
Cc: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMROSTENDORFF Resource; CMRMAGWOOD Resource
Subject: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

o whom it may concern: NOT FOR PUBLIC DISCLOSURE

Due to the delicate nature of this information I would like to make sure that this correspondence request/communication does not have any impact on my current/future employment. I can only hope that the public service work that I have been working on is viewed as a public service work and does not have any impact on my family's well being.

I was listening to the hearing today and I was able to listen to a large part of the meeting. I had to leave to go to another meeting today therefore I was wondering when the Hearing will be made available through the web archives that is on the NRC site. I was only able to hear part of the meeting and I would like to hear the rest of the meeting to see all the specifics that have been discussed.

Some initial observations is that the chairman has indicated that there might be an expedited since some of the design implementation might take 5 to 15 years to implement. I heard about the Station Blackout issues and there are various amounts of time that has been discussed that might be implemented. The chairman during the meeting indicated that he would like to see a realistic timeframe for some of the implementation of some of the suggestions. Just like my previous email there has been talk about an order versus rule making in that rule making takes time to implement. It appears that the design updates and rule implementation might take additional time.

One speaker at the meeting suggested that some of the European design technology potentially should be adapted in order to shorten the implementation timeframe.

Is there any discussion of separating the recommendations into two types of issues? One issue should deal with the continued change in design features based upon the existing technology to enhance the safety designs at the plant. The other would be to have an immediate emergency option. Maybe if these are dealt with independently the timeline can be shortened to come up with a quick emergency response plan. There was talk about getting the National Guard involved.

This was just a quick observation but I would like to hear the rest of the hearing to see if there are any other details that have been discussed to expedite this process.

Short term solution for water based plants with water access by ship would be to bring in ships with generation to provide power to the plant immediately in order to keep the pumps at the reactors operating to keep them cool. This might require a distribution hook up from the port to the distribution system at the plant. This distribution system can be elevated in order to keep it safe from a flood issue.

Has there been any discussion about parallel piping at a multiple reactor setup in order to provide switching at the plant to utilize working pumps at another reactor if one of the reactor pumps becomes damages due to a seismic event?

This would be another quick solution if it can be done with portable piping that is brought in by ship. A ship solution might be able to provide a quick emergency response to the plant that needs a quick cooling solution if there is no power at the plant.

Was this brought up with the National Guard plan?

Based upon what I have heard no specific details of the plan have been discussed. It appears that the meetings are still in the preliminary stage in which there is discussion about timelines to implement change and how long this process might take. With this type of issue it is very important to have an emergency response plan that would work short term so that the recommendations can be implemented much quicker than some of the timeframes that have been discussed. Of course I did not hear the entire hearing so some of these comments might change.

I have provided a specification in a motion that I have filed with the Florida Public Service Commission. You can take a look at some of the motion but in order for the NRC to have access to the full motion you would have to ask the Florida Public Service Commission to provide you a copy of the full motion that has been filed which has some of the

specifications/ideas that I have sent to the President and the Prime Minister of Japan. Attached is a copy of my motion that I have filed with the Commission. I think that I have sent you some of the email correspondence that I have sent to the Florida Public Service Commission regarding my suggestions. The Commission denied my motion based upon me not having intervenor status. Since I am a party with a full legal interest in the Florida rate case proceedings I wanted to make sure that my information was made part of the web public docket in the event that my suggestions are potentially utilized which would have an impact on current/future rate case proceedings that deal with Nuclear Cost recovery. I do not have the means to intervene but this should not prevent me to have my motion fully filed based upon both Federal/State law. This would be my right as a party with a full legal interest in these proceedings. I would like to file an appeal to their order denying my motion since my motion has to deal with potentially safety issues at Nuclear Power Plants. If I was able to file electronically I would so that this information would be made part of the web public docket just like the other motion(s) that I have file with the Commission. There denial of my motion due to me not being an intervenor appears to be invalid based upon Federal/State law.

Since I feel that this safety issue is very important in addition to current/future rate recovery I felt that the Florida Public Service Commission should have made my full motion part of the web public docket in the event some of my suggestions are finally adopted in order to provide a safety solution at Nuclear Power Plants.

I am sending you a copy of the motion since I feel that safety issues at the plant are very important to consider with any Nuclear Recovery cost type proceeding.

Please let me know when the web case will be available in the web archive files so that I can continue to listen to the parts of the hearing that I have missed.

Hopefully OPA2.Resource@nrc.gov receives this email since this is the region that Florida Power and Light Nuclear Plants are located. In the past all other regions have been receiving my emails except this region.

Thanks,

Robert H. Smith

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10/07/11	Beyond Nuclear 10 CFR 2.206 Petition Public Meeting	01h 30m	Video...	MP3	MPEG4

SCHEDULING NOTE

Title: **BRIEFING ON THE JAPAN NEAR TERM TASK FORCE REPORT – PRIORITIZATION OF RECOMMENDATIONS (Public)**

Purpose: To provide the Commission with a discussion of the staff's recommendations and external stakeholders' input on the prioritization of regulatory actions to be taken by the staff to respond to the Japan Near Term Task Force (NTTF) report and longer term evaluations to facilitate Commission voting on the notation vote paper providing staff's recommendations.

Scheduled: **October 11, 2011**
9:00 am and 1:00pm

Duration: Approx. 5 hours

Location: Commissioners' Conference Room, 1st floor OWFN

Sosa, Belkys

From: Sosa, Belkys
nt: Wednesday, October 12, 2011 5:11 PM
: Blake, Kathleen
ubject: RE: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report
Attachments: image003.jpg; image004.png; image005.png

No action

From: Blake, Kathleen
Sent: Wednesday, October 12, 2011 4:31 PM
To: Sosa, Belkys
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

Kathleen M. Blake
Administrative Assistant
Commissioner Apostolakis
S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: CMRAPOSTOLAKIS Resource
Sent: Wednesday, October 12, 2011 4:09 PM
To: Blake, Kathleen
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

From: (b)(6)
Sent: Wednesday, October 12, 2011 2:07 PM
To: Rakovan, Lance; Gallagher, Carol; OPA Resource; OPA1 RESOURCE; OPA2 Resource; Resource, OPA3; OPA4 Resource; Gallagher, Carol; Hannah, Roger; Ledford, Joey
: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMROSTENDORFF Resource; IRMAGWOOD Resource
ubject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

To all,

ent out to the web to check the slides again and they have been made available.

Thanks,

Robert H. Smith

From: RSmith (b)(6)
Sent: Wednesday, October 12, 2011 2:00 PM
To: 'Rakovan, Lance'; 'carol.gallagher@nrc.gov'; 'OPA Resource'; 'OPA1 RESOURCE'; 'OPA2 Resource'; 'Resource, OPA3'; 'OPA4 Resource'; 'Carol.Gallagher@nrc.gov'; 'Hannah, Roger'; 'Ledford, Joey'
Cc: 'CHAIRMAN Resource'; 'CMRSVINICKI Resource'; 'CMRAPOSTOLAKIS Resource'; 'CMROSTENDORFF Resource'; 'CMRMAGWOOD Resource'
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

To all,

I fixed a couple of **typo(s)** in the previous email.

I have been listening to the hearing.

Do we have a copy of the slides that appears to be only shown in the hearing in a PDF file format so that I can obtain a full copy of what was presented in the hearing?

I have been listening to the hearing and noticed that some of the slides that have been shown in the hearing are not part of the materials. Did these materials get published to the web so that I can download a copy of these documents.

Here is an example of what I have heard in the hearing. I took a screen print.

Thanks,

Robert H. Smith

Recommendations 2.1 and 2.3 – Seismic/Flooding

- The timeline (past and future) of GI-199 is questionable in terms of providing a timely resolution and informing near-term action
- Does the NRC intend to use resolution of GI-199 as the vehicle for establishing criteria and methods to assess seismic safety deficiencies at specific licensee sites?
- We urge the NRC to not wait years for inspection criteria when it has already established methods and regulations for dealing with this exact issue in the context of early site permits and combined license reviews
  - The staff recommendation in the latest SECY [illegible] the preferred path of applying present-day regulatory guidance and methodologies to the reevaluation of flooding hazards at operating reactors, but did not go far enough in extending this common sense conclusion to seismic hazards

I DON'T THINK THE MOST RECENT STAFF PAPER RESOLVES

From: RSmith (b)(6)
Sent: Tuesday, October 11, 2011 4:51 PM
To: 'Rakovan, Lance'; 'carol.gallagher@nrc.gov'; 'OPA Resource'; 'OPA1 RESOURCE'; 'OPA2 Resource'; 'Resource, OPA3'; 'OPA4 Resource'; 'Carol.Gallagher@nrc.gov'; 'Hannah, Roger'; 'Ledford, Joey'
Cc: 'CHAIRMAN Resource'; 'CMRSVINICKI Resource'; 'CMRAPOSTOLAKIS Resource'; 'CMROSTENDORFF Resource'; 'CMRMAGWOOD Resource'
Subject: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

To whom it may concern:

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Thanks,

Robert H. Smith

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10/07/11	Beyond Nuclear 10 CFR 2.206 Petition Public Meeting	01h 30m	Video...	MP3	MPEG4

SCHEDULING NOTE

Title: **BRIEFING ON THE JAPAN NEAR TERM TASK FORCE REPORT – PRIORITIZATION OF RECOMMENDATIONS (Public)**

Purpose: To provide the Commission with a discussion of the staff's recommendations and external stakeholders' input on the prioritization of regulatory actions to be taken by the staff to respond to the Japan Near Term Task Force (NTTF) report and longer term evaluations to facilitate Commission voting on the notation vote paper providing staff's recommendations.

Scheduled: **October 11, 2011**
9:00 am and 1:00pm

Duration: Approx. 5 hours

Location: Commissioners' Conference Room, 1st floor OWFN

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

m: Sosa, Belkys
t: Thursday, October 13, 2011 6:19 PM
: Blake, Kathleen
Subject: Re: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

No action

Sent from an NRC Blackberry
Belkys Sosa
(b)(6)

From: Blake, Kathleen
To: Sosa, Belkys
Sent: Thu Oct 13 16:57:59 2011
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

Kathleen M. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
01-415-1810

From: CMRAPOSTOLAKIS Resource
Sent: Thursday, October 13, 2011 3:42 PM
To: Blake, Kathleen
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

From: (b)(6)
Sent: Thursday, October 13, 2011 2:39 PM
To: CHAIRMAN Resource; CMRSVINICKI Resource; CMRAPOSTOLAKIS Resource; CMROSTENDORFF Resource; CMRMAGWOOD Resource; Rakovan, Lance; Gallagher, Carol; OPA Resource; OPA1 RESOURCE; OPA2 Resource; Resource, OPA3; OPA4 Resource; Gallagher, Carol; Hannah, Roger; Ledford, Joey
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

all,

NOT FOR PUBLIC DISCLOSURE

I have taken a look at the testimony of the interested parties with regard to providing a plant to implement various safety measures to protect our Nuclear Plants. Based upon my previous email I support my original reaction to the hearing in that maybe there should be an emergency response type plan that is separated from the tier plan. This would potentially provide for a quick turnaround time to implement a safety solution that might already be available based upon existing technologies that are available. Please see my motion that I have sent to the NRC regarding my suggestions. I am not an engineer but I have spent over a decade dealing with a lot of regulatory issues with Nuclear Power Plants from an Accounting/Legal perspective. I used to prepare ratecase forecasts that dealt with a very large decommissioning of a Nuclear Power Plant in the Northeast region. We had multiple issues with the decommissioning and it moved very slowly and the cost for the decommissioning was very costly. We had issues with removing the Spent Nuclear Fuel rods out of the Plant to another plant that can use the fuel. This was a very long process. Now that we are taking a look at safety issue(s) to ensure that our Nuclear Power Plants can be operated safely with the proper redundancy to put into to place the proper safety protections, we should strive to make sure that we utilize our existing technologies and skill sets to make sure that an emergency response plan can be put into place sooner rather than later. It appears that on some of the issues below that the timeframes to implement some of the recommendations might take too long.

Please take a look at the motion that I have sent regarding my recommendations and my concerns which might have an impact on current/future Nuclear Cost recovery.

I am looking forward to the next step in this process.

If you have any question to my comments below please email me at (b)(6)

Hopefully there are no typo(s).

Thanks,

Robert H. Smith

Robert H. Smith Comments

Prepared Comments of Christopher E. Paine
Nuclear Program Director, Natural Resources Defense Council (NRDC) on
SECY-11-0137, "Staff Assessment and Prioritization of Near-Term Task Force Recommendations."
October 11, 2011

4.1 Station Blackout regulatory actions

Based upon the statement below it is very important to maybe carve out an emergency response solution by order versus a design based rule making response.

5 years would not be acceptable since a similar type event can occur at any time. I fully understand the concerns with a seismic event. If there is an Earthquake that makes all/some of the equipment at the plant that prevents cooling to the reactor and/or spent fuel pools then an immediate solution would be needed. In some of the

testimony there is talk about limited solutions for seismic type events. These types of events have to be looked at as well since no one can provide assurance that there are enough redundancy and/or safety solutions in place to handle every type of scenario. Has any models been run for different scenario situations in which they can model the application of current/future safety solutions that have been put into place by plant/reactor/spent fuel pools? If not, then the best possible approach would be to have the ability to provide a mobile solution to provide power and/or pumping capability to come in after the event and immediately provide the power. We have to remember that when there is a seismic/flood event, equipment that has been put into place for safety backup plans might already been damaged or maybe become damaged after the actual event. As a redundancy response I would think that with today's technology we would be able to provide ample backup up power by a mobile based safety solution versus updated engineering designs which based upon some of the testimony would take time. I know that if the plant is water based with ocean access then bringing in ample portable power should not be a problem. I have provided for possible specifications for a mobile based plan for a water based plants. The same type of concepts can be used for land based plants. If the NRC comes up with an emergency response solution then an economic/cost study should be able to be completed rather quickly since it appears that there is existing technologies in place to provide this type of safety solution. There are military ships that have the capability to run the pumps at the plants. You can bring in these types of backup generation by ship or land based vehicles. A lot of utilities are utilizing combined cycle units in which they provide power as backup to the plants in the event the plant loses power. The ship based combined cycle units are very similar and depending on the footprint or the size of the generator these might be able to be brought in by land based vehicles as well. I am sure that we would be able to obtain this cost very easily as long as the Utility/the Generator Manufacturer (GE etc.) and the Military would provide the cost data and equipment specifications to see if this is a viable option.

The reason why this type of approach is a better approach than the design based approach is that based upon the testimony it appears that there are too many time constraints that might cause delays with actual implementation of the additional safety solutions.

I think that if the NRC decides to carve out an emergency response solution to expedite the time of implementation that the 4.25 year timeframe can be made much shorter. In addition, since the technology currently exists why would we want to keep reinventing the wheel with constant design changes when these types of changes might take anywhere from 5 to 15 years to implement?

Short term solution for Japan would have been to bring a ship based power solution to provide immediate power to the plant to run portable pumps after the event to keep both the reactor cores and spent fuel pools cool. I fully understand that there may have not been a distribution hookup from the dock to the electric grid at the plant but I am sure that this can be done on an economic basis with current technology that is already available. The distribution hookups can be elevated to avoid a flood issue and I am sure that existing engineering is available to provide the protection for the distribution to bring the power to the cooling pumps and/or portable pumps that would required to keep the core and spent fuel pools cool.

Since design-basis parameters for the full range of severe natural events are also the object of Tier 1 review and revision under NTTF Recommendations 2.1 and 2.3, via a process likewise destined to take years, any "interim protection" from SBO's under 4.2 would appear to be based on the current insufficient design basis criteria. So in effect the Staff is proposing no significant increase in SBO mitigation capability for at least 4.25 years, and if past is prologue, probably much longer than that. As I noted, NRDC finds this situation intolerable, and we urge the Commission to act expeditiously to strengthen the staff recommendations on mitigating SBO's with some meaningful near-term actions:

Based upon the testimony below: NOT FOR PUBLIC DISCLOSURE

Battery backup would only work in certain situations in which there is no damage to other components to the plant. What would happen with a seismic and/or flood event that takes out the actual cooling pumps and or pumps to keep the spent fuel pools cool? No Battery backup plan would be able to provide a solution for this if the pumps become damaged and/or the systems to keep the spent fuel pools cool are damaged. You would still need a portable pump solution in order to provide for pump capacity to keep both the reactor and/or the spent fuel pools cool. The statements appear to be indicating that the pumping capacity at the plants is still intact.

The price/performance ratio of battery bank energy storage has improved considerably in recent years and available to plant operators in the commercial marketplace, there are portable power technology options that can be ruggedized, seismically hardened, and survivably positioned within the plant site, and as I just noted, there are now reliable self-powering options.

All French PWR nuclear units, for example, already achieve some 20 hours of coping time by employing small emergency turbo-generators running on secondary loop steam from the steam generators. Within two minutes of emergency shut-down in response to an SBO, these units supply power to a primary system motor-driven test pump that ensures continued cooling of critical primary loop coolant pump seals, and ensures maintenance of a minimum of control valve and instrumentation functions for regulating pressure and temperature in primary and secondary cooling systems, primary system refill, speed control of the steam turbine-driven pump(s) for auxiliary supply of the steam generator, and control of the atmospheric steam relief valves.

In US PWRs, an extended self-powering option would seem to be readily available by attaching a modern low-maintenance generator, such as a permanent magnet generator, to the shaft end of the Auxiliary Feedwater Pump Turbine. This upgrade could simultaneously cure reliance on obsolete hydraulic speed control systems that frequent result in overspeed trips on startup, uncertain reliability, and high maintenance costs for this critical safety-related component.

In BWR's, there are numerous opportunities for extended self-powering options for speed and flow control of safety-related turbines, and for much longer than the minimum recommended eight hours of initial coping capability. These generators could be attached to the Reactor Core Injection Cooling (RCIC), High Pressure Safety Injection (HPSI), and Low Pressure Safety Injection (LPSI) turbines, providing AC power to critical instrumentation and control valves for emergency core-cooling as long as a supply of steam remains available. This could free the expanded battery bank for supplying power to other critical monitoring systems and controls, such as radiation monitors, emergency lighting, cameras in remote or radiation hazard locations, and upgraded spent fuel pool instrumentation.

Robert H. Smith Comments

Based upon the testimony below:

All type of vent design changes should be implemented as soon as possible if there is technology that would provide for better protection for containment and/or a catastrophic explosion(s). Has anyone asked the question if the explosions at the plants could have been prevented if they had immediate supply of power and pump capability brought into the plants right after the event? This is critical in that this would have provided the protection that would have been needed to avoid this type of catastrophic failure.

Recommendation 5.1 – Require Reliable Hardened Vents in BWRs with Mark I and II containments

Robert H. Smith Comments NOT FOR PUBLIC DISCLOSURE

Based upon the testimony below:

This is a good idea but it appears that any monitoring equipment might not make a difference if you cannot keep the pumps and/or the spent fuel pools cool. It was very evident by the timeline of the events in Japan that the timeframe was very narrow. This is why I sent an immediate email to the Prime Minister and the White House to see if they could bring in a portable power/pump solution. Without this type of redundancy protection if you cannot bring power and/or portable pumps to keep the reactors and/or the spent fuel rods cool no monitoring equipment is going to matter. You still have to deal with keeping the plant cool! This is a design idea that would be good to implement to have a better indication of the status but it appears that by the timeline of the events in Japan that the timeframe was narrow.

Recommendation 7.1 – Order Licensees to provide sufficient safety related instrumentation, able to withstand design-basis natural phenomena, to monitor key Spent Fuel Pool parameters (i.e. water level, temperature, and area radiation levels) from the control room.

The Staff prioritization paper (SECY-11-0137) introduces some subtle caveats that muddy the waters surrounding implementation of this important recommendation. The Staff wants to begin the process by engaging stakeholders on "what constitutes *potentially safety-related* SFP instrumentation" before it asks the Commission to issue orders providing only for "*reliable* SFP instrumentation," whereas the Task Force called for the provision of "*sufficient safety-related instrumentation* able to withstand design basis natural phenomena."

If the Commission is serious about this issue and not merely dabbling in it until the public concern fades away, it will direct that these SFP instrumentation upgrades be "safety-related," and therefore subject to the Commission's quality assurance requirements in 10 CFR Part 50 Appendix B, and also capable of maintaining performance in severe accident scenarios that are currently beyond a plant's approved design basis.

Robert H. Smith Comments

Based upon the testimony below:

We have to be very careful here. If the NRC feels that it will be an option to move the spent nuclear fuel to another location then this should be implemented as soon as possible but until this type of solution is in place you still have to deal with keeping the spent fuel pools cool. Again this is another design change that can take years to implement. If it going to take too much time then you still need a short term solution to keep the spent fuel rods cool! Again a portable power/pump solution should be able to take care of keeping the spent nuclear fuel cool. I am not sure about the design specifications of the actual pools against a seismic event. Are there any redundancy solutions for multiple spent nuclear fuel pools? Are the standards for these pools up to specification to withstand a seismic event? If not then what would be the alternative solution in the event an offsite solution cannot be provided for in the near term timeframe? How much of the spent fuel pool cooling issue in Japan was related to the catastrophic explosion event due to the reactors not being kept cool. Again this can be addressed with an emergency response plan to bring in the portable power/pump capacity to keep the reactor and/or spent fuel pools cool. If the pool becomes damaged as a result of the seismic event then you would still have to address if you can provide the capability to move them to another pool if possible or if need be utilizing a portable power/pumps solution can you bury the spent fuel in place with concrete to potentially help with a containment issue? I am not sure if the rods are cools enough for movement and/or you can bury the spent fuel rods to contain initially to be addressed after the event.

Recommendations 7.2 – 7.5 (Tier 2) – Enhancing SFP makeup capability.

The Staff prioritization paper demotes the Task Force recommendations for ensuring spent fuel makeup capability from a *near-term priority for Commission orders* to a *"Tier 2" priority for eventual rulemaking,* "after consideration of insights" from the extended rulemaking processes that the Staff now calls for. Once again, this kicks out any resolution and implementing action on this important issue for at least 4 years. We therefore oppose this staff recommendation, and urge that the Commission, as a minimum revert to the original Task Force recommendation.

However, as good as Task Force Recommendation 7 was in its original form, we note that it entered the current Staff review process with two inherent weaknesses:

(1) It ignores the safety advantages of off-loading densely packed spent fuel from vulnerable pools to better protected hardened dry cask storage, and

(2) It artificially constrains the problem of ensuring spent fuel cooling to SFP makeup capability only.

With respect to the first issue, it is of long standing, and the Commission's current position that the two methods of storing spent fuel are essentially equivalent in the risks they pose remains undocumented and untenable. We and others have already raised this issue in the context of this review and once again the Staff has failed to address these comments.

<u>Robert H. Smith Comments</u>

Based upon the statement below it is apparent that an Emergency type of plan is very important and it is very important to get this done with an order versus rule making to ensure that a proper emergency response plan is put into place in a much shorter timeframe.

Recommendation 8: Strengthening and Integrating Onsite Emergency Response Capabilities

Unfortunately, neither the Task Force recommendation nor the Staff's subsequent evaluation of it clearly bites the bullet and brings *severe accident mitigation hardware features and operating procedures firmly within the ambit of NRC operating license requirements* subject to the NRC's continuing inspection and enforcement process. It would greatly simplify matters if the Commission took this step, thereby making it clear to industry and the public that the era of non-binding, unaccountable self-regulation was over in the critical matter of on-site emergency responses.

It never made sense in the first place to push these issues to the margins of the regulatory system, and it makes even less sense now in the wake of Fukushima. Given that unexpectedly severe natural or man-made events or multiple equipment failures could challenge one or more units in a population of 104 aging nuclear power plant *at any time*, the Staff's proposal, to engage in a yet another leisurely rulemaking that would put us at the starting line for implementation in 4.25 years, is unacceptable.

The Commission should revert to the original Task Force recommendation for issuance of a near-term order and strengthen it in the manner I've just indicated.

Robert H. Smith Comments

Based upon the testimony below:

I did not hesitate to tell the President and the Prime Minister of Japan to utilize the existing technologies to help bringing in the power and/or portable pump capability to keep the plants cool. As evident by the testimony below it appears that the technology already exists to implement a type of plan that I have outlined in my motion to the Florida Public Service Commission in the State of Florida. If it take six months to see if we already have the capability then this should be implemented by an order and not rule making to make sure that this is put into place immediately to provide the protection needed with a seismic and/or flood event. Again if the platform for a combined cycle unit can be limited (i.e. a combined cycle unit is a jet turbine with additional equipment to capture the heat that comes out of the jet turbine and utilizes this heat to create steam which provides for a more efficient type of unit) by utilizing just a jet turbine type of setup as a peaking unit to provide the power then if the platform is conducive to bring the unit in by land as well you would already have the capability to supply the power to keep the reactors and/or spent fuel pools cool. When I worked at the utility we used a turbine to supply power to the plant as a peaking unit when they needed to supply power to the plant. The platform for this type of technology might be getting smaller and depending on the pump specifications for a reactor pump and/or portable pump solution this might be a workable solution for a land based nuclear plant. Just think about a nuclear aircraft carrier's capability to supply its own power and or fresh water. This might be the type of technology that might be able to be provided to a National Guard type of setup. It is apparent that this technology exists and this might be a quick response by order to implement for a short term solution that might work for water based plants. If the platform of the turbines is getting smaller then I am sure a land based solution can be implemented in a similar fashion. This is why I asked the President and the Prime Minister of Japan if the port at the Nuclear Plant was capable to bring in a Military ship to provide for immediate power/portable pumps to help keep the plants cool. We have to keep in mind that if you utilize this type of technology as a shared global technology that with global help the cost of providing this type of protection might be kept minimized to help with the cost recovery in a Nuclear rate case proceeding. This is why I filed the motion to get this information on the record since if this is a viable approach then it would make perfect sense by order to make this happen in the short term versus through a design implementation process that might take too long to implement.

Recommendation 9: Require that facility emergency plans address prolonged Station Blackout and multiunit events.

I have a simpler plan. Commissioner Ostendorff, I'm certain, would be willing to call one of his former colleagues in the Navy and pose a simple question, "what systems do you rely for shock resistant, radiation-hardened, enduring and survivable radio communications between personnel on a nuclear aircraft carrier. Others could call other government agencies and departments, such as DoD, the Army, Air Force and Marine Corps, FEMA, Homeland Security, and NNSA, having similar robust emergency communications requirements, and find out what they use. Then sit down and write a set of NRC requirements that several commercially-available robust portable power solutions can reasonably meet, and then issue an order to licensees to purchase this type of equipment. Then make the operational readiness of this equipment, and the ability to use it to achieve required safety goals, a matter for recurring inspection. This should take you no more than six months start-to-finish.

