

Energy, Air, Water, & Earth

Nuclear Reactor Accidents:
Three Mile Island & Fukushima

MIT ANES Symposium

March 30, 2011

Lake H. Barrett

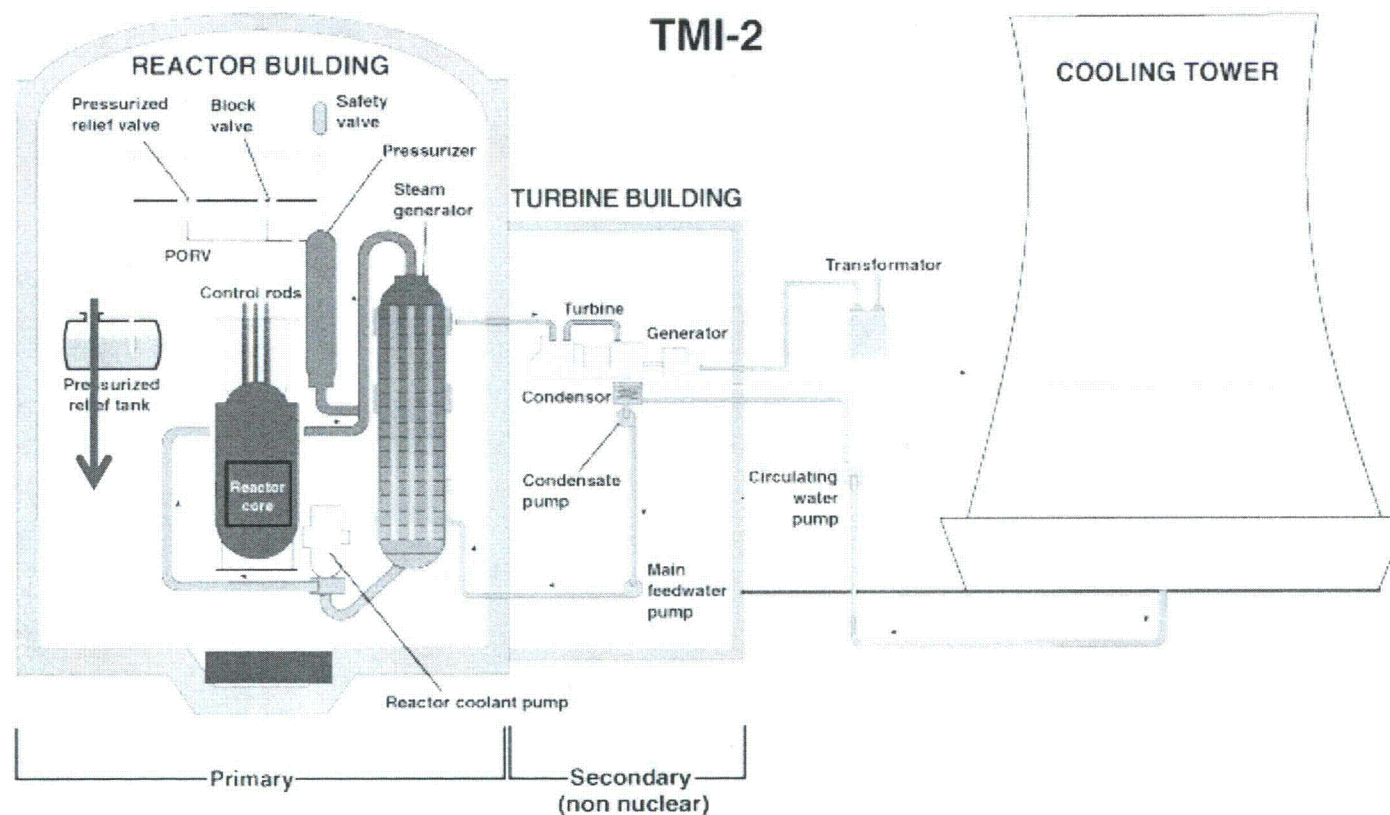
Rockville, MD

Disclaimer: Fukushima Information is preliminary especially regarding interpretation of events; opinions expressed are mine and mine alone.

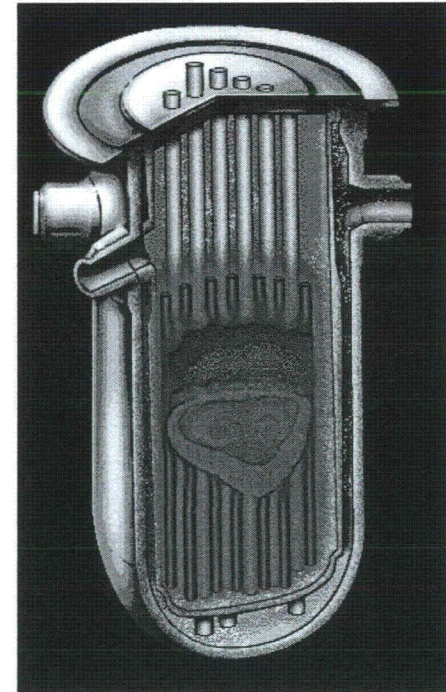
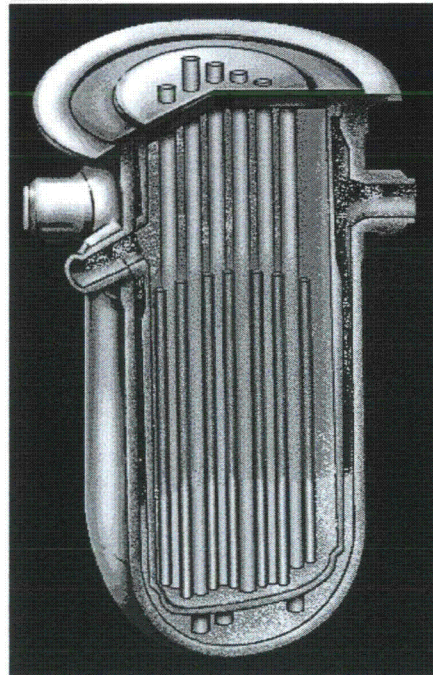
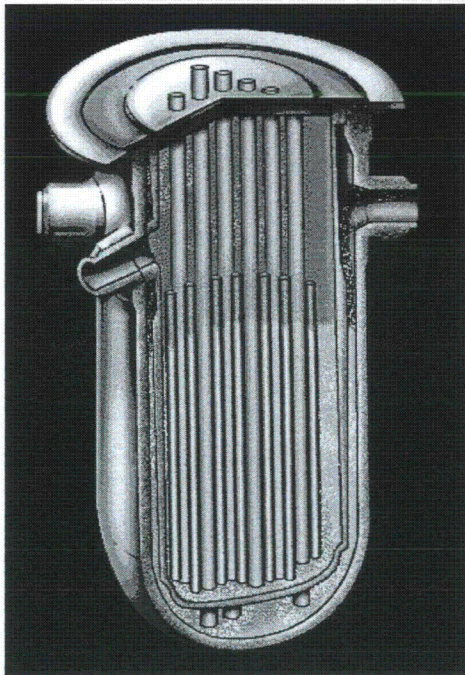
Y/303

Three Mile Island

March 28, 1979

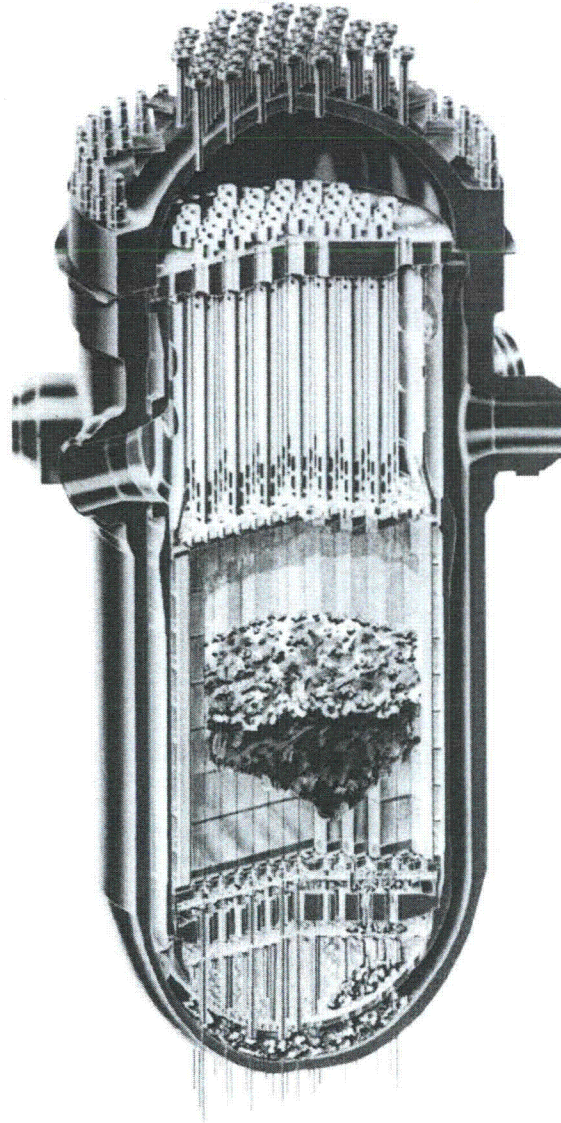


TMI Core Damage Sequence



TMI Core Configuration

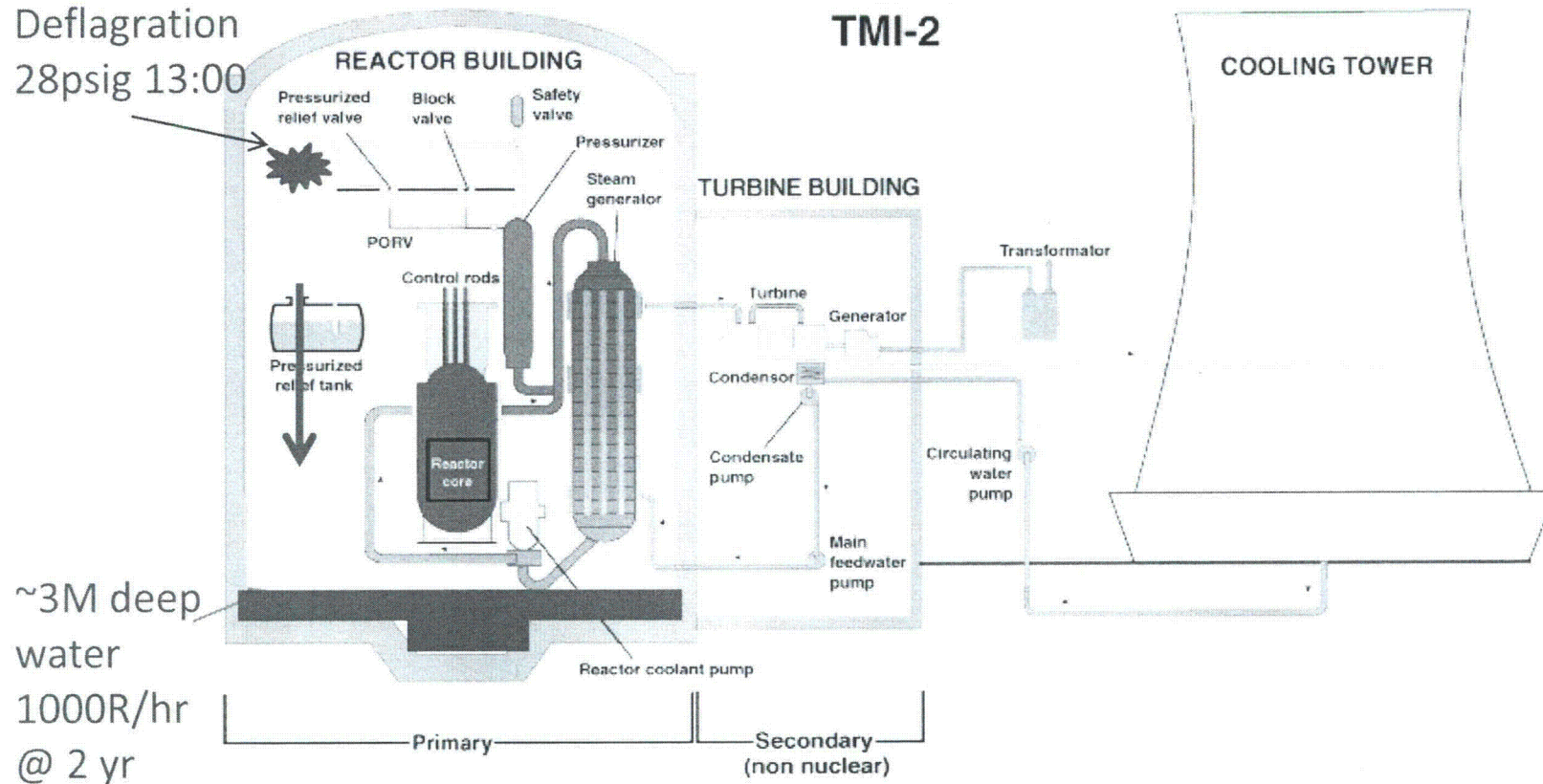
~Evening 3/28/1979



Three Mile Island

March 28, 1979

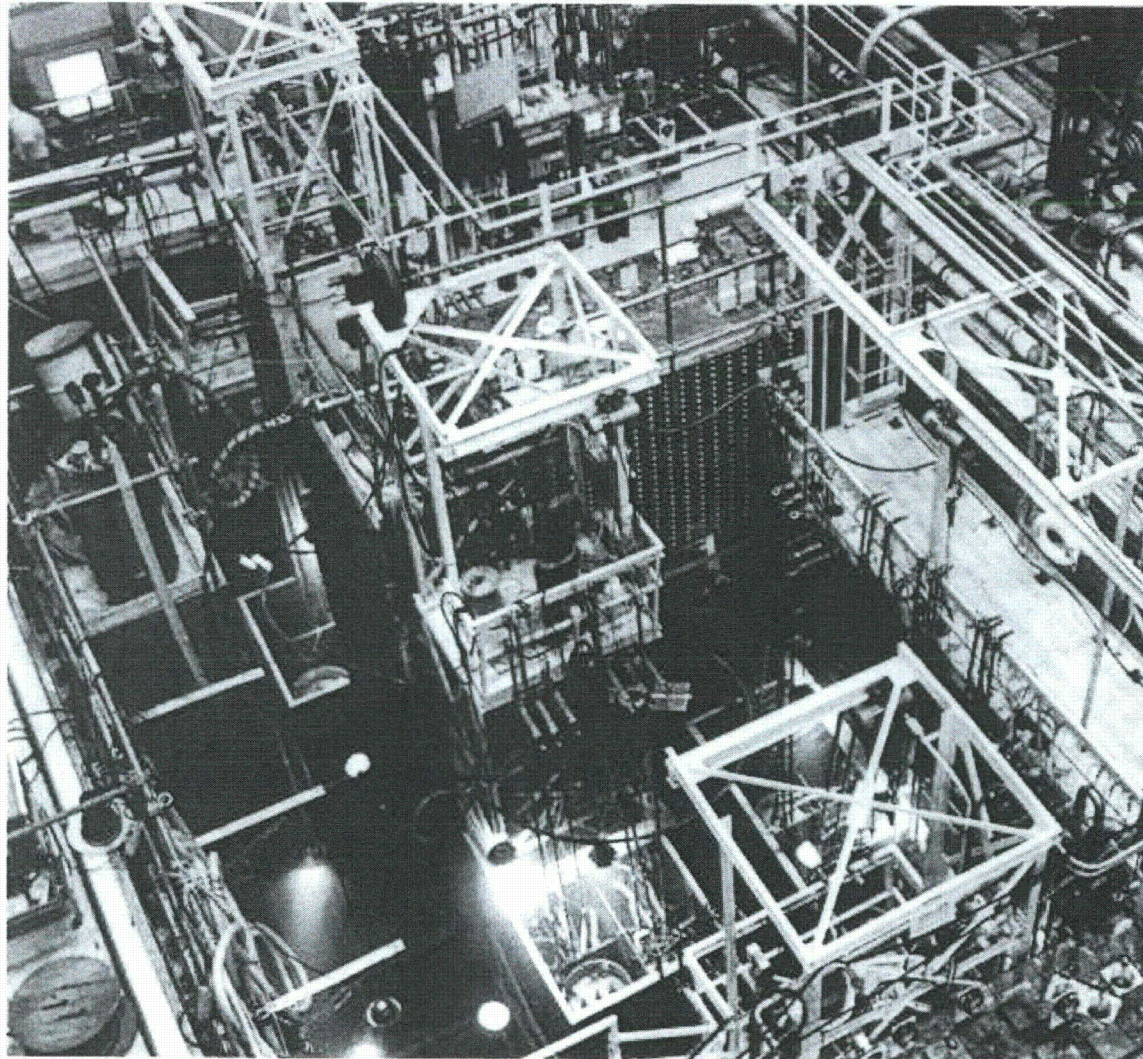
Hydrogen
Deflagration
28psig 13:00



Three Mile Island History

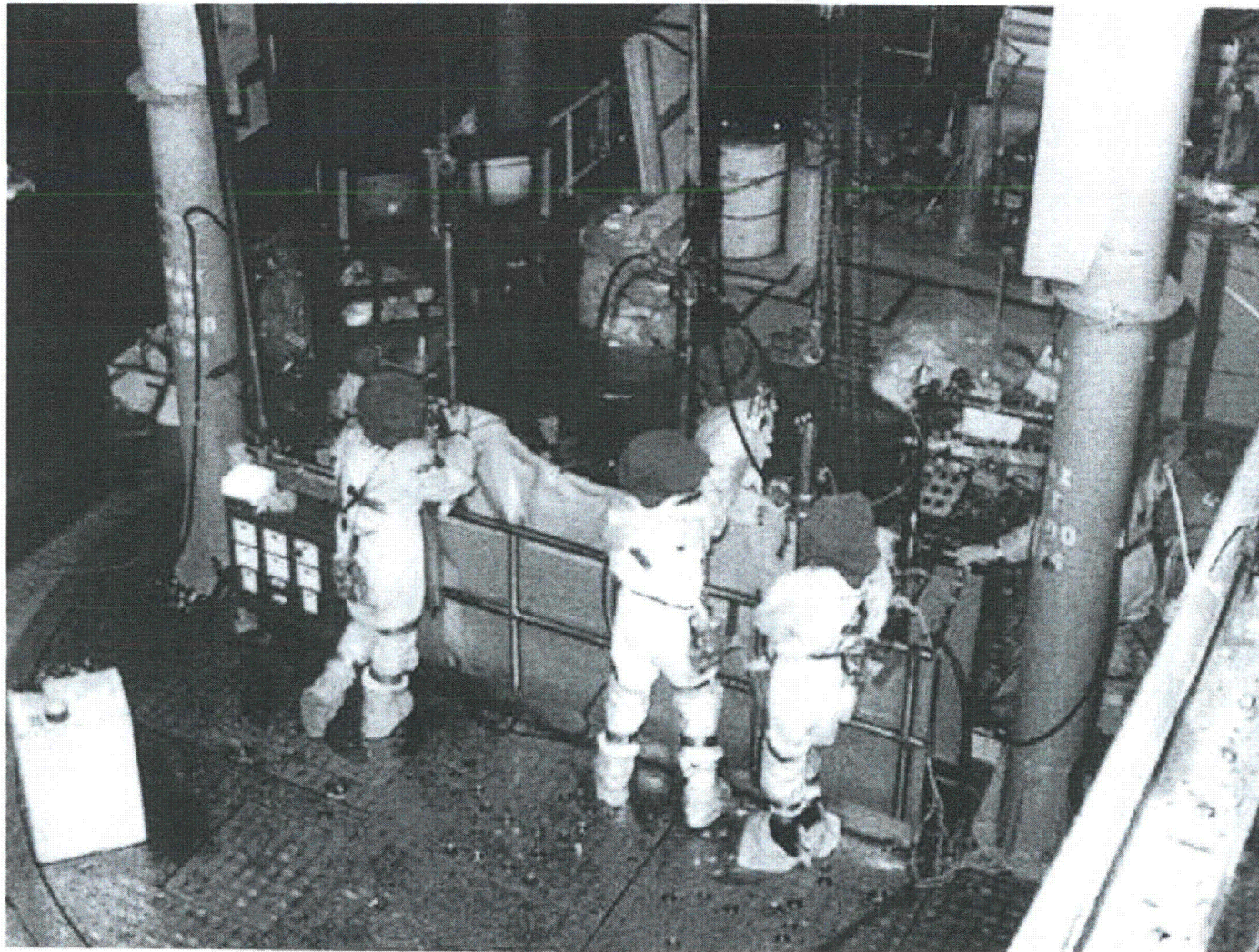
- Reactor Scram: 04:00 3/28/79
- Core melt and relocation: ~ 05:00 – 07:30 3/28/79
- Hydrogen Deflagration: 13:00 3/28/79
- Recirculation Cooling: Late 3/28/79
- Phased Water Processing: 1979-1993
- Containment Venting 43KCi Kr-85: July 1980
- Containment Entry: July 1980
- Reactor Head removed and core melt found: July 1984
- Start Defuel: October 1985
- Shipping Spent Fuel: 1988-1990
- Finish Defuel: Jan 1990
- Evaporate ~2M gallons Processed Water: 1991-93
- Cost: ~\$1 Billion