Robert H. Smith Comments

Based upon the testimony

I think that we have to define the right parameters of what is effective and efficient implementation of safety enhancements. This is why I think that separating an emergency response plan from the design implementation plan makes a lot of sense. Let's take the BP oil spill. Industry is always trying to provide safety but they are in the business maximizing their profits. This is not a bad thing but sometimes the parameters to control cost limits and/or minimizes the needed safety precautions that would have to be put in place to prevent a natural disaster. I have sent a letter to the Senate when the BP oil spill happened and I asked what the cost would have been to provide for a redundant setup with two blowout preventers with the deep sea oil rig. If the cost of providing this type of redundancy is minimal versus the cost of a potential catastrophic event then orders/rules should be put into place to make sure that there is compliance with providing the proper redundancy to keep the people safe. I think that when I sent the email to the Senate I saw a cost estimate to provide the additional safety redundancy was immaterial versus the catastrophic cost of the leak therefore if the proper orders/rules were put into place to make sure that the redundancy was put into place we might have averted the BP spill issue. This is supported by news reports of what they found after the event. This would be similar to providing an order to make sure that an emergency response plan was going to be implemented and the Utilities would have no choice but to comply with providing the redundancy. Sometimes the decision makers that make the decisions with regard to design and safety at companies are reluctant to speak about what would be required to potentially provide for a better safety redundancy. This is becoming evident with the BP Oil spill and it is very important to take a look at with an emergency response plan. Of course all the companies want to be involved but based upon the time constraints that are being talked about to implement a rule for a design change at a plant this might not be the best possible course of action. Again this is why in my initial email I thought that maybe an emergency response plan should be isolated from a design based plan.

Charles Pardee
Chairman, Industry Fukushima Response Steering Committee --
Chief Operating Officer, Exelon Generation

The Way Forward

- Industry ready to work with NRC to ensure effective and efficient implementation of safety enhancements
- Integrate and prioritize Fukushima recommendations with other agency regulatory activities

Robert H. Smith Comments

Based upon the testimony below:

This is very good in concept and these types of studies should have already been completed. This does not limit the amount of time to implement an emergency response plan. This could delay what would be needed in the short term to provide the proper redundancy and safety protection. To take this one step further. No matter what the risk is if you can provide this type of portable power/pump solution to keep the reactor and/or spent fuel pools cool this type of approach might be a global solution in that it might be able to work in all types of situations. If you carve out solutions on an individual basis you might find that the delay of the solutions that are needed might materialize in one type of situation but not across the board. Can anyone predict where the next type of event might occur? If not, then a global solution is very important. Bring the power/pumping capability to the plant to keep the plant cool. Make sure that you can do this by land and/or water based means to ensure that you can control the plant right after the event. Risk based solutions might only take into account specific risks and not all the risk that might occur in an event. Unless the models provide for all risks that occur at a plant there would be no assurance that the solutions that are going to be implemented in one plant will work at another. I would think that it would be more cost effective to keep the plant running with a portable power/pump solution that would work in all situations when it appears that this technology already exists and has been utilized for a long time. With a Navy Nuclear Aircraft Carrier they are self contained to provide power and fresh water solutions on a very large scale. If this is the platform needed to keep the pumps running at a nuclear power plant then a global solution probably would make more sense.

Industry Priorities

- Industry is generally aligned with Tier 1 recommendations as the priority items
  - Need common understanding on timeline of Fukushima Daiichi events
- Adequate protection – assessed on a case-by-case basis
  - Realistic regulatory analyses based on risk
  - Maintain focus on safety to prevent diversion of resources on activities that have minimal safety significance

UCS Perspective on the Prioritization of NTTF Recommendations

October 11, 2011

Dr. Edwin S. Lyman
Senior Scientist
Union of Concerned Scientists

bert H. Smith Comments

Based upon the testimony below:

The statement below supports my initial email in which the rulemaking might not work. An order should be utilized and/or the separation of the emergency response plan from the design plan should be done to minimize the time required to make sure that a safety plan can be put into place a lot sooner than the 4.25 year timeframe. Has anyone looking into a potential parallel pipe design to run the cooling of one plant off another set of pumps in another plant in a multi unit plant? This would be important to see if you would just need to bring in power to run the existing pumps at the plant. Please see my motion with my safety suggestions.

Recommendation 4

- **Enhancing equipment, planning and training to cope with multiunit events is essential – should not wait for completion of SAMG/EDMG rulemaking**
  - **Fukushima Daiichi timeline has revealed how interactions between adjacent reactors affected emergency measures**
  - **Impact of aftershocks, obstructions, radiological conditions must be assessed**
- **Tabletops and drills for a range of scenarios should be conducted**

Robert H. Smith Comments

I have taken a look at the other recommendations in this presentation and the comments are similar in nature to the Paine testimony therefore my comments for the other recommendations in this presentation would follow the comments that I have made in the Paine testimony.

Based upon the testimony below:

This would support my initial email regarding this hearing to separate the emergency response plan from the design implementation plan.

Recommendation 8

- **Staff's proposed timeline does not address this issue with the required urgency**
- **Will need an additional near-term component to facilitate interim reliance on 50.54(hh)(2) measures**

Robert H. Smith Comments

Based upon the testimony below:

Take a look at my solution and let me know if my solution would have worked with a ocean based plant if they were able to bring in the power/pump capability and hook it up to the plant immediately after the tsunami to provide power to the cooling pumps at the plant (if they were operational). If this would have worked then the skill set already would exist through utilizing existing technology therefore to have a delay as it was indicated below does not make sense. I have specifications that should be looked into with regard to the capability of a Nuclear Air Craft carrier ability to provide power to run the pumps in the plant. If there was a distribution hookup at the dock and the ship was able to be brought into port then there would have potentially been enough power to run the pumps at the plants indefinitely until regular power was restored. They also have a fresh water plant to potentially provide for fresh water to keep the reactors cool. If I recall this was an issue at the Japan plants in which they were cooling with sea water. This might have contributed to the radiation leaks into the water. I am not sure but I think that this has to be looked into as well. I think that the skill set is already available and based upon a previous comment to talk to the Navy about their capabilities the skill set might already be available. I am not an engineer but I think that my thought process would warrant a look. What do you think?

"Skill Set" Availability

- "So it is going to take longer than the one to two years to get the information, do the analysis ... to be able to make an informed decision on whether you need to do anything different." Tony Pietrangelo, NEI, 9/21/11
- The lack of availability of skilled personnel to perform detailed technical assessments should not be a reason to delay safety enhancements
- If necessary, conservative safety margins should be set now; detailed analysis can be used later to reduce conservatism

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

Briefing on the Japan Near Term Task Force Report – Prioritization of Recommendations

R. William Borchardt
Executive Director for Operations
October 11, 2011

Based upon the testimony below:

We have to ask the question if there is existing technology to provide a solution in the event that any of the recommendations below do not take into account all of the risk associated with preventing a similar issue just like Japan. If the technology already exists to provide the protection needed in the short term to provide immediate power/portable pump capacity to keep the reactor and/or spent nuclear fuel pool cool after a seismic and/or flood event then this type of solution should probably be addressed as part of an emergency response plan versus the Tier recommendation schedule. If the Tier recommendation schedule cannot be completed in the short term then it would make perfect sense to separate an emergency response plan with the Tier plan so that a safety solution can be provided in a short amount of time. Based upon the testimony it is apparent that a short term approach would be needed. The tiered approach should be worked on in conjunction with the emergency response plan.

Tier 1 Recommendations

- **Seismic and flood hazard reevaluations (2.1)**
- **Seismic and flood walkdowns (2.3)**
- **Station blackout (4.1)**
- **10 CFR 50.54(hh)(2) equipment (4.2)**

Tier 1 Recommendations (cont'd)

- Reliable hardened vent for Mark I and Mark II containments (5.1)
- SFP instrumentation (7.1)
- Strengthening on-site emergency response capabilities (8)
- Emergency preparedness (9.3)

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Additions to Tier 1

- **Reliable Mark II Containment Vents**
  - **Concurrent with Mark I (5.1)**
- **SFP Instrumentation (7.1)**
  - **Interact with stakeholders regarding functional requirements**
  - **Issue order requiring implementation**

Tier 2 Recommendations

- **Recommendations which could not be initiated without delay due to factors that include:**
  - **Need for further technical assessment and alignment**
  - **Dependence on Tier 1 issues**
  - **Availability of critical skill sets**

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Tier 2 Recommendations

- **SFP makeup capability (7.2, 7.3, 7.4, and 7.5)**
- **Emergency preparedness (9.3)**
  - **Remaining portions with the exception of ERDS capability**

SFP Makeup Capability (7.2, 7.3, 7.4, and 7.5)

- Engage stakeholders in support of rulemaking activities to provide reliable SFP instrumentation and makeup capabilities
- Development of regulatory basis, proposed rule and implementing guidance

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Emergency Preparedness (9.3)

- Tier 2 - remaining portions with the exception of ERDS capability
- Engage stakeholders on planning standard elements
- Issue order requiring necessary changes

Tier 3 Recommendations

- Require further staff study
- Follow after Tier 1 actions
- Depend on critical skill set availability
- Depend on resolution of NTTF Recommendation 1

Tier 3 Recommendations

- Ten-year confirmation of seismic and flooding hazards (2.2)
- Seismically induced fires and floods (3)
- Reliable hardened vents for other containment designs (5.2)
- Hydrogen control (6)

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Tier 3 Recommendations (cont'd)

- EP for prolonged SBO and multiunit events (9.1, 9.2, 10)
- Enhanced ERDS capability (9.3)
- EP-related decision-making, radiation monitoring, and public education (11)

Tier 3 Recommendations (cont'd)

- **Reactor Oversight Process modifications (12.1)**
- **Staff training on severe accidents, including SAMGs (12.2)**

Additional Issues

- **Additional issues identified by external stakeholders and NRC staff**
  - **Disciplined assessment of relationship to Fukushima lessons learned**
  - **Future assessment and potential prioritization**

Additional Issues

- Filtration of containment vents
- Instrumentation for seismic monitoring
- Basis of emergency planning zone size

Additional Issues (cont'd)

- Prestaging of potassium iodide beyond ten miles
- Transfer of spent fuel to dry cask storage
- Loss of ultimate heat sink

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Resources

- **Tier 1 and Tier 2 estimates**
  - **Fiscal Year 2012 – 30 FTE**
  - **Fiscal Year 2013 – 90 FTE**
  - **Total (including out years) – 205 FTE**

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Next Steps

- **Evaluate Tier 3 schedules and resource impacts**
- **Identify and provide prioritization of additional issues**
- **Provide options regarding NTTF Recommendation 1**

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From: RSmith (b)(6)
Sent: Wednesday, October 12, 2011 2:07 PM
To: 'Rakovan, Lance'; 'carol.gallagher@nrc.gov'; 'OPA Resource'; 'OPA1 RESOURCE'; 'OPA2 Resource'; 'Resource, OPA3'; 'OPA4 Resource'; 'Carol.Gallagher@nrc.gov'; 'Hannah, Roger'; 'Ledford, Joey'
Cc: 'CHAIRMAN Resource'; 'CMRSVINICKI Resource'; 'CMRAPOSTOLAKIS Resource'; 'CMROSTENDORFF Resource';

NOT FOR PUBLIC DISCLOSURE

'CMRMAGWOOD Resource'
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

NOT FOR PUBLIC DISCLOSURE

To all,

I went out to the web to check the slides again and they have been made available.

Thanks,

Robert H. Smith

From: RSmith (b)(6)
Sent: Wednesday, October 12, 2011 2:00 PM
To: 'Rakovan, Lance'; 'carol.gallagher@nrc.gov'; 'OPA Resource'; 'OPA1 RESOURCE'; 'OPA2 Resource'; 'Resource, OPA3'; 'OPA4 Resource'; 'Carol.Gallagher@nrc.gov'; 'Hannah, Roger'; 'Ledford, Joey'
Cc: 'CHAIRMAN Resource'; 'CMRSVINICKI Resource'; 'CMRAPOSTOLAKIS Resource'; 'CMROSTENDORFF Resource'; 'CMRMAGWOOD Resource'
Subject: FW: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

To all,

I fixed a couple of **typo(s)** in the previous email.

I have been listening to the hearing.

Do we have a copy of the slides that appears to be only shown in the hearing in a PDF file format so that I can obtain a full copy of what was presented in the hearing?

I have been listening to the hearing and noticed that some of the slides that have been shown in the hearing are not part of the materials. Did these materials get published to the web so that I can download a copy of these documents.

Here is an example of what I have heard in the hearing. I took a screen print.

Thanks,

NOT FOR PUBLIC DISCLOSURE

Robert H. Smith

Recommendations 2.1 and 2.3 – Seismic/Flooding

- The timeline (past and future) of GI-199 is questionable in terms of providing a timely resolution and informing near-term action
- Does the NRC intend to use resolution of GI-199 as the vehicle for establishing criteria and methods to assess seismic safety deficiencies at specific licensee sites?
- We urge the NRC to not wait years for inspection criteria when it has already established methods and regulations for dealing with this exact issue in the context of early site permits and combined license reviews
  - The staff recommendation in the latest SECY describes the preferred process of applying present day regulatory guidance and methodologies to the reevaluation of flooding hazards at operating reactors but did not go far enough in extending this common sense conclusion to seismic hazards

[redacted]

From: RSmith (b)(6)
Sent: Tuesday, October 11, 2011 4:51 PM
To: 'Rakovan, Lance'; 'carol.gallagher@nrc.gov'; 'OPA Resource'; 'OPA1 RESOURCE'; 'OPA2 Resource'; 'Resource, OPA3'; 'OPA4 Resource'; 'Carol.Gallagher@nrc.gov'; 'Hannah, Roger'; 'Ledford, Joey'
Cc: 'CHAIRMAN Resource'; 'CMRSVINICKI Resource'; 'CMRAPOSTOLAKIS Resource'; 'CMROSTENDORFF Resource'; 'CMRMAGWOOD Resource'
Subject: NRC Meeting Today / Briefing on the Japan Near Term Task Force Report

To whom it may concern:

Due to the delicate nature of this information I would like to make sure that this correspondence request/communication does not have any impact on my current/future employment. I can only hope that the public service work that I have been working on is viewed as a public service work and does not have any impact on my family's well being.

I was listening to the hearing today and I was able to listen to a large part of the meeting. I had to leave to go to another meeting today therefore I was wondering when the Hearing will be made available through the web archives that is on

the NRC site. I was only able to hear part of the meeting and I would like to hear the rest of the meeting to see all the specifics that have been discussed.

One initial observation(s) is that the chairman has indicated that there might be an expedited **implementation plan** since some of the design implementation might take 5 to 15 years to implement. I heard about the Station Blackout issues and there are various amounts of time that has been discussed that might be implemented. The chairman during the meeting indicated that he would like to see a realistic timeframe for some of the implementation of some of the suggestions. Just like my previous email there has been talk about an order versus rule making in that rule making takes time to implement. It appears that the design updates and rule implementation might take additional time.

One speaker at the meeting suggested that some of the European design technology potentially should be adapted in order to shorten the implementation timeframe.

Is there any discussion of separating the recommendations into two types of issues? One issue should deal with the continued change in design features based upon the existing technology to enhance the safety designs at the plant. The other would be to have an immediate emergency option. Maybe if these are dealt with independently the timeline can be shortened to come up with a quick emergency response plan. There was talk about getting the National Guard involved.

This was just a quick observation but I would like to hear the rest of the hearing to see if there are any other details that have been discussed to expedite this process.

Short term solution for water based plants with water access by ship would be to bring in ships with generation to provide power to the plant immediately in order to keep the pumps at the reactors operating to keep them cool. This might require a distribution hook up from the port to the distribution system at the plant. This distribution system can be elevated in order to keep it safe from a flood issue.

Has there been any discussion about parallel piping at a multiple reactor setup in order to provide switching at the plant to utilize working pumps at another reactor if one of the reactor pumps becomes damages due to a seismic event?

This would be another quick solution if it can be done with portable piping that is brought in by ship. A ship solution might be able to provide a quick emergency response to the plant that needs a quick cooling solution if there is no power at the plant.

Was this brought up with the National Guard plan?

Based upon what I have heard no specific details of the plan have been discussed. It appears that the meetings are still in the preliminary stage in which there is discussion about timelines to implement change and how long this process might take. With this type of issue it is very important to have an emergency response plan that would work short term so that the recommendations can be implemented much quicker than some of the timeframes that have been discussed. Of course I did not hear the entire hearing so some of these comments might change.

I have provided a specification in a motion that I have filed with the Florida Public Service Commission. You can take a look at some of the motion but in order for the NRC to have access to the full motion you would have to ask the Florida Public Service Commission to provide you a copy of the full motion that has been filed which has some of the specifications/ideas that I have sent to the President and the Prime Minister of Japan. Attached is a copy of my motion that I have filed with the Commission. I think that I have sent you some of the email correspondence that I have sent to the Florida Public Service Commission regarding my suggestions. The Commission denied my motion based upon me having intervenor status. Since I am a party with a full legal interest in the Florida rate case proceedings I wanted to make sure that my information was made part of the web public docket in the event that my suggestions are potentially utilized which would have an impact on current/future rate case proceedings that deal with Nuclear Cost recovery. I do not have the means to intervene but this should not prevent me to have my motion fully filed based upon both

Federal/State law. This would be my right as a party with a full legal interest in these proceedings. I would like to file an appeal to their order denying my motion since my motion has to deal with potentially safety issues at Nuclear Power Plants. If I was able to file electronically I would so that this information would be made part of the web public docket at like the other motion(s) that I have file with the Commission. There denial of my motion due to me not being an intervenor appears to be invalid based upon Federal/State law.

Since I feel that this safety issue is very important in addition to current/future rate recovery I felt that the Florida Public Service Commission should have made my full motion part of the web public docket in the event some of my suggestions are finally adopted in order to provide a safety solution at Nuclear Power Plants.

I am sending you a copy of the motion since I feel that safety issues at the plant are very important to consider with any Nuclear Recovery cost type proceeding.

Please let me know when the web case will be available in the web archive files so that I can continue to listen to the parts of the hearing that I have missed.

Hopefully OPA2.Resource@nrc.gov receives this email since this is the region that Florida Power and Light Nuclear Plants are located. In the past all other regions have been receiving my emails except this region.

Thanks,

Robert H. Smith

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Date	Name	Duration			
10/07/11	Beyond Nuclear 10 CFR 2.206 Petition Public Meeting	01h 30m	Video...	MP3	MPEG4

SCHEDULING NOTE

Title: **BRIEFING ON THE JAPAN NEAR TERM TASK FORCE REPORT – PRIORITIZATION OF RECOMMENDATIONS (Public)**

Purpose: To provide the Commission with a discussion of the staff's recommendations and external stakeholders' input on the prioritization of regulatory actions to be taken by the staff to respond to the Japan Near Term Task Force (NTTF) report and longer term evaluations to facilitate Commission voting on the notation vote paper providing staff's recommendations.

Scheduled: **October 11, 2011**
9:00 am and 1:00pm

Duration: Approx. 5 hours

Location: Commissioners' Conference Room, 1st floor OWFN

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Sosa, Belkys
Sent: Friday, March 11, 2011 6:22 PM
To: Snodderly, Michael; Baggett, Steven
Cc: Davis, Roger
Subject: FYI: Commissioner's Assistant Briefing Notification

Mike, please note that GA would prefer to get an email summary of any significant updates from the incident in Japan rather than phone calls.

Thanks,
Belkys

From: ANS.HOC@nrc.gov [mailto:ANS.HOC@nrc.gov]
Sent: Friday, March 11, 2011 1:04 PM
To: Sosa, Belkys
Subject: ACTION: Commissioner's Assistant Briefing Notification

There will be a Commissioner's Assistant Briefing given by Region4/HQ at 1300 concerning the event Tsunami from Japan. Call (b)(6) approximately 5 minutes before the scheduled start time. When prompted, enter security code (b)(6). You may call 301-816-5164 at this time and follow the voice prompts if you do not wish to receive this notification from our Automatic Notification System.

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Snodderly, Michael
Sent: Saturday, March 12, 2011 8:44 AM
To: Apostolakis, George
Cc: Sosa, Belkys; Baggett, Steven; Davis, Roger
Subject: FW: Latest Talking Points and Q&A
Attachments: 03_11_QUAKE_talk_pts5.docx; Chairman Jaczko_QA2_earthquake031111.docx

Please see attached.

From: Burnell, Scott
Sent: Saturday, March 12, 2011 7:05 AM
To: Franovich, Mike; Orders, William; Snodderly, Michael; Castleman, Patrick
Cc: Brenner, Eliot
Subject: Latest Talking Points and Q&A

Gentlemen;

Current guidance is that all media requests go through OPA and all intergovernmental inquiries go through the Chairman's office. Thank you.

Scott

Sosa, Belkys

From: Snodderly, Michael
Sent: Saturday, March 12, 2011 8:45 AM
To: Apostolakis, George
Cc: Sosa, Belkys; Baggett, Steven; Davis, Roger
Subject: FW: Just a tweak or two
Attachments: Chairman Jaczko_QA3_earthquake031111.docx

FYI

From: Burnell, Scott
Sent: Saturday, March 12, 2011 7:34 AM
To: Franovich, Mike; Orders, William; Snodderly, Michael; Castleman, Patrick
Cc: Brenner, Eliot
Subject: Just a tweak or two

Gentlemen;

Just a couple of things courtesy of the EDO.

Scott

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Snodderly, Michael
Sent: Saturday, March 12, 2011 10:32 AM
To: Apostolakis, George
Cc: Sosa, Belkys; Baggett, Steven; Davis, Roger
Subject: FW: Latest talking points
Attachments: 03_11_QUAKE_talk_pts6.docx

Commissioner,

To help put things in perspective, the incident at Fukushima Daiichi 1 is often referred to as a TW sequence in many PRAs. Long term SBO with venting from containment. As a result of this sequence the NRC had operating BWRs install a hardened vent to allow venting at higher pressures. The containment is being pressurized by steam from the suppression pool. Along with the steam is hydrogen from radiolysis. The staff believes it is this hydrogen that ignited while venting from containment that caused the explosion.

From: Burnell, Scott
Sent: Saturday, March 12, 2011 9:42 AM
To: Franovich, Mike; Orders, William; Snodderly, Michael; Castleman, Patrick
Subject: Latest talking points

And on we go...

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys ~~NOT FOR PUBLIC DISCLOSURE~~

From: Snodderly, Michael
Sent: Saturday, March 12, 2011 4:27 PM
To: Apostolakis, George
Cc: Sosa, Belkys; Baggett, Steven; Davis, Roger
Subject: Summary of 3:30 Commission TA Phone Call

Bill Borchardt ran the briefing.

Information continues to be limited. (b)(5)

(b)(5)

Focus right now is Fukushima Daiichi Unit 1. Long term SBO continues. Explosion occurred in Turbine Building. Evacuation out to 20 km. Use of borated sea water to either inject in to the reactor vessel or cool the torus externally appears to be working.

We have less information on Fukushima Daini. Long term SBO was experienced may be ongoing. Evacuation out to 10 km.

(b)(5)

Next phone call is scheduled for 11:30 pm and 7:30 am. I plan to cover the 7:30 am call.

See you at the airport tomorrow.

Mike Snodderly
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-2241
Email: michael.snodderly@nrc.gov

~~NOT FOR PUBLIC DISCLOSURE~~

Sosa, Belkys

From: Sosa, Belkys
Sent: Saturday, March 12, 2011 5:58 PM
To: Snodderly, Michael; Apostolakis, George
Cc: Baggett, Steven; Davis, Roger
Subject: Re: Summary of 3:30 Commission TA Phone Call

Thanks Mike for the summaries. Please let us know after you meet with GA how we can support during the trip.

(b)(5)

Thks

Sent from an NRC Blackberry
Belkys Sosa
(b)(6)

From: Snodderly, Michael
To: Apostolakis, George
Cc: Sosa, Belkys; Baggett, Steven; Davis, Roger
Sent: Sat Mar 12 16:26:59 2011
Subject: Summary of 3:30 Commission TA Phone Call

Bill Borchardt ran the briefing.

Information continues to be limited. (b)(5)

(b)(5)

Focus right now is Fukushima Daiichi Unit 1. Long term SBO continues. Explosion occurred in Turbine Building. Evacuation out to 20 km. Use of borated sea water to either inject in to the reactor vessel or cool the torus externally appears to be working.

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Mike Snodderly
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-2241
Email: michael.snodderly@nrc.gov

Sosa, Belkys

From: Baggett, Steven
Sent: Saturday, March 12, 2011 7:12 PM
To: Sosa, Belkys; Snodderly, Michael; Apostolakis, George
Cc: Davis, Roger
Subject: Re: Summary of 3:30 Commission TA Phone Call

All,

Just spoke to GEH, visit is still on.

They will call me if thing s change.

Steve

From: Sosa, Belkys
To: Snodderly, Michael; Apostolakis, George
Cc: Baggett, Steven; Davis, Roger
Sent: Sat Mar 12 17:57:46 2011
Subject: Re: Summary of 3:30 Commission TA Phone Call

Thanks Mike for the summaries. Please let us know after you meet with GA how we can support during the trip.

(b)(5)

Thks

Sent from an NRC Blackberry
Belkys Sosa
(b)(6)

From: Snodderly, Michael
To: Apostolakis, George
Cc: Sosa, Belkys; Baggett, Steven; Davis, Roger
Sent: Sat Mar 12 16:26:59 2011
Subject: Summary of 3:30 Commission TA Phone Call

Bill Borchardt ran the briefing.

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Mike Snodderly
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-2241
Email: michael.snodderly@nrc.gov

Sosa, Belkys

From: Sosa, Belkys
Sent: Monday, March 14, 2011 11:48 AM
To: Blake, Kathleen; Apostolakis, George; Snodderly, Michael; Baggett, Steven; Davis, Roger
Subject: RE: Newspaper TA NEA
Attachments: FW: Latest talking points

Commissioner my recommendation is to stay away from any public comments other than the talking points that OPA has prepared. We can have Kathleen respectfully decline noting that you are traveling.

Thanks,
Belkys

From: Blake, Kathleen
Sent: Monday, March 14, 2011 9:23 AM
To: Apostolakis, George; Sosa, Belkys
Subject: FW: Newspaper TA NEA

And here it is in English. kb

Kathleen M. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
ckville, Maryland 20852
1-415-1810

From: CMRAPOSTOLAKIS Resource
Sent: Monday, March 14, 2011 9:05 AM
To: Blake, Kathleen
Subject: FW: Newspaper TA NEA

From: Giannis Papadopoulos [mailto: (b)(6)
Sent: Sunday, March 13, 2011 11:40 AM
To: CMRAPOSTOLAKIS Resource
Subject: Newspaper TA NEA

Dear Mr. Apostolakis,
This is Ioannis Papadopoulos, reporter of the newspaper TA NEA. I interviewed you about you nomination at NRC in October 2009. I've been working at the Athens bureau of TA NEA since September. I would like to talk to you about the nuclear plants in Japan and how the earthquake is affecting their safety. Please let me know if you would be interested. Thank you.
Sincerely,
Ioannis Papadopoulos
tel (+30)6977888693
0)2113658511

Sosa, Belkys

From: Schmidt, Rebecca
Sent: Monday, March 14, 2011 1:29 PM
To: Nieh, Ho; Sharkey, Jeffry; Bubar, Patrice; Sosa, Belkys
Cc: Powell, Amy
Subject: *hearing book -- Wed hearing*

We have a budget hearing book prepared for you all that we started Friday. Obviously, the focus of the hearing has moved to the Japanese earthquake. I would prefer to hold this budget material and give it to you for the next budget hearing that is scheduled at the end of the month. Is that ok with everyone? I can give it to you, but it is sorta useless for the hearing.....

Sosa, Belkys

From: Baggett, Steven
Sent: Tuesday, March 15, 2011 6:57 AM
To: Apostolakis, George; Snodderly, Michael; Sosa, Belkys
Subject: Morning op center brief on Japan

Good morning,

Op center noted the following.

Reported spent fuel pool fire is out, staff questions if it was a zirc fire given how quickly the fire was put out.

Another loud noise, reported as an explosion, may be something else. Staff guessing that due to extreme pressure drop, that the vessel has failed. But not confirmed.

(b)(5)

NRC folks should be on the ground around 8:30 this morning. DOE monitoring team will arrive shortly and confirm some of the release numbers.. NNSA also has pumps within 3 hours of the site.

(b)(5)

Staff will send out the updated Q and A later this morning.

Steve

Baggett, Steven NOT FOR PUBLIC DISCLOSURE

From: Snodderly, Michael
Sent: Tuesday, March 15, 2011 7:38 AM
To: Baggett, Steven
Subject: Re: Morning op center brief on Japan

Thanks Steve

Sent from my NRC Blackberry
at (b)(6)

----- Original Message -----
From: Baggett, Steven
To: Apostolakis, George; Snodderly, Michael; Sosa, Belkys
Sent: Tue Mar 15 06:57:05 2011
Subject: Morning op center brief on Japan

Good morning,

Op center noted the following.

Reported spent fuel pool fire is out, staff questions if it was a zirc fire given how quickly the fire was put out.

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(b)(5)

Staff will send out the updated Q and A later this morning.

Steve

NOT FOR PUBLIC DISCLOSURE

Baggett, Steven

From: Baggett, Steven
Sent: Tuesday, March 15, 2011 7:44 AM
To: Snodderly, Michael
Subject: Re: Morning op center brief on Japan

They did not say, and - did not ask. I was driving and had to limit my note taking.

Steve

----- Original Message -----
From: Snodderly, Michael
To: Baggett, Steven
Sent: Tue Mar 15 07:41:21 2011
Subject: Re: Morning op center brief on Japan

Who is on the second team

Sent from my NRC Blackberry
at (b)(6)

----- Original Message -----
From: Baggett, Steven
To: Apostolakis, George; Snodderly, Michael; Sosa, Belkys
Sent: Tue Mar 15 06:57:05 2011
Subject: Morning op center brief on Japan

Good morning,

Op center noted the following.

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(b)(5)

Staff will send out the updated Q and A later this morning.

Steve

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Blake, Kathleen
Sent: Tuesday, March 15, 2011 8:47 AM
To: Apostolakis, George; Sosa, Belkys; Baggett, Steven; Snodderly, Michael; Davis, Roger; Lui, Christiana
Cc: Savoy, Carmel
Subject: FW: FYI: Talking Points & Q&As
Attachments: Talking Points 2.pdf; Talking Points for Chairman 245 PM 3-14-11.doc; State Q&A Rev 1.pdf

Fyi - kb

Kathleen M. Blake
Administrative Assistant
to Commissioner Apostolakis
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852
301-415-1810

From: LIA07 Hoc
Sent: Monday, March 14, 2011 6:27 PM
To: Pace, Patti; Speiser, Herald; Gibbs, Catina; Lepre, Janet; Harves, Carolyn; Blake, Kathleen; Savoy, Carmel; Crawford, Carrie; Jimenez, Patricia; Herr, Linda; Bozin, Sunny
Subject: FYI: Talking Points & Q&As

er request, attached are the latest talking points and Q&As for all Commissioners' offices.

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Schmidt, Rebecca
Sent: Tuesday, March 15, 2011 7:22 PM
To: Sharkey, Jeffry; Nieh, Ho; Sosa, Belkys; Bubar, Patrice
Cc: Powell, Amy
Subject: Info for hearing

I believe you all received the Q and As which OPA and OCA put together for the Chairman in preparation for the hearing tomorrow. The oral testimony is not finalized yet but I will get it to you before the hearing. We didn't really put any books together on japan.

Sosa, Belkys

NOT FOR PUBLIC DISCLOSURE

From: Powell, Amy
Sent: Tuesday, March 15, 2011 9:48 PM
To: Batkin, Joshua; Sosa, Belkys; Sharkey, Jeffry; Bubar, Patrice; Nieh, Ho
Cc: Coggins, Angela; Bradford, Anna; Schmidt, Rebecca
Subject: Q&A's provided to Chairman at hearing prep meeting
Attachments: Chairman JaczkoQA7_031511.docx

Hi all –

Attached are the Q&As that were provided to Chairman Jaczko at his hearing prep meeting tonight. Content-wise, I believe that these are the same as what Anna provided to you earlier today. OCA organized the Qs by subject matter to make quick reference easier.

I will send the prepared text for his oral statement shortly.

Amy

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

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Powell, Amy
Sent: Tuesday, March 15, 2011 10:04 PM
To: Sharkey, Jeffry; Bubar, Patrice; Sosa, Belkys; Nieh, Ho; Batkin, Joshua
Cc: Coggins, Angela; Schmidt, Rebecca
Subject: Prepared text of NRC Chairman Jaczko's oral statement
Attachments: FINAL - GBJ oral statement 031611 .docx

Hi all –

Attached is the prepared text for Chairman Jaczko's oral statement tomorrow at the House Energy and Commerce subcommittees' hearing. We will work from the same text to open the Senate EPW public briefing that afternoon.

Amy

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

From: Sosa, Belkys
Sent: Tuesday, March 15, 2011 10:31 PM
To: Apostolakis, George; Davis, Roger; Baggett, Steven; Snodderly, Michael
Subject: Fw: Prepared text of NRC Chairman Jaczko's oral statement
Attachments: FINAL - GBJ oral statement 031611 .docx

Fyi

Sent from an NRC Blackberry
Belkys Sosa
(b)(6)

From: Powell, Amy
To: Sharkey, Jeffry; Bubar, Patrice; Sosa, Belkys; Nieh, Ho; Batkin, Joshua
Cc: Coggins, Angela; Schmidt, Rebecca
Sent: Tue Mar 15 22:03:44 2011
Subject: Prepared text of NRC Chairman Jaczko's oral statement

Hi all –

Attached is the prepared text for Chairman Jaczko's oral statement tomorrow at the House Energy and Commerce subcommittees' hearing. We will work from the same text to open the Senate EPW public briefing that afternoon.

Amy

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

STATEMENT
BY GREGORY B. JACZKO, CHAIRMAN
UNITED STATES NUCLEAR REGULATORY COMMISSION
TO THE
HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEES ON ENERGY AND POWER, ENVIRONMENT AND THE ECONOMY
MARCH 16, 2011

Mr. Chairmen, Ranking Members Rush and Green, and Members of the Subcommittees, I am honored to appear before you today on behalf of the U.S. Nuclear Regulatory Commission. Given the events that are unfolding overseas, my opening remarks will focus on the crisis in Japan, and I have additional information on the Fiscal Year 2012 budget that I have submitted for the record.

I would first like to offer my condolences to all those affected by the earthquake and tsunami in Japan over the last few days. My heart goes out to those who have been dealing with the aftermath of these natural disasters.

I want to publicly acknowledge the tireless efforts, professionalism and dedication of the NRC staff in reacting to the events in Japan. This is just another example from my 6 ½ years on the Commission of the dedication of the NRC staff to the mission of protection of public health and safety. The American people can be proud of the commitment and dedication within the Federal workforce, exemplified by our staff every day.

While the NRC regulates the safe and secure commercial uses of radioactive materials in the United States, we also interact with nuclear regulators from around the world. Since Friday, the NRC's headquarters Operations Center has been operating on a 24-hour basis to monitor events unfolding at nuclear power plants in Japan. Since the earthquake hit northeastern Japan last Friday, some reactors at the Fukushima No. 1 plant have lost their cooling functions, leading to hydrogen explosions and rises in radiation levels. Two NRC experts on boiling-water reactors have already been deployed to Japan as part of a U.S. International Agency for International Development team, and they are currently in Tokyo. Since then, the Japanese government has formally asked for assistance from the United States as it continues to respond to the situation. Another NRC team is scheduled to land today.

Within the U.S., the NRC has been coordinating its efforts with other Federal agencies as part of the government response to the situation. This includes monitoring radioactive releases and predicting their path. Given the thousands of miles between Japan and the United States, Hawaii, Alaska, the U.S. Territories and the West Coast are not expected to experience any harmful levels of radioactivity.

Examining all available information is part of the effort to analyze the event and understand its implications both for Japan and the United States. The NRC has been working with several agencies to assess recent seismic research for the central and eastern part of the

country. That work continues to indicate that the U. S. public remains safe; we will continue to work to maintain that level of protection.

U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area. The NRC then adds a margin for error to account for the historical data's accuracy. This means that U.S. nuclear power plants are designed to be safe based on historical data from the area's maximum credible earthquake.

The NRC remains attentive to any information that can be applied to U.S. reactors. Our focus is always on keeping plants in this country safe and secure. As this immediate crisis in Japan comes to an end, we will look at whatever information we can gain from the event and see if there are changes we need to make to our own system. Within the next few days, I intend to meet with my colleagues on the Commission on the current status and to begin a discussion of how we will systematically and methodically review information from the events in Japan. In the meantime, we continue to oversee and monitor plants to ensure that U. S. reactors remain safe.

The NRC will continue to monitor the situation and provide updates via press releases and our public blog. The NRC also stands ready to offer further technical assistance as needed. We hope that this situation will be resolved soon so that Japan can begin to recover from this terrible tragedy.

NOT FOR PUBLIC DISCLOSURE

Apostolakis, George

m:	Michael Corradini [corradin@cae.wisc.edu]
:	Wednesday, March 16, 2011 10:47 PM
	JOY REMPE; Bill Shack; John Stetkar
Subject:	SOURCE of JACZKO's CALCULATION for HIS EVACUATION ORDER for AMERICANS in JAPAN
Attachments:	11-050.pdf; ATT00003..txt; 11-050-Attached.pdf; ATT00004..txt

besides being wrong about water in the spent fuel pools - you have to see his statement and calc (below)

it appears his 50mi declaration was based on a bounding calc for a BWR at 2500MWth - Mk1 containment
(complete meltdown, total containment bypass, calm winds and low release height)

i have the RASCAL code and can reproduce the calculation

my question is - why the heck this was apparently done without any documentation or QA within the staff

if a stupid professor can get the code, make assumptions and get a bounding result in a day?? is it useful??

NOT FOR PUBLIC DISCLOSURE

Discussion of the MARCH 16, 2011 PRESS RELEASE DOSE ASSESSMENT ASSUMPTIONS

There are two dose assessments attached to the March 16th press release. Both assessments are worst case hypothetical, computer model analyses of consequences for releases from the Fukushima site The first assessment assumed a Unit 2 reactor 100% core melt as an unfiltered release from a totally failed containment and actual meteorological conditions during early morning hours of the date indicated The low dispersion characteristics included low wind speeds, relatively stable air and light precipitation.

The second assessment represented multiple unit failures.1) Unit 2 with 33% reactor core damage as an unfiltered release from a totally failed containment ; 2) Unit 3 spent fuel pool with 50% damage (with 180 bundles of spent fuel discharged 105 days ago) , and 3) Unit 4 spent fuel pool with 100% damage (with 550 bundles of spent fuel discharged 30 days ago) To account for the combined inventories of the three units, the staff adjusted the reactor power level, fuel burnup and number of assemblies in the calculation. The meteorological conditions for the second assessment also assumed actual conditions, but no precipitation, greater wind speeds, and less stable atmospheric conditions, result in greater atmospheric dispersion. In addition, the source term included two additional days of decay before release For the multi-unit assessment, the increased decay time before release and the greater atmospheric dispersion significantly reduced the resultant dose estimate.

Although the dose projections for the first assessment are somewhat higher than the second assessment, the differences in the modeling assumptions did not affect the overall conclusion that protective action guides would be exceeded beyond fifty miles. Both assessments are highly speculative given the lack of actual (representative) site data and assumed no mitigation of the current situation at the time of the press release

Although there is postulated reactor core damage in Unit 1 and Unit 3, the primary containment structure is reported to be intact.

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Although there is postulated reactor core damage in Unit 1 and Unit 3, the primary containment structure is reported to be intact.

NOT FOR PUBLIC DISCLOSURE

Baggett, Steven

From: Kinneman, John
Sent: Wednesday, March 16, 2011 1:26 PM
To: Baggett, Steven; Gody, Tony
Subject: Operations Center

Steven,

(b)(5)

John
Sent from NRC Blackberry
John Kinneman

NOT FOR PUBLIC DISCLOSURE

Compiled Seismic Questions for NRC Response to the March 11, 2001 Japanese Earthquake and Tsunami

This is current as of 3-17-11 at 2am.

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.

We greatly appreciate the assistance of the many people who have contributed. The enclosed list of questions and answers has been compiled from multiple sources including, questions forwarded from NRC staff, GI-199 communications plan, Diablo Canyon communications plan, the NEI website, lists of questions that followed the 2007 earthquake that shut down the Kashiwazaki-Kariwa plant, and others. Please do not distribute beyond the NRC.

CONTENTS

Natural Hazards and Ground Shaking Design Levels

1) 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 by seismologists worldwide. The Japanese plants were recently reviewed to ground shaking similar to that observed. The review level ground motions were expected to result from a smaller earthquake closer to the sites.

Additional, technical, non-public information: None.

2) Can a very large earthquake and tsunami happen here?

Public response: This earthquake was caused by a "subduction zone" event, which is the type of mechanism that produces the largest magnitude earthquakes. 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. 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, which is 10 times smaller than a magnitude 9.

Additional, technical, non-public information: Magnitude is on a log scale, so 9 is 10 times bigger than an 8.

3) Has this changed our perception of Earthquake risk?

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.

4) 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. 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. 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.

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

Public Answer: Although we often think of the U.S. as having "active" and "non-active" earthquake zones, earthquakes can actually happen almost anywhere. Seismologists typically separate the U.S. 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.

Seismic designs at U.S. 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" that accounts for the largest earthquake expected in the area around the plant.

Generally speaking, seismic activity in the regions surrounding U.S. plants is much lower than that for Japan since most U.S. plants are located in the interior of the stable continental U.S. However, the most widely felt earthquakes within the continental U.S. are the 1811-12 New Madrid sequence and the 1886 Charleston, SC, which were estimated to be between about magnitude 7.0 to 7.75. Nuclear power plants in the U.S. are sited far away from these two earthquake zones as well as other identified potential seismic sources.

On the west coast of the U.S., 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) type earthquakes, not subduction zone earthquakes. Therefore, the likelihood of a tsunami from these faults is remote.

Additional, technical non-public information: None.

6) **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.

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

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?**

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

Additional, technical, non-public information: ADD

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

Public response: *ADD*

Additional, technical, non-public information: ADD

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?)

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

10) Can this happen here i.e. an earthquake that significantly damages a nuclear power plant? Are the Japanese plants similar to U.S. plants?

Public Answer: All U.S. 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.

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 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.

11) 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, which has a return period of 10,000 years on average over very long time periods.

Additional technical, non-public information: None

12) Does the NRC consider earthquakes of magnitude 9?

Public Answer: Earthquakes with very large magnitudes, such as the recent earthquake of the coast of Japan, occur only within subduction zones. Subduction zones are regions where one of the earth's

tectonic plates is subducting beneath another. In the continental US, the only subduction zone is the Cascadia subduction zone, which lies off of the coast of northern California, Oregon, and Washington. The only nuclear power plant in that area is Columbia, which is far from the coast and the subduction zone.

Seismic designs at U.S. 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 U.S. plants is much lower than that for Japan since most U.S. plants are located in the interior of the stable continental U.S. The largest earthquakes within the continental U.S. are the 1811-12 New Madrid sequence and the 1886 Charleston, SC, which were estimated to be between about magnitude 7 to 7.5. On the west coast of the U.S., 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) type earthquakes, not subduction zone earthquakes. Therefore, the likelihood of a tsunami from these faults is very remote.

Additional technical, non-public information: None.

13) What are the definitions of the SSE and OBE?

CLEAN UP BELOW information – late question

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 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.

Definition of Safe Shutdown Earthquake	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).
Definition of Operating Basis Earthquake:	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: (i) For the certified design portion of the plant, the OBE ground motion is one-third

		of the CSDRS.
	(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).
	(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).

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

To estimate the probability of exceeding a specified ground motion level, such as an SSE, during a given time interval, the Poisson model is generally used. Using seismic hazard curves from the 2008 US Geological Survey National Seismic Hazard Map and assuming a 60-year life for a typical nuclear power plant, we can estimate the probability of exceeding the SSE over the life of the plant. The NRC recently performed these estimates as part of its GI-199 program (see Questions 54-59). The mean probability value 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 there is margin above the 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.

15) What is magnitude anyway? What is the Richter Scale? What is intensity?

ADD

16) We need to pull Q&As out of the Markey/Capp letter of March 15th...there's a lot there to answer...

ADD

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

ADD

18) 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.

19) 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

21) Are power plants designed for Tsunami's?

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.

22) What level of Tsunami are we 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.

23) 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

24) 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.

25) 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.

26) 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, which is reviewing the adequacy of earthquake design of US NPPs in the central and eastern North America based on the latest data and analysis techniques.

Additional, technical, non-public information: None.

27) Was the Japanese plant designed for this type of accident? Are US plants?

Public Answer: Plants in both the US and Japan area 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.

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

Public Answer: Plants in both the US and Japan area 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.

29) Can this happen here i.e. an earthquake that significantly damages a nuclear power plant? Are the Japanese plants similar to U.S. plants?

Public Answer: All U.S. 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 U.S. designs, including Oyster Creek, Nine Mile Point and Dresden Units 2 and 3.

30) Could an accident like the one at Japan's Fukushima Daiichi nuclear plant happen in the United States?

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." U.S. 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. U.S. 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.

Even under severe EQs!

In addition, U.S. 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.

U.S. 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

31) Should U.S. nuclear facilities be required to withstand earthquakes and tsunamis of the kind just experienced in Japan? If not, why not?

Public response: U.S. 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 U.S. 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 U.S. 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.

Additional technical, non-public information: None

32) 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

33) 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-I

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

Public response: 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

35) 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/piping require protection from the elements. Above ground tanks have tornado/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

36) How do we know that the EDGs in Diablo Canyon and SONGS will not fail to operate like in Japan?

Public response: EDGs 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.

37) Is all equipment at the plant vulnerable to tsunami?

Public response: Plants are designed law GDC 2 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

38) What protection measures do plants have against tsunami?

Public response: Plants are designed iaw GDC 2 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

39) 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

40) 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

41) 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

42) 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

43) 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 U.S. 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.

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.

44) Are there any U.S. 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.

45) 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.

About Japanese Hazard, Design and Earthquake Impact

46) Was the damage done to the plants from the Earthquake or the Tsunami?

Public response: It is hard to tell at this point. In the nuclear plants there seems to have been some damage from the shaking. However, the tsunami lead to some of the biggest problems in terms of the loss of backup power. This is also true in the general population; the tsunami seems to have lead to most of the deaths.

Additional, technical, non-public information: None

47) 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

48) 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_s.

The S_S 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_S 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

49) Did this earthquake affect Kashiwazaki-Kariwa NPP?

Public response: No, this earthquake did not affect Kashiwazaki-Kariwa NPP and all reactors remained in their pre-earthquake operating state. 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 NPPs.

Additional, technical, non-public information: None

50) How high were the tsunami at the 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.

51) 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 were checked for a M=7, but the earthquake was a 9. The reality is the 7 close in (that they assumed) 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.

What happened in US Plants during the earthquake?

52) Was there any damage to U.S. 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.

53) 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, inevitably, leads to the indemnification of lessons that warrant further study. However, a complete understanding of lessons learned requires 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.

Future Actions, Reassessment of US Plants and GI-199

54) 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.

55) 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 $1x10^{-4}$ 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.

56) 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)

he 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 U.S. (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.

57) 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.

58) 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.

59) 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.

60) What is Generic Issue 199 about?

Public Answer: Generic Issue 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.

61) 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 U.S. Geological Survey provides data and results that are publicly available at http://earthquake.usgs.gov/hazards/products/conterminous/2008/.

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.

62) 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.

63) 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.

64) Are all U.S. 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 U.S. (as well as all independent spent fuel storage installation licensees). The staff will also consider inclusion of operating reactors in the Western U.S. 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.

65) 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 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).

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 U.S. (CEUS) (based on the new U.S. 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, 4×10^{-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.

66) 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 below.

67) What do the following terms mean?

- Annual exceedance frequency
- Core damage frequency
- Design basis earthquake or safe shutdown earthquake
- Ground acceleration
- High confidence of low probability of failure capacity
- Large early release frequency
- Seismic hazard
- Seismic margin
- Seismic risk

Public Answer: The terms are defined as follows:

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

Core damage frequency (CDF) **– Expected number of core damage events per unit of time.** *Core damage* refers to the uncovery 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.

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.

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.

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.

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.

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*.

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

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 2.5x10-6, 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

69) The GI-199 documents give updated probabilistic seismic hazard estimates for existing nuclear power plants in the Central and Eastern U.S. What document has the latest seismic hazard estimates (probabilistic or not) for existing nuclear power plants in the Western U.S.?

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 U.S. 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 U.S. have adequate safety margin. NRC staff has continued to stay abreast of the latest research on seismic hazards in the Western U.S. and interface with colleagues at the U.S. Geological Survey. The focus of Generic Issue 199 has been on the CEUS. However, the Information Notice that summarized the results of the Safety/Risk Assessment was sent to all existing 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

70) 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, U.S. Department of Energy, U.S. Geological Survey (USGS) and Electric Power Research Institute (EPRI) project). These consensus seismic hazard estimates will supersede the existing EPRI, Lawrence Livermore National Laboratory, and USGS hazard estimates used in the GI-199 Safety/Risk Assessment."

Public Response: The new consensus hazard curves are being developed in a cooperative project that has NRC, U.S. Department of Energy, U.S. Geological Survey (USGS) and Electric Power Research Institute (EPRI) participation. The title is: the Central and Eastern U.S. Seismic Source Characterization (CEUS-SSC) project. The project is being conducted following comprehensive standards to ensure quality and regulatory defensibility. It is in its final phase and is expected to be 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). 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_userid=2&cached=true.

Additional, technical, non-public information: None

71) 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

Seismic Probabilistic Risk Assessment (SPRA)

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

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

Additional, technical, non-public information: None

Plant-Specific Questions

SONGS questions

73) 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

74) Has the earthquake hazard at SONGS been reviewed like 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. 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 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

75) 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

76) 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

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

77) 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

78) Is SONGS designed against tsunami and earthquake?

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

Additional, technical, non-public information: None

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

Public Response: 30 feet. Information for all plants can be found in the "Additional Information' section of this document.

Additional, technical, non-public information: None

80) 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

81) Will this be reviewed in light of the Japan quake.

Public Response: The NRC will do a through 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

82) 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.

Additional, technical, non-public information: None

83) 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 from SONGS. This is significantly less than the Japan quake, 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

84) 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), 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 U.S.). 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

85) 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 away. The Japanese earthquake was much larger (8.9), but was also almost 9 miles away. The local ground motion at a particular plant is significantly affected by the local soil and bedrock conditions. SONGS was designed (,67g) to withstand more than 2 times the design motion at average US plants.

Additional, technical, non-public information: None

86) 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

87) Regarding tsunami at Diablo 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

88) 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

89) Is there potential linkage between the South Coast Offshore fault near San Onofre NPP 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 Ingelwood 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 Questions

90) 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 quake and tsunami?

Public response: ADD

Additional, technical, non-public information: ADD

91) 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

92) 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

93) 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

94) 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

95) Why did a Emergency Warning go out for a 'tsunami' that was only 6 ft 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 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. Tsunami have far more energy and power than wind-driven waves.

Additional, technical, non-public information: ADD

96) **How big did the Japanese think a quake/tsunami could be before 3/11? Why were they so wrong (assuming this quake/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

97) **Regarding tsunami at Diablo 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.

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

ADD

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

ADD

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

ADD

101) 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?

ADD

Work the following into Q&As as time permits.

After an earthquake, in orderto 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 quake, and probably is why it had taken Japan so long to restore the KK plants following the earlier quake.

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

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

Public Response: 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, because the Indian Point plants are built on solid bedrock, 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.

Additional, technical, non-public information: The Question asks: Why is Indian Point safe if there is a fault line beneath it? The response focuses on the Ramapo fault (within a couple of miles not directly beneath) specifically and also states that the plant is designed for the largest observable earthquake. The information is consistent with the literature and the UFSAR for IP related to the Ramapo fault.

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.

103) Comments From the letter received 3/16/11 from Congresswoman Lowey:

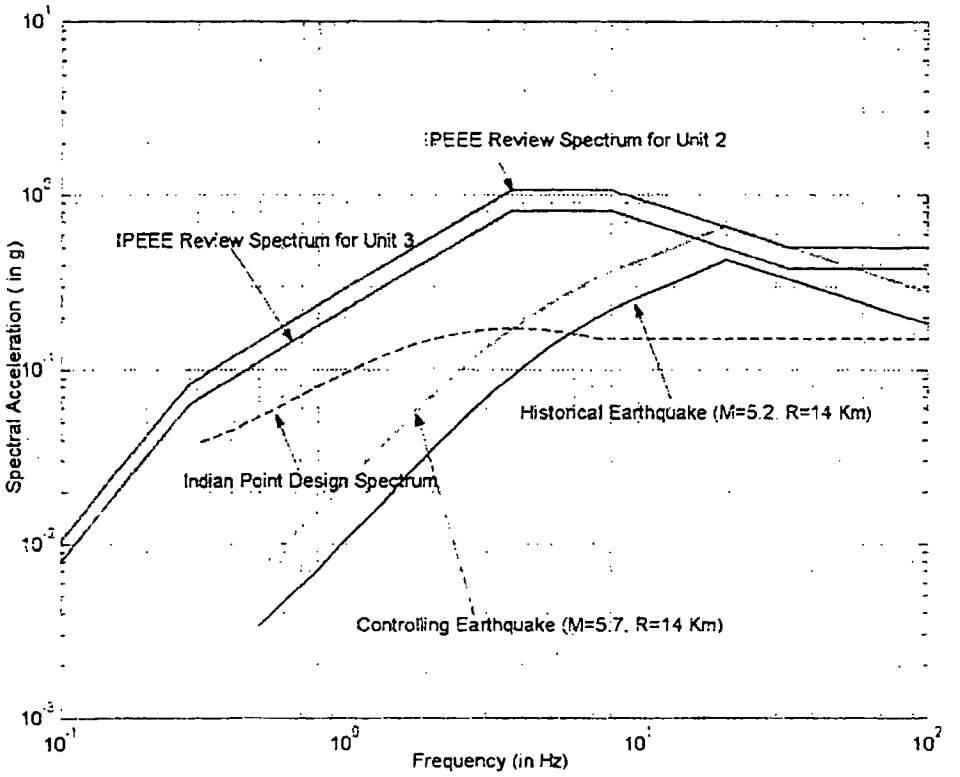
Text of the letter:

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

The Ramapo Seismic Zone is a particular threat because the zone passes within two miles of Indian Point. The Ramapo Seismic zone includes the Dobbs Ferry fault in Westchester, which generated a 4.1 magnitude earthquake in 19S5. The Columbia University study suggests that this pattern of subtle but active faults increases the risk to the New York City area and that an earthquake with a magnitude of 7.0 on the Richter scale is within reach. Disturbingly, Entergy measures the risk of an earthquake near Indian Point to be between 1.0 and 3.0 on the Richter scale, despite evidence to the contrary.