High Rad Reactor Water Cleanup System Installed in Spent Fuel Pool

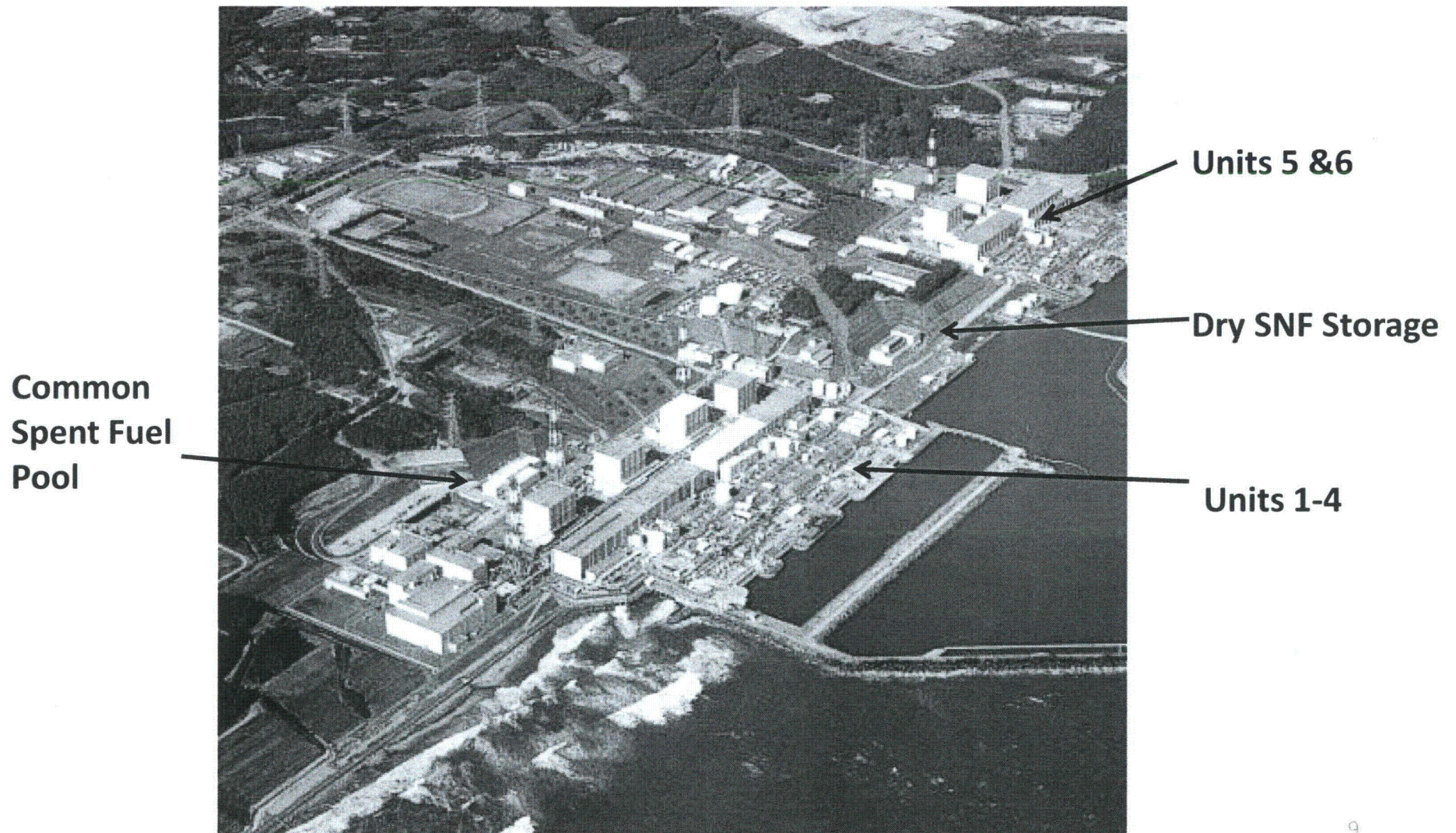


TMI Damaged Core Removal

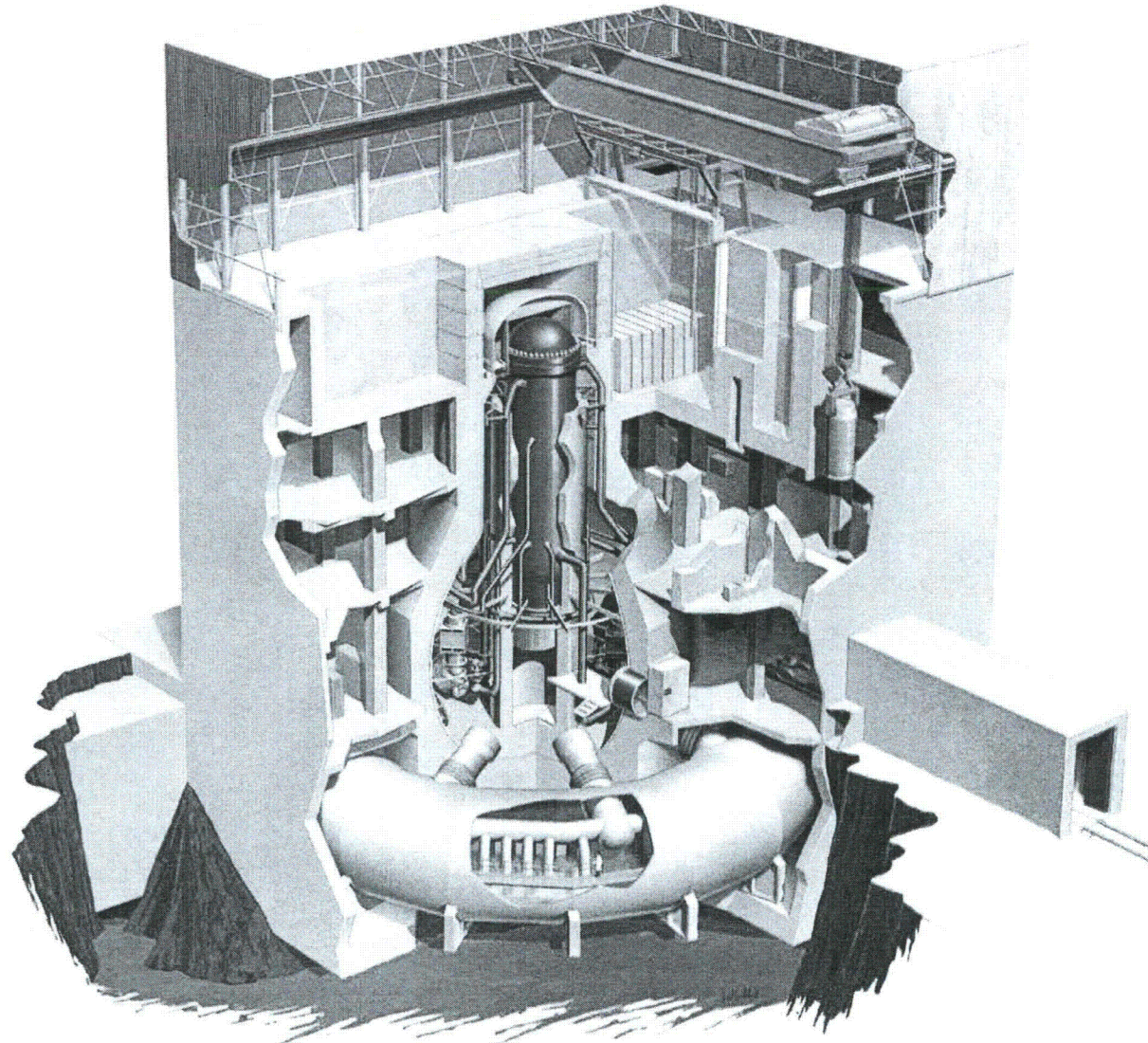
~1985-1990



Fukushima Daiichi Nuclear Power Station

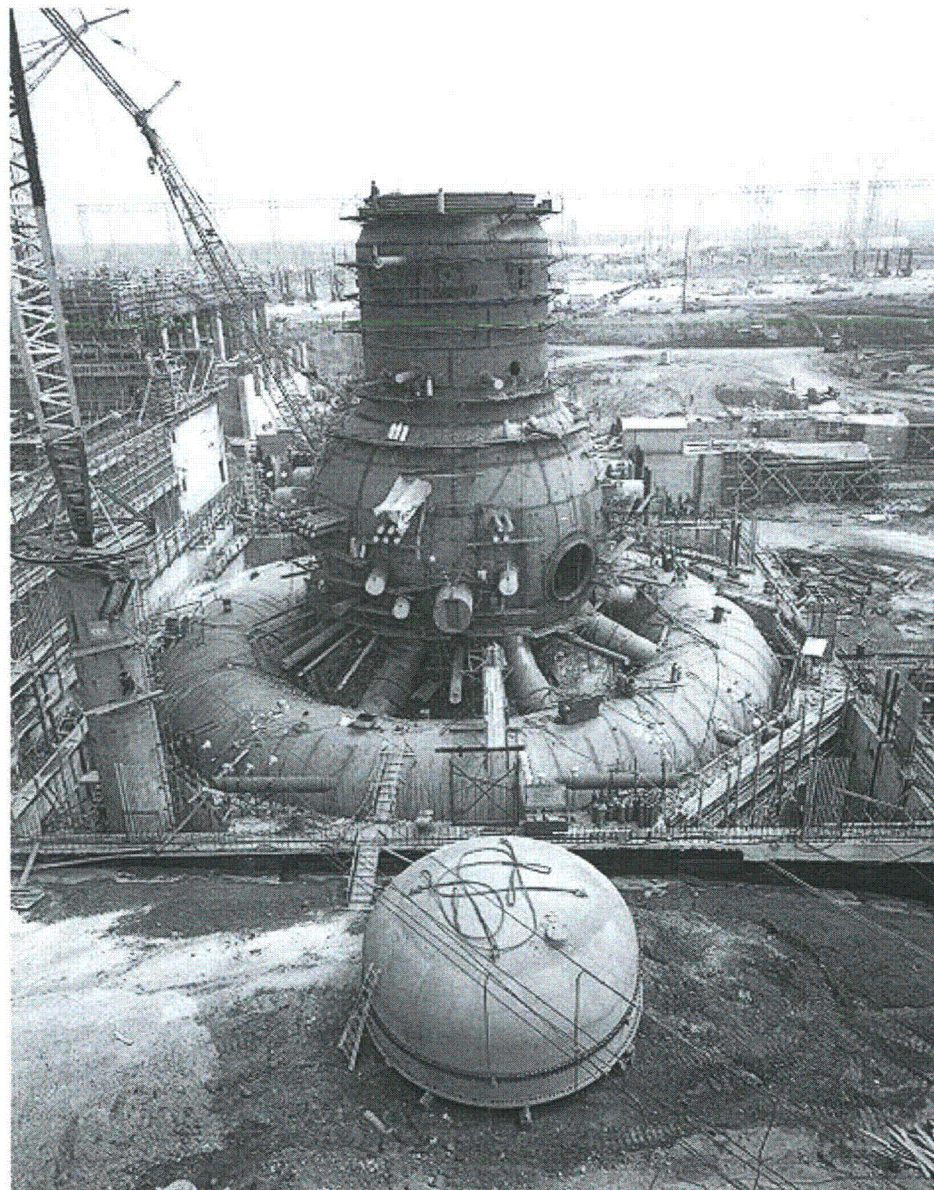


GE Mark 1 Reactor Building



DRYWELL TORUS

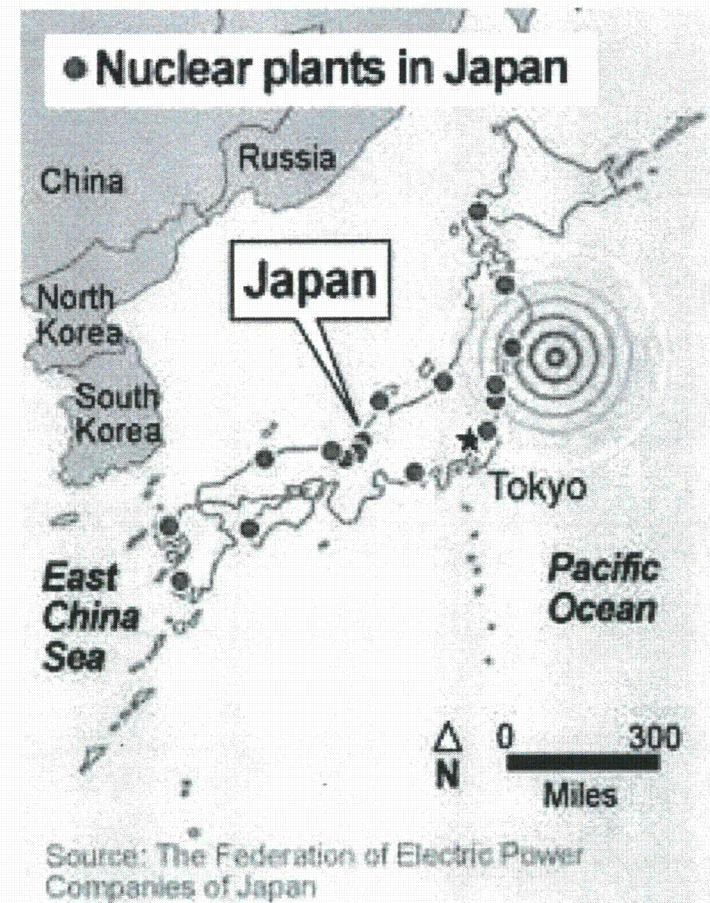
Browns Ferry Primary Containment



Event Initiation

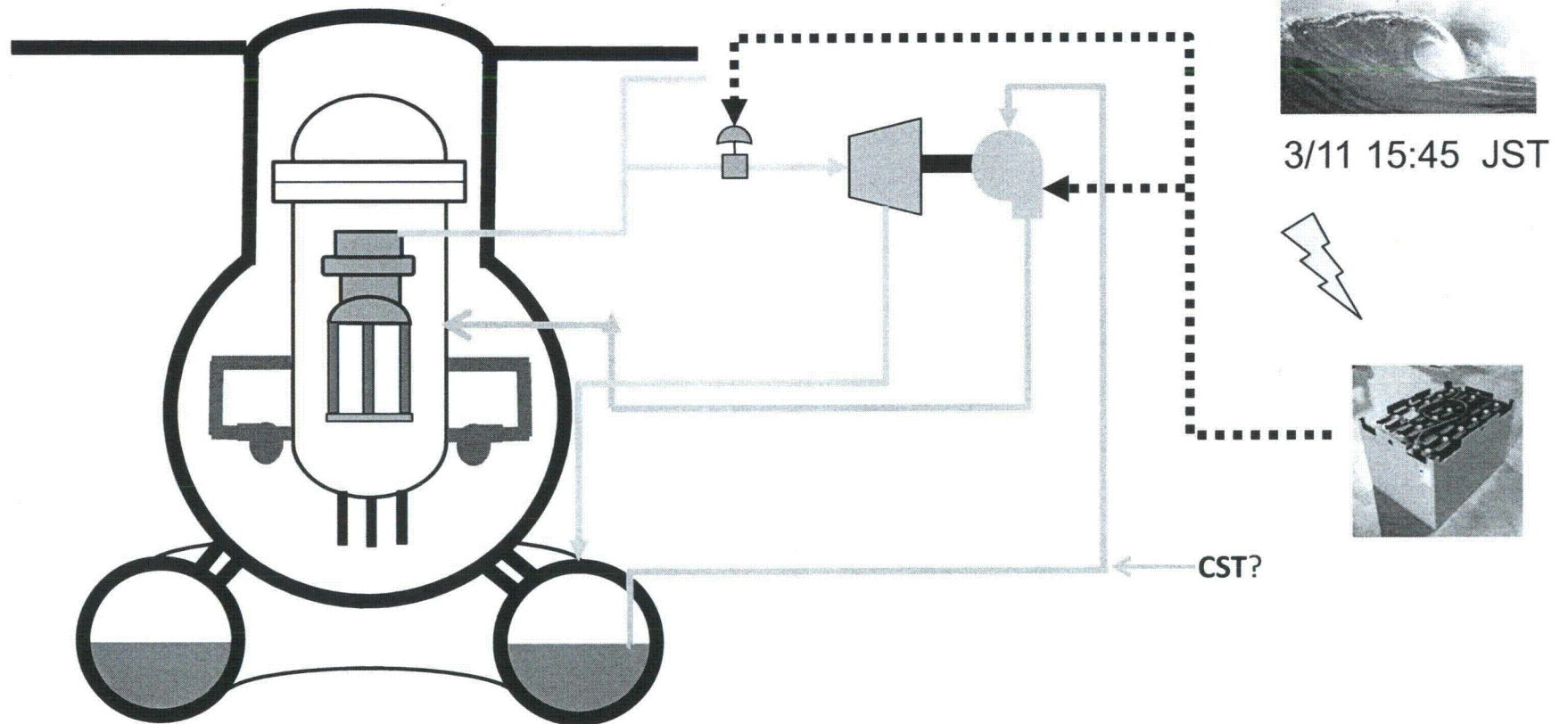
March 11, 2011

- About 14:46, a 9.0 magnitude earthquake struck (Plant design basis earthquake: 8.2)- Plant safety systems reportedly function satisfactorily.
- Units 1, 2 & 3 Scram & Unit 4 has 100 day old core offloaded into Unit 4 Spent Fuel Pool
- ~ 15:45, a tsunami 14 meters high inundated the site, whose design basis was 5.7 meters – the reactors and backup diesel power sit roughly 10 to 13 meters above sea level
- The impacts up and down the northeast coast resulted in tragic loss of 10,000+ lives, damage, and destruction of infrastructure.