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

NRR has the lead in response. We can assist NRR at their request. Either way, we need to turn this into appropriate questions and then provide answers consistent with the formal response.



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

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

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, *g***	**OBE Peak Acceleration, *g***	**Soil Condition**
New York					
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
New Jersey					
Salem 1,2	VII-VIII	Near	0.2	0.1	Deep Soil
Connecticut					
Millstone 1, 2, 3	VII	Near	0.17	0.07	Rock
Vermont					
Vermont Yankee	VI	Near	0.14	0.07	Rock
Ohio					
Davis Besse 1	VII	Near	0.15	0.08	Rock
Perry 1	VII	Near	0.15	0.08	Rock
Georgia					
Hatch 1, 2	VII	Near	0.15	0.08	Deep Soil
Vogtle 1, 2	VII-VIII	Near	0.2	0.12	Deep Soil
Tennessee					
Seqouyah 1, 2	VIII	Near	0.18	0.09	Rock
Watts Bar 1	VIII	Near	0.18	0.09	Rock
California					
San Onofre 2, 3	IX-X	Near	0.67	0.34	Soil
Diablo Canyon 1, 2	X-XI	Near	0.75	0.20	Rock
Florida					

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 MLLW.
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 (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.
Connecticut			
Millstone	0.170	0.090	18 ft SWL
Florida			
Crystal River	0.050	0.025	N/A (Non-Coastal)

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
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

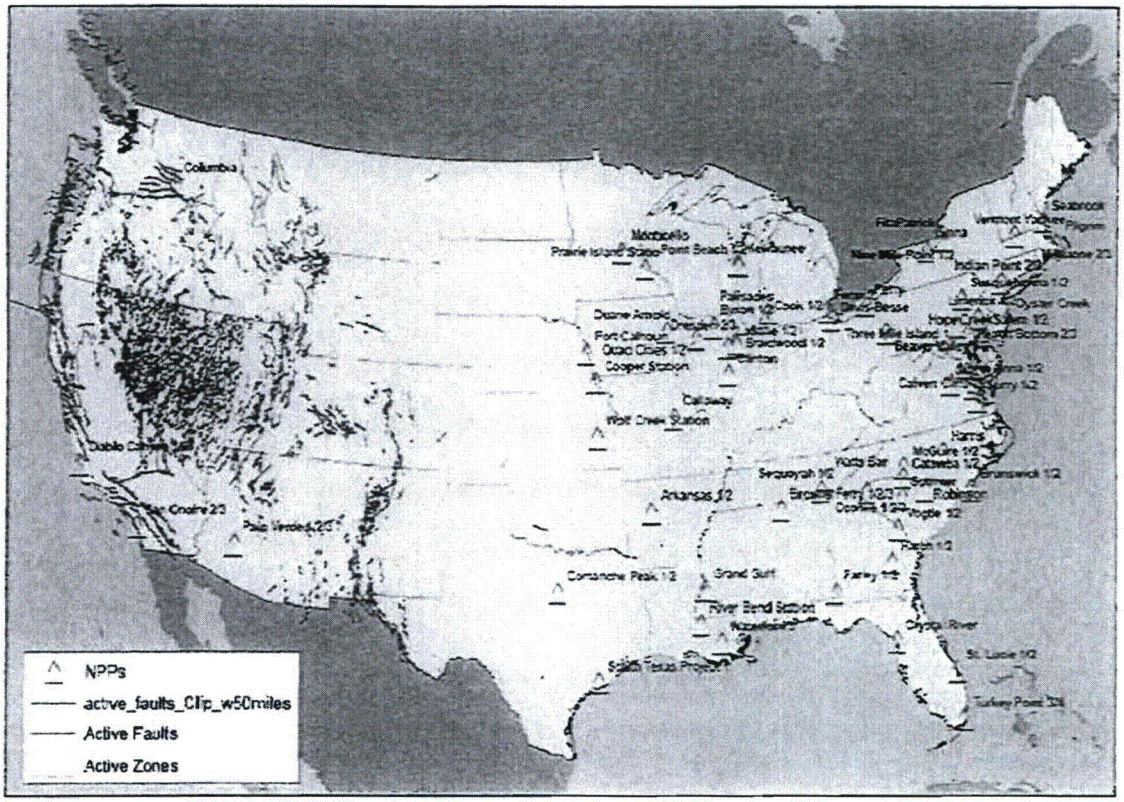
Nuclear Plant Name By State/ Location	Safe Shutdown Earthquake (SSE) Peak Acceleration (g)	Operating Basis Earthquake (OBE) Peak Acceleration, (g)	Probable Maximum Tsunami OR Maximum Tsunami Water Level
Missouri			
Callaway	0.200		N/A (Non-Coastal)
Mississippi			
Grand Gulf	0.150	0.075	N/A
Minnesota			
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 U.S. 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.)

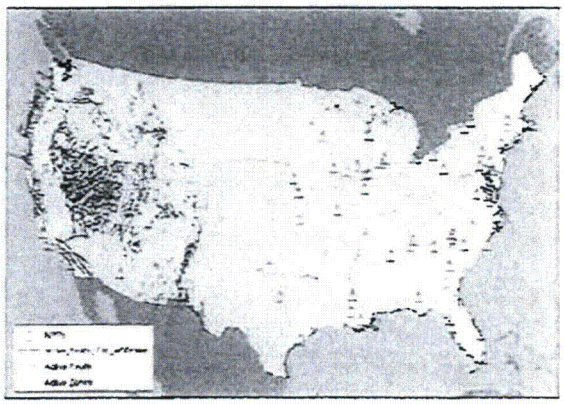
Nuclear Plant Name By State/ Location	Safe Shutdown Earthquake (SSE) Peak Acceleration (g)	Operating Basis Earthquake (OBE) Peak Acceleration, (g)	Probable Maximum Tsunami OR Maximum Tsunami Water Level
Salem	0.200	0.100	21.9 MSL (There is no evidence of surface rupture in East Coast earthquakes and 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			

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
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			
Kawaunee	0.120	0.060	N/A
Point Beach	0.120		N/A
Definition of Safe Shutdown Earthquake	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).		
Definition of Operating Basis Earthquake:	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: (iv) For the certified design portion of the plant, the OBE ground motion is one-third of the CSDRS. (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). (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).		

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.



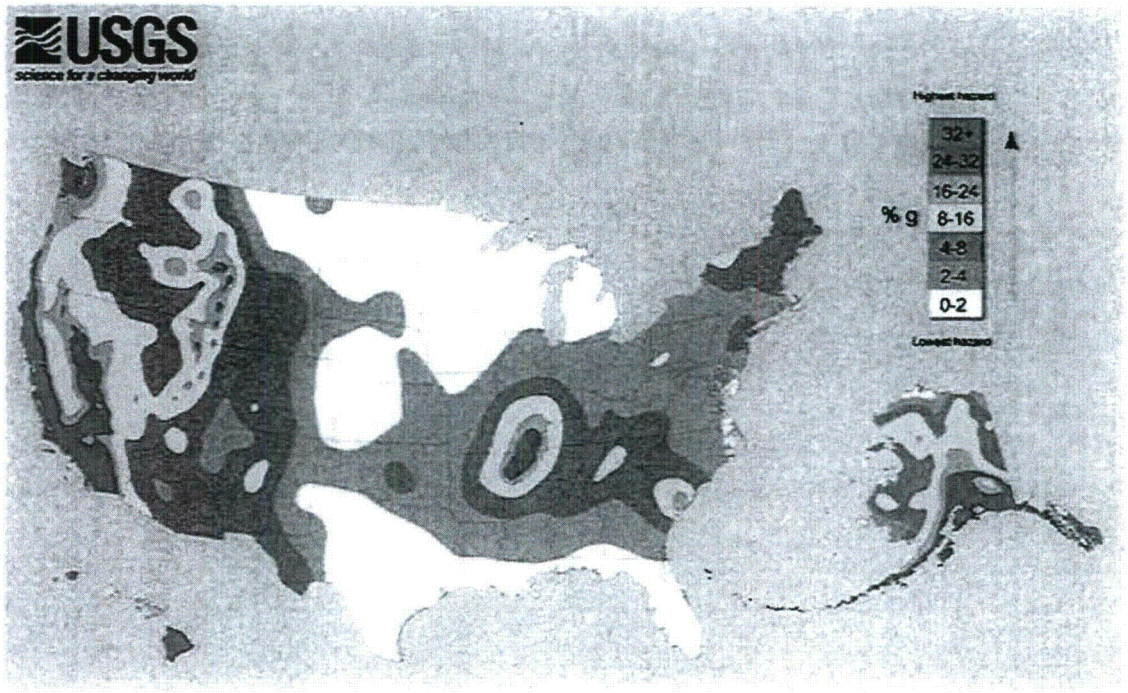


Nuclear Plants in the US Compared to the USGS National Seismic Hazard Maps

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/



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?)

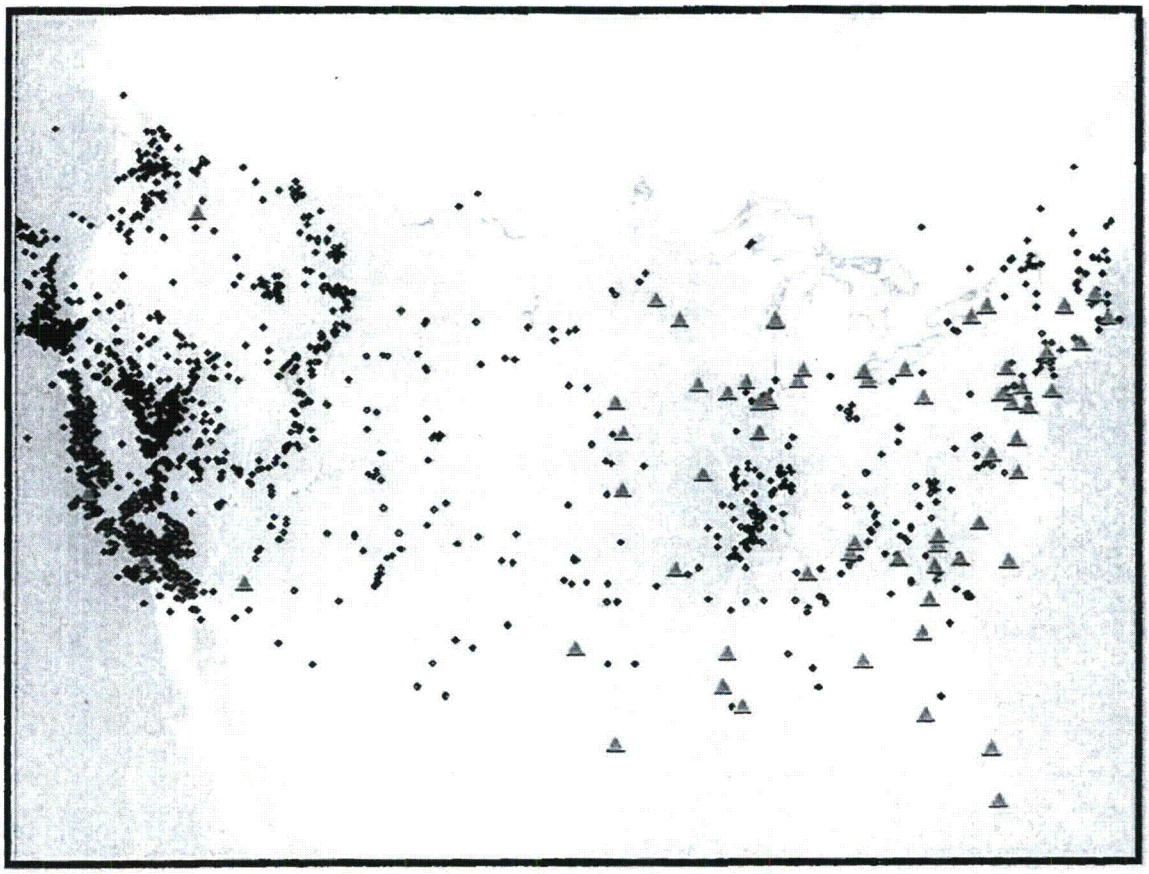


Table of Plants Near Known Active Faults

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.

PLACEHOLDER ONLY....TO BE COMPLETED ON 3/17/11 PLEASE DON'T USE!!!

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					

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

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

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

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

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		

Summary of seismological information from regional instrumentation

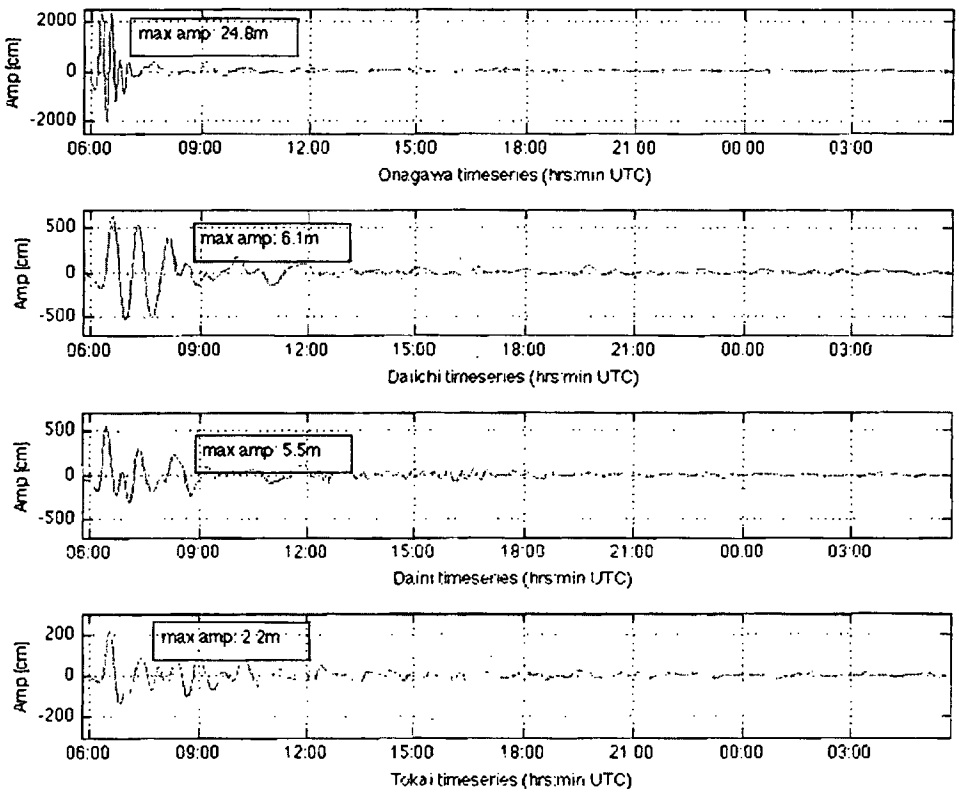
Placeholder: Rasool Anooshehpoor is developing.

Tsunami Wave Heights at the Japanese Plants (unofficial from NOAA)

The below plots were developed for NRC seismic staff a few hours after the earthquake and tsunami by the PMEL group of NOAA. This group is responsible for scientific development of the models and tools used by the US tsunami warning system, as well as notification elements of system itself.

On 3/16/11, the PMEL NOAA team informed NRC staff that additional analyses have generally confirmed the below estimates and so they don't expect the final official numbers at the plant locations to change much.

Offshore wave amplitudes, scaled to the coastline



Fact Sheet on 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

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

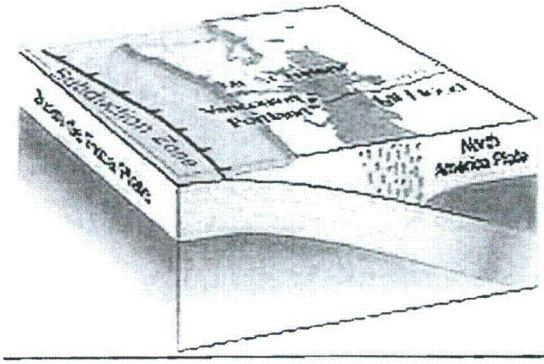
Seismicity of the Central and Eastern US Fact Sheet

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 U.S. 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 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 U.S. 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 U.S. plants is much lower than that for Japan since **most U.S. plants are located in the interior of the stable continental U.S.** The largest earthquakes within the continental U.S. 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 U.S., 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.

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

Plant sites	Contributing earthquakes	New DBGM S_s	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
Monjyu (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	△
Tohoku	Onagawa (Unit1)	BWR	◎
	Higashi-dori	BWR	△
Tokyo	Kashiwazaki-Kariwa	BWR	Unit 1,5,6,7 ◎
	Fukushima-No1	BWR	Unit 3 ◇, 5 ◎
	Fukushima-No2	BWR	Unit 4,5 ◎
Chubu	Hamaoka	BWR	△
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	△
JAEA	Monjyu	Proto Type FBR	◎
Japan Nuc. Fuel	Rokkasyo	Reprocessing	◎

◎: NSC review finished, ○: NISA review finished and in NSC review, △: Under review by NISA

US Portable Array briefing sheet for brief congressional staffers

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

IRIS

The Incorporated Research Institutions for Seismology is the Consortium of Unites 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.

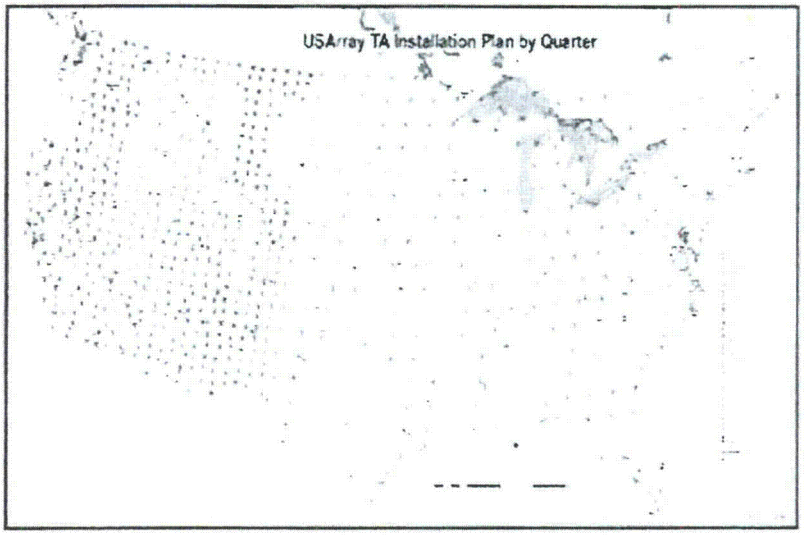
Estimate of annual acquisition and O&M costs for the 1-in-4, 250-station network in central and eastern US.

Year	Stations	Acquisition[1]	O&M[2]	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

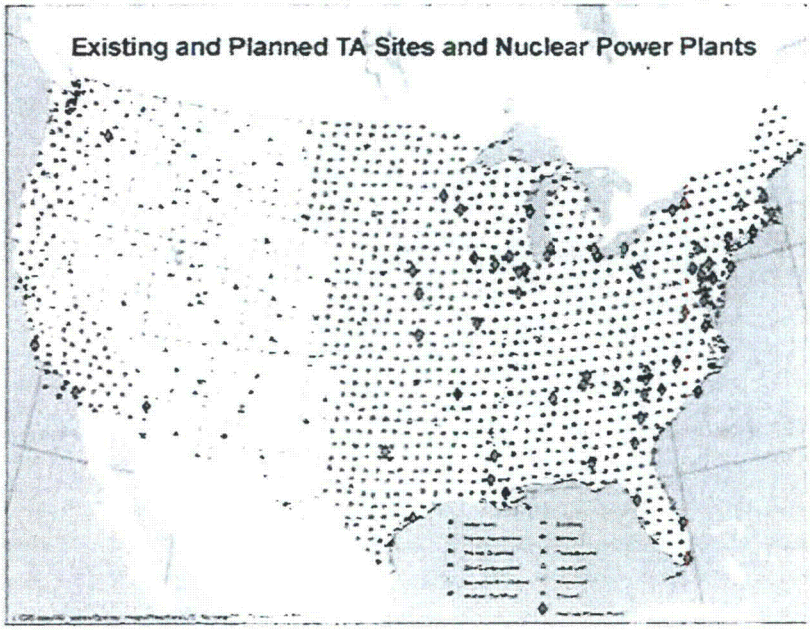
[1] Assumes upgrades to six channel data loggers with strong motion sensors.

[2] 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



List of Questions

Summary Seismic Q and A's by Annie Kammerer et al.

For discussion of "subduction zone" event please see Question 2 on Page 1.

San Onofre (pages 23-26)

The San Onofre plant grade is elevation +30.0 feet mean lower low water (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 seawall. When storm waves are superimposed, the predicted maximum runup is to elevation +27 MLLW.

Diablo Canyon (pages 27-29)

The Diablo Canyon main plant is located above the flood level associated with tsunami. The intake structures and Auxiliary Sea Water System at Diablo Canyon is designed for a combination of tsunami-storm wave activity.

Generic Issue 199 (15-22)

In support of Early Site Permits for new reactors, the NRC staff reviewed updates to seismic source and ground motion models provided by applicants. The seismic update information included new models to estimate earthquake ground motion and updated models for earthquake sources in seismic regions such as eastern Tennessee, and around both Charleston, South Carolina, and New Madrid, Missouri. This new data and models resulted in increased estimates of the seismic hazards for plants in the Central and Eastern United States (CEUS), but these estimates remain small in an absolute sense. The staff reviewed and evaluated this new information along with recent U.S. Geological Survey (USGS) seismic hazard estimates for the CEUS, used for building code applications (as opposed to nuclear power plant licensing). From this review, the staff identified that the estimated seismic hazard levels at some current CEUS operating sites might be higher than seismic hazard values used in design and previous evaluations. This Generic Issue will investigate if these curves should be back fit on licensees in the CEUS.

The Generic Issue Panel recommended based on a screening analysis that this issue proceed to the safety and risk assessment phase of the GIP.

Sosa, Belkys

From: Baggett, Steven
Sent: Thursday, March 17, 2011 5:31 AM
To: Sosa, Belkys
Subject: FW: Operations Center

Belkys,

GE asked the Commissioner for help with obtaining the basis for our requests of them, and for some imagery, specially of the spent fuel pool. Tony Gody, RgII took the action, below indicates seems it is in play, GEA does not need to engage at this point.

Steve

-----Original Message-----
From: Kinneman, John
Sent: Wednesday, March 16, 2011 1:26 PM
To: Baggett, Steven; Gody, Tony
Subject: Operations Center

Steven,

(b)(5)

John
Sent from NRC Blackberry
John Kinneman

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: HRMSBulletin Resource
Sent: Thursday, March 17, 2011 9:25 AM
To: HRMSBulletin Resource
Cc: HRMSBulletin Resource
Subject: Clarification for use of the Tac ZG0061

Clarification for use of the TAC (ZG0061) that was established for the events in JAPAN

This TAC (ZG0061) was established to track activity related to staff that are supporting the recent events in Japan. Managers that are performing managerial functions relating to the events in Japan should continue to use the TAC (ZM0000). In the situation where a manager is required to perform duties which would be considered different than managerial responsibilities should record their time under the new TAC ZG0061. Support staff that are performing Japan events should use TAC's that relate to their normal responsibilities. In the situation where administrative support staff is required to perform duties that would be considered different than routine administrative support responsibilities should record their time under the new TAC ZG0061.

If you have any additional questions please e-mail Jackie Jones Jackie.Jones@NRC.GOV or Mary Matheson at Mary.Matheson@NRC.GOV.

Sosa, Belkys

From: Davidson, Lawrence
Sent: Thursday, March 17, 2011 2:06 PM
To: Abraham, Susan; Abrams, Charlotte; Ader, Charles; Akstulewicz, Frank; Albert, Ronald; Allwein, Russell; Alston, Timothy; Andersen, James; Anderson, Joseph; Armentrout, Deborah; Ash, Darren; Ash, Melissa; Astwood, Heather; Auluck, Rajender; Austin, Joseph; Ayres, David; Bahadur, Sher; Bailey, Marissa; Bailey, Stewart; Baker, Pamela; Banas, Paul; Barss, Dan; Bartlett, Bruce; Bartley, Jonathan; Bartley, Malion; Batkin, Joshua; Baum, Robin; Bayliff, Shirley; Beardsley, James; Beasley, Benjamin; Bell, Hubert; Bell, Marvin; Bellamy, Ronald; Bellinger, Alesha; Benjamin, Jamie; Benner, Eric; Benney, Brian; Bergman, Thomas; Biggins, James; Bladey, Cindy; Blamey, Alan; Bloom, Steven; Bloomer, Tamara; Blount, Tom; Boger, Bruce; Boland, Anne; Bolduc, Angela; Bonser, Brian; Borchardt, Bill; Borden, William; Bouling, Ramona; Bower, Fred; Bower, Phyllis; Boyce, Tom (RES); Boyce, Thomas (OIS); Brady, Joseph; Brenner, Eliot; Brezovec, Michael; Broaddus, Doug; Brooks, Kenneth; Brown, Frederick; Brown, Tony; Brown, Milton; Brown, Rohn; Bubar, Patrice; Buchholz, Jeri; Buckley, Michael; Bumpass, Sheila; Burns, Stephen; Burritt, Arthur; Burton, Stephen; Burton, William; Bush-Goddard, Stephanie; Cain, Chuck; Caldwell, Robert; Calle, Joselito; Cameron, Jamnes; Campbell, Andy; Campbell, Larry; Campbell, Stephen; Campbell, Vivian; Camper, Larry; Caniano, Roy; Cardenas, Daniel; Carlson, Robert; Carpenter, Cynthia; Case, Michael; Casto, Chuck; Casto, Greg; Cataldo, Paul; Catts, Michelle; Champion, Bryan; Chang, Helen; Chang, Lydia; Cheok, Michael; Chernoff, Harold; Chernoff, Margaret; Chokshi, Nilesh; Christensen, Harold; Clark, Jeff; Clay, Earnestine; Clayton, Brent; Clifford, James; Cobey, Eugene; Cochrum, Steven; Coe, Doug; Cohen, Miriam; Cohen, Ronald; Cohen, Stephen; Colaccino, Joseph; Coleman, Judy; Collins, Daniel; Collins, Elmo; Conte, Richard; Cook, Christopher; Corbett, James; Cordes, John; Correia, Richard; Costello, Ralph; Coyne, Kevin; Croteau, Rick; Crowe, Eddy; Cruz, Jeffrey; Csontos, Aladar; Cubbage, Amy; Cubellis, Louis; Cullison, David; Curtis, David; Daley, Robert; Daly, Jill; Dambly, Jan; Daniel, Susan; Danna, James; Dapas, Marc; Davis, Henry; Davis, Jack; Davis, Marlone; Dean, Michael; Dean, Bill; Dehn, Janine; Delligatti, Mark; Dembek, Stephen; Demoss, Gary; Dennig, Robert; Dentel, Glenn; Desai, Binoy; Dias, Antonio; Diaz-Toro, Diana; Dickson, Billy; Dingbaum, Stephen; DiPaolo, Eugene; Dixon, John; Dixon-Herrity, Jennifer; Doane, Margaret; Dodmead, James; Doerflein, Lawrence; Donaldson, Leslie; Donnell, Tremaine; Donoghue, Joseph; Doornbos, Roger; Dorman, Dan; Dorsey, Jeryll; Dosch, William; Dreisbach, Jason; Droggitis, Spiros; Dudes, Laura; Dumbacher, David; Duncan, Eric; Dwyer, James; Dyer, Jim; Eads, Johnny; Easson, Pamela; Egan, Dennis; Egli, Richard; Einberg, Christian; Elkins, Scott; Ellegood, John; Elliott, Robert; Ellsbury, Richard; Erlanger, Craig; Ernstes, Michael; Brown, Cris; Evans, Carolyn; Michele.ca@nrc.gov; Farnholtz, Thomas; Felts, Russell; Fenton, Darlene; Ferdas, Marc; Ferrell, Kimberly; Ficks, Ben; Fields, Leslie; Finney, Patrick; Fitch, Karen; Flanders, Scott; Flynn, Sean; Foster, Jack; Franke, Mark; Franovich, Rani; Fredericks, Carl; Freeman, Scott; Fretz, Robert; Frumkin, Daniel; Frye, Timothy; Fuller, Michael; Gaddy, Vincent; Gallo, Jenny; Galloway, Melanie; Gartman, Michael; Gavrilas, Mirela; Giantelli, Adelaide; Gibson, Kathy; Giessner, John; Giitter, Joseph; Givvines, Mary; Gody, Tony; Golder, Jennifer; Golshan, KG; Gorham, Tajuan; Gott, William; Graham, Thorne; Grancorvitz, Teresa; Grant, Jeffery; Graser, Dan; Gray, Mel; Greene, Kathryn; Grice, Thomas; Griffin, Steven; Grobe, Jack; Hawkins, Kimberly; Gusack, Barbara; Guthrie, Eugene; Guttmann, Jack; Haag, Robert; Habighorst, Peter; Hackett, Edwin; Haeg, Lucas; Haire, Mark; Hall, Donald; Hall, Patricia; Hamzehee, Hossein; Haney, Catherine; Hansell, Samuel; Harris, Tim; Harrison, Donnie; Hatchett, Gregory; Hawkens, Roy; Hay, Michael; Hayden, Elizabeth; Hays, Myra; Heck, James; Heck, Jared; Helton, Shana; Henderson, Pamela; Hickey, James; Hiland, Patrick; Hills, David; Hilton, Nick; Hiltz, Thomas; Hirsch, Patricia; Hoeg, Tim; Hogan, Rosemary; Holahan, Gary; Holahan, Patricia; Holian, Brian; Holland, Crystal; Holody, Daniel; Holonich, Joseph; Holt, BJ; Hopper, George; Howard, Patrick; Howe, Allen; Howell, Art; Howell, Linda; Hoxie, Chris; Hsia, Anthony; Hsu, Caroline; Hsueh, Kevin; Huber, Deborah; Hudson, Jody; Humerick, David; Hunegs, Gordon; Hunter, James; Huth, Virginia; Hutto, Andy; Huyck, Doug; Imboden, Andy; Itzkowitz, Marvin; Jackson, Deborah; Jackson, Donald; Jackson, Terry; James, Lois; Jankovich, John; Janney, Margie; Jarvis, Rodney; Jenkins, Ronaldo; Jernell, Eleni; Johns, Nancy; Johnson, Michael; Johnson, Clay; Johnson, Robert; Jolicoeur, John; Jones, Bradley; Jones, Evan; Jones, William; Josey, Jeffrey; Joustra, Judith; Julian, Emile; Jung, Ian; Junge, Michael; Kahler, Robert; Kaplan, Michele; Karas, Rebecca; Kellar, Ray; Kelley, Corenthis; Kemerer, Myron; Kemker, Brian; Kennedy, Kriss; Kennedy, Silas; Kerben, Valerie; Kern, David; Khanna, Meena; Kim, Yong; Kimble, Daniel; King, Donald; King, Michael; Kinneman,

To: John; Kirkland, John; Kirkwood, Sara; Klein, Alex; Knutson, Ed; Kobetz, Timothy; Kokajko, Lawrence; Kolaczyk, Kenneth; Konzman, Carl; Koshy, Thomas; Kowal, Mark; Kramer, John; Krohn, Paul; Krsek, Robert; Krupnick, David; Kulesa, Gloria; Kulp, Jeffrey; Kunowski, Michael; Lam, Donna; Lambert, Kenneth; Landau, Mindy; Langan, Scott; Lankford, Jeffrey; Lantz, Ryan; Lara, Julio; Larkin, Grant; Laura, Richard; Layton, Michael; Le, Hong; Lee, Bert; Lee, David; Lee, Richard; Lee, Samson; Lee, Samuel; Leeds, Eric; Lennartz, Jay; Lesser, Mark; Lew, David; Lewis, Robert; Lipa, Christine; Lombard, Mark; Long, Chris; Lopez, Joseph; Lorson, Raymond; Louden, Patrick; Lubinski, John; Luehman, James; Lui, Christiana; Lukes, Robert; Lund, Louise; Lupold, Timothy; Lyons-Burke, Kathy; Ma, May; Madden, Patrick; Madison, Wil; Magruder, Stewart; Mamish, Nader; Markley, Michael; Marshall, Jane; Marshfield, Mark; Martin, Gillian; Masnik, Michael; Masse, Todd; Matheson, Mary; Mathew, Roy; Matthews, David; Mattingley, Joel; Maxin, Mark; Mayfield, Michael; McCann, Carrie; McConnell, Keith; McCoppin, Michael; McCoy, Gerald; McCrary, Cheryl; McCree, Victor; McDermott, Brian; McGhee, James; McGill, Clinton; McGinty, Tim; McGowan, Anna; McHale, John; McKelvey, Harold; McKenna, Eileen; McKenney, Christepher; McKirgan, John; McMillan, Joseph; McMurtray, Anthony; Mendiola, Anthony; Meyer, David; Michalak, Paul; Miller, Charles; Miller, Chris; Miller, Geoffrey; Miller, Marie; Miller, Mark; Miller, Michael; Miotla, Sherri; Mitchell, Matthew; Mitchell, Reggie; Mohseni, Aby; Monk, Robert; Monninger, John; Montgomery, Jack; Moore, Scott; Moore, Thomas; Moorman, James; Morris, Eddie; Morris, James; Morris, R. Michael; Morris, Scott; Morrissey, Thomas; Moulding, Patrick; Moy, Romena; Mrowca, Lynn; Muessle, Mary; Munday, Joel; Murphy, Jerome; Murphy, Martin; Musser, Randy; Narick, Marianne; Nazario, Tomy; Nease, Rebecca; Neff, Deborah; Nelson, Robert; Nichols, Russell; Nieh, Ho; Norato, Michael; Norris, Michael; Nute-Blackshear, Lora; OBrien, Kenneth; OBryan, Phil; O'Donohue, Kathleen; Offutt, David; Ogle, Chuck; OKeefe, Neil; Oklesson, Edward; Ordaz, Vonna; Orth, Steven; O'Sullivan, Kevin; Ott, William; Ousley, Elizabeth; Owens, Janice; Paradiso, Karen; Partlow, Benjamin; Pascarelli, Robert; Peck, Michael; Pederson, Cynthia; Pelke, Patricia; Pellet, John; Pelton, David; Peralta, Juan; Perry, Jamila; Perry, Neil; Persinko, Andrew; Peters, Sean; Peterson, Gordon; Peterson, Hironori; Pham, Bo; Phillips, Charles; Piccone, Josephine; Pool, Stephen; Poole, Brooke; Powell, Amy; Powell, Dawn; Powell, Raymond; Prescott, Peter; Pretzello, Andrew; Price, Georgette; Pruett, Troy; Pstrak, David; Pulliam, Timothy; Quay, Theodore; Quichocho, Jessie; Rabideau, Peter; Rahimi, Meraj; Raione, Richard; Rajnic, Cecilia; Ramirez, Frances; Rasmussen, Richard; Rasouli, Houman; Raspa, Rossana; Rayland, Andrew; Raymond, William; Reckley, William; Reddick, Darani; Reece, James; Regan, Christopher; Reis, Terrence; Remsburg, Kristy; Reynolds, Steven; Reynoso, John; Rheaume, Cynthia; Ricci, John; Rich, Daniel; Rich, Thomas; Richards, Stuart; Ricketts, Paul; Riemer, Kenneth; Ring, Mark; Roach, Edward; Roach, Gregory; Roberts, Darrell; Rodgers, Felecia; Rogge, John; Rosenberg, Stacey; Ross, Thierry; Ross-Lee, MaryJane; Rothschild, Trip; Rough, Richard; Rowhani, Bahman; Royal, Judith; Rubenstone, James; Rubic, Mark; Ruiz, Robert; Ruland, William; Rule, David; Rutkowski, John; Rutledge, Steven; Rzepka, Robert; Sabisch, Andrew; Safford, Carrie; Salgado, Nancy; Salley, MarkHenry; Salter, Susan; Sanchez, Alba; Sanchez, Alfred; Sangimino, Donna-Marie; Santiago, Patricia; Santos, Cayetano; Sargent, Kimberly; Satorius, Mark; Schaaf, Robert; Schaeffer, James; Schmidt, Rebecca; Schneider, Max; Schnetzler, Bonnie; Schoenmann, Sandra; Schroeder, Daniel; Schum, Constance; Scott, Catherine; Scott, Michael; Sealing, Donna; Segala, John; Serepca, Beth; Seymour, Deborah; Shaeffer, Scott; Shaffer, Steve; Shannon, Mel; Shannon, Michael; Sharkey, Jeffry; Shay, Jason; Shear, Gary; Shehee, James; Sheron, Brian; Shields, James; Shoop, Undine; Shuaibi, Mohammed; Silva, Patricia; Simms, Sophonia; Skeen, David; Skokowski, Richard; Smith, Arthur; Smith, Brian; Smith, Galen; Smith, Rich; Smith, Tuwanda; Solorio, Dave; Sosa, Belkys; Sotiropoulos, Dina; Spencer, Mary; Spindler, David; Spitzberg, Blair; StAmour, Norman; Stablein, King; Stapleton, Bernard; Stetson, Kathleen; Stewart, Scott; Stewart, Sharon; Stoedter, Karla; Stone, AnnMarie; Suber, Gregory; Subosits, Stephen; Sullivan, Allen; Swain, Karol; Sydnor, Russell; Sykes, Marvin; Szyperski, Bill; Tailleart, Don; Talley, Sandra; Tappert, John; Tate, Travis; Taylor, Robert; Tenaglia, Mickey; Terao, David; Terry, Leslie; Thaggard, Mark; Thomas, Brian; Thomas, Christopher; Thorp, John; Tonacci, Mark; Tracy, Glenn; Tran, Tu; Trapp, James; Travick, Vanette; Trent, Glenn; Tschiltz, Michael; Turner, Joseph; Turtil, Richard; Uhle, Jennifer; Ulses, Anthony; Usilton, William; Valentin, Andrea; Vegel, Anton; Vias, Steven; Vietti-Cook, Annette; Virgilio, Martin; VonTill, Bill; Voytko, Victoria; Walker, Tracy; Walker, Wayne; Wall, Scott; Warnick, Greg; Wastler, Sandra; Waters, Michael; Watson, Bruce; Weaver, Doug; Webber, Robert; Weber, Michael; Weerakkody, Sunil; Welling, Blake; Werkheiser, David; Werner, Greg; Wert, Leonard; West, Garmon; West, Steven; Westreich, Barry; Whetstine, Jack; White, Duncan; White, Darrell; Whited, Ryan; Whitten, Jack; Widdup, Joseph; Widmann, Malcolm; Wiggins, Jim; Williams, Barbara; Williams, Evelyn; Williams, Kevin; Williams, Michael; Williams, Mona; Williams-Johnson,

To: Patrice; Williamson, Edward; Wilson, Ernest; Wilson, George; Wilson, Peter; Wood, Gene; Wood, Kent; Wright, Lisa (Gibney); Wrona, David; Wunder, George; Yerokun, Jimi; Young, Cale; Young, Mitzi; Zane, Steven; Zeiler, John; Zimmerman, Jacob; Zimmerman, Roy; Zobler, Marian

Cc: Scott, Tracy; Tallarico, Alison; Thoman, Raymond; Jones, Jackie; Blair, Tina; Chin, Allison; Dean, Vivian; Evans(HR), Marilyn; Himmelberg, Jude; Jackson, Briana; Jaigobind, Savi; Silberfeld, Dafna; Watson, Madonna; Williams, Michelle; Atkinson, Jeanne; Broadwater, Lynne; Brown, Keisa; Hicks, Beverly; Hicks, Valencia; Jonsson, Dawn; Lindsay, Sandy; Marziale, Riqueza; ORourke, Christine; Reeves, Gloria; Scott, Mary; Thomas-Richards, Karen; Todd, Colleen

Attachments: Work Schedule and Premium Pay Guidance for Japan Response 3.docx

Managers, supervisors, team leaders, and T&L Coordinators,

Attached for your information is a document that addresses, in detail, work schedules and premium pay for individuals who serve in and support the NRC Operations Center or work in Japan, in response to the current, serious nuclear power plant issues in that country. NSIR and the NRC Japanese support team leader will provide the document to all participants.

T&L Coordinators, please note that participants in your organization may contact you to request a change in their HRMS workgroups for pay periods in which they perform emergency response work.

Participants should contact me if they have any questions on work schedules or premium pay.

Larry Davidson
Office of Human Resources
Nuclear Regulatory Commission
301-492-2286; lawrence.davidson@nrc.gov

WORK SCHEDULE AND PREMIUM PAY GUIDANCE FOR RESPONSE TO EVENTS IN JAPAN

Please first review this document and contact Larry Davidson of the Office of Human Resources (301-492-2286 or lawrence.davidson@nrc.gov) for any needed assistance.

Work Schedules

One or more types of work schedules may be appropriate during a pay period in which you serve in and support the NRC Operations Center or work in Japan, in response to the current, serious nuclear power plant issues in that country. You are authorized to select the type of work schedule you will work during the pay period depending on:

- Your specific workdays and work clocks hours in the Operations Center or in Japan, as well as any flexibility you have to choose those workdays and clock hours;
- Your entitlement to premium pay for work in the Operations Center or Japan;
- Your performance, if any, of regular duties outside of the Operations Center/Japan during the pay period; and,
- Your loss of earned credit hours if you switch from NEWFlex to another type of work schedule.

Possible work schedules include:

- Compressed work schedule – Appropriate if, during the entire pay period, your workdays and work clock hours are fixed (i.e., you do not have any flexibility to choose either) and there are fewer than ten nonovertime workdays in the pay period (at least one nonovertime workday contains more than eight nonovertime hours). Note that restrictions on nonovertime work clock hours and weekend workdays have been lifted for the pay period. An Expanded-Compressed Work Schedule may be appropriate (see the Yellow Announcement at http://www.internal.nrc.gov/announcements/yellow/2003/2003-032.html and Article 6.10.3 of the Collective Bargaining Agreement).
- NEWFlex - Appropriate if, during at least a portion of the pay period, you have some discretion to select your workdays and/or work clock hours (for example, if/when performing regular duties outside of the Operations Center or Japan). Note that restrictions on nonovertime work clock hours and weekend workdays have been lifted for the pay period.
- First-40 – Appropriate if it is impracticable to prescribe a regular schedule of definite hours of duty for each workday of the workweek (likely not appropriate).

Note that you must advise your T&L coordinator to change your HRMS workgroup if you change the type of schedule you work, e.g., if you normally work CWS and change to NEWFlex for the pay period in which you serve in and support the NRC Operations Center or work in Japan. Also note that if you switch from NEWFlex to another type of work schedule, you will lose and will be paid for any accumulated credit hours.

Also note that if you work fewer than 80 hours serving in and supporting the NRC Operations Center or working in Japan, your "home" supervisor will allow you discretion, to the extent possible, to decide how/when to cover any missing time.

Premium Pay

Cap on Combined Salary Plus Premium Pay –The biweekly cap on premium pay has been lifted and will be applied on an annual basis during any pay period in which you serve in and support the NRC Operations Center or work in Japan (the annual cap will benefit you if you are paid a salary below the GG-15 step 10 salary rate). Your organization has been advised to contact CFO with employee names and dates of work.

Overtime pay or regular comp time – Overtime (limited to the higher of: your regular rate; or, 150% of GG-10 step 10) is paid for your work in excess of your full-time work schedule during the pay period. You may choose to be compensated via regular compensatory time off instead (limited to a 40-hour pay period carryover) if your overtime work was not scheduled in advance of the workweek, or regardless of when it was scheduled if you are on NEWFlex.

TRCs – Use "OT" for overtime pay and "COMPE" for regular comp time.

Night premium (10%) –This premium is paid for your *nonovertime* work between 6:00 p.m. and 6:00 a.m. the following morning, and for your *overtime* work during these clock hours if the work was scheduled in advance of the week in which you performed it. Also, this premium is paid for your periods of paid leave, if any, during night clock hours if, during the pay period, you have fewer than 8 hours of total paid leave inclusive of both night and day work.

TRC – NDIFF (hours must also be recorded under another TRC such as REG or OT).

Sunday premium (25%) – This premium is paid for your *nonovertime* work performed on a shift(s), any part(s) of which falls on a Sunday (e.g., a shift from Saturday at 6:00 p.m. to Sunday at 6:00 a.m.). Sunday premium is not payable for periods of nonwork, including leave, holidays not worked, and excused absence.

TRC – SUNP (hours must also be recorded under another TRC such as REG).

Standby status - You are eligible for special overtime pay if you are restricted by official order to a designated post of duty and assigned to be in a state of readiness to perform work, versus actually performing work, with limitations on your activities so substantial that you cannot use

your time effectively for your own purposes. We do not anticipate that any employee will be in a standby status.

Miscellaneous

Employee Assistance Program (EAP)

Free, confidential counseling is available to you and your family members to address emotional issues, work problems, substance abuse, stress, crisis, marital/family concerns, financial matters, legal issues, eldercare resources, and childcare referrals. Call 1-800-869-0276 or check www.eapconsultants.com.

Travel

If you travel to/from Japan:

- Keep a log of specific travel times and work clock hours to help NRC compute your entitlement to compensation.

- Consider enrolling in the Smart Traveler Enrollment Program or STEP) to make it easier for the Embassy/Consulates to contact you in case of an emergency. You may enroll at https://travelregistration.state.gov, or if you have no internet access, directly at the U.S. Embassy or U.S. Consulates.

- If you are paid a salary below the GG-15 step 10 salary rate, you are entitled to overtime pay (limited to higher of: your regular rate; or, 150% of GG-10 step 10) for travel to/from Japan, and if the travel is during night hours (6:00 p.m. to 6:00 a.m.) and scheduled in advance of the workweek, you are also entitled to night premium pay. You may substitute regular compensatory time off (limited to a 40-hour pay period carryover) for overtime pay if your travel was not scheduled in advance of the workweek, or regardless of when it was scheduled if you are on NEWFlex.

  TRCs – Use "OT" for overtime pay, "COMPE" for regular comp time, and "NDIFF" for night premium pay.

Quake_TP_3_17.docx

OPA

TALKING POINTS

JAPAN NUCLEAR SITUATION

As of 3/17/2011 7:30 p.m. EDT

Update: Addition of bullets on expanding EPZ to 50 miles, and response to news report ranking plants by vulnerability to earthquakes.

- Based on calculations performed by NRC experts, we now believe that it is appropriate for U.S. residents within 50 miles of the Fukushima reactors to evacuate. Our recommendation is based on NRC guidelines for public safety that would be used in the United States under similar circumstances.

- The 10-mile EPZ reflects the area where projected doses from design basis accidents at nuclear power plants would not exceed the EPA's protective action guidelines, and we are confident that it would be adequate even for severe accidents. However, the 10-mile zone was always considered a base for emergency response that could be expanded if the situation warranted. The situation in Japan, with four reactors experiencing exceptional difficulties simultaneously, creates the need to expand the EPZ beyond the normal 10-mile radius.

  We have said from the beginning of this crisis that the NRC would analyze this situation for any lessons that can be derived to improve our oversight of U.S. nuclear power plants. Emergency planning will be part of that review.

- Given the results of the monitoring and distance between Japan and Hawaii, Alaska, U.S. Pacific Territories and the U.S. West Coast, the NRC expects the U.S. to avoid any harmful levels of radioactivity. The NRC is aware of various internet postings depicting modeled radiation plumes for the ongoing events at the nuclear power plants in Japan. All of the models the NRC has seen are based on generic assumptions regarding the potential radiation release from the plants and as such are unable to predict actual radiation levels away from the site. The NRC is working closely with our federal partners to monitor radiation releases from the Japanese nuclear power plants.

- The NRC is working with other U.S. agencies to monitor radioactive releases from Japan and to predict their path.

- The NRC continues to believe, based on all available information, that the type and design of the Japanese reactors, combined with how events have unfolded, will prevent radiation at harmful levels from reaching U.S. territory.

- The Department of Energy has been designated the lead agency for communicating information to the States regarding monitoring of radiation heading toward or over the United States. The DOE's Lawrence Livermore National Laboratory (National Atmospheric Release Assessment Center) is monitoring weather patterns over the Pacific Ocean. The Environmental Protection Agency maintains air monitoring stations throughout the country and has reinforced its monitoring effort. DOE will provide aerial monitoring. Questions about this effort should be directed to DOE at 202-586-4940.

- [Status as of 9:35pm on 3/16] The NRC is closely monitoring information about the spent fuel pools as well as radiation levels at the Japanese nuclear power plants. Given the totality of the situation, the NRC's recommendation for U.S. residents within 50 miles of the Fukushima reactors to evacuate remains unchanged. That recommendation was based on actual radiation levels in the nuclear complex.

- In accordance with established protocols, U.S. Customs and Border Protection (CBP) employs several types of radiation detection equipment in its operations at both air and sea ports, and uses this equipment, along with specific operational protocols, to resolve any security or safety risks that are identified with inbound travelers and cargo. Out of an abundance of caution, CBP has issued field guidance reiterating its operational protocols and directing field personnel to specifically monitor maritime and air traffic from Japan. CBP will continue to evaluate the potential risks posed by radiation contamination on inbound travelers and cargo and will adjust its detection and response protocols, in coordination with its interagency partners, as developments warrant.

- The Japanese government has formally asked for U.S. assistance in responding to nuclear power plant cooling issues triggered by an earthquake and tsunami on March 11. The NRC has eleven staff on the ground in Japan as part of the USAID team.

- The NRC is coordinating its actions with other federal agencies as part of the U.S. government response. The NRC's headquarters Operations Center was activated at the beginning of the event and has been monitoring the situation on a 24-hour basis ever since.

- The NRC is always looking to learn information that can be applied to U.S. reactors and we will analyze the information that comes from this incident. President Obama has directed the agency to conduct a comprehensive review of the safety of U.S. nuclear plants. the agency will do so.

- U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster.

- The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area. The NRC then adds a margin for error to account for the limitations on historical data. In other words, U.S. nuclear power plants are designed to be safe based on historical data to predict the area's maximum credible earthquake.

- In response to MSNBC report ranking US NPPs according to vulnerability to earthquakes. The NRC does not rank nuclear power plants according to their vulnerability to earthquakes. This "ranking" was developed by an MSNBC reporter using partial information and an even more partial understanding of how we evaluate plants for seismic risk. Each plant is evaluated individually according to the geology of its site, not by a "one-size-fits-all" model - therefore such rankings or comparisons are highly misleading.

OPA

TALKING POINTS

JAPAN NUCLEAR SITUATION

As of 3/16/2011 7:15 p.m. EDT

Update: Addition of bullet on status of SFPs

- Based on calculations performed by NRC experts, we now believe that it is appropriate for U.S. residents within 50 miles of the Fukushima reactors to evacuate. Our recommendation is based on NRC guidelines for public safety that would be used in the United States under similar circumstances.

- Given the results of the monitoring and distance between Japan and Hawaii, Alaska, U.S. Pacific Territories and the U.S. West Coast, the NRC expects the U.S. to avoid any harmful levels of radioactivity. The NRC is aware of various internet postings depicting modeled radiation plumes for the ongoing events at the nuclear power plants in Japan. All of the models the NRC has seen are based on generic assumptions regarding the potential radiation release from the plants and as such are unable to predict actual radiation levels away from the site. The NRC is working closely with our federal partners to monitor radiation releases from the Japanese nuclear power plants.

- The NRC continues to believe, based on all available information, that the type and design of the Japanese reactors, combined with how events have unfolded, will prevent radiation at harmful levels from reaching U.S. territory.

- [Status as of 7:00pm on 3/16] The NRC is closely monitoring the condition of the spent fuel pools at the Japanese nuclear power plants. Our current understanding, which is based on the best available information provided to NRC reactor experts in Japan, is the following:

    - Unit 4 – The SFP is likely dry and the integrity of the spent fuel pool is in question.
    - Units 2 & 3 – Steam is escaping which indicates that boiling is likely occurring in the spent fuel pool. The current water level of the pool is uncertain.
    - Unit 1 – The status of the SFP is unknown.

- In accordance with established protocols, U.S. Customs and Border Protection (CBP) employs several types of radiation detection equipment in its operations at both air and sea ports, and uses this equipment, along with specific operational protocols, to resolve any security or safety risks that are identified with inbound travelers and cargo. Out of an abundance of caution, CBP has issued field guidance reiterating its operational protocols and directing field personnel to specifically monitor maritime and air traffic from Japan. CBP will continue to evaluate the potential risks posed by radiation contamination on inbound travelers and cargo and will adjust its detection and response protocols, in coordination with its interagency partners, as developments warrant.

- The Japanese government has formally asked for U.S. assistance in responding to nuclear power plant cooling issues triggered by an earthquake and tsunami on March 11. The NRC has eleven staff on the ground in Japan as part of the USAID team.

- The NRC is coordinating its actions with other federal agencies as part of the U.S. government response. The NRC's headquarters Operations Center was activated at the beginning of the event and has been monitoring the situation on a 24-hour basis ever since.

NOT FOR PUBLIC DISCLOSURE

- The NRC is always looking to learn information that can be applied to U.S. reactors and we will analyze the information that comes from this incident.

- The NRC is working with other U.S. agencies to monitor radioactive releases from Japan and to predict their path.

- U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster.

- The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area. The NRC then adds a margin for error to account for the limitations on historical data. In other words, U.S. nuclear power plants are designed to be safe based on historical data to predict the area's maximum credible earthquake.

NOT FOR PUBLIC DISCLOSURE

NOT FOR PUBLIC DISCLOSURE

OPA

TALKING POINTS

JAPAN NUCLEAR SITUATION

As of 3/16/2011 6:45 p.m. EDT

- Based on calculations performed by NRC experts, we now believe that it is appropriate for U.S. residents within 50 miles of the Fukushima reactors to evacuate. Our recommendation is based on NRC guidelines for public safety that would be used in the United States under similar circumstances.

- Given the results of the monitoring and distance between Japan and Hawaii, Alaska, U.S. Pacific Territories and the U.S. West Coast, the NRC expects the U.S. to avoid any harmful levels of radioactivity. The NRC is aware of various internet postings depicting modeled radiation plumes for the ongoing events at the nuclear power plants in Japan. All of the models the NRC has seen are based on generic assumptions regarding the potential radiation release from the plants and as such are unable to predict actual radiation levels away from the site. The NRC is working closely with our federal partners to monitor radiation releases from the Japanese nuclear power plants.

- The NRC continues to believe, based on all available information, that the type and design of the Japanese reactors, combined with how events have unfolded, will prevent radiation at harmful levels from reaching U.S. territory.