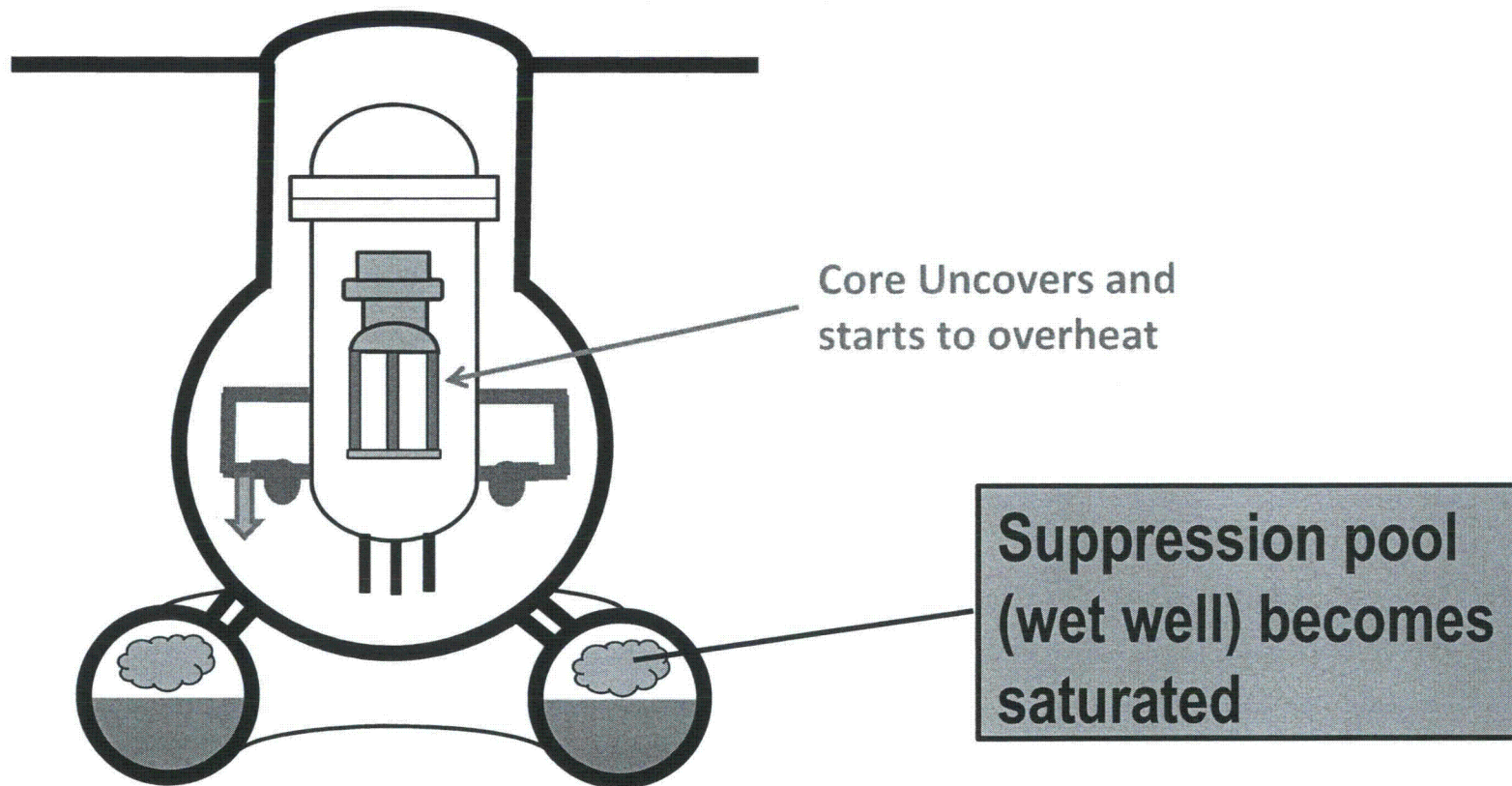


By Janet Loehrke, USA TODAY

Battery Power Control of Steam-Driven Reactor Core Isolation Cooling System In Units 2 & 3 (Unit 1 Had Isolation Condenser which Boiled Dry)

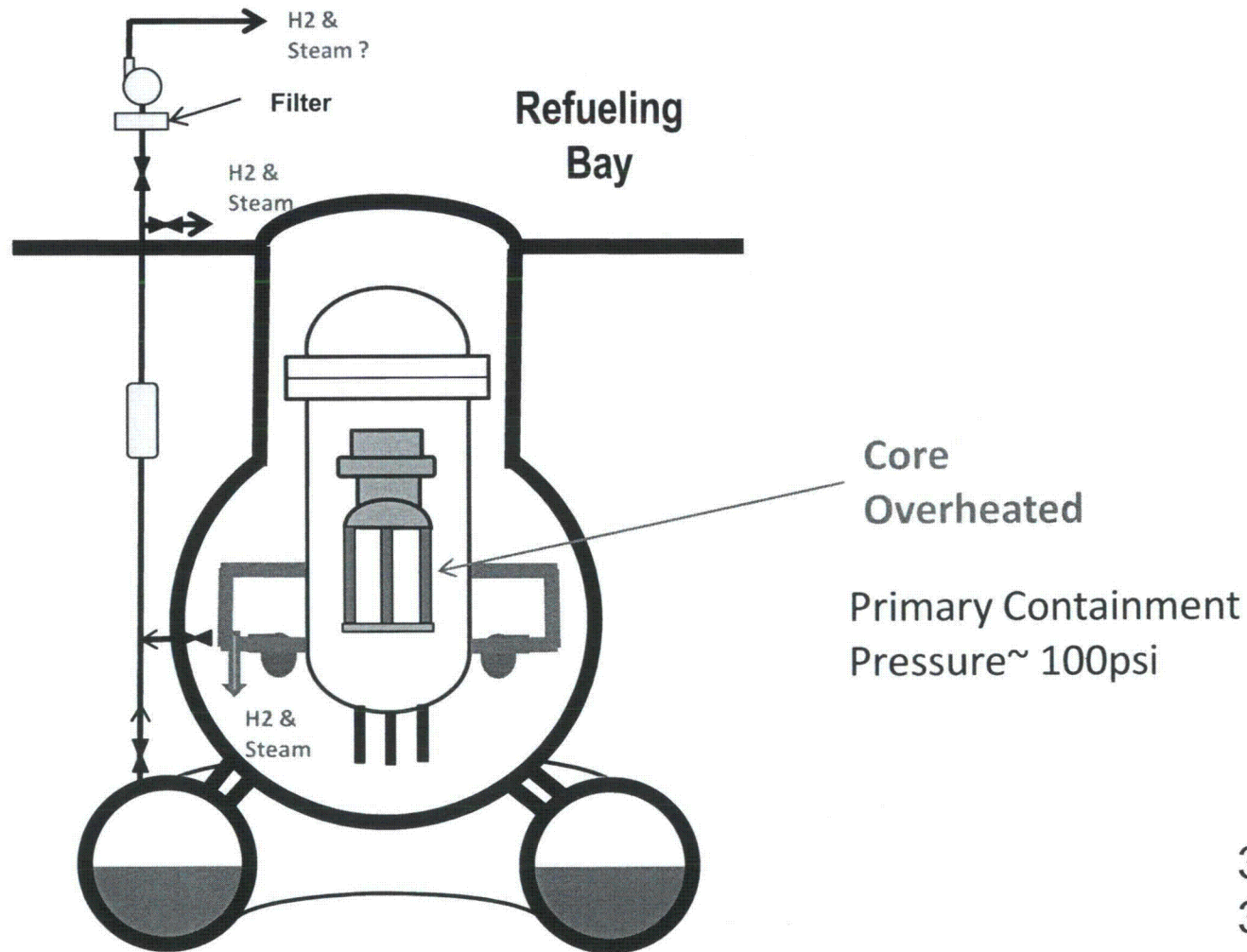


Battery Power Exhausted



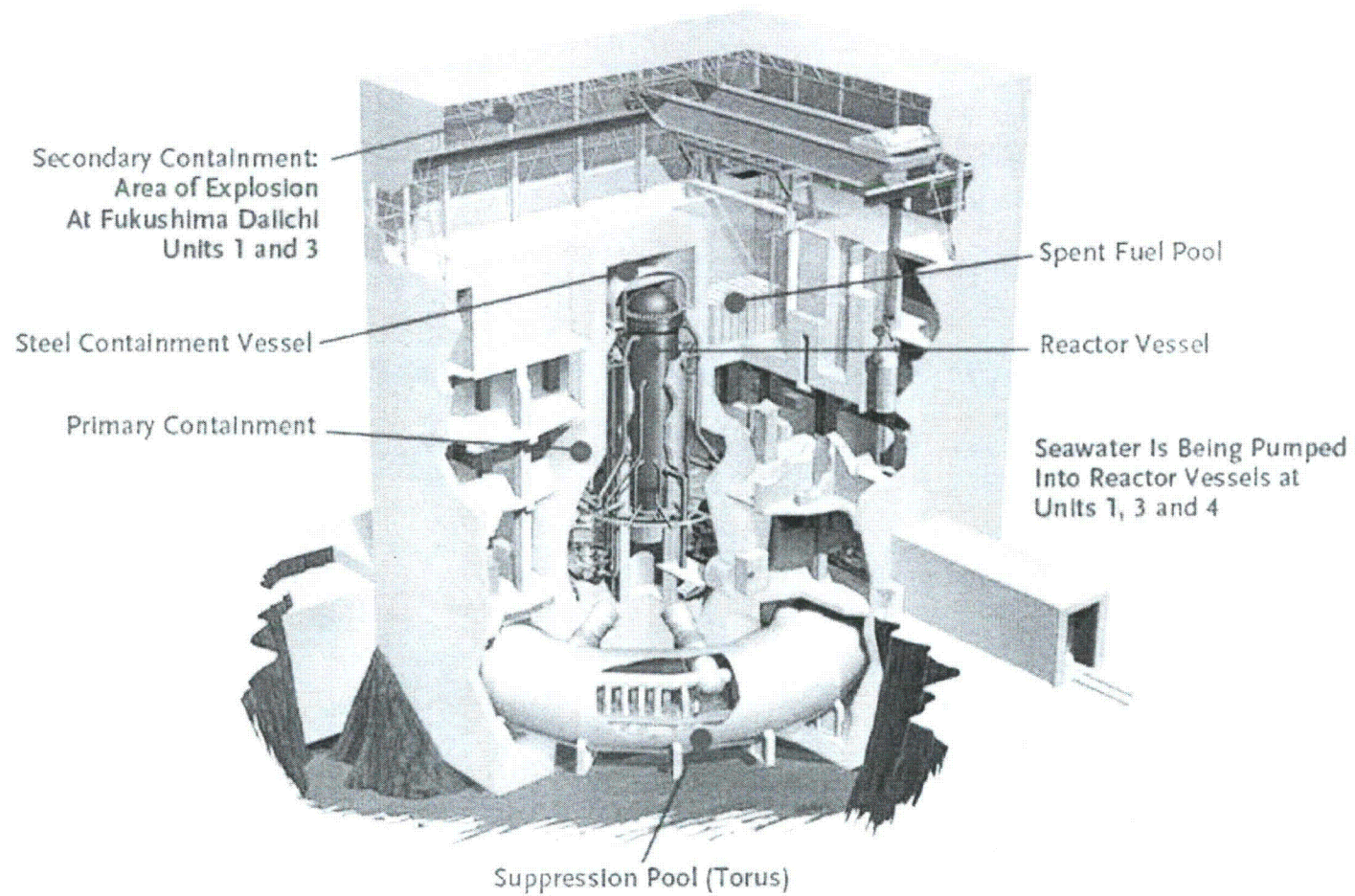
3/12 ~02:00 JST

Venting Primary Containment



3/12 ~05:30 U1
3/13 ~ 00:00 U2
3/13 ~ 08:40 U3

BWR Barriers



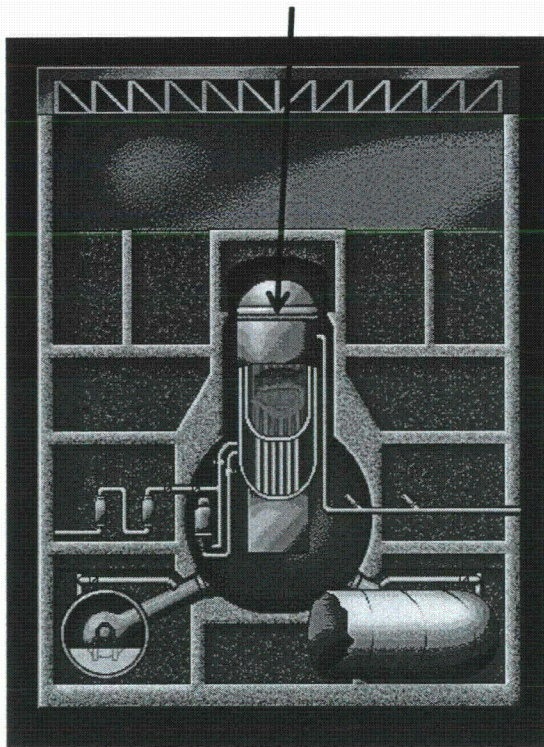
Unit 1 Explosion 3/12 15:30

Unit 3 Also Explodes 3/14 11:15



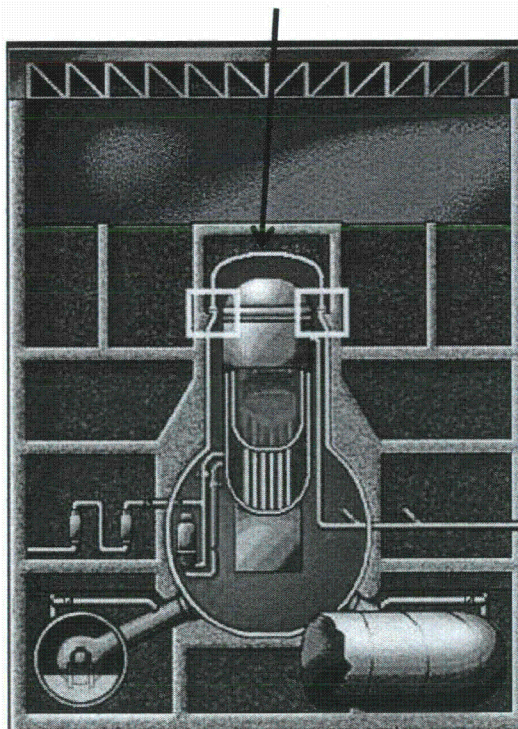
Fukushima: Reactor Vessel-Primary-Secondary Containment Sequence

Primary Coolant System



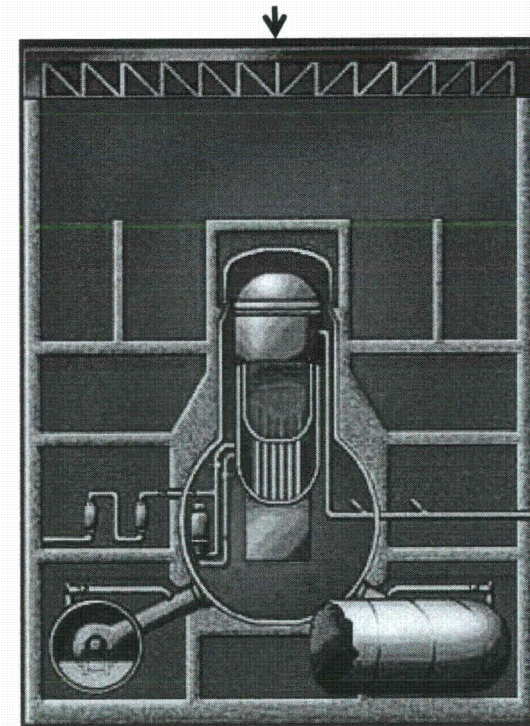
Core Over Heat
-Clad Burst ~900C
-Clad Oxidize ~1200C
-H₂ Release
-Partial Melt~1800C-2700C
-Primary Coolant System Overpressure

Primary Containment



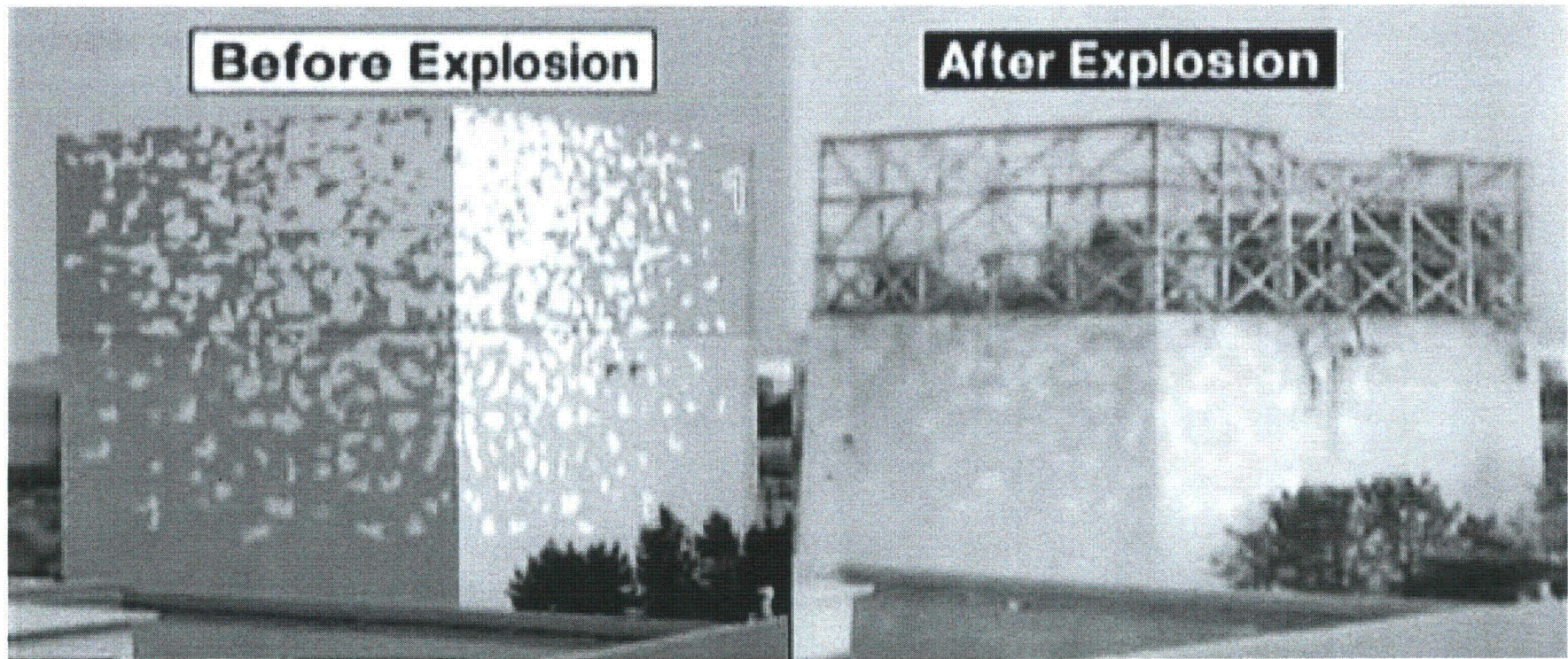
Vent from Primary
Coolant Sys to Primary
Containment- H₂,
Steam, & Fission
Products (Xe, Kr, I, Cs
etc)

Secondary Containment



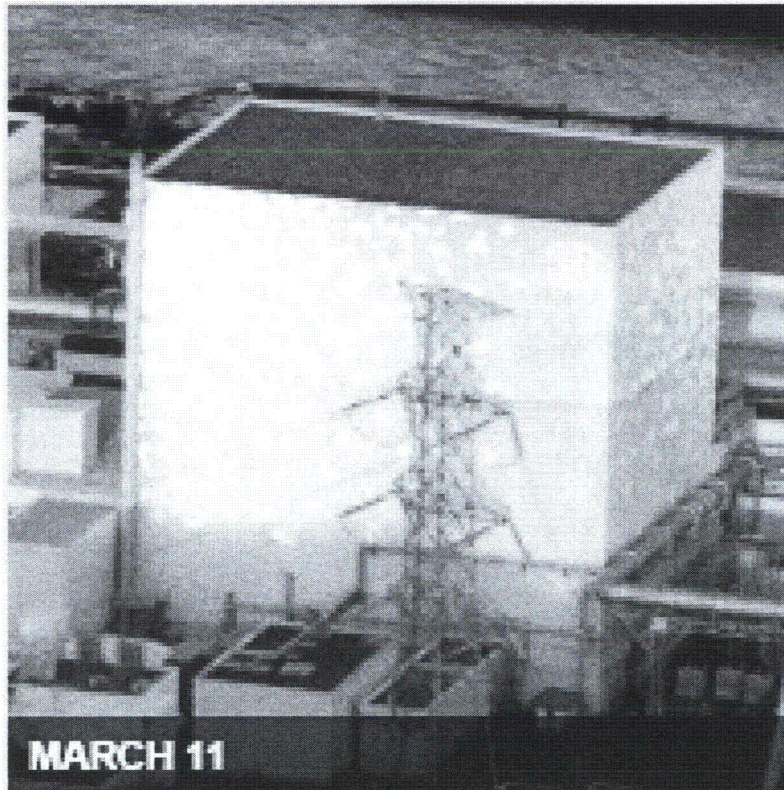
No Primary Containment
Cooling therefore Primary
Containment Overpressure-
Vent to Secondary
Containment