- In accordance with established protocols, U.S. Customs and Border Protection (CBP) employs several types of radiation detection equipment in its operations at both air and sea ports, and uses this equipment, along with specific operational protocols, to resolve any security or safety risks that are identified with inbound travelers and cargo. Out of an abundance of caution, CBP has issued field guidance reiterating its operational protocols and directing field personnel to specifically monitor maritime and air traffic from Japan. CBP will continue to evaluate the potential risks posed by radiation contamination on inbound travelers and cargo and will adjust its detection and response protocols, in coordination with its interagency partners, as developments warrant.

- The Japanese government has formally asked for U.S. assistance in responding to nuclear power plant cooling issues triggered by an earthquake and tsunami on March 11. The NRC has eleven staff on the ground in Japan as part of the USAID team.

- The NRC is coordinating its actions with other federal agencies as part of the U.S. government response. The NRC's headquarters Operations Center was activated at the beginning of the event and has been monitoring the situation on a 24-hour basis ever since.

- The NRC is always looking to learn information that can be applied to U.S. reactors and we will analyze the information that comes from this incident.

- The NRC is working with other U.S. agencies to monitor radioactive releases from Japan and to predict their path.

- U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster.

- The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area. The NRC then adds a margin for error to account for the limitations on historical data. In other words, U.S. nuclear power plants are designed to be safe based on historical data to predict the area's maximum credible earthquake.

OPA

TALKING POINTS

JAPAN NUCLEAR SITUATION

As of 3/16/2011 1:45 p.m. EDT

- Based on calculations performed by NRC experts, we now believe that it is appropriate for U.S. residents within 50 miles of the Fukushima reactors to evacuate. Our recommendation is based on NRC guidelines for public safety that would be used in the United States under similar circumstances.

- The NRC continues to believe, based on all available information, that the type and design of the Japanese reactors, combined with how events have unfolded, will prevent radiation at harmful levels from reaching U.S. territory.

- The Japanese government has formally asked for U.S. assistance in responding to nuclear power plant cooling issues triggered by an earthquake and tsunami on March 11. The NRC has eleven staff on the ground in Japan as part of the USAID team.

- The NRC is coordinating its actions with other federal agencies as part of the U.S. government response. The NRC's headquarters Operations Center was activated at the beginning of the event and has been monitoring the situation on a 24-hour basis ever since.

- The NRC is always looking to learn information that can be applied to U.S. reactors and we will analyze the information that comes from this incident.

- The NRC is working with other U.S. agencies to monitor radioactive releases from Japan and to predict their path.

- Given the results of the monitoring and distance between Japan and Hawaii, Alaska, U.S. Pacific Territories and the U.S. West Coast, the NRC expects the U.S. to AVOID any harmful levels of radioactivity.

- U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster.

- The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area. The NRC then adds a margin for error to account for the historical data's limited accuracy. In other words, U.S. nuclear power plants are designed to be safe based on historical data to predict the area's maximum credible earthquake.

OPA

TALKING POINTS

JAPAN NUCLEAR SITUATION

As of 3/14/2011 3 P.M. EST

In a White House briefing this morning, Chairman Jaczko said the type and design of the Japanese reactors and the way events have unfolded give us confidence in saying radiation at harmful levels will not reach the U.S.

Jaczko also said today that we believe the protective steps the Japanese are taking are comparable to ones we would use here and that we advise Americans in Japan to follow the guidance of Japanese officials.

According to Chairman Jaczko, the NRC is always looking to learn information that can be applied to the U.S. reactors and we will certainly be looking at the information that comes from this incident.

The Japanese government has formally asked for assistance from the United States as it continues to respond to nuclear power plant cooling issues triggered by an earthquake and tsunami on March 11. The NRC is assembling a team to send over in response to the request for help.

The NRC already has two experts in boiling-water reactors (BWR) in Tokyo offering technical assistance. They are part of a USAID team.

The NRC is working with other U.S. agencies to monitor radioactive releases from Japan and to predict their path. All the available information indicates weather conditions have taken the small releases from the Fukushima reactors out to sea away from the population.

Given the results of the monitoring and distance between Japan and Hawaii, Alaska, the U.S. Territories and the U.S. West Coast, the NRC does NOT expect the U.S. to experience any harmful levels of radioactivity.

Nuclear power plants are built to withstand environmental hazards, including earthquakes. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster.

The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area. The NRC then adds a margin for error to account for the historical data's limited accuracy. In other words, U.S. nuclear power plants are designed to be safe based on historical data from the area's maximum credible earthquake.

The NRC is coordinating its actions with other federal agencies as part of the U.S. government response. The NRC's headquarters Operations Center is activated and monitoring the situation on a 24-hour basis.

March 14, 2011

Talking Points

~~NOT FOR PUBLIC DISCLOSURE~~

~~*For Internal Use Only*~~

RESPONSE TO RADIOLOGICAL EMERGENCIES INVOLVING NUCLEAR POWER PLANTS IN THE U.S.

- **In the event of an incident or explosion occurring at a nuclear power plant in the U.S., the Department of Homeland Security would bring to bear the expertise and authorities of agencies across the Federal government.** These roles are outlined in the National Response Framework, a guide to how the nation conducts all-hazards response – from the smallest incident to the largest catastrophe. The NRF makes clear the roles and responsibilities of federal agencies under all domestic incidents, so that all other members of the nation's emergency management team understand how the federal response would be coordinated. It applies to both Stafford Act and non-Stafford Act events. For more on the NRF, click here: http://www.fema.gov/pdf/emergency/nrf/NRF_FAQ.pdf.

- **Under this scenario, several agencies would have lead roles in technical and operational needs. For instance:**
  - The Nuclear Regulatory Commission (NRC) would coordinate incidents at, or caused by, a facility that is licensed by the NRC or under agreement with the NRC, such as commercial nuclear power plants.
  - The Environmental Protection Agency EPA would coordinate the Federal environmental response to incidents involving the release of nuclear/radioactive materials that occur in the inland zone and in certain coastal zones.

- **FEMA would stand ready to support the federal response efforts in any way needed, as permitted under our authorities.** We would leverage all of the resources our agency brings to bear, including our expertise in disaster response and recovery coordination, help with staffing, and other needs, in support of the federal response and the impacted states and local communities.

- When disasters, strike, the first responders are local emergency and public works personnel, volunteers, humanitarian organizations, and numerous private interest groups who provide emergency assistance required to protect the public's health and safety and to meet immediate human needs.

- While the NRC has a key role in working with many of the nation's nuclear power plants meet regulatory requirements for emergency planning and preparedness for onsite nuclear power plant activities, FEMA has a key role in working with states and local communities with

emergency planning and preparedness for offsite radiological activities – meaning for the residents and communities beyond the physical boundaries of the power plant.

- FEMA established the Radiological Emergency Preparedness Program to provide state and local communities the support and resources they need to ensure the health and safety of citizens living around commercial nuclear power plants would be adequately protected in the event of a nuclear power plant accident; and inform and educate the public about radiological emergency preparedness.

- As part of this effort, FEMA works closely with state, local and tribal communities to ensure they have adequate emergency plans in place to protect public health and safety, ensure that these plans can be used by emergency response personnel and include sufficient resources and equipment during an emergency, and provided emergency preparedness training to state and local officials as needed. Under this program, FEMA also evaluates the alert and notification system for nuclear power plants, including outdoor warning sirens and back-up systems.

- FEMA cooperates closely with the NRC in these efforts and provides its findings from these evaluations to the NRC.

- As we do with all hazards, FEMA is focused on making sure the public is aware of the various risks in their communities and providing preparedness and safety information about the potential impact of a nuclear or radiological threat. Families that live near or around nuclear power plants should become informed about simple steps they can take to protect themselves in the event of a nuclear explosion by contacting their local Office of Emergency Management, referring to information in the local telephone directory and publications received about emergency preparedness. Individuals and families can also visit http://www.ready.gov/america/beinformed/nuclear.html

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Sosa, Belkys

From: Sosa, Belkys
Sent: Friday, March 18, 2011 5:05 PM
To: Davis, Roger; Baggett, Steven; Snodderly, Michael
Subject: FW: Commissioner Briefing Package
Attachments: DCbriefingpackage.docx; SONGS MARCH 22 2011 briefing package.docx

Here is the briefing package for the site visit with Senators. Please review and comment.

Roger, please let me know if (b)(5)

Thanks,
Belkys

From: Hay, Michael
Sent: Friday, March 18, 2011 4:27 PM
To: Sosa, Belkys; Powell, Amy
Subject: Commissioner Briefing Package

Belkys and Amy,
Attached are two briefing packages, for San Onofre and Diablo Canyon.

(b)(5)

If you need anything else please don't hesitate to call or send me an email.

Mike Hay
Chief/DRS

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Sosa, Belkys NOT FOR PUBLIC DISCLOSURE

From: Sosa, Belkys
Sent: Friday, March 18, 2011 5:03 PM
To: Hay, Michael; Powell, Amy
Subject: RE: Commissioner Briefing Package

Thanks Mike. - Belkys

From: Hay, Michael
Sent: Friday, March 18, 2011 4:27 PM
To: Sosa, Belkys; Powell, Amy
Subject: Commissioner Briefing Package

Belkys and Amy,
Attached are two briefing packages, for San Onofre and Diablo Canyon.

(b)(5)

If you need anything else please don't hesitate to call or send me an email.

Mike Hay
Chief/DRS

NOT FOR PUBLIC DISCLOSURE

Sosa, Belkys

From: Hay, Michael
Sent: Friday, March 18, 2011 4:27 PM
To: Sosa, Belkys; Powell, Amy
Subject: Commissioner Briefing Package
Attachments: DCbriefingpackage.docx; SONGS MARCH 22 2011 briefing package.docx

Belkys and Amy,
Attached are two briefing packages, for San Onofre and Diablo Canyon.

(b)(5)

If you need anything else please don't hesitate to call or send me an email.

Mike Hay
Chief/DRS

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3/20/2011

MARCH 20, 2011 0600 EDT

~~NOT FOR PUBLIC DISCLOSURE~~

FUKUSHIMA DAI-ICHI

- Units 1, 2, and 3 reactors appear to in a stable condition with seawater injection continuing.
- Containment integrity is believed to be intact on Units 1, 2, and 3.
- Water continues to be sprayed on the Unit 3 reactor building/spent fuel pool. TEPCO believes the Unit 3 pool can be completely refilled in about 7 more hours. Containment pressure has been reported as "increasing" ... TEPCO is monitoring and assesses that this is consistent with ongoing injection activities. NISA indicated that another release may be needed.
- The Japanese Self Defense Force plans to resume water injection to the Unit 4 spent fuel pool from the ground level today.
- Two diesel generators are running and supplying AC power to Units 5 and 6. A Unit 5 RHR pump, powered by one of the U-6 diesel generators was started and is providing cooling to the Unit 5 spent fuel.
- TEPCO is now installing high voltage cables from a nearby transmission line to Units 1&2. Priority is being given to restoring power to RHR and cooling water pumps. Power is expected to be restored to Unit 1&2 later today. The same kind of cables are planned to be extended to Units 3&4 (perhaps by Monday). DOE Secretary Chu requested update the status of power restoration in advance of his appearance on Sunday morning news programs. The Liaison Team provided an update to DOE.
- Dose rates around Units 3 and 4 are reducing [was 40 rem/hr, now 15 rem/hr]. Dose rates around Units 5 and 6 are 100 mRem/hr. Dose rates near the power block range from 1 to 5 Rem/hr. The site access gate was reading 60 mRem/hr (which is about 4000 feet from the plant). The winds continue to blow from the North West, so the plume is going out to the sea. A dose rate was recorded to be 12 mRem/Hr at a point 20 km inland from the plant. All other dose rates 20 to 40 km from the plant are marginally above background. It was reported that very low levels of radioactive materials were detected in spinach and milk. [Dose rate data provided by industry representatives.]
- Still awaiting results from NARAC on "bounding worst case" source term's potential effects on U.S. Pending these results, NRC's protective measures team has drafted a more realistic worst case source term that is still being evaluated. Forecast meteorological data for the next 48 hours indicate light wind oscillating on-shore during the day and off-shore at night.
- Participated in conference call with NRC Site Team, TEPCO reps, and INPO to discuss installation of the first train of emergency cooling equipment designed by Bechtel. TEPCO raised several issues regarding logistics for transporting this equipment to the site, equipment assembly, training etc. In addition, TEPCO also requested additional items including radiation monitoring equipment, protective gear, etc. We are working to address these issues on a high priority basis.
- No new overhead imagery has been received.

~~NOT FOR PUBLIC DISCLOSURE~~

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Davis, Roger

From: Snodderly, Michael
Sent: Monday, March 28, 2011 12:25 PM
To: Sosa, Belkys; Baggett, Steven; Davis, Roger
Subject: FW: 50 Mile EPZ justification response

Bill Borchardt's answers to Mr. Takashi who is a Director at Japan's Ministry of Education, Culture, Sports, Science and Technology on justification for the 50 mile EPZ justification.

From: LIA08 Hoc
Sent: Monday, March 28, 2011 11:56 AM
To: Franovich, Mike; Orders, William; Snodderly, Michael; Castleman, Patrick; Marshall, Michael; Batkin, Joshua; Hipschman, Thomas
Cc: LIA06 Hoc
Subject: FW: 50 Mile EPZ justification response

Attached for your info is an email sent by the Ops Center Liaison Team to Mr. Takashi regarding questions he raised about the 50 mile evacuation recommendation we made for US Citizens in Japan. Please let me know if you have any questions or would like additional information about this.

Jeff Temple
Response Program Manager
Liaison Team/Interagency Response Team/Corporate Support Response Team
301-816-5185

From: LIA03 Hoc
Sent: Monday, March 28, 2011 11:07 AM
To: takashi.inutsuka@mofa.go.jp
Cc: Doane, Margaret; Mamish, Nader; LIA02 Hoc; LIA08 Hoc; Borchardt, Bill; LIA03 Hoc
Subject: 50 Mile EPZ justification response

On behalf of Bill Borchardt, we are responding to your questions:

1. In the NRC NEWS, March 16, 2011, there are attachments of the results of two sets of computer calculations. One, 15 March 2010 02:51am (EDT), has a hypothetical, single-reactor site, 2350 MWt, Boiling Water Reactor. On the other hand, 16 March 2010 12:24pm (EDT), has a hypothetical, four-reactor site. But in these attachments there is no detailed assumption for calculations about
(1) the power and type of reactor for the four-reactor site,
(2) weather, wind direction and speed, and the status of the problem at the reactors (for example: Source Term).

Q1: Are these sentences correct?

A1: These sentences are correct. Although the press release identified one of the computer calculations being based on a hypothetical four-reactor site, the source term used in the calculation was the approximate activity available for release from one reactor and two spent fuel pools.

Q2: Have you ever explained these detailed assumptions to the public?

A2: The assumptions have been generally described in press releases, interviews, and congressional testimony.

Q3: Could you explain the relation between the number of Total EDE and 1rem (PAGs)? For example 8.1rem (15 March calculation) and 9.9rem (16 March calculation), 50 mi, and 1rem? Could you also explain the relation between the number of Thyroid CDE and 5rem (PAGs)? For example 23rem (15 March calculation) and 48rem (16 March calculation), 50 mi, and 5rem? Is there no need to calculate this for distances greater than 50 mi?

A3: As stated in the press release, these two computer calculations are hypothetical, rough estimates that would not necessarily characterize an actual release. Although the calculation references have TEDE and CDE doses exceeding PAGs beyond 50 miles, these were only two of several cases run. Given that other cases projected PAG doses less than 50 miles and there would be time to extend our recommendations beyond 50 miles, if necessary, the 50 mile recommendation was considered appropriate to protect US citizens.

2. At the White House Regular Briefing, March 17, 2011, Chairman Jaczko said, "We have a team of 11, some of our best technical experts in Tokyo, and they are working with counterparts from the utility in Tokyo as well as other individuals with the government. So that is one of the sources. We are collecting data from as many places as we can to make the best judgments we can with the information available. But I would stress that this is a very difficult situation. There is often conflicting information. And so we made what we thought was a prudent decision."

Q4: Does this statement accurately reflect the NRC's decisionmaking process that led to the recommendation (50 miles)?

A4: Yes.

Q5: Did NRC have evidence to suggest that radiation levels around Fukushima were higher than what Japanese officials had said?

A5: No. The NRC had very limited radiation level information at this time. The computer calculations and subsequent protective action decisions were based on conservative assumptions based on limited information and the deteriorating state of several reactors and spent fuel pools.

3. At the meeting of NRC, March 21, 2011, you said, "the situation that led to the 50 mile guidance in Japan was based upon what we understood and still believe had existed that there were degraded conditions in two spent-fuel pools at the site and, in all likelihood, some core damage in three of the reactor units. Based on the situation as we understood it at that time, we thought it was prudent to provide the recommendation to the ambassador to evacuate out to 50 miles in Japan."

Q6: Does this statement accurately reflect the NRC's decisonmaking process that led to the recommendation (50 miles)?

A6: Yes.

Q7: There are some differences on the basis for making recommendation between 1. and 3. Could you explain the basis for making the recommendation (50 miles) again?

A7: The comments made by NRC Chairman Jaczko and Mr. Borchardt were consistent in that seriously degrading conditions at several Daiichi units supported a need to take pre-emptive protective action. The computer calculations helped to provide perspective on possible impacts.

Q8: I understand the recommendation is prudent. How do you define "prudent" in the assumptions for your calculations? in the decision about the distance?

A8: Since communications were limited and there was a large degree of uncertainty about plant conditions at the time, it was difficult to accurately assess the radiological hazard. Computer models used meteorological model data appropriate for the Fukushima Daiichi vicinity. Source terms were based on hypothetical, but not unreasonable estimates of fuel damage, containment, and other release conditions. Subsequent modeling can be correlated with the ground deposition as observed in flyover and other monitoring data. Therefore, prudent (reasonable conservative protective actions made with a predictive approach to limit radiation exposure to US citizens) can be substantiated based on the conditions present and the information known at the time.

If you have additional questions please contact Mr. Borchardt at the email address above.

Baggett, Steven

From: Kammerer, Annie
Sent: Monday, March 28, 2011 10:32 PM
To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc
Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean; FOIA Response.hoc Resource; Bensi, Michelle; 'rmtpactsu_elnrc@ofda.gov'
Subject: Seismic Q&As March 28th 10pm update

All,

It seems that some people actually missed getting the Q&As since I'm starting to get emails asking if I can do an update. Sorry it's been a while, for some reason my workload seems to have exploded...LOL. *(Actually I really have no excuse as Shelby has been a compiling machine!).* We've added several new sections including **ACRONYMS**, located near the back. *(Thanks to Stephanie Devlin for pulling the acronyms together)*

Now that the agency is moving out of the heart of the emergency response phase, and looking towards short, medium and long term actions and goals, our little seismic group has been discussing what to do with this document; and specifically how to make it useful beyond this event. We've discussed the fact that ever since the Kashiwazaki earthquake, we have recognized the need to develop a "generic" seismic Q&A document so that the agency can hit the ground running in cases such as this. It is obvious to us that we now have the guts of the document we've envisaged for years in one 140 page compilation; and it's time to make it happen!

So the next time you see this document (which won't be for a while), it will be radically transformed. We'll be putting all the "static" information in the front, and will be pulling the japan earthquake-specific information into a separate section. It will be more user friendly and will be easier to find any new information. It's unclear to us how long these updates will be useful, but we suspect, not much longer. So, now's the time to start wrapping it up and putting a bow on it...

We hope the new document will be worth the wait...

Seismic Questions for Incident...

Dr. Annie Kammerer, P.E.
US NRC/RES/DE
(301) 251-7695 Office
(b)(6) Mobile

-----Original Message-----
From: Kammerer, Annie
Sent: Wednesday, March 23, 2011 3:15 AM
To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc

Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean; FOIA Response.hoc Resource; Bensi, Michelle
Subject: Seismic Q&As March 22th 10pm update

All,

Attached please find an updated set of Q&As. I also included some new Q&As for SONGS and Diablo Canyon, just in case anyone is interested.

This version has an expanded set of definitions and new sections on station blackout, spent fuel, flooding and some other topics. It also has fewer duplicate questions.

Let me also pass on a tidbit of info. According to TEPCO (via an NEI press release), the tsunami at Fukushima was 14 meters and the design tsunami llevel was 5.7 meters. The reactors and backup power sources were at 10 meters and at 13 meters. Ouch.

Cheers,
Annie

From: Kammerer, Annie
Sent: Sunday, March 20, 2011 11:00 PM
To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc
Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean; FOIA Response.hoc Resource; Bensi, Michelle
Subject: Seismic Q&As March 20th 8pm update

All,

Here's today's version. It includes updates on related topics for tomorrow's briefing. Also, some of the sections have been streamlined and some (though not all) of the answers have been updated.

The biggest news from the seismic team's perspective is that starting tomorrow a very bright young risk analyst (Michelle Bensi) who recently joined us from UC Berkeley (my beloved alma mater) will be helping with the compilation of this document. That will allow our team to spend more time cleaning and streamlining it; which inevitably will make it more user friendly...and shorter! Starting with tomorrow's version her name will start to show up on the front.

Best of luck to everyone with the briefing tomorrow!

Annie

From: Kammerer, Annie
Sent: Saturday, March 19, 2011 9:00 AM
To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc
Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean; FOIAResource.hoc@nrc.gov
Subject: Seismic Q&As March 19th 8am update

NOT FOR PUBLIC DISCLOSURE

All,

Here is today's updated version. Lot of new fact sheets have been prepared for various briefings and for Monday's public meeting!

However, the big news of the day is that we just sent off a 6 page, 22 question, much better edited version for a public Q&A set. It's all in OPA's capable hands now. I think it's pretty good...but then I'm biased.

Cheers,
Annie

From: Kammerer, Annie
Sent: Friday, March 18, 2011 6:51 AM
To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc
Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean
Subject: RE: Seismic Q&As March 18th 5am update

All,

Please see the updated version of the Seismic Q&As.

Among today's highlights:
*We added a Terms and Definitions section at the end of the document. (We know that an acronyms list would be helpful too, but it will have to wait a little) *The "additional information" section has been split into tables, plots, and fact sheets *A high-level draft fact sheet on NRC's seismic regulations has been added *We added a section to track outstanding questions that have come in from congress. This will support those who get the tickets in the short terms (most likely NRR). The questions will be moved to the appropriate sections long term (as long as they are not duplicates.)

I'm sure we all agree this has been a crazy week!. We're hoping that the weekend workload is lighter (if only because we don't get as many email from in house) and we can clean up this document and fill in some of the missing answers in preparation for the news story changing. We're trying hard to get out in front of the next wave.

Cheers,

NOT FOR PUBLIC DISCLOSURE

Annie

NOT FOR PUBLIC DISCLOSURE

om: Kammerer, Annie
nt: Thursday, March 17, 2011 2:36 AM
To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc
Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Glitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Giitter, Joseph; Howe, Allen; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Munson, Clifford; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas
Subject: Seismic Q&As March 17th 2am update All,

As promised, a sharepoint site has been set up where our friends in NRR will be posting the latest version of the Seismic Q&A document on an ongoing basis. If someone would prefer to use the sharepoint site, instead of being on this distribution list, please let me know...
http://portal.nrc.gov/edo/nrr/NRR%20TA/FAQ%20Related%20to%20Events%20Occuring%20in%20Japan/Forms/AllItems.aspx

This latest update has a number of new questions (not many with answers today, but we are working hard). A high priority question we are working on is "how many plants are near a mapped active fault". We're focusing on anything within 50 miles. We're also pulling relevant questions from the congressional inquiries we just received; and will also give these high priority to support any needs by NRR.

any new figures and some draft fact sheets have added to the "additional information" section. These include the NRO half a tsunami fact sheet...a description of the tsunami research is still to come from RES.

Some good news: Yesterday's version seems to have been widely forwarded around the agency. So, we are also starting to get some excellent questions from staff looking forward. This is allowing us to feel that we are finally getting out in front of things to a small degree. Also, our team has grown and we now have someone acting as source of seismic expertise for the 11pm to 7 am shift. This means that we now have seismic experts available to the RST and OPA at the Op Center 24 hours, with 2 people during the day. That extra support is allowing us to get this out at least an hour earlier today ☺

We are continuing to compile the questions that come in and update the seismic Q&A document. If you have suggested changes, or want to provide missing answers, please forward them to me for compilation.

This is a living document and will be updated daily in the foreseeable future.

Happy St. Paddy's Day. May the world (especially our friends in Japan) have the luck of the Irish today.

Cheers,
Annie

Dr. Annie Kammerer, PE
Senior Seismologist and Earthquake Engineer US Nuclear Regulatory Commission Office of Nuclear Regulatory Research
Washington DC 20555
(b)(6) mobile
BB

NOT FOR PUBLIC DISCLOSURE

From: Kammerer, Annie
Sent: Tuesday, March 15, 2011 3:41 AM

To: Hiland, Patrick; Skeen, David NOT FOR PUBLIC DISCLOSURE
Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Kammerer, Annie; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Giitter, Joseph; Howe, Allen; Case, Michael; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Munson, Clifford; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael
Subject: latest version of Q&As

All,

This is the first draft of the seismic-specific Q&As. It is pretty rough and there are many answers still missing, but people have contributed a lot and we thought it may be useful for many people trying to answer questions coming in.

We are continuing to compile the questions that come in and update the seismic Q&A document. If you have suggested changes, or want to provide missing answers, please forward them to me for compilation.

This is a living document and will be updated daily in the foreseeable future.

Annie

Dr. Annie Kammerer, PE
Senior Seismologist and Earthquake Engineer US Nuclear Regulatory Commission Office of Nuclear Regulatory Research
Washington DC 20555
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NOT FOR PUBLIC DISCLOSURE

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

This is current as of 3-28-11 at 10 pm.

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

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 provided at the end of the document.
A list of acronyms is provided 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.

CONTENTS

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: None.

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. However, the Japanese nuclear plants were recently reassessed using ground motion levels similar to those that are believed to have occurred at the sites. The ground motions against which the Japanese nuclear plants were reviewed 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 maximum tsunami height that was expected at the sites.
Additional, technical, non-public information: Jon Ake is doing some review of the data to determine the likely return period of this motion.

3) Can an earthquake and tsunami as large as happened in Japan also happen here?

Public response: See below.

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

Public response: This earthquake occurred on a "subduction zone", which is the type of tectonic region that produces earthquakes of the largest magnitude. A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate. Subduction zone earthquakes are also required to produce the kind of massive tsunami seen in Japan. 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, a continental earthquake and tsunami as large as in Japan could only happen there. The only nuclear plant near the Cascadia subduction zone is the Columbia Generating Station. This plant is located a large distance from the coast (approximately 225 miles) and the subduction zone (approximately 300 miles), so the ground motions estimated at the plant are far lower than those seen at the Fukushima plants. This distance also precludes the possibility of a tsunami affecting the plant. Outside of the Cascadia subduction zone, earthquakes are not expected to exceed a magnitude of approximately 8. Magnitude is measured on a log scale and so a magnitude 9 earthquake produces about ten times stronger shaking and releases about 31 times more energy than a magnitude 8 earthquake.
Additional, technical, non-public information: None.

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

Public Answer: Ground motion is a function of both the magnitude of an earthquake and the distance from the fault to the site. Nuclear plants, and in fact all engineered structures, are actually designed

based on ground motion levels, not earthquake magnitudes. The existing nuclear plants were designed based on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquakes expected in the area around the plant. A margin is further added to the predicted ground motions to provide added robustness.

Additional, technical non-public information: In the past, "deterministic" or "scenario based" or "maximum credible earthquake" analyses were used to determine ground shaking (seismic hazard) levels. 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. Probabilistic methods account 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.

The NRC also 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.

6) How many US reactors are located in active earthquake zones?

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 nuclear plant be designed for site-specific ground motions that are appropriate for their locations. In addition, the NRC has specified a minimum ground motion level to which nuclear plants must be designed.

Additional, technical non-public information: The preliminary consensus opinion by NRC staff is that there are approximately 9 plants in the moderate seismicity zones in the CEUS: 4 or 5 in the Charleston SZ (depending on whose interpretation you use, it varies widely), 1 in the Wabash valley SZ, 2 in the East Tennessee SZ, 1 in the Central Virginia SZ. But some of these are open to interpretation and debate. This does not have a simple answer and NRC seismic staff are developing a fact sheet to respond to this question. There are also two plants that are in highly seismicity areas of California. Unfortunately, the extent of the moderate seismicity zones in the US are open to interpretation and are a matter of scientific debate.

Please note that although the earthquakes in the CEUS are rare, they can be big. 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.

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

Public Answer: The NRC continues to determine that US nuclear plants are safe. This does not change the NRC's perception of earthquake hazard (i.e., ground motion levels) at US nuclear plants. It is too early to tell what the lessons from this earthquake are. 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 nuclear 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) **Why do we have confidence that US nuclear power plants are adequately designed for earthquakes and tsunamis?**

Public Answer: [use the first paragraph of the response below]
Additional, technical, non-public information: None.

9) **Can significant damage to a nuclear plant like we see in Japan happen in the US due to an earthquake? Are the Japanese nuclear plants similar to US nuclear plants?**

Public Answer: All US nuclear plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those nuclear 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 management. This approach is called defense-in-depth.
The Japanese facilities are similar in design to some US facilities. However, the NRC has required modifications to the plants since they were built, including design changes to control hydrogen and pressure in the containment. The NRC has also required plants to have additional equipment and measures to mitigate damage stemming from large fires and explosions from a beyond-design-basis event. The measures include providing core and spent fuel pool cooling and an additional means to power other equipment on site.
Additional technical, non-public information: See notes under question "What magnitude earthquake are US nuclear plants designed to?"

10) **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 Nilesh*
Additional, technical, non-public information: ADD

11) **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 nuclear plants were designed on a "deterministic" or "scenario earthquake" basis that accounts for the largest earthquakes expected in the area around the plant, without consideration of the likelihood of the earthquakes considered, and with an additional factor applied for conservatism. New reactors are designed using probabilistic techniques that characterize both the ground motion levels and uncertainty at the proposed site. These probabilistic techniques account for the ground motions that may result from all potential seismic sources in the region around the site. Technically speaking, this is the ground motion with an annual frequency of occurrence of 1×10^{-4}/year, but this can be thought of as the ground motion that occurs every 10,000 years on average. One

important aspect is that probabilistic hazard and risk-assessment techniques account for beyond-design basis events. NRC's Generic Issue 199 (GI-199) project is using the latest probabilistic techniques used for new nuclear plants to review the safety of the existing plants. [see questions in the section about GI-199 for more information]

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.

12) How was the seismic design basis for existing nuclear plants established?

Public Answer: The seismic ground motions used for the design basis of existing nuclear plants were 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: None.

13) What is the likelihood of the design basis or "SSE" ground motions being exceeded over the life of a nuclear plant?

Public response: The ground motions that are used as seismic design bases at US nuclear plants are called the Safe Shutdown Earthquake ground motion (SSE). 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 nuclear plants in the US have adequate safety margins for withstanding earthquakes. Currently, the NRC is in the process of conducting GI-199 to again assess the resistance of US nuclear plants to earthquakes. Based on NRC's preliminary analyses to date, the mean probability of ground motions exceeding the SSE over the life of the plant for the plants in the Central and Eastern United States is less than about 1%.

It is important to remember that structures, systems and components are required to have "adequate margin," meaning that they must continue be able withstand shaking levels that are above the plant's design basis.

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

14) What is magnitude anyway? What is the Richter Scale? What is intensity?

Public Answer: 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 most 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,

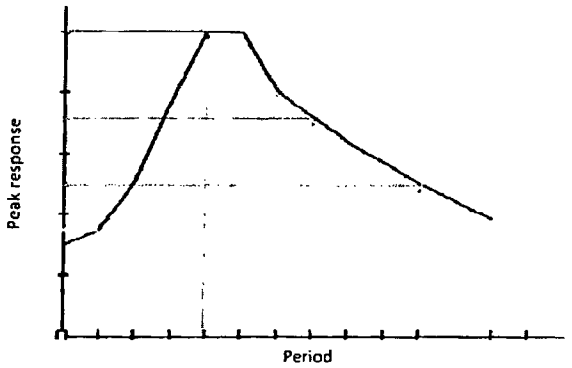
each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.
The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology and was based on the behavior of a specific seismograph that was manufactured at that time. The instruments are no longer in use and the magnitude scale is, therefore, 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.
Additional, technical non-public information: None.

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

Public Answer: The ground motion experienced at a particular location is a function of the magnitude of the earthquake, the distance from the fault to the location of interest, and other elements such as the geologic materials through which the waves pass.
Additional, technical non-public information: None.

16) What is a seismic response spectrum?

Public Answer: not yet available
Draft of a simple "non-technical answer" (needs revision): For a given earthquake, different types of structures will respond to the earthquake ground motion differently depending on the characteristics of the structure and earthquake ground motion. For example, a rigid short building will "feel" an earthquake very differently than a tall flexible building. In fact, if the rigid short building and the flexible tall building are subjected to the exact same ground motion, one building may be damaged while the other is relatively unharmed. One important difference between these two buildings is a characteristic known as the natural period of vibration of the building. While defining the period of a building is a complicated engineering problem, as a general rule, a short rigid building will tend to have a short period while the tall flexible building will tend to have a long period of vibration.
If the natural period of the response of a building is "in tune" with the vibrations of the earthquake, it will experience resonance and the building may be badly damaged. (Many people have experienced resonance when using a playground swing. Pushing a swing in time with the interval of the swing causes the swing to go higher while pushing the swing at a faster or slower tempo will cause the swing to slow down.) In the example above, the short rigid building will tend to resonate and be damaged by seismic waves with short wavelengths (periods), while the tall flexible building will tend to resonate and be damaged by seismic waves with long wavelengths.
A response spectrum is a plot of the peak response of different oscillators (e.g. simple buildings) with varying natural periods that are subjected to the same base ground motion. An example of a response spectrum used for design is shown below:



Seismic response spectra are used by earthquake engineers to analyze the performance of structures and components subjected to the ground motion caused by earthquakes. The design response spectrum tells the engineer how strong the earthquake forces on the structure will be depending on its natural period of vibration.

17) Which reactors are along coastal areas that could be affected by a tsunami?

Public Answer: Many nuclear plants are located in coastal areas that could potentially be affected by a tsunami. Two nuclear plants, Diablo Canyon and San Onofre, are on the Pacific Coast, which is known to have a tsunami hazard. Two nuclear plants on the Gulf Coast, South Texas and Crystal River, could also be affected by tsunami. There are many nuclear 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 nuclear plants on the Atlantic and Gulf Coast. Regardless, all nuclear plants are designed to withstand a tsunami.
Additional, technical non-public information: A table with information on tsunami design levels is provided in the "Additional Information" section of this document.

18) 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.

19) 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.

20) Could a "mega-tsunami" strike the U.S. East Coast as indicated in a recent Washington Post Weather Gang article?

Public Answer: Please verify information before public release.
Additional, technical, non-public information: The Washington Post Weather Gang article is based on a scenario involving a mega-tsunami caused by a massive landslide in the Canary Islands. This scenario has

been debunked by the scientific community (including the NRC's tsunami research program). Volcanic flank failures on the Canary Islands will produce a mega-tsunami in the very near area, but won't be noticeable in the United States. Refer to the 2008 USGS report on tsunamis for additional information: [insert citation].

Design Against Natural Hazards & Plant Safety in the US

21) Are US nuclear plants designed for tsunamis? If so, what level of tsunami are they designed for?

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.) 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. [See table with tsunami design heights in Tables section of document]

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 (prior to the March 2011 earthquake) 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.

22) Is there a minimum earthquake shaking that nuclear plants are designed for?

Public Answer: Yes. According to Appendix S to 10 CFR Part 50, the foundation level ground motion must be represented by an appropriate response spectrum with a peak ground acceleration of at least 0.1g.

Additional, technical, non-public information: NOTE TO OPA: this comes straight from RG1.208 and it, therefore, approved for public release. If you get this question, we can help make it more user friendly.

23) 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".

Additional, technical, non-public information: ADD

24) 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.

General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena," in Appendix A 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.

Additional, technical, non-public information: None.

25) Are US plants safe? Would a plant in the U.S. be able to withstand a large earthquake?

Public Answer: US plants are designed for appropriate earthquake shaking levels that are based on historical data for the site plus additional margin to account for uncertainties. Currently, the NRC is conducting a program called Generic Issue 199, which is reviewing the adequacy of the earthquake design of US NPPs in central and eastern North America based on the latest data and analysis techniques. The NRC will look closely at all aspects of the response of the plants in Japan 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: None.

26) 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 to the plant, 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

27) 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.
Additional technical, non-public information: None

28) Do any plants have special design considerations associated with seismic design?

Public response: Many plants have unique features. However, the most notable design element is the automatic reactor trip systems in Diablo Canyon and San Onofre.
Additional, technical, non-public information: None

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

Public response: [see below]

30) 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) has significant seismic margin and 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. See also part 100 Reactor Site Criteria

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

Public response: NRC previously 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: Additional SBO information is found in a fact sheet on the subject at the back of the document. 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.

32) **How do we know that the emergency diesel generators will not fail to operate like in Japan?**

Public response: Emergency Diesel Generators (EDGs) are installed in a seismically qualified structure and are seismic Category I equipment. Even if these EDGs did fail, plants can safely shutdown using station blackout power source law 10 CFR 50.63. In 1988 the NRC concluded that additional regulatory requirements were justified in order to provide further assurance that a loss of both offsite and onsite emergency ac power systems would not adversely affect public health and safety and the station blackout rule was enacted. Studies conducted by the NRC since this rule has been in effect confirms that the hardware and procedures that have been implemented to meet the station blackout requirements have resulted in significant risk reduction and have further enhanced defense-in-depth. However, we plan to carefully evaluate the lessons learned from the events in Japan to determine if enhancements to the station blackout rule are warranted.
Additional, technical, non-public information: None.

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

Public response: Yes. Section 2.4.6 (Tsunami Hazards) of NUREG 0800 Standard Review Plan) specifically addresses tsunami drawdown in the safety review of new reactor applications.
Additional, technical, non-public information: None.

34) **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

35) **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.
Additional, technical, non-public information: ADD

36) **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.
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.

37) **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.

38) **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

39) How does the NRC address seismic-induced fire?

Public Response: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.
Additional, technical, non-public information: 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.

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

Public Response: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.
Additional, technical, non-public information: The NRC recommends the licensee follow the applicable National Fire Protection Association (NFPA) codes and standards for the fire protection systems or provide an acceptable alternative. This would include local building code earthquake requirements. Since 1976, the NRC has recommended that, "At a minimum, the fire suppression system should be capable of delivering water to manual hose stations located within hose reach of areas containing equipment required for safe plant shutdown following the safe shutdown earthquake (SSE)." For plants located, "in areas of high seismic activity, the staff will consider on a case-by-case basis the need to design the fire detection and suppression system to be functional following the SSE." This is the guidance provided to plants that were licensed to operate, or had construction permits prior to July 1, 1976. For plants with applications docketed but construction permit not received as of July 1, 1976, they were required, " in the event of the most severe earthquake, i.e., the SSE, the fire suppression system should be capable of delivering water to manual hose stations located within hose reach of areas containing equipment required for safe plant shutdown."
The NRC's guidance since 1976 also 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 further recommends plant operators in areas of high seismic activity consider the need to design those fire protection systems to function after a severe earthquake.

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

Public Response: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.
Additional, technical, non-public information: In general, the NRC recommends that curbing and dikes be located around all equipment that presents an oil fire hazard. In one special case, the Reactor Cooling Pumps (RCPs) located inside the containment of Pressurized Water Reactors (PWRs) the NRC requires that plants have a seismically qualified oil collection system. The purpose of this requirement is that in the event of a severe earthquake the lubrication oil is not spread out inside containment.

42) How are safe shutdown equipment protected from a hydrogen fire?

Public Response: The below is from an internal document. This needs to be cleared before it can be used.

Additional, technical, non-public information: Hydrogen can be normally found in a couple areas of the plant. For example, most all large electric generating stations (Nuclear, Coal, Oil, Gas and Hydro) use hydrogen as a blanket in the electric generator. This hydrogen storage is typically well separated from safe shutdown equipment. Hydrogen may also be generated in Battery Rooms during charging and discharging of the stations emergency batteries. The battery rooms are typically equipped with hydrogen detectors set to alarm at about 2% (Hydrogen's lower flammable limit is 4.1%). The ventilation system is typically run to prevent any hydrogen build up. In PWR's hydrogen is used as a cover gas in the Volume Control Tank (VCT). This gas is kept at a normally lower pressure (15-20 psig) to allow oxygen scavenging in the tank. Systems like this typically have devices such as excess flow check valves that automatically isolate the system if excess flow occurs. 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.

[Also please note that this is general information. Mark Salley noted that if the question relates to H2 generated as a part of fuel failure there is a whole other conversation that needs to happen. Please contact him with questions.]

Seismically Induced Internal Flooding

43) How does the NRC consider seismically induced equipment failures leading to internal flooding?

Public Response: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.
Additional, technical, non-public information: 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.

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

Public Response: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.
Additional, technical, non-public information: 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.

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

Public Response: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.

Additional, technical, non-public information: 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

46) Was the damage to the Japanese nuclear plants mostly from the earthquake or the tsunami?

Public response: Because this event happened in Japan, it is hard for NRC staff to make the assessment necessary to understand exactly what happened at this time. In the nuclear plants there may have been some damage from the shaking, and the earthquake caused the loss of offsite power. However, the tsunami appears to have played a key role in the loss of other power sources at the site producing station blackout, which is a critical factor in the ongoing problems.
Additional, technical, non-public information: None

47) 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.

48) 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 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. 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 DBGM S_s	Original DBGM S_2
Fukushima	Magnitude 7.1 Earthquake near the site	600 gal (0.62g)	370 gal (0.37g)

Additional, technical, non-public information: Add

49) 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.

50) **Was the Fukushima power plant designed to withstand a tsunami of any size? What specific design criteria were applied?**

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

51) **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: 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.

52) **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_S. The S_S 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_S 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

53) 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

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

Public response: The tsunami modeling team at the National Oceanic and Atmospheric Administration's Pacific Marine Environmental Lab have estimated the wave height offshore (at the 5 meter bathymetric line) to be approximately 8 meters in height at Fukushima Daiichi and approximately 7 meters in Fukushima Daini. This is based on recordings from NOAA's Deep-ocean Assessment and Reporting of Tsunamis (DART) buoys and a high resolution numerical model developed for the tsunami warning system. NEI subsequently reported that TEPCO believes that TEPCO believes the tsunami that inundated the Fukushima Daiichi site was 14 meters high at the plant location. This is not inconsistent as wave heights increase as they come ashore. NEI also noted that 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, according to TEPCO.
Additional, technical, non-public information: NOAA's PMEL center has provided us their best numbers for all the plants on the NW coast of Japan. These can be found in the Additional Information section in the back of this document.

55) 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?

56) 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.

57) 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.

58) It appears that the estimates of the tsunami are changing frequently. The NOAA and TEPCO estimates are different. Why?

The following is based on an email and added here for record-keeping (it needs to be revised into a formal Q&A):

NOAA best prediction of 8m offshore (at the 5 meter bathymetric line) and TEPCO's most recent estimate of 14m runup onshore are consistent. A tsunami has two phases of response. In the open ocean it is very well behaved and calculations are highly accurate. As it gets close to shore and the shoaling effect begins, the behavior starts to go non-linear and very high resolution bathymetric (an topographic) information is required for a very precise prediction of runup (onto land) at any particular point on the coastline. However, it is well understood that as a tsunami wave comes onshore it grows in size significantly. Therefore, NOAA's calculation of 8 meters offshore and TEPCO's (most recently) announcement of 14 meters onshore are consistent.

This is the third estimate that TEPCO has published, and we do not have information about why their estimates are changing.

59) How well can we predict a tsunami wave height? What have we learned about our prediction abilities based on the events in Japan?

The following is based on an email and added here for record-keeping (it needs to be revised into a formal Q&A):
First, it's very important to understand that the method used by the Japanese nuclear industry is very different from how assessments are made in the US. The under-prediction of the possible tsunami in Japan does not indicate a problem in the US. The Japanese approach is heavily focused on using their extensive database of past events and doing modeling based on segmented faults.

NOAA's tsunami warning system models (NOAA, not the USGS) have been extremely well validated over time (with hundreds of real tsunami), and that continues to be the case. But, that is up to water depth where they have the necessary resolution of bathymetric data (and where the non-linear response begins in earnest). As a result of this fact, there is an effort currently to collect very high resolution data for the entire US pacific coast and to implement it into the NOAA database (currently the resolution of US data is not uniform). This will make US Pacific coast onshore runup predictions highly accurate.

NRC Response and Future Licensing Actions

60) 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 with our counterparts in that country. In addition, we currently have a team of experts in boiling water reactors working in Japan.
Additional technical, non-public information: NOTE TO OPA: please check the current staffing in Japan to provide more accurate information. This is changing on an ongoing basis. 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.

61) 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 $1x10^{-4}$ 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.

62) What are the near term actions that U.S. plants are taking in consideration of the events in Japan?

Public Answer: The U.S. nuclear energy industry has already started an assessment of the events in Japan and is taking steps to ensure that U.S. reactors could respond to events that may challenge safe operation of the facilities. These actions include:

- Verify each plant's capability to manage major challenges, such as aircraft impacts and losses of large areas of the plant due to natural events, fires or explosions.
  Verify each plant's capability to manage a total loss of off-site power.

- Verify the capability to mitigate flooding and the impact of floods on systems inside and outside the plant.
- Perform walk-downs and inspection of important equipment needed to respond successfully to extreme events like fires and floods.

Additional technical, non-public information: Note to OPA: This was a Q&A from the 3/21 briefing. please check that this is OK to provide to the public before doing so.

63) What are the immediate steps NRC is taking?

Public Answer: To date (march 20, 2011) the NRC has taken the following steps:

- The Nuclear Regulatory Commission has issued an Information Notice to all currently operating U.S. nuclear power plants, describing the effects of the March 11 earthquake and tsunami on Japanese nuclear power plants.
- The notice provides a brief overview of how the earthquake and tsunami are understood to have disabled several key cooling systems at the Fukushima Daiichi nuclear power station, and also hampered efforts to return those systems to service. The notice is based on the NRC's current understanding of the damage to the reactors and associated spent fuel pools as of Friday, March 18.
- The notice reflects the current belief that the combined effects of the March 11 earthquake and tsunami exceeded the Fukushima Daiichi plant's design limits. The notice also recounts the NRC's efforts, post-9/11, to enhance U.S. plants' abilities to cope with severe events, such as the loss of large areas of a site, including safety systems and power supplies.

The NRC expects U.S. nuclear power plants will review the entire notice to determine how it applies to their facilities and consider actions, as appropriate.

Additional technical, non-public information: Note to OPA: This was a Q&A from the 3/21 briefing. please check that this is OK to provide to the public before doing so.

64) Should U.S. residents be using Potassium iodide?

Public Response: It is the responsibility of the individual States to decide on the use of KI. It is EPAs responsibility to inform states of projected doses. Due to the extremely low levels of radioactivity expected on the U.S. West coast and Pacific States/territories, the NRC staff does not recommend use of KI.

Additional technical, non-public information: None.

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

65) What is Generic Issue 199 about?

Public Answer: Generic Issue 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 motion above the seismic design basis for some nuclear plants in the Central and Eastern United States, although is still low, is larger than previous estimates.
Additional, technical, non-public information: See additional summary/discussion of GI-199 and terms below.

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

Public Response: [see below]

67) A recent 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 NRC does not rank nuclear plants by seismic risk. 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 safety risk assessment should not be interpreted as definitive estimates of plant-specific seismic risk because some analyses were very conservative making the calculated risk higher than in reality. The nature of the information used (both seismic hazard data and plant-level fragility information) make these estimates useful only as a screening tool.
Additional, technical, non-public information: NOTE TO OPA: Add the answer to "What are the current findings of GI-199", to create a longer answer if it is appropriate.

68) What are the current findings of GI-199?

Currently operating nuclear plants in the US 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 first stage of GI-199. Existing nuclear 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 earthquakes expected in the area around the plant. 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 probabilities of seismic core damage are lower than the guidelines for taking immediate action. Although there is not an immediate safety concern, 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) 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.

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

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.

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.

71) 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.

72) 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.

73) 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.

74) 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.

75) 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.

76) 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.

77) 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.

78) 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.

79) 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.

80) 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.

81) 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.

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/.
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) Are all US plants being evaluated as a part of Generic Issue 199?

Public Answer: Currently 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.

84) 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).
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, 4×10^{-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.

85) 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 motion 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 motion, 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.

86) 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.)?

Public Response: Seismic core damage frequency 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.

87) 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.

88) 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.

89) 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.

90) 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.

91) 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.

92) 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

93) **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

94) **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). 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.

Additional, technical, non-public information: None

95) **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 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 moist likely to fail due to a seismic event?

Seismic Probabilistic Risk Assessment (SPRA)

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

Public response: Nilesh Chokshi to provide Q&As on SPRA
Additional, technical, non-public information: None

State-of-the-art Reactor Consequence Analysis (SOARCA)

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

Public Answer: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.
Additional, technical, non-public information: The NRC and its contractor presently are completing a research project entitled "State-of-the-Art Reactor Consequence Analysis" (SOARCA). This research project develops best estimates of the potential public health effects from a nuclear power plant accident where low-likelihood scenarios could release radioactive material into the environment and potentially cause offsite consequences. The project also evaluates and improves, as appropriate, methods and models for evaluating outcomes of such severe accidents. In addition, research is being conducted to develop advanced risk assessment modeling techniques (e.g., dynamic probabilistic risk assessment (PRA) using simulation based methods) to improve the state-of-the practice in PRA severe accident modeling. Key goals of this research include increased analysis realism, reduced reliance on modeling simplification, and improved the treatment of human interactions with the reactor plant system.

98) Why is the NRC performing the SOARCA study?

Public Answer: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.
Additional, technical, non-public information: NRC is doing this study to develop the most realistic evaluations for the potential consequences of severe nuclear accidents. Over the years, NRC, industry, and international nuclear safety organizations have completed substantial research on plant response to hypothetical accidents that could damage the core and containment. The results have significantly improved NRC's ability to analyze and predict how nuclear plant systems and operators would respond to severe accidents. Also, plant owners have improved the plant design, emergency procedures, maintenance programs, and operator training, all of which have improved plant safety. Emergency preparedness measures also have been refined and improved to further protect the public in the highly unlikely event of a severe accident. Combining all of this new information and analysis will improve the realism of accident consequence evaluations.

99) Does the NRC intend to revisit previous risk studies?

Public Answer: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.
Additional, technical, non-public information: The last NRC-sponsored Level 3 probabilistic risk assessment (PRA) studies to estimate the integrated risk to the public from severe nuclear reactor accidents were conducted in the late 1980s with the results published in a collection of reports and a corresponding summary document, NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants." Based on advances in both nuclear power plant safety and PRA technology since NUREG-1150 was published, the NRC staff is considering conducting new Level 3 PRA studies to update its understanding of the integrated risk to the public from accidents involving nuclear power plant sites. The NRC staff is currently conducting a scoping study to develop various options for proceeding with Level 3 PRA activities, and plans to provide the Commission with these potential options and a specific recommendation for proceeding by July 2011.

100) How will the SOARCA study be different from earlier studies?

Public Answer: The below is from the internal Q&As for the 3/21 briefing. This needs to be cleared before it can be used.

Additional, technical, non-public information: The SOARCA project will:

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

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

Defense-in-Depth and Severe Accident Management

This is not exactly related to seismic questions. I read these with great interest. I believe there are many staff who would like to be more informed about this topic. So, I have included it.

102) Although there undoubtedly will be many lessons learned about severe accidents from the tragic events at Fukushima, have you identified any early lessons?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: There will undoubtedly be many lessons learned in the months and years to come as we learn more about the tragic events at the Fukushima Daiichi plant in Japan. However, one of the early lessons is this: You can't anticipate — either in the deterministic design basis of the plant or through probabilistic risk assessment models — everything that could happen. That is why the NRC's defense-in-depth philosophy is fundamental to ensuring that safety is achieved, even under extreme circumstances, such as those experienced at the Fukushima Daiichi plant. This NRC focus on defense-in-depth has led to a number of improvements in the design and operation of U.S. Nuclear Power Plants:

- Studies of severe accident prevention and mitigation in the 1980s led to a number of improvements at plants, such as installation of hardened vents at BWRs with Mark I containments. (See "fact sheet" for more detail.)
- Also, in the 1980s (specifically in 1988) the NRC concluded that additional regulatory requirements were justified in order to provide further assurance that a loss of both offsite and onsite emergency ac power systems would not adversely affect public health and safety and the station blackout rule was enacted. Studies conducted by the NRC since this rule has been in effect confirms that the hardware and procedures that have been implemented to meet the station blackout requirements have resulted in significant risk reduction and have further enhanced defense-in-depth. However, we plan to carefully evaluate the lessons learned from the events in Japan to determine if enhancements to the station blackout rule are warranted. (See "fact sheet" on station black-out.)
- Operator procedures that are symptom-based and ensure that operators primary focus is maintaining the critical safety functions such as ensuring the core is cooled and covered.
- Addition procedures for operators to use in the event of a severe accident (Severe Accident Mitigation Guidelines (SAMG)).
- Provisions in 10 CFR 50.54hh that require licensees to develop and implement guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in situations involving loss of large areas of the plant due to explosions or fire.

103) What procedures do U.S. plants have for responding to an unexpected event like the events in Japan.

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: One of the most significant lessons learned from the Three Mile Island Accident in 1979 was that operating procedures need to be symptom based and less prescriptive. Procedures that previously directed operators to take a series of actions based on a preestablished accident were replaced with procedures that directed operators to maintain the critical safety functions, such as keeping the core covered and cooled. Operators routinely practice these

procedures on a plant specific simulator to ensure that they can be implemented for a wide range of accident scenarios, including a station blackout scenario, or other events caused by an earthquake or a flood.

104) What are Severe Accident Management Guidelines

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: SAMGs are the set of guidelines employed to manage the in-plant response following a severe accident (i.e., Beyond design basis events that are expected to have resulted in significant core damage).