Unit 1 Reactor Building



Unit 3 Reactor Building

Before



Reuters

After



TEPCO

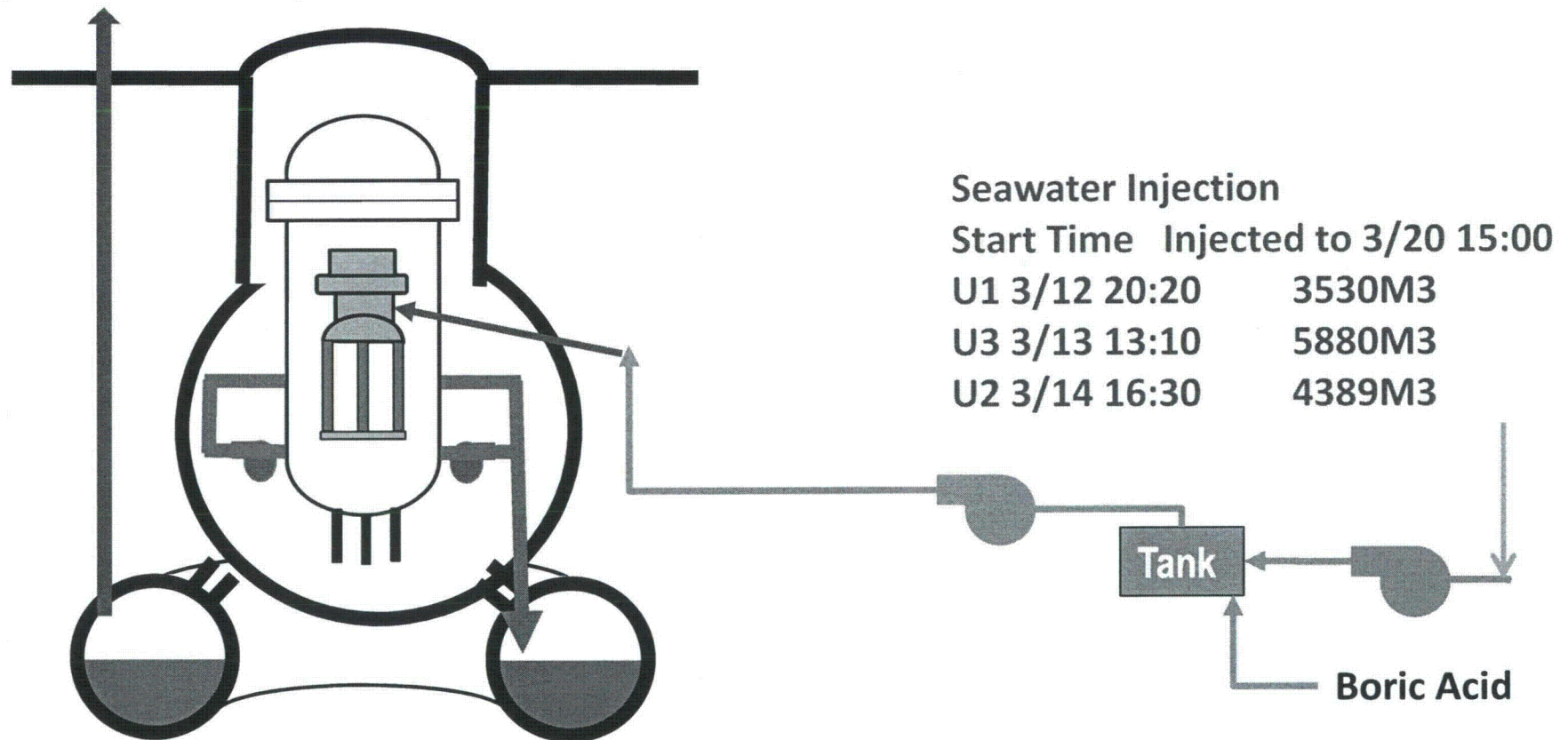
Bleed & Feed Core Cooling Established

Seawater Injection Started Using Fire Engine Pump

Shift to Fresh Water Injection ~3/26-Present: To Dissolve

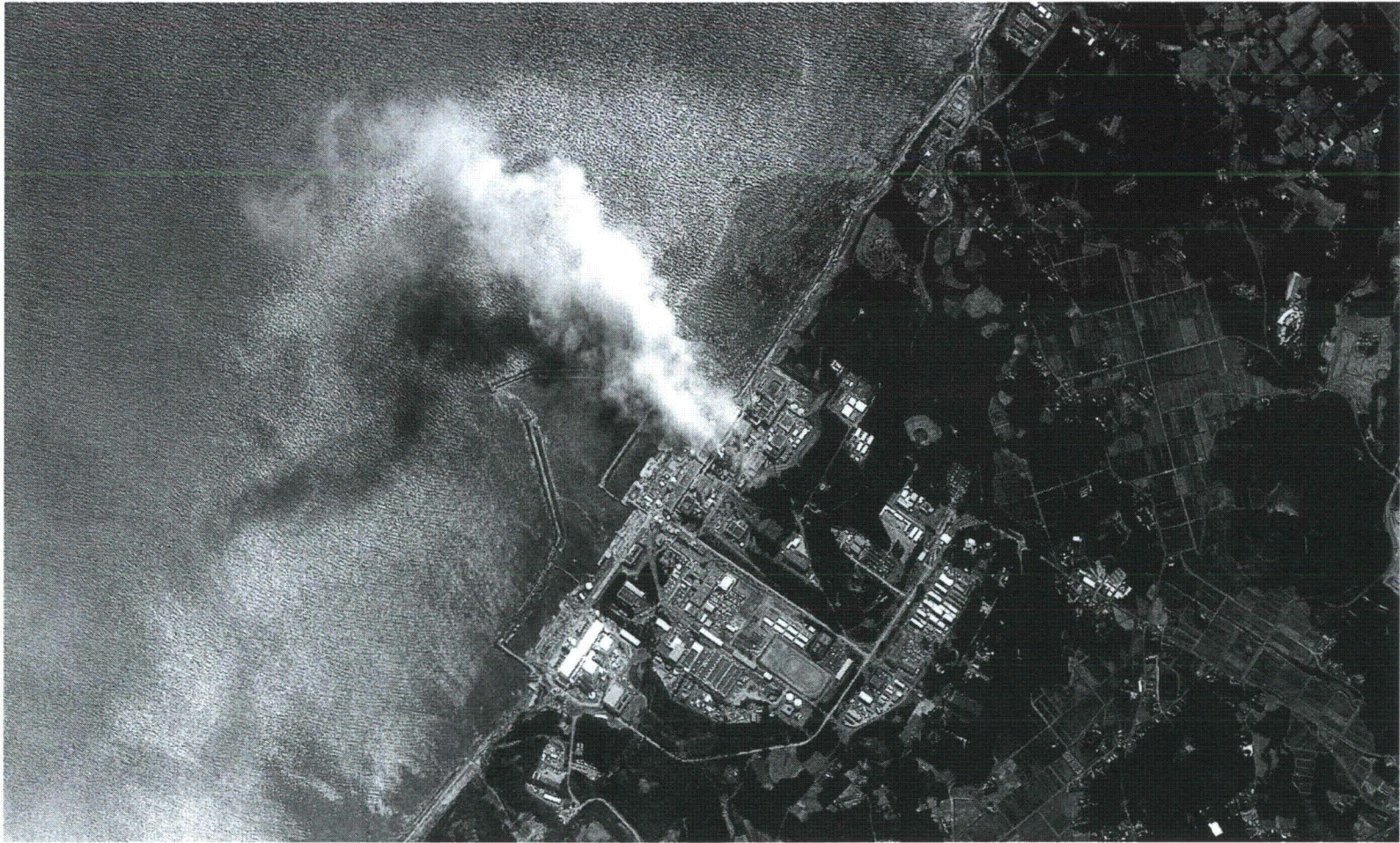
Vapor Venting

Possible Salt Cakes

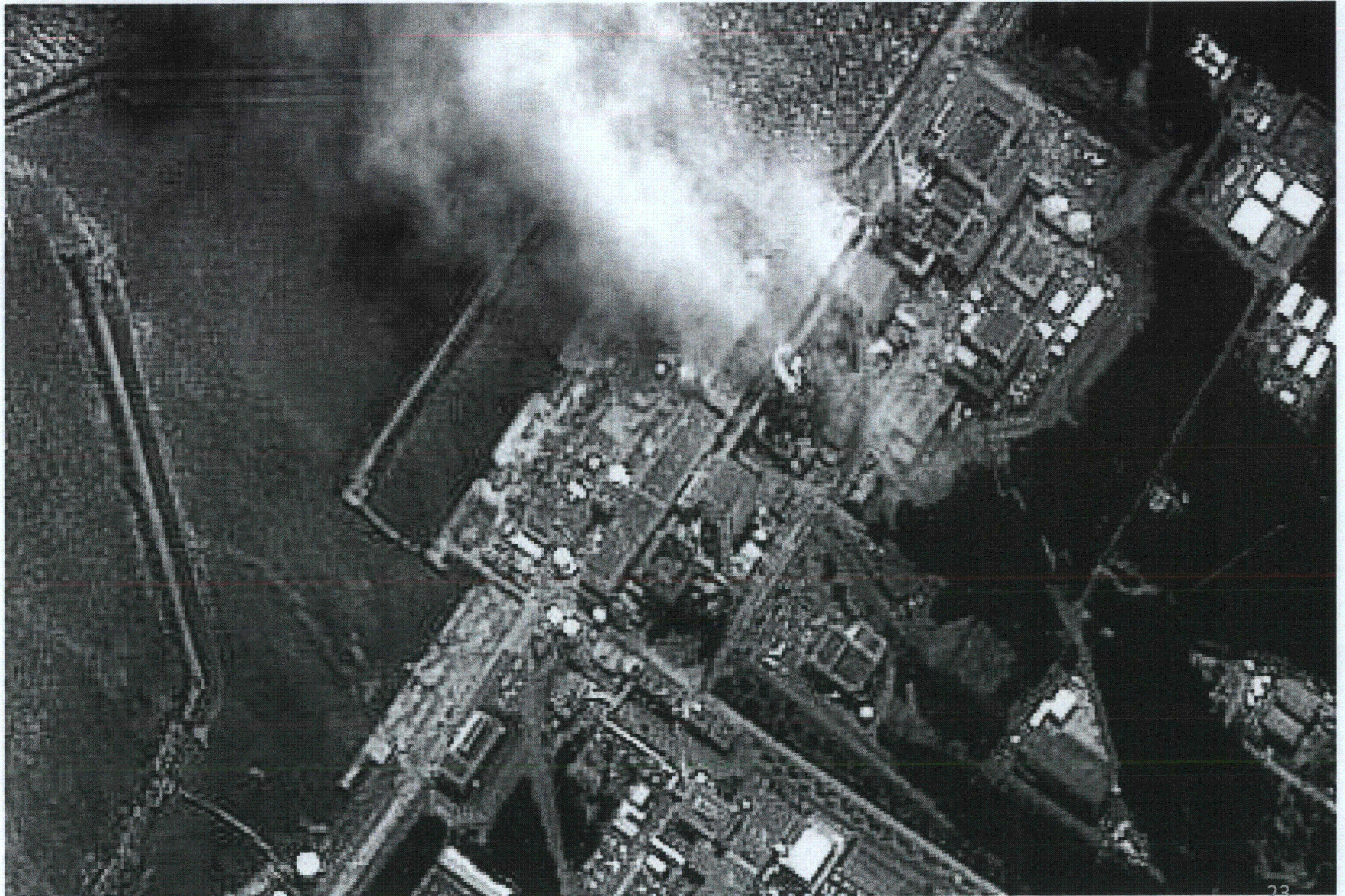


Immediately After Unit 3 Explosion

3/15/11 ~10:00AM JST



Post Unit 3 & Pre Unit 4 Explosion(s)



Reactor Building Cross Section

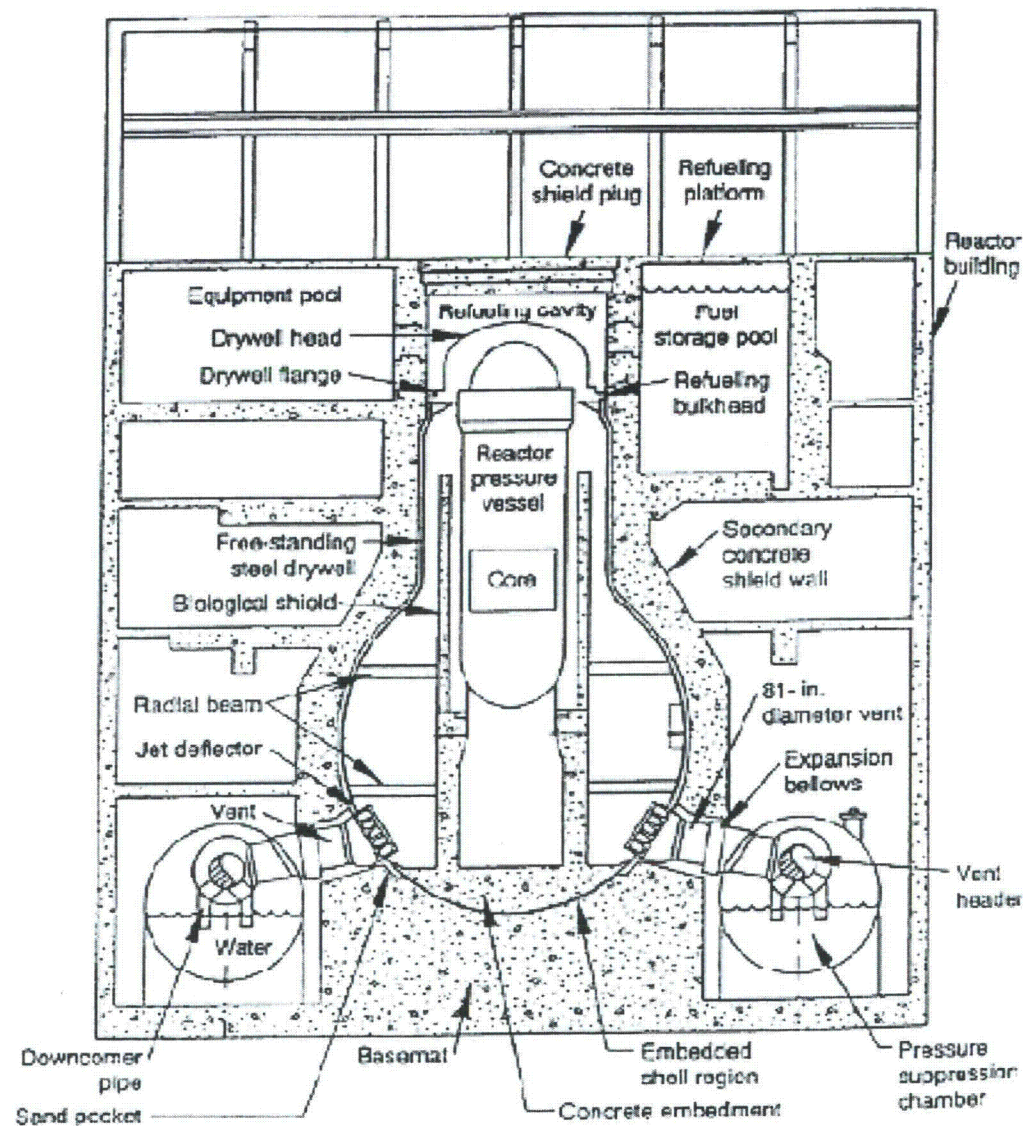
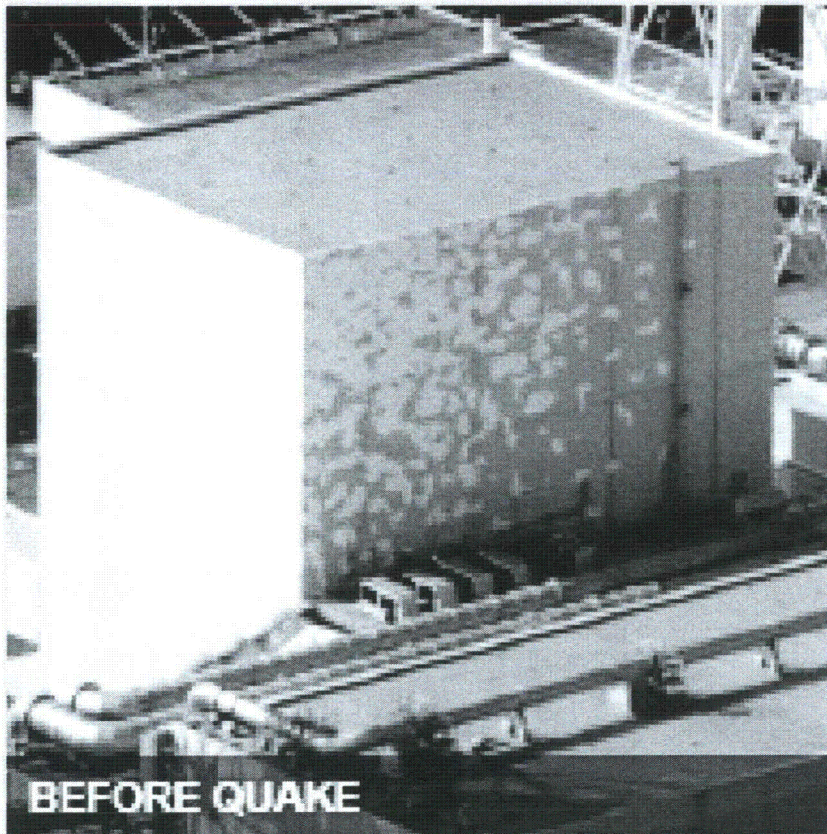


Figure 20. Mark I General Electric, GE BWR Containment.