The *ultimate objective* of SAMGs is to protect the health and safety of the public from the hazards associated with the uncontrolled release of radioactive materials
The *operational objective* of SAMGs is to protect or restore, if possible, the integrity of the three physical barriers (fuel, reactor coolant system, and containment) to contain fission products.
Some important aspects of the guidelines are as follows:

- SAMGs go beyond the Emergency Operating Procedures (EOPs)
- SAMGs identify all possible means of achieving the operational objective, including the use of non-safety-related equipment and capabilities on site (including capabilities from other units)
- plant-specific SAMGs identify the various safety functions and list the capabilities to achieve that function, with some high-level procedure-like guidance.

Spent Fuel Pools and Independent Spent Fuel Storage Installations

105) Are Independent Spent Fuel Storage Installations (ISFSIs) required to withstand the same ground shaking as the reactor?

Public Response: Nuclear plant licensees use the same Safe Shutdown Earthquake (SSE) ground motion developed for the nuclear plant site for the design basis ground motion for the spent fuel dry cask storage facilities (also known as independent spent fuel storage installations, or ISFSIs) located at that site. Some reactor licensees have ISFSIs under a site-specific 10 CFR Part 72 license, and these licensees are required to use the same Part 50 reactor SSE for their design basis earthquake, in accordance with 10 CFR 72.102(f)(1). Other reactor licensees have onsite ISFSIs under the general license provisions of 10 CFR 72.210; they are similarly required to apply the same seismic design bases for the Part 50 license to the ISFSI design, in accordance with 10 CFR 72.212(b)(3).
Additional, technical, non-public information: none.

106) What do we know about the potential for and consequences of a zirconium fire in the spent fuel pool?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Spent fuel pools contain large amounts of water to keep the fuel cooled, and no fire can result as long as the water covers the fuel. Should the pool not be cooled for a substantial amount of time (on the order of days), the water in the pool may boil off. Should that continue and the fuel be exposed, the fuel could overheat. In the worst case, the zirconium cladding could oxidize and burn. The result of such a fire would be significant damage to the fuel, also the fire has the potential to propagate to the other assemblies, as well as release of hydrogen gas and volatile radioactive materials.

107) Can a zirconium fuel fire be prevented by wide spacing of spent fuel assemblies in the spent fuel pool?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Wider spacing would help in preventing a fire. Preventing a fire requires coolability in absence of water submersion. This depends on the heat and the assembly arrangement in the pool. A checkerboard arrangement (no two assemblies in adjacent locations) is coolable in about one third the time needed for a fully loaded (no open locations) pool. Other arrangements can also mitigate the potential of the onset of zirconium fires.

108) Are the implications of new seismic hazard estimates being considered for the storage of spent fuel?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Yes, while the GI-199 Safety/Risk Assessment focused solely on operating power reactors in the Central and Eastern U.S., spent fuel storage has been considered by NRC.
The NRC Office of Nuclear Materials Safety and Safeguards (NMSS) was informed of GI-199 and a preliminary screening review was performed in November, 2008 by the NMSS Division of Spent Fuel Storage and Transportation. There is a total of 40 operating independent spent fuel storage installations

(ISFSIs) in the Central and Eastern U.S. (CEUS). Except for a wet storage facility at G. E. Morris located in Illinois, the ISFSIs are co-located at the operating and permanently shutdown reactor sites. A review of design earthquakes (DE) used at the existing ISFSI locations in CEUS indicated that the safety margin (defined for ISFSIs as the ratio of DE/SSE, where SSE is the safe shutdown earthquake discussed in answer A8) for the cask designs were in the range of 1.20 ~ 3.90.
Therefore, NMSS considers that there is significant margin built into the existing designs and has confidence that the ISFSIs can continue to operate safely while the licensees' investigate this issue using their site specific information. Even so, holders of operating license for ISFSIs are included among addressees in the Information Notice on GI-199. Spent fuel pools (SFPs) were not specifically evaluated as part of GI-199. However, based on their design attributes (as follows), SFPs remain safe. SFPs are constructed of reinforced concrete, several feet thick, with a stainless steel liner to prevent leakage and maintain water quality. Due to their configuration, SFPs are inherently structurally-rugged and are designed to the same seismic requirements and ground motion intensity as the nuclear plant. However, the spent fuel cooling systems are not always seismic category 1.
Note: Typically, SFPs are about 40 feet deep and vary in width and length. The fuel is stored in stainless steel racks and submerged with approximately 23 feet of water above the top of the stored fuel. Each plant has a preferred SFP make-up water source (the refueling water storage tank for pressurized water reactors and the condensate storage tank for boiling water reactors). SFPs have alternate means of make-up such as service water systems and the fire water system. SFPs are also typically designed (e.g. with anti-siphon check valves) and instrumented such that leakage is minimized and promptly detected.

109) What are the design acceptance criteria for cooling systems for the spent fuel pools?

Public Response: The Standard Review Plan (NUREGO-800) acceptance Criteria for SP Cooling includes the following aspects:
General Design Criterion (GDC) 2 contained in Appendix A to 10 CFR Part 50, as related to structures housing the system and the system itself being capable of withstanding the effects of natural phenomena such as earthquakes, tornadoes, and hurricanes. Acceptance for meeting this criterion is based on conformance to positions C.1, C.2, C.6, and C.8 of RG 1.13 and position C.1 of RG 1.29 for safety-related and position C.2 of RG 1.29 for nonsafety-related portions of the system.
This criterion does not apply to the cleanup portion of the system and need not apply to the cooling system if the fuel pool makeup water system and its source meet this criterion, the fuel pool building and its ventilation and filtration system meet this criterion, and the ventilation and filtration system meets the guidelines of RG 1.52.
The cooling and makeup system should be designed to Quality Group C requirements in accordance with RG 1.26. However, when the cooling system is not designated Category I it need not meet the requirements of ASME Section XI for in-service inspection of nuclear plant components.

110) How does B.5.b apply to spent fuel pools?

Public Response: The answer below is a compilation of two questions contained in the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Section B.5.b of the ICM Order required licensees to "Develop specific guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities using existing or readily available resources (equipment and personnel) that can be effectively implemented under the circumstances associated with loss of large areas of the plant due to explosions or fire." Phase 1 was part of a larger NRC effort to enhance the safety and security of the nation's nuclear power plants. In Phase 2, the NRC independently looked at additional

ways to protect the spent fuel pools at nuclear power plants. The NRC's plant-specific assessments identified both "readily available" and other resources that could be used to mitigate damage to spent fuel pools and the surrounding areas. The assessments considered damage that could have been caused by land, water, or air attacks.

Station Blackout

This is not exactly related to seismic questions. But, similar to the above topics, I read these with great interest. I believe there are many staff who would like to be more informed about this topic and this is an excellent summary. So, I have included it here.
A Factsheet related to station blackout has been added (see pg XX).

111) What is the definition of station blackout?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Station blackout (SBO) means the complete loss of alternating current (ac) electric power to the essential and nonessential switchgear buses in a nuclear power plant (i.e., loss of offsite electric power system concurrent with turbine trip and unavailability of the onsite emergency ac power system). Station blackout does not include the loss of available ac power to buses fed by station batteries through inverters or by alternate ac sources as defined in this section, nor does it assume a concurrent single failure or design basis accident. At single unit sites, any emergency ac power source(s) in excess of the number required to meet minimum redundancy requirements (i.e., single failure) for safe shutdown (non-DBA) is assumed to be available and may be designated as an alternate power source(s) provided the applicable requirements are met. At multi-unit sites, where the combination of emergency ac power sources exceeds the minimum redundancy requirements for safe shutdown (non-DBA) of all units, the remaining emergency ac power sources may be used as alternate ac power sources provided they meet the applicable requirements. If these criteria are not met, station blackout must be assumed on all the units.

112) What is the existing regulatory requirement regarding SBO?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Each light-water-cooled nuclear power plant licensed to operate must be able to withstand for a specified duration and recover from a station blackout as defined in Sec. 50.2.

113) How many plants have an alternate ac (AAC) source with the existing EDGs

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: 60 plants

114) How many plants cope with existing class 1E batteries?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: 44 plants

115) What are the coping duration determined for the plants based on the SBO Rule ?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: 4-16 hours (4 hours only with batteries; 4-16 with AAC)

116) How is coping duration determined?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: The specified station blackout duration shall be based on the following factors:

(i) The redundancy of the onsite emergency ac power sources;
(ii) The reliability of the onsite emergency ac power sources;
(iii) The expected frequency of loss of offsite power; and
(iv) The probable time needed to restore offsite power.

117) When does the SBO event start?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: The onset of a loss of offsite power and onsite power as verified by the control room indications

118) When does the SBO event end?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Either onsite or offsite power is recovered.

119) Did the NRC review the licensee's actions to meet the SBO rule?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Yes. The NRC staff reviewed the responses from each licensee and issued a SER accepting the proposed coping methods. All plants have (1) established SBO coping and recovery procedures; (2) completed training for these procedures; (3) implemented modifications as necessary to cope with an SBO; and (4) ensured a 4-16 hour coping capability. In addition, the staff performed pilot inspections at 8 sites to verify the implementation of the SBO rule implementation. No issues were identified during initial implementation.

120) Are all plants designed to mitigate a station blackout event?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Yes. All plants have the capability to withstand and recover from a SBO event. In 1988, the NRC concluded that additional regulatory requirements were justified in order to provide further assurance that a loss of both offsite and onsite emergency ac power systems—a station blackout condition--would not adversely affect public health and safety. Studies conducted by the NRC have shown that the hardware and procedures that have been implemented to meet the station blackout requirements have resulted in significant risk reduction and have further enhanced defense in depth.

Emergency Preparedness (Emphasis on B.5.b)

Although this is not strictly seismic, it is often the case that design for mitigation actions taken for one issue have impact on others. It seems apparent that the actions taken for B.5.b are going to have an impact on the assessment of seismic risk at the plants.

121) Is the emergency preparedness planning basis for nuclear power plants is valid?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Yes- NRC continues to conduct studies to determine the vulnerability of nuclear power plants and the adequacy of licensee programs to protect public health and safety. Whether the initiating event is a severe earthquake, a terrorist based event, or a nuclear accident, the EP planning basis provides reasonable assurance that the public health and safety will be protected. EP plans have always been based on a range of postulated events that would result in a radiological release, including the most severe.

122) What is B.5.b?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: After the terrorist attacks of 9/11, the NRC issued an Interim Compensatory Measures (ICM) Order on February 25, 2002, requiring power reactor licensees to take certain actions to prevent or mitigate terrorist attacks. Section B.5.b of the ICM Order required licensees to "Develop specific guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities using existing or readily available resources (equipment and personnel) that can be effectively implemented under the circumstances associated with loss of large areas of the plant due to explosions or fire."

123) What were Phases 1, 2, and 3 of the B.5.b?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information:
Phase 1: Phase 1 was part of a larger NRC effort to enhance the safety and security of the nation's nuclear power plants. The Phase 1 effort was initiated as part of the February 2002 ICM Order. The Order, among other things, required licensees to look at what might happen if a nuclear power plant lost large areas due to explosions or fire. The licensees then were required to identify – and later implement – strategies that would maintain or restore cooling for the reactor core, containment building, and spent fuel pool. The requirements listed in Section B.5.b of the ICM Order directed licensees to identify "mitigative strategies" (meaning the measures licensees could take to reduce the potential consequences of a large fire or explosion) that could be implemented with resources already existing or "readily available."
Phase 2: In Phase 2, the NRC independently looked at additional ways to protect the spent fuel pools at nuclear power plants. The NRC's plant-specific assessments identified both "readily available" and other resources that could be used to mitigate damage to spent fuel pools and the surrounding areas. The assessments considered damage that could have been caused by land, water, or air attacks.
Phase 3: In Phase 3, each nuclear power plant licensee identified ways to improve its ability to protect the reactor core and containment from a terrorist attack. This was done by identifying both "readily available" and other resources that could be used to mitigate loss of large areas of the plant due to fires

and explosions. In addition, the NRC independently assessed the plant and audited the licensee's effort to identify additional mitigation strategies.

124) Has the NRC inspected full implementation of the mitigating strategies?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: All phases of the B.5.b mitigating strategies were complete and inspected by December 2008.

125) What additional action has been taken?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: On March 27, 2009, the NRC amended 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," which added 10 CFR 50.54(hh)(2) in order to impose the same mitigating strategies requirements on new reactor applicants and licensees as those imposed by the ICM Order and associated license conditions. The Statement of Considerations for this rulemaking specifically noted that the requirements described in Section 50.54(hh) are for addressing certain events that are the cause of large fires and explosions an in addition, the rule contemplates that the initiating event for such large fires and explosions could be any number of beyond-design basis events, including natural phenomena such as earthquakes, tornadoes, floods, and tsunami.

126) Is more information available about the mitigating strategies and inspections and reviews conducted?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: In general, the B.5.b mitigating strategies are plans, procedures, and pre-staged equipment whose intent is to minimize the effects of adverse events or accidents due to terrorist attacks. The NRC does not publicly release information that could assist terrorists to make nuclear power plants less safe. Since the NRC cannot share the details of the mitigating strategies with the public, we have given briefings to elected officials such as state governors and members of Congress to share sensitive unclassified or classified information, as appropriate. In addition, the NRC

Other External Hazards

127) How many plants are in hurricane zones?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: The plants near Gulf of Mexico and East coast as far north as Pilgrim have experienced Hurricane force winds in the past. Approximately 30 plants fall in this category.

128) How many plants are susceptible to flooding?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Most nuclear plants are close to large bodies of water and are situated on flat lands. Approximately 80% of the plants fall in this category. There are a few plants that may NOT be vulnerable to flooding such as Palo Verde.

129) How many plants are susceptible to blizzard?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: The plants in California, Arizona, South Texas, Louisiana and Florida are not expected to fall in this category. Approximately 80% of the plants are likely to experience blizzard conditions or adverse wintry weather conditions.

130) How many plants are susceptible to tornadoes?

Public Response: The below comes from the Q&As for the 3/21 commissioner's briefing. Please make sure these are OK to provide to the public before doing so.
Additional, technical, non-public information: Majority of the plants in the Midwest and the South have had tornado activity in the area. Approximately 50% of the operating plants

Plant-Specific Questions

San Onofre Nuclear Generating Station (SONGS) Questions

131) Could an earthquake and tsunami the size of the one in Japan happen at San Onofre?

No. This earthquake occurred on a "subduction zone", which is the type of tectonic region that produces the largest magnitudes earthquake. A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate. Subduction zone earthquakes are also required to produce the kind of massive tsunami seen in Japan. In the continental US, the only subduction zone is the Cascadia subduction zone which lies off the coast of far northern California, Oregon and Washington. So, a continental earthquake and tsunami as large as in Japan could only happen there. Outside of the Cascadia subduction zone, earthquakes are not expected to exceed a magnitude of approximately 8.25; and that would only occur on the largest fault lines, such as the San Andreas fault, which is 50 miles away onshore.

132) What magnitude earthquake are currently operating US nuclear plants such as SONGS designed to?

Each reactor is designed for a different ground motion that is determined on a site-specific basis. Ground motion is a function of both the magnitude of an earthquake and the distance from the fault to the site; and it is ground motion that causes damage. So, Nuclear plants, and in fact all engineered structures, are actually designed based on ground motion levels, not earthquake magnitudes. The existing nuclear plants were designed based on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquakes expected in the area around the plant. The scenario earthquake at SONGS is a magnitude 7 approximately 5 miles from the main plant. This earthquake results in a ground motion that has a peak ground acceleration of 0.67g, that is 67% of the acceleration of gravity.

133) Could San Onofre withstand an earthquake of the magnitude of the Japanese earthquake?

It could withstand the ground shaking experienced by the Japanese nuclear plants. As discussed above, it is actually ground motions that structures, systems, and components "feel". We do not have direct recordings of ground motion at the Japanese reactors. However, we do have estimates of shaking that come from a ShakeMap produced by the K-NET system. The ground motion at the Japanese nuclear reactors is believed to be somewhat on the order of the 0.67g, or possibly slightly higher, that San Onofre peak ground acceleration has been analyzed to. However, US nuclear plants have additional seismic margin, as demonstrated by the result of the Individual Plant Examination of External Events program carried out by the NRC in the mid-90s.
It should be noted that, the Fukushima plant also withstood the earthquake. In the hour or so after the earthquake the Fukushima plant's safety systems, including the diesel generators, performed as expected and effectively shut down the reactor. The cause of the problems at the plant stemmed from the loss of emergency power that appears to be the direct result of the subsequent tsunami, which far exceeded the design basis tsunami for the Fukushima plant.

134) Is possible to have a tsunami at San Onofre that is capable of damaging the plant?

Public Information: The San Onofre Units 2 and 3 plant grade is elevation +30.0 feet MLLW. San Onofre 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. 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 larger than this is extremely unlikely.
Additional, technical, non-public information: None

135) Has the earthquake hazard at San Onofre been reviewed like Diablo Canyon nuclear power plant is doing? Are they planning on doing an update before relicensing?

Relicensing does not evaluate seismic hazard or other siting issues. Seismic safety is part of NRC's ongoing licensing activities. If an immediate safety concern immerged, the issue would be addressed as part of NRC's response, regardless of relicensing status.
The closest active fault is approximately five miles offshore from San Onofre, a system of folds and faults exist called the offshore zone of deformation (OZD). The OZD includes the Newport-Inglewood-Rose Canyon fault system. 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 earthquakes in the OZD for San Onofre.
Notwithstanding the above, the NRC is considering extending the Generic Issue 199 program to all operating reactors. This would require a reassessment of hazard for San Onofre using the latest probabilistic seismic hazard assessment approaches. Based on a preliminary assessment using the source model developed by the USGS for the national seismic hazard maps, the annual probability of occurrence of a 0.67g ground motion at the San Onofre site is only slightly higher than is than the annual probability of occurrence that is recommended for new nuclear plants.
Additional, technical, non-public information: 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.

136) How do we know that the emergency diesel generators in San Onofre will not fail to operate like in Japan?

Emergency Diesel Generators (EDGs) are installed in a seismically qualified structure and are seismic Category I equipment. Even if these EDGs did fail, plants can safely shutdown using station blackout power source law 10 CFR 50.63. In 1988 the NRC concluded that additional regulatory requirements were justified in order to provide further assurance that a loss of both offsite and onsite emergency ac power systems would not adversely affect public health and safety and the station blackout rule was enacted. Studies conducted by the NRC since this rule has been in effect confirms that the hardware and procedures that have been implemented to meet the station blackout requirements have resulted in significant risk reduction and have further enhanced defense-in-depth. However, we plan to carefully evaluate the lessons learned from the events in Japan to determine if enhancements to the station blackout rule are warranted.

137) Was there any damage to San Onofre from either the earthquake or the resulting tsunami?

There was no damage at the San Onofre nuclear plant from either the earthquake or tsunami.

138) What about emergency planning for San Onofre. Does it consider tsunami?

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 San Onofre. The next such exercise is planned for April 12, 2011.

The San Onofre emergency plan initiates the emergency response organization and results in declaration of emergency conditions via their Emergency Action Levels. The facility would then make protective action recommendations to the Governor, who would then decide on what protective actions would be ordered for the residents around San Onofre. The consideration of tsunami would be contained in the State and local (City, County) emergency plans, which are reviewed by FEMA.

Additional, technical, non-public information: None

139) 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

140) 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

141) 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

142) 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

143) 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.
Additional, technical, non-public information: None

144) 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

145) 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

146) 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

147) 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

148) 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

149) What is the design level flooding for San Onofre? Can a tsunami be larger?

Public response: San Onofre is located above the flood level associated with tsunami. San Onofre 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

Additional songs questions

Diablo Canyon Nuclear Power Plant (DCNPP) Questions

150) Could an earthquake and tsunami the size of the one in Japan happen at Diablo Canyon?

No. This earthquake occurred on a "subduction zone", which is the type of tectonic region that produces the largest magnitudes earthquake. A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate. Subduction zone earthquakes are also required to produce the kind of massive tsunami seen in Japan. In the continental US, the only subduction zone is the Cascadia subduction zone which lies off the coast of far northern California, Oregon and Washington. So, a continental earthquake and tsunami as large as in Japan could only happen there. Outside of the Cascadia subduction zone, earthquakes are not expected to exceed a magnitude of approximately 8.25; and that would only occur on the largest fault lines, such as the San Andreas fault, which is 50 miles away onshore.

151) What magnitude earthquake are currently operating US nuclear plants such as Diablo Canyon designed to?

Each reactor is designed for a different ground motion that is determined on a site-specific basis. Ground motion is a function of both the magnitude of an earthquake and the distance from the fault to the site; and it is ground motion that causes damage. So, Nuclear plants, and in fact all engineered structures, are actually designed based on ground motion levels, not earthquake magnitudes. The existing nuclear plants were designed based on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquakes expected in the area around the plant. The scenario earthquake at Diablo is a magnitude 7.5 on the Hosgri Fault 3 miles from the main plant. This earthquake results in a ground motion that has a peak ground acceleration of 0.75g, that is 75% of the acceleration of gravity.

152) Could the newly discovered Shoreline Fault produce a larger "Scenario Earthquake"?

The NRC's preliminary analyses indicate that the ground motions from the largest earthquakes expected on the smaller Shoreline Fault do not exceed the ground motions from the Hosgri Fault, for which the plant has already been analyzed and been found to be safe. NRC is currently reviewing the Final Report

on the Shoreline Fault that was submitted to the NRC earlier this year. The NRC is performing an independent analysis of potential ground motions based the data contained in the report and other information. Much of the data on the Shoreline Fault comes from the USGS in Menlo Park.

153) Could Diablo Canyon withstand an earthquake of the magnitude of the Japanese earthquake?

It could withstand the ground shaking experienced by the Japanese nuclear plants. As discussed above, it is actually ground motions that structures, systems, and components "feel". We do not have direct recordings of ground motion at the Japanese reactors. However, we do have estimates of shaking that come from a ShakeMap produced by the the K-NET system. The ground motion at the Japanese nuclear reactors is believed to be somewhat smaller than the 0.75g peak ground acceleration that Diablo Canyon has been analyzed to. Do, Diablo Canyon could withstand the ground shaking experienced by the Fukushima plant.
In fact, the Fukushima plant also withstood the earthquake. In the hour or so after the earthquake the Fukushima plant's safety systems, including the diesel generators, performed as expected and effectively shut down the reactor. The cause of the problems at the plant stemmed from the loss of emergency power that appears to be the direct result of the subsequent tsunami, which far exceeded the design basis tsunami for the Fukushima plant.

154) Is Diablo Canyon's equipment vulnerable to tsunami?

Nuclear plants are designed to withstand protection against natural phenomena such as tsunami, earthquakes. Diablo Canyon's main plant is located above the flood level associated with tsunami. The intake structures and Auxiliary Sea Water System at Diablo canyon are designed for combination of tsunami and storm wave activity.

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

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.

156) Was there any damage to Diablo Canyon from either the earthquake or the resulting tsunami?

A small tsunami did hit the region around Diablo Canyon. There was no damage at the nuclear plant.

157) How do we know the evacuation routes in the region around Diablo Canyon are realistic?

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.

158) **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

159) **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

160) **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

161) **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

162) **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

163) **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
The Japanese were supposed to have one of the best tsunami warning systems around. What went wrong last week?
Public Response: ADD can HQ answer?
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.

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

ADD

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

ADD

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

ADD

167) 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.

168) Has anyone done work to look at the effect of many cycles of low amplitude acceleration following a larger event. 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.

169) Aren't the California plants right on the San Andreas fault?

No. Both plants are approximately 50 miles from the San Andreas Fault. However, both are closer to other active fault zones. Diablo Canyon is closer to the Hosgri fault zone and has been retrofit to be safe in ground motions from a magnitude 7.5 earthquake on the Hosgri, which is 3 miles away. Recently there was a new fault, called the Shoreline fault discovered, about a 1/2 mile from the plant. But it is smaller and only capable of about a 6.5 earthquake at the most. The ground motions from the Hosgri's 7.5 earthquake would be larger than an 6.5 on the Shoreline fault. San Onofre is closes to the Newport-Inglewood fault which is about 5 miles away and capable of a magnitude 7. San Onofre was built to withstand the ground motions from that earthquake.

The following questions are from a series of questions asked by a reporter:

170) I heard that, at the urging of PG&E, effective acceleration was calculated at an average value, rather than peak. Is this true?

NRC response:
To be clear, the term "average" value in this case refers to the average of the two horizontal components of motion (accelerations) as recorded by seismographs. The maximum motion is the largest motion in any horizontal direction. It is most common to calculate the peak ground acceleration as an average horizontal value, rather than the maximum in any single direction, because that is what ground motion prediction equations are developed for and that is what is used in design. This is done because the weakest direction of a structure is rarely exactly aligned with the direction that has the single largest acceleration pulse.

Ground motion prediction equations are statistical relationships that provide the range of ground motion values for a particular magnitude and distance pair. The peak ground acceleration is typically determined as the maximum single value of the average of the horizontal accelerations. It should be noted also that the peak acceleration ground motions predicted are a distribution, rather than a single value (consider that not every time you record a magnitude 7 earthquake from 10 kilometers away are you going to get the same exact values; there is natural variability.) So, the ground motions they used are not the "average" value from that distribution, but rather the +1standard deviation motions (i.e. the ground motions that have an 84% chance of being greater than the actual ground motions recorded for a particular magnitude-distance pair.) So, what 0.75g actually represents is the 84th percentile peak ground acceleration motions (where the motions are the average of the horizontal directions). This is the standard approach for a deterministic assessment.

171) (Continued from previous question) A so-called "tau factor" was used, which reduced it again to .67g. Can you please explain this?

NRC Response:
During the operating license review for the evaluation of the Diablo Canyon plant for the Hosgri earthquake (HE), the licensee used NRC-outlined procedures and parameters that were considered appropriate for the evaluation of the seismic response of plant structures, including an adjustment of the response spectra to account for the filtering effect of the large building foundations (Tau filtering procedure) (Reference Supplement 5 of NRC Safety Evaluation Report). It should be noted that the Tau factors were used for the evaluation of the seismic response of the Diablo Canyon plant structures only for the HE, and not for the design earthquake (DE) and the original Double Design earthquake (DDE or Safe Shutdown Earthquake (SSE)). It is further noted that the Tau effect in the HE evaluation is generally analogous to the combined effects of soil structure interaction (SSI) between plant structures and underlying foundation rock, foundation embedment, and ground motion incoherence effects associated with the horizontal spatial variation of the free-field ground-shaking on the seismic response of plant structures.

The NRC does not readily have a count of nuclear plants that have used the Tau factor approach for evaluation of seismic response of plant structures. Such information may be typically found in the updated Final Safety Analysis Report (FSAR) of the plant, which is a public document. Detailed state-of-the-art SSI analyses including the effects of incoherence and embedment are being used by applicants for new reactors.

172) (Continued from previous question) To assess the strength of concrete, actual values were used, rather than code allowable minimums. Can you please explain this?

NRC Response:
The NRC does not readily have a count of nuclear plants that have made such changes to design concrete compressive strength of concrete structures. Such information may be typically found in the updated FSAR of the plant, which is a public document. Diablo Canyon did use an increased concrete compressive strength only for design evaluation of its containment structures for accident load combination that includes the HE seismic design spectrum based on a postulated magnitude 7.5 earthquake on the Hosgri Fault 3 miles from the Diablo Canyon site with a peak ground acceleration of 0.75g. The specified minimum compressive strength of concrete was used for all other load combinations including those with the original operating-basis design earthquake and the original Double Design earthquake (or SSE).