Unit 4 Reactor Building



Reuters

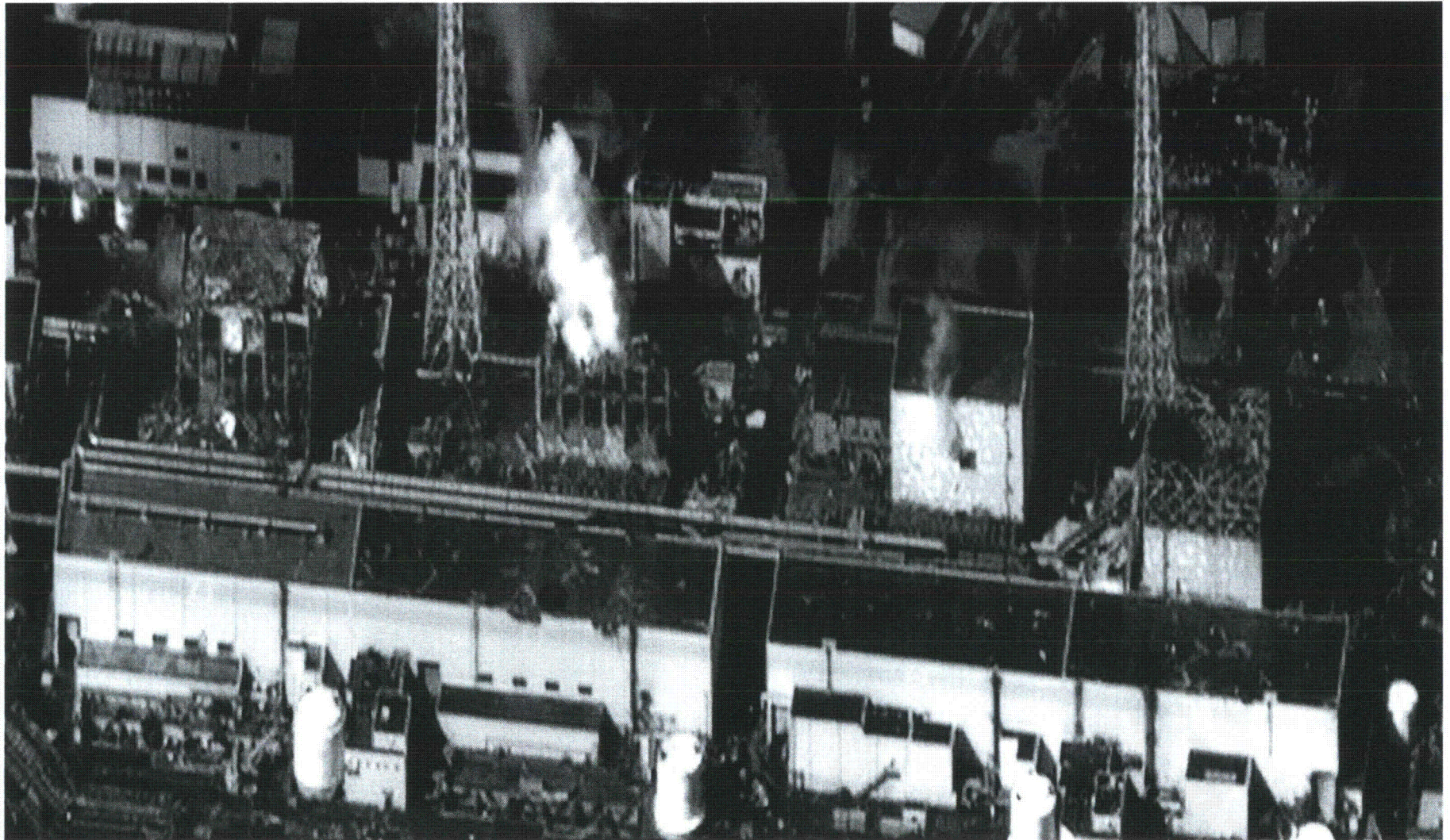


TEPCO

Units 1-6 After U4 Spent Fuel Pool Explosion



Units 1-4 After U4 Spent Fuel Pool Explosion 3/16



Unit 4 Fuel Pool

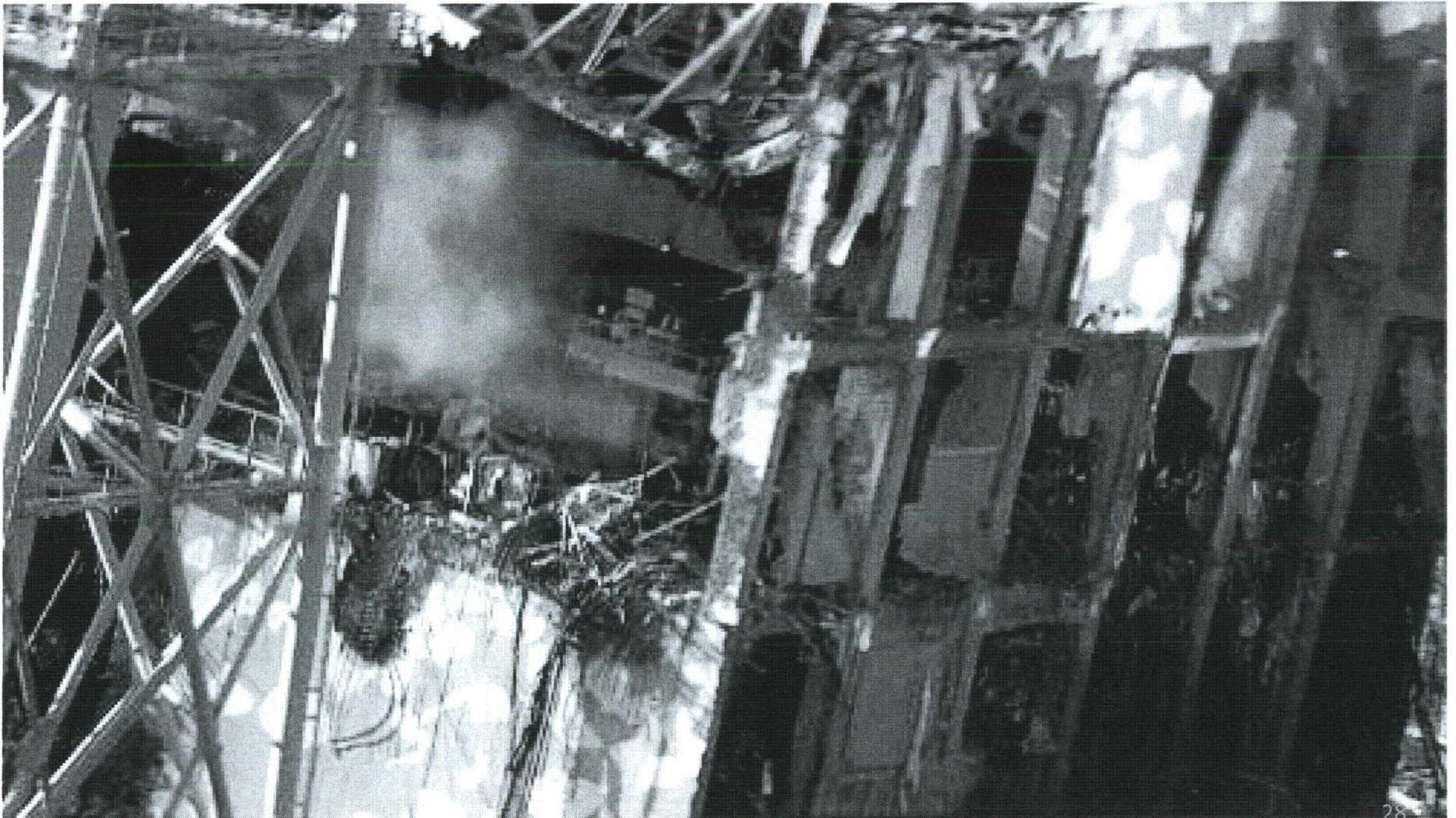
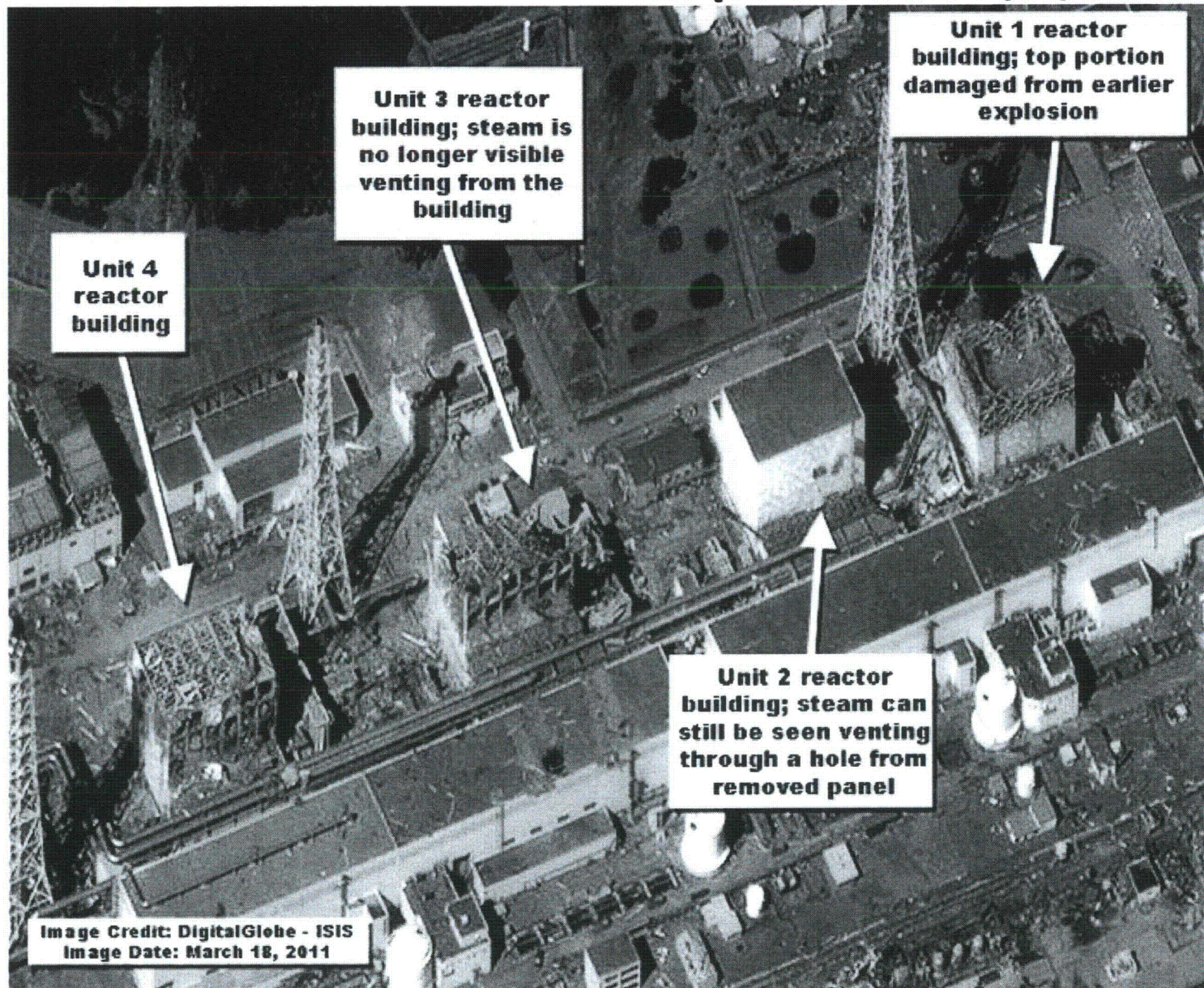
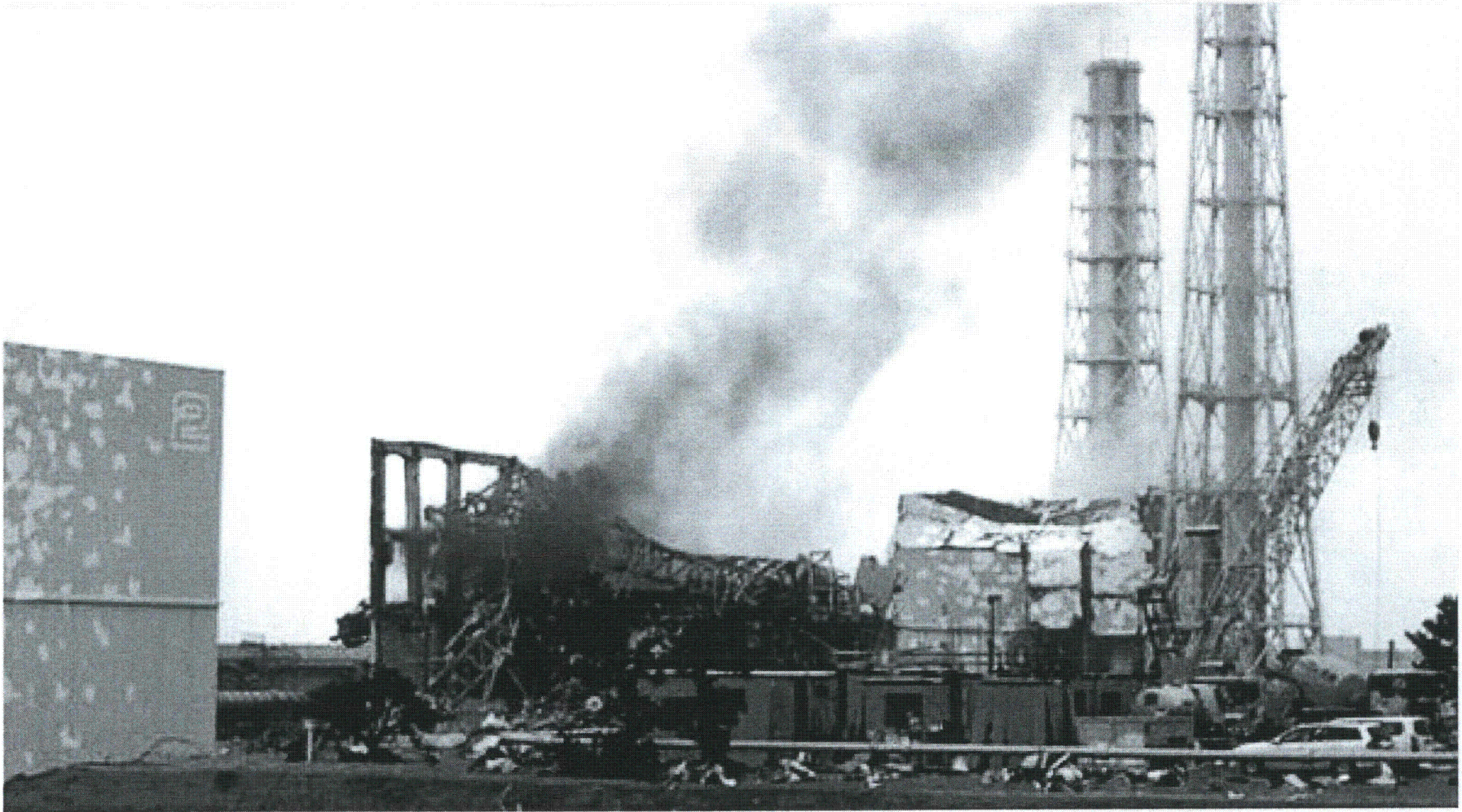


图 4-1 燃料池内部结构 (2011 年 12 月 12 日拍摄)

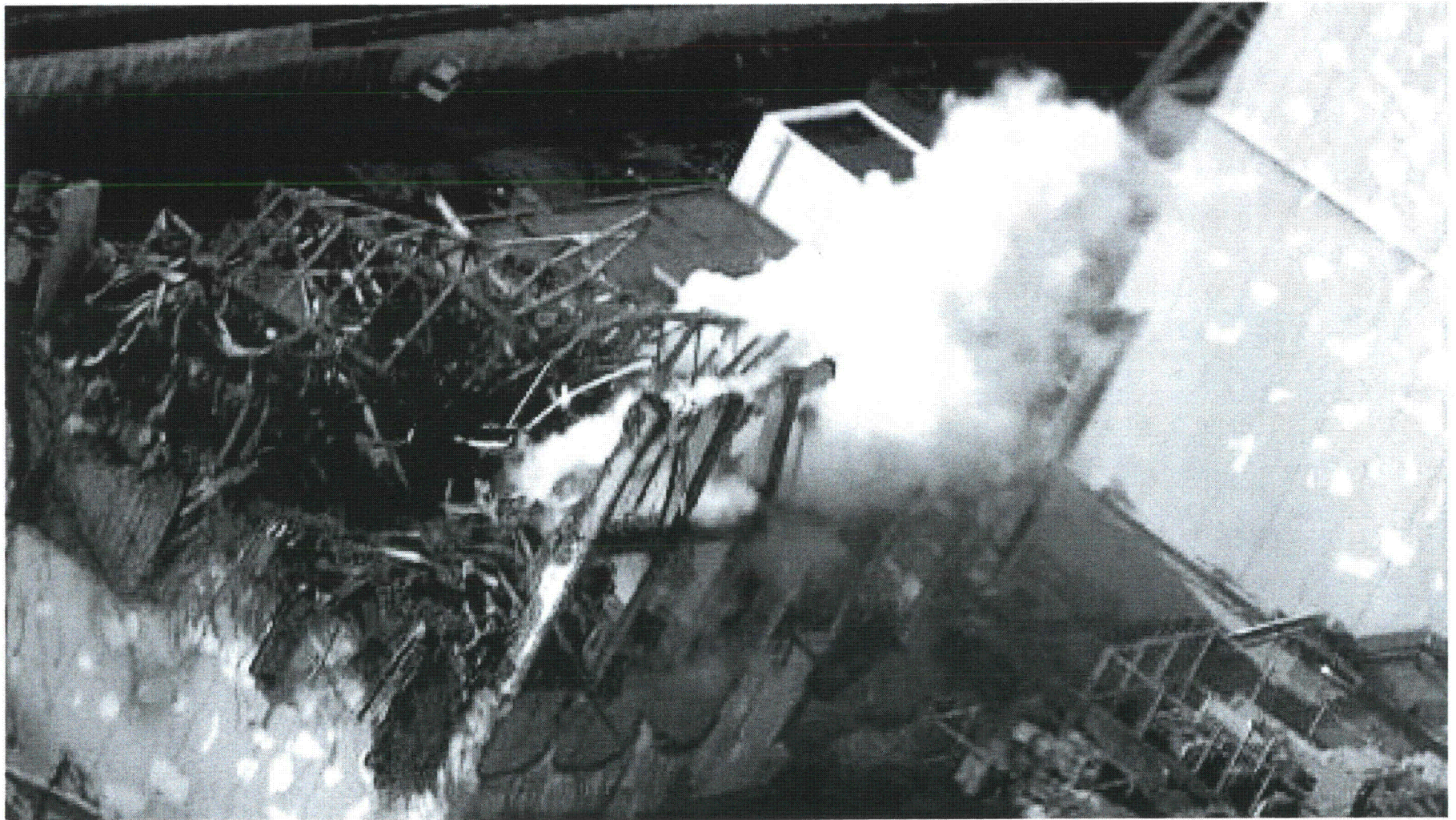
After Unit 4 Explosion(s)



Unit 3 & Unit 4



Unit 3 Spent Fuel Pool March 16



福島第一原子力発電所 3号機(3/16 PM撮影)

Water Spray to Unit 3 Pool Area

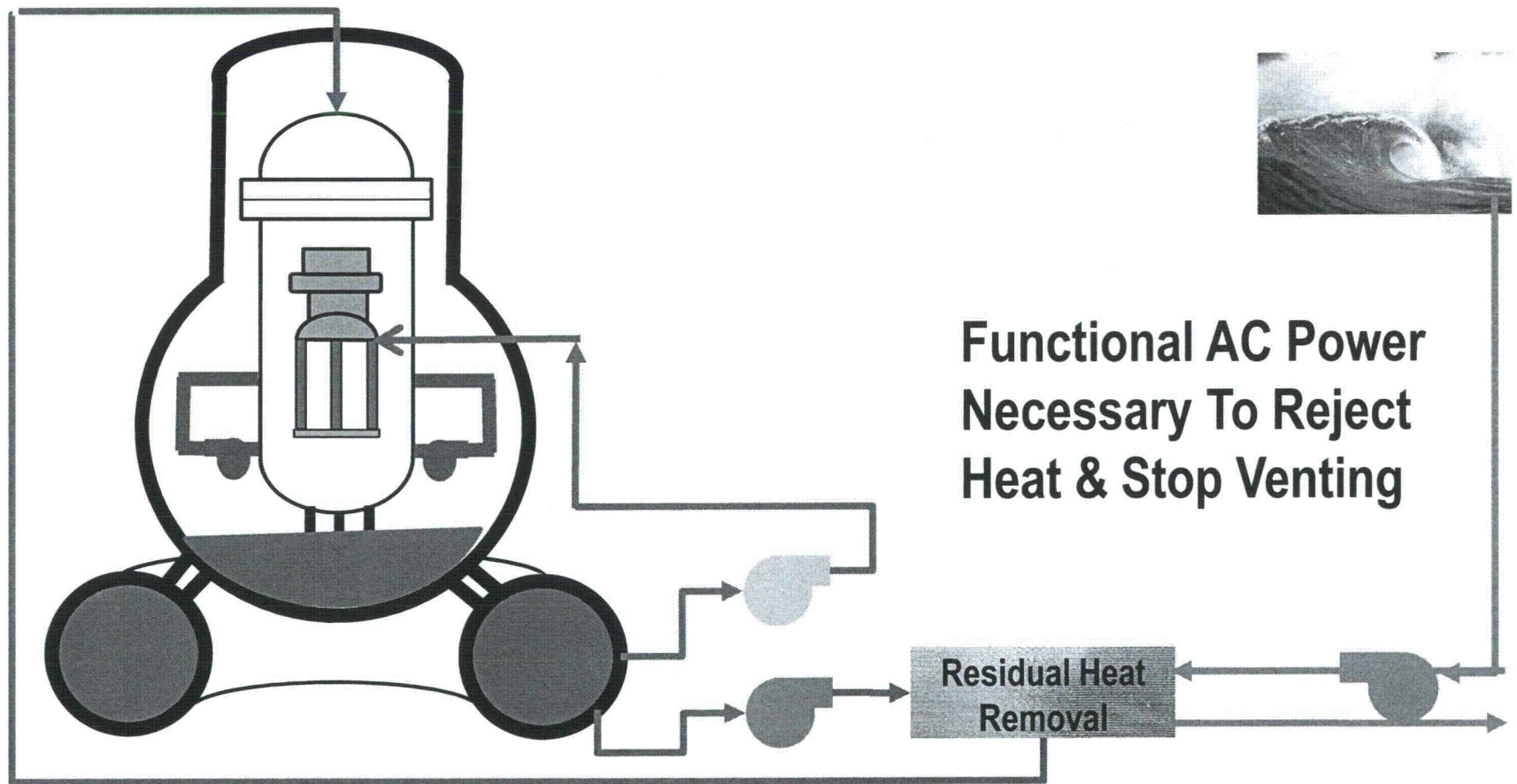


Unit 4 Reactor Building

Water Injection Boom To Spent Fuel Pool

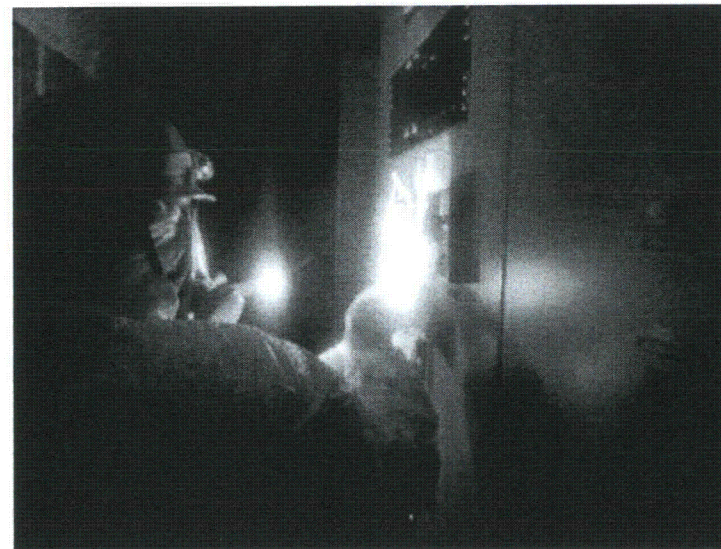
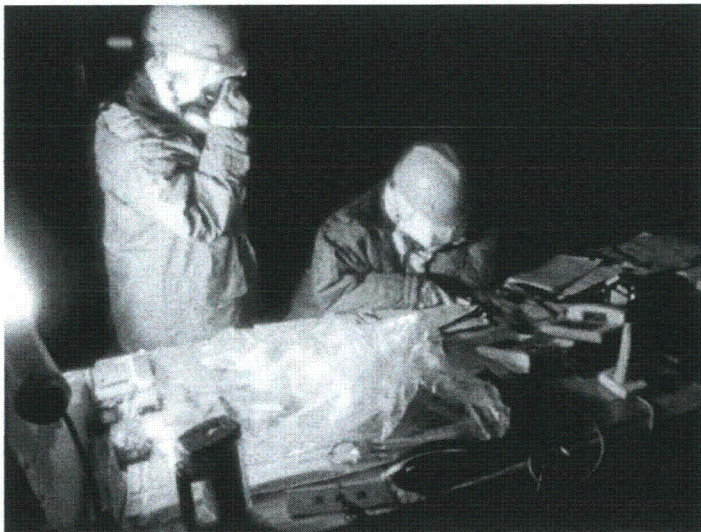
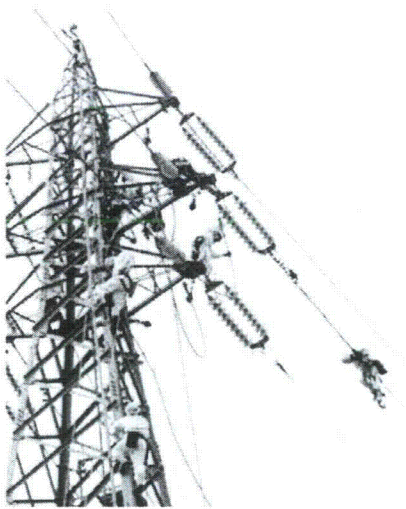


Need Electric Motors To Establish Recirculation Cooling-Ongoing Effort



Working Conditions are Challenging

Restoring Power In High Radiation & Contaminated Areas



Internal Accident Recovery Phases

Per Basic Four Elements

- 1. Energy Heat Rejection Control**
 - 1. Open Feed & Bleed: Cools but Vents**
 - 2. Closed Residual Heat Removal Operation**
- 2. Gas Release Control/Mitigation**
 - 1. Containments**
 - 2. Filtration**
- 3. Liquid Release Control/Mitigation**
 - 1. Containments**
 - 2. Filtration**
- 4. Solids/Contamination Control Materials Management**
 - 1. Contain/package**
 - 2. Store/transport**
 - 3. Dispose**

External Phases Of Accident

- **Plant Accident Recovery Period**
 - Impossible Information Demands
 - Hours-Days-Weeks-?
- **Environmental Impact Period**
 - Public Perception/Impacts/Remediation
 - Weeks-Months-Years
- **Societal/Institutional Reactions Period**
 - Cultural
 - Political
 - Policy
 - Financial
 - Days-Weeks-Months-Years-Decades

Personal Fukushima Observations

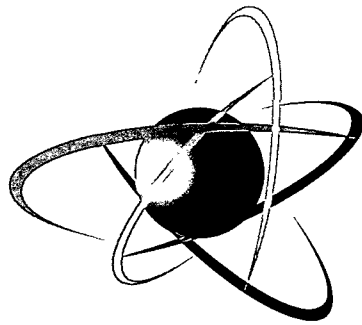
- **Not a Public Health Catastrophe**
 - Inconsequential Compared to Earthquake/Tsunami Impacts
 - US Evacuation Decision Inconsistent
- **Is An Industrial Plant Catastrophe**
 - Three Severely Damaged Cores and Two Severely Damaged Spent Fuel Pool inventories
 - Units 1-4 Complete Loss, Units 5 & 6 Technically Recoverable
 - Cleanup Long, Expensive & Technically Achievable (But Much Larger than TMI)
- **Energy Dissipation is Getting Better, but Challenging**
 - Salt Cake Dissolution Concerns
 - Need Closed Cooling to Stop Venting
- **Environmental Release Mitigation is a Growing Challenge**
 - Technically at Plant
 - Environmental/Social Impact
 - Institutionally Challenging Infrastructure Ahead
- **Lessons Learned Ahead**
 - TMI Lessons Learned Improved US Nuclear Safety and Productivity
 - Most Painful Lessons are the Most Teachable
 - Hopefully the Fukushima Lessons Will Strengthen Nuclear Energy As TMI Did

Lake H. Barrett

Lake@Lbarrett.com

Lake Barrett is a part time independent consultant in the energy field. He has worked in the nuclear energy and nuclear materials management areas for over 4 decades, most recently as the former head of the US Department of Energy's Office of Civilian Nuclear Waste Management which is responsible for implementing the United States' programs for spent nuclear fuel and high-level radioactive waste, as mandated by the Nuclear Waste Policy Act. In that capacity, he lead the complex scientific Yucca Mountain Geologic Repository program through the statutory site selection process culminating with the Presidential site designation and following successful House and Senate votes.

He also served at U. S. Nuclear Regulatory Commission, where he was directly involved with the early response to the Three Mile Island reactor accident and became the Site Director, responsible for regulatory programs during the stabilization, recovery, and cleanup of the damaged reactor. He also has had extensive managerial and engineering experiences in DOE's Defence Programs and private industry at both Bechtel Power Corporation, with commercial nuclear power plants, and Electric Boat Division of General Dynamics with nuclear reactor and submarine systems design, operation, and decommissioning.



U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Events at Fukushima Units 1-4

March 30, 2011

Bill Dean, Regional Administrator

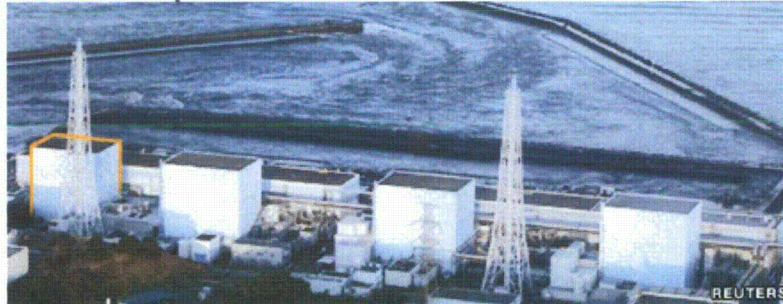
Y/304

Fukushima Units 1 - 4



3/11 Earthquake & 3/12 Unit 1 Hydrogen Explosion

After earthquake 11 March



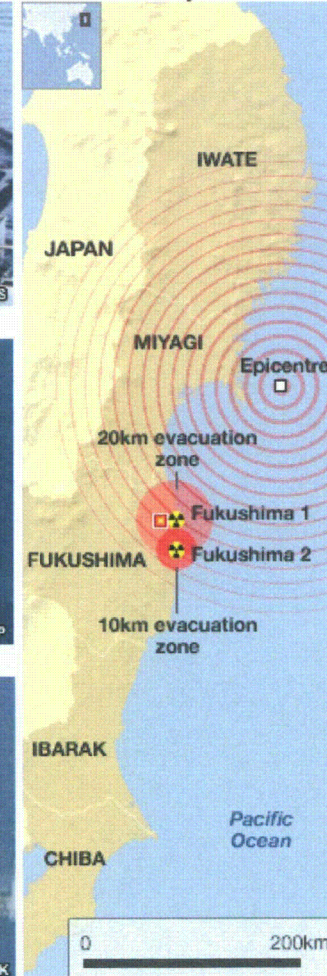
Explosion 0630 GMT 12 March



After explosion 0730 GMT



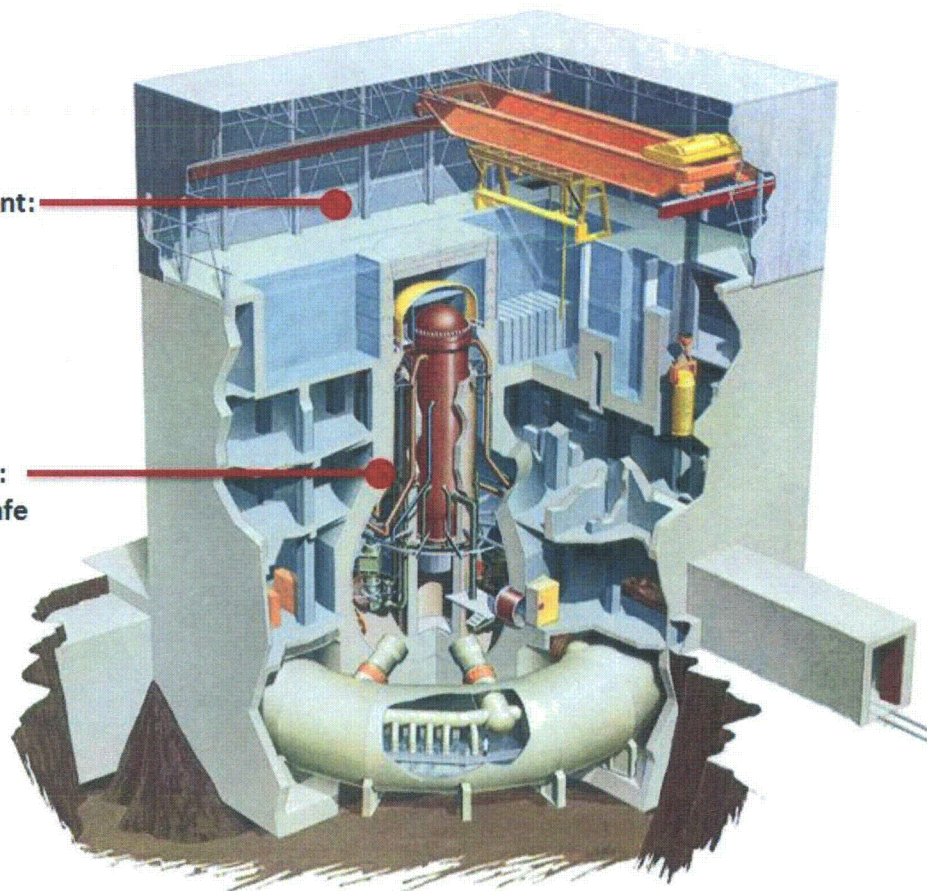
Fukushima plants



BWR with Mark 1 Containment

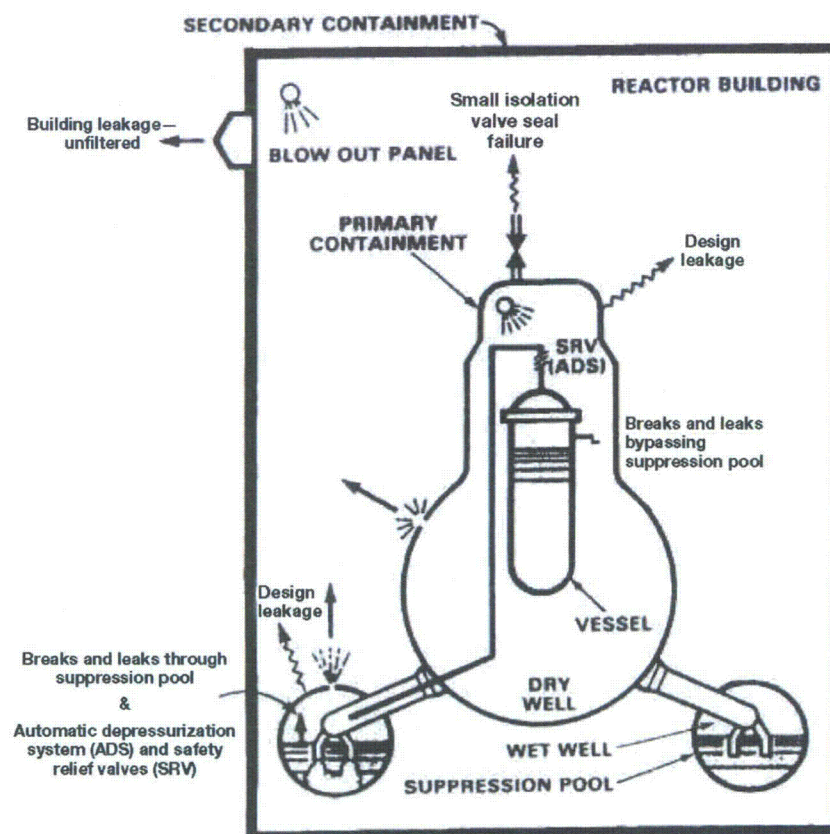
Secondary containment:
Area of explosion at
Fukushima Daiichi 1

Primary containment:
Remains intact and safe

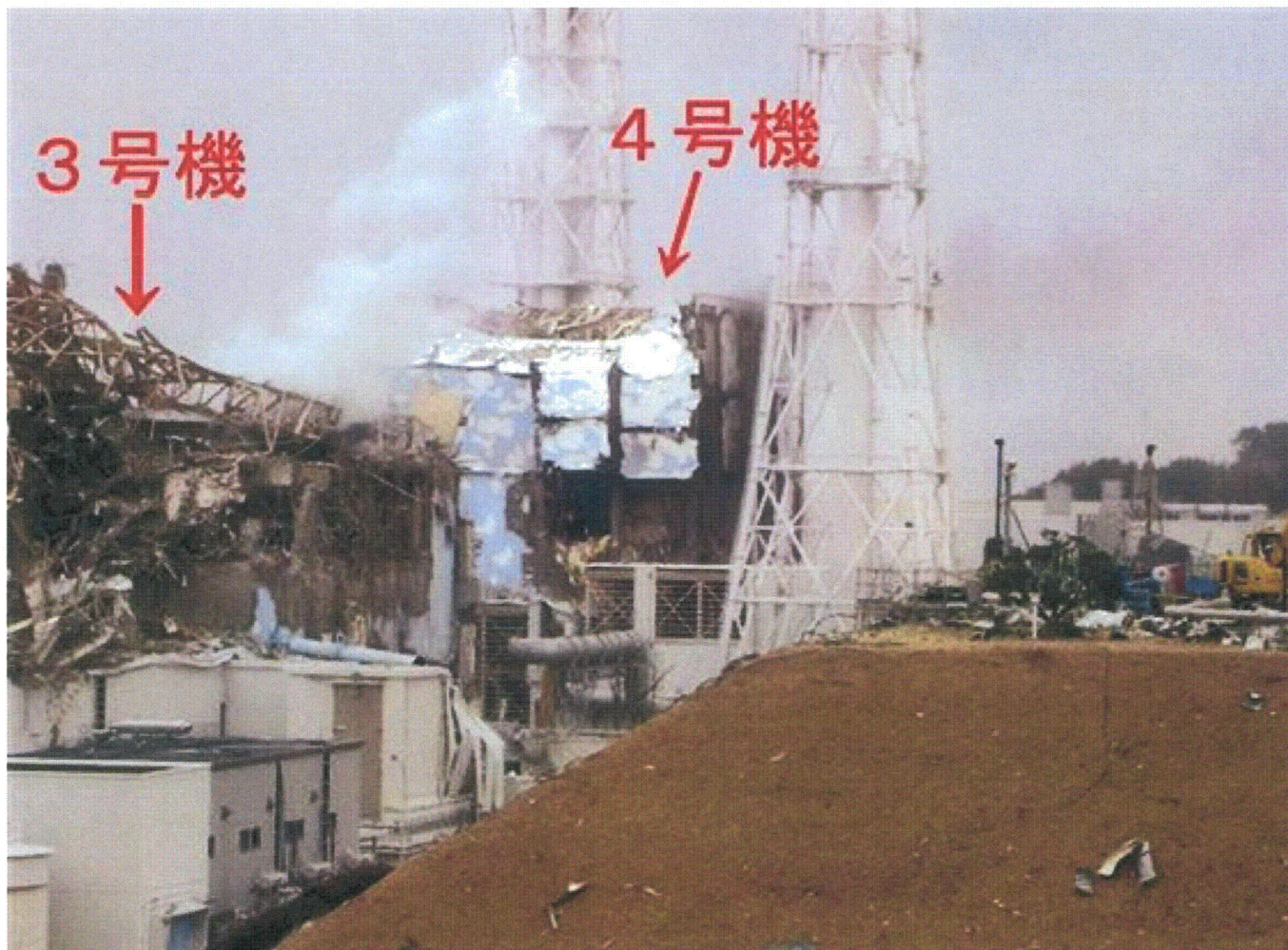


Boiling Water Reactor Design

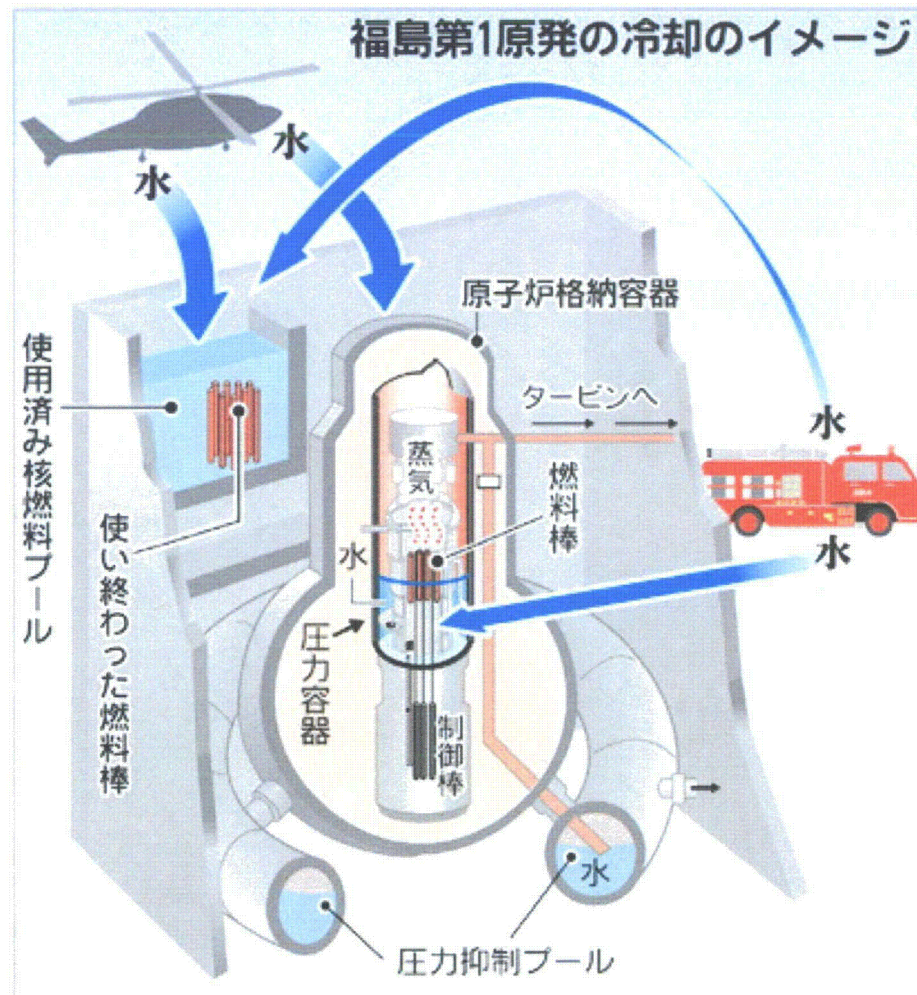
Mark I Containment Release Pathways Simplified



Most Recent View of Units 3 & 4



Japanese Depiction of Cooling Water Sources at Units 3 & 4 (Prior to the Return of Offsite Power)





Current Conditions - NRC's Assessment

- Units 1, 2, 3 Stable w/some degree of core damage. Being cooled with fresh water.
- Units 2 and 3 some primary containment damage. Releases of radioactivity including significant contamination in the lower levels of the Unit 2 and Unit 3 turbine buildings.
- The spent fuel pools on Units 1-4 have experienced varying water levels, but also have been receiving seawater from helicopters and spray systems.



Current Conditions - NRC's Assessment Cont.

- The U-2 spent fuel pool receiving fresh water and they are trying to change all the units from fire trucks to normal pumping in the next few days.
- Tokyo Electric Power Company has restored electric power to the site and the six reactor control rooms, and the situation, in general, continues to further stabilize, although many hurdles remain.



NRC Response Efforts

- NRC continues to monitor the unfolding events in Japan.
- NRC is coordinating their response with other federal agencies.
- NRC has deployed a team to Tokyo.
- NRC providing technical assistance to the U.S. Ambassador in Japan and the Japanese Government.
- NRC continues assessment of radiological conditions, dose projections, and protective action recommendations.
- NRC Chairman Jaczko in Japan this week and keeps White House apprised.



Ensuring Reactor Safety

- General Design Criteria (10CFR50, Appendix A) lay out the deterministic basis for the design of nuclear power plant safety systems.
- In 1975 NRC completed its first PRA study and continues to evaluate the risks to the public from the operation of nuclear power plants to within our safety goals by limiting the chance of core damage and fission product release to the environment.



Ensuring Reactor Safety

- Significant activity to evaluate the chance and consequences of a Station Blackout (SBO Rule 10CFR50.63 1988) plant procedures and changes implemented in the 1990s.
- Generic Letters 88-20 “Individual Plant Examination for Severe Accident Vulnerabilities”
- NRC Maintenance Rule (10CFR50.65, 1991) Implemented in 1996



Ensuring Reactor Safety

- In 2000 the NRC implemented the Reactor Oversight Program (ROP).
- Following September 11, 2001, the NRC and industry conducted detailed assessments . NRC issued orders for licensees to take actions to develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire, to include strategies in the following areas: (i) Fire fighting; (ii) Operations to mitigate fuel damage; and (iii) Actions to minimize radiological release.



NRC Initiatives

- NRC Issued Information Notice 2011-005
- NRC Commission supported the establishment of an agency task force.
- Temporary Instruction 2515/183
- Ongoing Communications with the public, Congressional, State (SLO), Local Agencies

Dunham, Katrina

From: Jackson, Donald
Sent: Wednesday, March 30, 2011 6:35 PM
To: Dunham, Katrina
Subject: FW: F1 plant parameters on Marc 23

From: Trapp, James
Sent: Wednesday, March 23, 2011 11:37 PM
To: Jackson, Donald
Subject: RE: F1 plant parameters on Marc 23

We've had 600 quakes since I arrived with 300 over 5 on the Richter scale. It's really a bit unnerving.

From: Jackson, Donald
Sent: Wednesday, March 23, 2011 7:27 PM
To: Trapp, James
Subject: RE: F1 plant parameters on Marc 23

Are you experiencing many quakes?? Are they big ones??

From: Trapp, James
Sent: Wednesday, March 23, 2011 7:26 PM
To: Jackson, Donald
Subject: RE: F1 plant parameters on Marc 23

Earthquakes are more scary than the zoomies.

From: Jackson, Donald
Sent: Wednesday, March 23, 2011 7:25 PM
To: Trapp, James
Subject: RE: F1 plant parameters on Marc 23

Hi Jim....I bet this experience is something you will tell your grandchildren about...please stay safe!

From: Trapp, James
Sent: Wednesday, March 23, 2011 7:22 PM
To: Wilson, Peter; Jackson, Donald; Rogge, John
Subject: FW: F1 plant parameters on Marc 23

From: Sano, Mikako [SanoMX@state.gov]
Sent: Wednesday, March 23, 2011 1:16 AM
To: Uchida, Koichi; Cherry, Ronald C; NITOPS; JapanEmbassy, TaskForce
Cc: Alan Remick; Aleshia Duncan; Duncan, Aleshia D; Trapp, James; James Trapp (BB); Mears, Jeremy M; Morales, Russell A; Ulises, Anthony; OConnor, Rod; Bryan, William; Williams, Melvin; Hurlbut, Brandon; Anderson, Margot; Mueller, Stephanie; LaVera, Damien; Damian Peko; Reynolds, Tom; Hunsaker, Christopher; Koontz, Thomas; Leistikow, Dan;

Zubarev, Jill E; Cherry, Ronald C; Miller, Chris
Subject: RE: F1 plant parameters on Marc 23

Dear all,

You may have already seen them, but just in case.

NISA releases updated information on seismic damage including F1 plant parameters.

English version is released a several hours later than Japanese one.

As of 18:00 of March 22 (English)

<http://www.nisa.meti.go.jp/english/files/en20110322-4-1.pdf>

As of 8:00 of March 23 (Japanese)

<http://www.meti.go.jp/press/20110323002/20110323002-1.pdf>

Mikako Sano/ ECON

From: Uchida, Koichi

Sent: Wednesday, March 23, 2011 12:09 PM

To: Cherry, Ronald C; 'NITOPS'; JapanEmbassy, TaskForce

Cc: 'Alan Remick'; 'Aleshia Duncan'; Duncan, Aleshia D; 'James Trapp'; 'James Trapp (BB)'; Mears, Jeremy M; Morales, Russell A; 'Tony Ulses'; 'OConnor, Rod'; Bryan, William; 'Williams, Melvin'; 'Hurlbut, Brandon'; 'Anderson, Margot'; 'Mueller, Stephanie'; 'LaVera, Damien'; 'Damian Peko'; 'Reynolds, Tom'; 'Hunsaker, Christopher'; 'Koontz, Thomas'; 'Leistikow, Dan'; Zubarev, Jill E; Cherry, Ronald C; 'Chris.Miller@nrc.gov'; Sano, Mikako

Subject: F1 plant parameters on Marc 23

Plant parameters of Fukushima -1 as of 06:00 on March 23 is attached.

<http://www.meti.go.jp/press/20110323002/20110323002-3.pdf>

Uchida
DOE Tokyo

This email is UNCLASSIFIED.

Dunham, Katrina

From: Jackson, Donald
Sent: Wednesday, March 30, 2011 6:35 PM
To: Dunham, Katrina
Subject: FW: March 20, 2011- 2000- CA Briefing On Japan Reactor Accidents

From: Trapp, James
Sent: Monday, March 21, 2011 1:19 AM
To: Jackson, Donald
Subject: RE: March 20, 2011- 2000- CA Briefing On Japan Reactor Accidents

Our you running the IRC or is this just a collateral duty? Thanks

From: Jackson, Donald
Sent: Sunday, March 20, 2011 8:40 PM
To: Dean, Bill; Lew, David; Wilson, Peter; Roberts, Darrell; Collins, Daniel; Lorson, Raymond; Baker, Pamela; Walker, Tracy; Clifford, James; Miller, Chris; Weerakkody, Sunil
Cc: Screnci, Diane; Sheehan, Neil; Trapp, James; McNamara, Nancy; Tifft, Doug; Hansell, Samuel; Hinson, Felicia; McKinley, Raymond; Rogge, John; Jackson, Donald; Cook, William
Subject: March 20, 2011- 2000- CA Briefing On Japan Reactor Accidents

The following is a synopsis of the briefing with changes or noteworthy items underlined:

Status of Fukushima Daiichi Units:

Unit 1-
No Significant Change

Unit 2-
TEPCO has offsite power to an aux transformer- Working to restore control room envelope and ventilation, and switchgear/pumps/etc
Primary Containment intact as RCS is at a positive pressure

Unit 3-
No Significant Change
External seawater spray applied most of day

Unit 4-
No Significant Change
Water sprayed on SFP up to 4 times today, now this is TEPCO highest priority

Other Issues-
Unit 5 and Unit 6- Both have AC Power
Unit 5 and Unit 6 SFPs Being Positively Cooled

Bechtel spray system still in Perth, Australia to leave at 11pm EDT. Single train to still be shipped to Japan today with 2 techs, unsure if TEPCO will use it.

The band of elevated dose rates up to 18 mi from plant to the northwest seems to coincide with the only time wind was blowing in that direction being when the "lube oil fire" occurred on Unit 4 when we thought a H2 detonation and SFP fire occurred.

In country team is reported to be frustrated with the lack of information and cooperation that they are receiving

I-131 reported in milk, spinach, and tap water near Tokyo, team is trying to confirm

NRC priority is still to continue dose assessment with the minimal information, and get our own information for confirmation.

More at 0730 Monday from the NEW RDO...Mr. John Rogge...

Detailed info in attachment!

VR

Don Jackson

Chief- Region I DRP PB5
610) 337-5306

Dunham, Katrina

From: Jackson, Donald
Sent: Wednesday, March 30, 2011 6:35 PM
To: Dunham, Katrina
Subject: FW: March 18, 2011- 2000- CA Briefing On Japan Reactor Accidents

From: Trapp, James
Sent: Saturday, March 19, 2011 5:22 AM
To: Jackson, Donald
Subject: RE: March 18, 2011- 2000- CA Briefing On Japan Reactor Accidents

What a mess!

From: Jackson, Donald
Sent: Friday, March 18, 2011 8:45 PM
To: Dean, Bill; Lew, David; Wilson, Peter; Roberts, Darrell; Collins, Daniel; Lorson, Raymond; Baker, Pamela; Walker, Tracy; Clifford, James; Miller, Chris; Weerakkody, Sunil
Cc: Screnci, Diane; Sheehan, Neil; Trapp, James; McNamara, Nancy; Tifft, Doug; Hansell, Samuel; Hinson, Felicia; McKinley, Raymond; Rogge, John; Jackson, Donald
Subject: March 18, 2011- 2000- CA Briefing On Japan Reactor Accidents

The following is a synopsis of the briefing with changes or noteworthy items underlined:

Status of Fukushima Daiichi Units:

Unit 1-
No Significant Change

Unit 2-
No Significant Change

Unit 3-
No Significant Change, new photos of Unit 3 from west to east provided to in country team by TEPCO show massive structural and system damage to multiple levels of the reactor building. The photos are being analyzed by the team and General Electric to determine potential for extreme SFP damage, and whether or not the drywell head is intact.

Unit 4-
No Significant Change

Other Issues-
Unit 5 and Unit 6- Both have AC Power
Unit 5 and Unit 6 SFPs Being Positively Cooled

Chairman on a conference call this evening with Naval Reactors and INPO, purpose of call unknown

Water sprays to Unit 3 having little or no impact

AMS flyovers have shown most deposition now north and west of plant with a narrow band where 13 miles from the site, the 4 day integrated dose to a member of the public would be 1 REM.....the 50 mile evacuation was a good call

NARAC has some calculations that may show meaningful I-131 uptake is possible in the Aleutian Islands, more work being done

San Onofre and Diablo Canyon may have detected small amounts of I-131.....being confirmed

Large press contingent has confirmed plans to be at Monday Commission meeting.

VR

Don Jackson

Chief- Region I DRP PB5
(610) 337-5306

Rihm, Roger

From: Rihm, Roger
Sent: Wednesday, March 30, 2011 8:38 AM
To: Landau, Mindy
Subject: Items prepared for Chairman yesterday
Attachments: seismic margin.docx; Hill staff ques_NRR responses.docx; ISFSI & Info Notice.docx; NAS Study on Spent fuel.docx; UPDATE: Isotopic make up of spent fuel including MOX

Do you also want items prepared for Weber?

Y/208

Use of Margin in Seismic Analysis

- Currently operating reactors (licensed prior to 1997) had their seismic regulatory basis in the General Design Criteria 2 in Appendix A to Part 50. That standard required that the design bases include "sufficient margin." This was an undefined term that varied across facilities.
- Proposed new reactors (submitted after 1997) have to demonstrate a seismic margin of 1.67 times the site-specific 10,000 year ground motion that defines the Safe-Shutdown earthquake ground motion (SSE). That is, the high confidence of low probability of failure for a plant (where failure is defined by some type of core damage) should be at least 1.67 times the ground motion acceleration of the design basis safe-shutdown earthquake (SSE). (*HCLPF=the high confidence (more than 95% confidence) of low probability (less than 5%)*)
- For the ongoing and planned GI 199 analyses we anticipate evaluating the seismic margin in the existing facilities using the same techniques as we are using for new facilities.

Other helpful info: The seismic margin in existing plants arises from several factors including (1) the use of a relatively infrequent design basis earthquake scenario, (2) the use of conservative design spectral shape, and (3) the application of conservative design philosophy in the codes and standards used by the nuclear industry. The "design spectral shape" is the relative strength of different frequencies of vibration in the ground motion.)

ISFSI Security Rule Status

- In November 2010, (SRM SECY-10-0114) the Commission approved expanding the rulemaking to include spent nuclear fuel stored at monitored retrievable storage installations and directed the staff to expand stakeholder outreach.
- The staff is currently performing outreach to licensees, States, tribes, and other stakeholders who are authorized to have Safeguards information. Outreach to non-authorized stakeholders is also being performed but is limited to publically available information.
- An information paper will be provided to the Commission in November 2011, providing the results and analysis of stakeholder comments.
- Proposed Rule and Draft Regulatory Guidance due in July 2013.
- Final Rule due in July 2014

NRC Information Notice 2011-03: Nonconservative Criticality Safety Analyses For Fuel Storage

(<http://pbadupws.nrc.gov/docs/ML1030/ML103090055.pdf>)

- The staff concern has to do with the treatment of uncertainties in licensee calculations to determine the safety margin for criticality events in spent fuel pools.
- Staff review of 2 amendment requests from separate operating power reactor licensees have identified minor errors (nonconservative) in licensee's criticality analyses such that those licensees may not be in compliance with NRC regulations.
- The staff believes there is ample margin based on analyses being performed.
- The staff finding implies that some licensee margins for criticality in spent fuel pools are slightly smaller than previously determined.
- NRC has an action plan and is working on clarifying guidance to improve quality of analyses.

NAS Study on Spent fuel

- RES staff indicates that the Washington Post op-ed piece by Matt Bunn of Harvard was retracted because its basic assertion (improvements have not been made) is incorrect. We have implemented both water spray and fuel distribution.
- Regarding implementation of other suggestions from NAS and elsewhere in light of events in Japan – We have not gotten complete information yet about Japan, so won't speculate.

Merzke, Daniel

From: Merzke, Daniel
Sent: Wednesday, March 30, 2011 9:04 AM
To: Morris, Scott
Subject: RE: Fukushima Reactor Event & Commission Assistants Briefings

Hey Scott. An earlier e-mail mentioned that this issue was going to be discussed this morning at the 0800 status briefing with the CAs. Do you know if there was any discussion? If so, were the CAs on-board with a daily briefing at 1300? I'm trying to figure out what action I need to take. Thanks.

Dan

From: Morris, Scott
Sent: Wednesday, March 30, 2011 6:02 AM
To: Merzke, Daniel
Cc: Wiggins, Jim; ET05 Hoc; Virgilio, Martin; Weber, Michael; McDermott, Brian; Gott, William; Marshall, Jane; HOO Hoc
Subject: Fukushima Reactor Event & Commission Assistants Briefings

Dan ...

The Executive Team in the Operations Center was tasked yesterday with providing a recommendation for a once-per-day Commissioner Assistants (CAs) briefing vice the current twice-per-day schedule (i.e., 0730 and 2000). Based on the current schedule of standing meetings and routine phone calls, the ET recommends that a daily CA briefing be conducted at 1300 to minimize the potential for conflict with other known activities. Please coordinate with the EDO/DEDOs and the Commissioner's offices to determine if this proposed time is acceptable.

Thanks!

Scott

Rihm, Roger

From: Rihm, Roger
Sent: Wednesday, March 30, 2011 2:33 PM
To: Schmidt, Rebecca
Subject: RE: NAS info for Chr
✓ **Attachments:** NAS Study on Spent fuel.docx

See attached. It was responding to the questions David Decker gave me yesterday AM

From: Schmidt, Rebecca
Sent: Wednesday, March 30, 2011 2:31 PM
To: Rihm, Roger
Subject: NAS info for Chr

Do you still have that? Somewhere along the line yesterday, the Chr was missing it. Can you email me what you have?

NAS Study on Spent fuel

- RES staff indicates that the Washington Post op-ed piece by Matt Bunn of Harvard was retracted because its basic assertion (improvements have not been made) is incorrect. We have implemented both water spray and fuel distribution.
- Regarding implementation of other suggestions from NAS and elsewhere in light of events in Japan – We have not gotten complete information yet about Japan, so won't speculate.

Rihm, Roger

From: Rihm, Roger
Sent: Wednesday, March 30, 2011 3:21 PM
To: 'hoc.pmt12@nrc.gov'
Subject: Per conversation

Sandra, I need to update 3/29/11 Borchardt congressional testimony for use by Virgilio or Leeds on 4/6/11. One sentence reads as follows:

"Natural background radiation from sources such as rocks, the sun, and buildings, is 100,000 times more than the doses attributed to any level of the radiation from this event that has been detected in the U.S. to date."

I need to verify or change this statement, as appropriate, based on current information (so that testimony can go to the Commission for review tomorrow). I guess I will have to check back early next week to see if there has been any change between now and then.

Can I get a response by 3PM tomorrow (3/31/11)?

Thank you and keep up the good work!

Roger S. Rihm

**Communications and Performance Improvement Staff
Office of the Executive Director for Operations**

US NRC

301.415.1717

roger.rihm@nrc.gov

From: Aissa, Mourad / RES
To: Taylor, Robert
Cc: Carlson, Donald; Lee, Richard
Subject: Unit 3 MOX Loading Question From Commissioner.
Date: Wednesday, March 30, 2011 2:46:08 PM
Importance: High

Rob,

Don suggested that you are the appropriate person to answer the following request. We (RES) were contacted by the EDO office to provide information on MOX fuel. One of the questions was "has the NRC staff verified the claim that Reactor 3 contains MOX fuel." All the information I have about Unit 3 containing MOX was through the media (including Scientific American), and an email from ANS. The information I have was that 32 MOX assemblies were loaded in Unit 3 in November 2010 and that these are the only MOX assemblies at Fukushima Daiichi plant. Could you tell me if NRC staff obtained the confirmation from their Japanese counterparts that Unit 3 contains MOX? This - and other questions - need to be answered to Commissioner Ostendorff by COB Thursday 3/31.

Thanks

Mourad

Mourad Aissa, PhD
Senior Criticality Analysis and Reactor Physics Engineer
Office of Nuclear Regulatory Research
Mail Stop CSB-3A07M
US Nuclear Regulatory Commission
Washington, DC 20555-0001
Phone: (301) 251-7511

4/3/12

Nelson, Robert

From: Nelson, Robert *NR*
Sent: Wednesday, March 30, 2011 9:56 AM
To: Guzman, Richard; Lyon, Fred; Markley, Michael; Meighan, Sean; Nguyen, Quynh; Oesterle, Eric; Polickoski, James; Tam, Peter; Thomas, Eric
Cc: Leeds, Eric
Subject: FW: Presentation to NE
Attachments: image003.jpg; NERT Overview v2.ppt

See attached. Great slides. Most are probably too complex for the NGA presentation but some could be used.

NELSON

From: Roberts, Darrell *DR*
Sent: Wednesday, March 30, 2011 9:38 AM
To: Nelson, Robert
Subject: FW: Presentation to NE

Don't know if you saw these.

DJR

From: Dean, Bill *BD*
Sent: Tuesday, March 29, 2011 5:53 PM
To: Roberts, Darrell; Clifford, James; Wilson, Peter; Weerakkody, Sunil; Floyd, Niklas; Cline, Leonard
Subject: FW: Presentation to NE

May be helpful in some of the things we are developing for annual assessment meetings.

Bill

From: Coe, Doug *DC*
Sent: Tuesday, March 29, 2011 10:22 AM
To: McNamara, Nancy
Cc: Beasley, Benjamin; Dean, Bill; Correia, Richard; Sheron, Brian
Subject: FW: Presentation to NE

Nancy – these DOE slides might provide good background info for Bill before he briefs the governor.
Doug

From: Sheron, Brian *BS*
Sent: Tuesday, March 29, 2011 10:12 AM
To: HOO Hoc; LIA06 Hoc; RST01 Hoc; PMT01 Hoc
Cc: Weber, Michael; Virgilio, Martin
Subject: FW: Presentation to NE

FYI.

From: Larzelere, Alex [<mailto:alex.larzelere@nuclear.energy.gov>]
Sent: Tuesday, March 29, 2011 9:50 AM
To: DL-NITsolutions
Subject: Presentation to NE

Everyone,

Attached is a presentation I gave yesterday at the NE All Hands meeting that you might find useful. As you will see, it provides a pretty good chronology of events for the accident at Fukushima Daiichi. This information was put together by Dr. Mattias of AREVA. I have not gone back and verified every number but I am pretty confident that they are mostly correct.

Please let me know if you have any questions or comments.

Regards,

Alex

Alex R. Larzelere

Director, Advanced Modeling and Simulation Office

Office of Nuclear Energy (NE-71)

U.S. Department of Energy

202-586-1906

Alex.Larzelere@nuclear.energy.gov



Roche, Kevin

From: Joe Colvin [president@ans.org]
Sent: Thursday, March 31, 2011 4:39 AM
To: Roche, Kevin
Subject: ANS Member Activities and Fukushima

Dear ANS Member,

In the days since Japan's earthquake and tsunami combined to create the situation at Fukushima, nuclear professionals across the country have been united in our deep concern over the events in Japan and have contributed countless hours working to ensure that information provided to the public and media was based on fact and reason rather than hysteria and misinformation. I want to take this opportunity to express my appreciation to the many ANS Members who stepped forward to support the efforts of the Society in this time of great need.

The Society has played—and is continuing to play—a major role in addressing the scientific and technical aspects of the accident at Fukushima with the public, policy makers and the media. ANS Headquarters, the ANS Corporate Officers, and our media, social media and federal consultants have worked diligently, with the support of many members, to improve the public understanding of the situation in Japan. Within several hours of the events at Fukushima, ANS initiated the Crisis Communications Team, which has met daily by conference call since the accident to coordinate the Society's activities, including media outreach. Though ANS Members could not be everywhere, we have had a significant and positive effect.

ANS Members have participated in more than 150 interviews in venues like *The Today Show*, *CBS Evening News*, *NBC Nightly News*, *CBS Morning News* & local affiliates, *CNN*, *NPR*, *Good Morning America*, the *New York Times*, the *Washington Post*, and the *Wall Street Journal*—to name a few. Over one hundred members volunteered their services when Candace Davison, ANS Public Information Committee Chair, explained the urgent need for media resources.

Thanks to your efforts, ANS Members reached more than 81 million people through proactive media outreach. That's over one in four U.S. households—a truly remarkable effort!

While some ANS Members could not serve as media spokespersons due to company restrictions, they provided essential analysis of the ongoing technical events in Japan. That analysis helped to formulate documents such as the *Japan Background* and the *ANS Talking Points*. ANS Social Media Group members actively engaged in positive, proactive media outreach—something they have done so successfully in the past. They identified and shared media opportunities and formed the backbone of the early media efforts.

Those who could not speak helped those who could by lending information, analysis, and advice.

The [ANS Nuclear Cafe](#) blog site was repurposed as an information clearinghouse during the early morning hours of March 11. As ANS Members shared links to factual, non-alarmist information provided on the blog, traffic to the site increased by a factor of 100.

The strength of the Society is rooted in our membership and catalyzed by effective and talented expertise. ANS Student Sections, Nuclear Engineering Departments, and Local Sections have engaged in efforts across the country to reach out via public forums, webinars, presentations, conversations with friends and colleagues, and social networks. Visit the [ANS website](#) and be inspired by the wealth of activities catalogued under 'Featured Content.'

ANS Members have engaged in the vital grassroots efforts that drive greater understanding—and thus greater acceptance—of nuclear science and technology.

In response to your overwhelming feedback, ANS established the ANS Japan Relief Fund to help our friends, colleagues, and their families in Japan who have been affected by the earthquake and tsunami. This fund symbolizes how the international nuclear community stands together to help one another.

ANS will continue to play a key role in placing the Fukushima incident into perspective, as well examining the factors that have contributed to the incident. We are in the process of outlining the important role that the Society can play in developing a greater understanding into the scientific and technical issues surrounding the accident at Fukushima. Nuclear professionals will continue to set the bar high for nuclear energy, which remains the safest source of electricity generation.

I look forward to working with you, the dedicated and passionate members of this Society, as we continue to promote the awareness and understanding of nuclear science and technology.

Sincerely,

Joe Colvin
ANS President

Visit the ANS Nuclear Cafe: <http://ansnuclearcafe.org/>

Follow ANS on Twitter: [@ans_org](https://twitter.com/ans_org)

Like ANS on Facebook: [American Nuclear Society](https://www.facebook.com/AmericanNuclearSociety)

Join the ANS LinkedIn Group: [ANS](#) (reserved for ANS Members)

Dunham, Katrina

From: Krafty, James
Sent: Thursday, March 31, 2011 3:02 PM
To: Dunham, Katrina
Subject: FOIA 2011-0147 - FW: Japanese injury report

FOIA

From: Setzer, Thomas
Sent: Wednesday, March 23, 2011 12:01 PM
To: Dunham, Katrina; Keighley, Elizabeth; Dodson, Douglas; Jackson, Donald; Spindler, David; Rich, Sarah; Smith, Brian; Schneider, Max; Krafty, James; Haagensen, Brian; Shaffer, Steve; Sanders, Carleen; Guzman, Richard; Kim, James; Ziedonis, Adam
Subject: Japanese injury report

I am reading the press releases from TEPCO today which detail the injuries so far. Its so sobering to read this knowing how distracted workers are while trying to get the job done. I cant think of any pre job brief I could give that would keep these guys working safe, but somehow they are keeping it together.

One interesting item form today's press release is that they are using police water cannons designed for riot control to loft water into the spent fuel pools.

Casualty

- 2 workers of cooperative firm were injured at the occurrence of the earthquake, and were transported to the hospital on March 11th.
- 4 workers were injured and transported to the hospital after explosive sound and white smoke were confirmed around the Unit 1on March 11th.
- Presence of 2 TEPCO employees at the site is not confirmed on March 11th.
- 1 TEPCO employee who was not able to stand by his own holding left chest with his hand, was transported to the hospital by an ambulance on March 12th.
- 1 subcontract worker at the key earthquake-proof building was unconscious and transported to the hospital by an ambulance on March 12th.
- The radiation exposure of 1 TEPCO employee, who was working inside the reactor building, exceeded 100mSv and he was transported to the hospital on March 12th.
- 2 TEPCO employees felt bad during their operation in the central control rooms of Unit 1 and 2 while wearing full masks, and were transferred to Fukushima Daini Nuclear Power Station for consultation with a medical advisor on March 13th.
- 11 workers were injured and transported to Fukushima Daini Nuclear Power Station etc. after explosive sound and white smoke were confirmed around the Unit 3. One of the workers was transported to the FUKUSHIMA Medical University Hospital on March 14th.
- At approximately 10 pm on March 22nd, 1 worker who had been working on setting up a temporary power panel in the common pool was injured and transported to Fukushima Daini Nuclear Power Station where the industrial doctor is.
- At approximately 1 am on March 23rd, 1 worker who had been working on setting up a temporary power panel in the common pool was injured and transported to Fukushima Daini Nuclear Power Station where the industrial doctor is.

Kern, Ludwig

From: Montgomery, Richard
Sent: Thursday, March 31, 2011 10:28 AM
To: Kern, Ludwig
Subject: foia 11

From: Matakas, Gina
Sent: Wednesday, March 16, 2011 9:52 AM
To: All R1 Users
Subject: FW: Can you send this out to the Region

From: McNamara, Nancy
Sent: Wednesday, March 16, 2011 9:45 AM
To: Matakas, Gina
Subject: Can you send this out to the Region

Hyperlink to the Chairman's testimony that you can listen to at your desk:

<http://energycommerce.house.gov/hearings/hearingdetail.aspx?NewsID=8329>

click on "Listen Live"

Kern, Ludwig

From: Montgomery, Richard
Sent: Thursday, March 31, 2011 10:28 AM
To: Kern, Ludwig
Subject: FOIA 12 FW: Commenting on Japan

Importance: High

From: Powell, Raymond
Sent: Monday, March 14, 2011 6:27 PM
To: Bickett, Carey; Khan, Cheryl; Ayala, Juan; Rao, Ami; Montgomery, Richard; DeBoer, Joseph; Kern, Ludwig; Floyd, Niklas; Ziev, Tracey; Dunham, Katrina
Subject: Commenting on Japan
Importance: High

all received inquires are to be referred to PAO. that's really the end of my message, but i am always available to discuss further.

Y1317

Dunham, Katrina

From: Krafty, James
Sent: Thursday, March 31, 2011 3:10 PM
To: Dunham, Katrina
Subject: FOIA 2011-0147 - FW: NRC IS RESPONDING TO AN EMERGENCY OUTSIDE of the United States

FOIA

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

From: Hinson, Felicia
Sent: Sunday, March 13, 2011 2:14 PM
To: All R1 Users
Subject: FW: NRC IS RESPONDING TO AN EMERGENCY OUTSIDE of the United States

The attached Operations Center Bulletin is being sent to All Region I employees for awareness.

The Bulletin provides information regarding NRC/Federal efforts underway in support of our international partners.

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

THIS IS NOT A DRILL

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

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

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

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

Two important reminders:

It is possible that some of us will be requested by colleagues in another country to provide technical advice and assistance during this emergency. It is essential that all such communications be handled through the NRC

Operations Center. Any assistance to a foreign government or entity must be coordinated through the NRC Operations Center and the U.S. Department of State (DOS). If you receive such a request, contact the NRC Operations Officer (301-816-5100 or via the NRC Operator) immediately.

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

Other Sources of Information:

USAID – www.usaid.gov<<http://www.usaid.gov>>

U.S. Department of State – www.state.gov<<http://www.state.gov>>

FEMA – www.fema.gov<<http://www.fema.gov>> White House –
www.whitehouse.gov<<http://www.whitehouse.gov>>

Nuclear Energy Institute – www.nei.org<<http://www.nei.org>> International Atomic Energy Agency –
www.iaea.org/press<<http://www.iaea.org/press>>

No response to this message is required.

THIS IS NOT A DRILL

Dunham, Katrina

From: Krafty, James
Sent: Thursday, March 31, 2011 3:09 PM
To: Dunham, Katrina
Subject: FOIA - 2011-0147 - FW: UPDATE: NRC IS RESPONDING TO JAPANESE EVENTS

FOIA

From: Operations Center Bulletin
Sent: Wednesday, March 16, 2011 12:51 PM
To: Operations Center Bulletin
Subject: UPDATE: NRC IS RESPONDING TO JAPANESE EVENTS

THIS IS NOT A DRILL

The Office of Public Affairs is expecting a large volume of calls from media and the general public regarding the latest statements from the State Department and the NRC regarding the situation in Japan. ALL CALLS from media or the general public on this topic must be referred to Regional Public Affairs or the 301-415-8200 number for HQ employees.

THIS IS NOT A DRILL

*****Event Information is Attached*****

The NRC is responding to an event.

Please contact the NRC Executive Support Team if necessary at 301-816-5100 or reply to this e-mail.

4/12/19

Turilin, Andrey

From: Douglas, Christopher
Sent: Thursday, March 31, 2011 4:48 PM
To: Turilin, Andrey
Subject: FW: OPA Talking Points

From: Burritt, Arthur
Sent: Tuesday, March 15, 2011 4:17 PM
To: Cline, Leonard; DeBoer, Joseph; Douglas, Christopher; Johnson, Jonathan; Kern, Ludwig; McKenna, Philip; Patel, Amar; Raymond, William; Schroeder, Daniel; Turilin, Andrey; Welling, Blake
Subject: FW: OPA Talking Points

Please review and internalize

From: Clifford, James
Sent: Monday, March 14, 2011 5:34 PM
To: Bellamy, Ronald; Burritt, Arthur; Dentel, Glenn; Gray, Mel; Jackson, Donald; Krohn, Paul; Powell, Raymond
Cc: Roberts, Darrell
Subject: FW: OPA Talking Points

Provided for your information. Even with this, we need to refer any questions to the regional PA officers

Jim Clifford
Deputy Director
Division of Reactor Projects
Region I

From: Dean, Bill
Sent: Monday, March 14, 2011 5:05 PM
To: Screnci, Diane; Sheehan, Neil; Roberts, Darrell; Wilson, Peter; Lorson, Raymond; Collins, Daniel; Weerakkody, Sunil; Clifford, James; Lew, David
Subject: FW: OPA Talking Points

Bill

From: LIA04 Hoc
Sent: Monday, March 14, 2011 5:02 PM
To: Tifft, Doug; McNamara, Nancy; Woodruff, Gena; Barker, Allan; Logaras, Harral; Maier, Bill; Dean, Bill; McCree, Victor; Collins, Elmo; Heck, Jared; Trojanowski, Robert; Browder, Rachel; Erickson, Randy
Cc: Turtill, Richard; Virgilio, Rosetta; Rautzen, William; Ryan, Michelle; Rivera, Alison; Lukes, Kim; Flannery, Cindy
Subject: OPA Talking Points

Please see the attached for your information and use.

Amanda Noonan
State Liaison – Liaison Team
Incident Response Center

Bickett, Brice

From: Catts, Michelle
Sent: Thursday, March 31, 2011 5:20 PM
To: Jennerich, Matthew
Cc: Bickett, Brice
Subject: FOIA 147

From: Boska, John
Sent: Wednesday, March 16, 2011 8:33 AM
To: Catts, Michelle
Subject: RE: Status of Japanese reactors

The radiation levels tend to fluctuate. The most disturbing reading is just outside the Unit 3 reactor building, at 400 millisieverts/hr (40 rem/hr). I understand some workers were rotated out of the site after their dosimeters reached 10 rem of dose. They originally had 800 workers at Daiichi trying to cope with the 6 reactors, I believe they removed all but 50 workers due to the high radiation levels.

John Boska
Indian Point Project Manager, NRR/DORL
U.S. Nuclear Regulatory Commission
301-415-2901
email: john.boska@nrc.gov

From: Catts, Michelle
Sent: Wednesday, March 16, 2011 8:21 AM
To: Boska, John
Subject: RE: Status of Japanese reactors

Thanks John. This is the best info I have seen so far. I have been getting my info from the NEI updates, but they are slow coming. Any idea what the radiation numbers were after this recent white smoke and spike in radioactivity?

From: Boska, John
Sent: Wednesday, March 16, 2011 8:10 AM
To: Bickett, Brice; McCarver, Sammy
Cc: Cataldo, Paul; Catts, Michelle; Knutson, Ed
Subject: Status of Japanese reactors

<http://www.iaif.or.jp/english/index.php>

The reactor status updates (in pdf) on this web page are the best source I have seen.

John Boska
Indian Point Project Manager, NRR/DORL
U.S. Nuclear Regulatory Commission
301-415-2901
mail: john.boska@nrc.gov

Bickett, Brice

From: Catts, Michelle
Sent: Thursday, March 31, 2011 5:19 PM
To: Jennerich, Matthew
Cc: Bickett, Brice
Subject: FOIA 147

From: Kulp, Jeffrey
Sent: Wednesday, March 16, 2011 9:47 AM
To: Catts, Michelle
Subject: RE: Most vivid depictions of Japan's damage I've seen

Okay. How are you getting Cspan?

From: Catts, Michelle
Sent: Wednesday, March 16, 2011 9:46 AM
To: Kulp, Jeffrey
Subject: RE: Most vivid depictions of Japan's damage I've seen

Need to chat after I listen to this thing on c-span.

From: Kulp, Jeffrey
Sent: Wednesday, March 16, 2011 9:38 AM
To: Catts, Michelle
Subject: FW: Most vivid depictions of Japan's damage I've seen

Check out this site. Satellite photo before and after of the Fukushima site.

In each twin photo, first slide the center vertical divider to the right side.

Then, like a giant Etch-a-Sketch eraser sweeping across the land, slide it to the left.

<http://www.nytimes.com/interactive/2011/03/13/world/asia/satellite-photos-japan-before-and-after-tsunami.html>

Rihm, Roger

From: Rihm, Roger
Sent: Thursday, March 31, 2011 10:14 AM
To: Powell, Amy
Subject: Proposed updated testimony for Marty
Attachments: Testimony_April6_2011.docx

Used the version you sent yesterday and all changes I suggest are marked in some way for ease of review!

Y/ 223

**TESTIMONY OF MARTIN VIRGILIO
DEPUTY EXECUTIVE DIRECTOR FOR REACTOR AND PREPAREDNESS PROGRAMS
UNITED STATES NUCLEAR REGULATORY COMMISSION
TO THE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON INVESTIGATIONS
UNITED STATES HOUSE OF REPRESENTATIVES**

**NRC RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN AND THE CONTINUING
SAFETY OF THE U.S. COMMERCIAL NUCLEAR REACTOR FLEET**

APRIL 6, 2011

The staff of the U.S. Nuclear Regulatory Commission is deeply saddened by the tragedy in Japan. I and many of my colleagues on the NRC staff have had many years of very close and personal interaction with our regulatory counterparts and we would like to extend our condolences to them.

Introduction

The NRC is mindful that our primary responsibility is to ensure the adequate protection of the public health and safety of the American people. We have been very closely monitoring the activities in Japan and reviewing all currently available information. Review of this information, combined with our ongoing inspection and licensing oversight, allows us to say with confidence that the U.S. plants continue to operate safely. There has been no reduction in the licensing or oversight function of the NRC as it relates to any of the U.S. licensees.

We have a long history of conservative regulatory decision-making. We have been using risk insights to help inform our regulatory process, and, over more than 35 years of civilian nuclear power in this country, we have never stopped making improvements to our regulatory framework as we learn from operating experience.

Notwithstanding the very high level of support being provided to respond to events in Japan, we continue to maintain our focus on our domestic responsibilities.

I'd like to begin with a brief overview of our immediate and continuing response. I

then want to spend the bulk of my time discussing the reasons for our confidence in the safety of the U. S. commercial nuclear reactor fleet, and the path forward that we will take to ensure we learn any lessons we need to from events in Japan.

The NRC's immediate and Continuing Response to Events in Japan

On Friday, March 11th an earthquake hit Japan, resulting in the shutdown of more than 10 reactors. From what we know now, it appears possible that the reactors' response to the earthquake went according to design. The ensuing tsunami, however, appears to have caused the loss of normal and emergency AC power to the six units at the Fukushima Daiichi site; it is those six units that have received the majority of our attention since that time. Units One, Two, and Three at the site were in operation at the time of the earthquake. Units Four, Five, and Six were in previously scheduled outages.

Shortly after 4:00 AM EDT on Friday, March 11th, the NRC Emergency Operations Center made the first call, informing NRC management of the earthquake and the potential impact on U.S. plants. We went into the monitoring mode at the Emergency Operations Center and the first concern for the NRC was possible impacts of the tsunami on U.S. plants and radioactive materials on the West Coast, and in Hawaii, Alaska, and U.S. Territories in the Pacific.

On that same day, we began interactions with our Japanese regulatory counterparts and dispatched two experts to help at the U.S. embassy in Japan. By Monday, we had dispatched a total of 11 staff to Japan. We have subsequently rotated in additional replacement staff to continue our on-the-ground assistance in Japan. The areas of focus for this team are: 1) to assist the Japanese government with technical support as part of the USAID response; and 2) to support the U.S. ambassador. The NRC's Chairman, Dr. Gregory Jaczko, traveled to Toyko on March 28th for several days to convey directly to his Japanese counterparts a message of support and cooperation, and to discuss the current situation.

Formatted: Superscript

While our focus now is on helping Japan in any way that we can, the experience will also help us assess the implications for U.S. citizens and the U.S. reactor fleet in as timely a manner as possible.

We have an extensive range of stakeholders with whom we have ongoing interaction, including the White House, Congressional staff, our state regulatory counterparts, a number of other federal agencies, and international regulatory bodies around the world. We recently sent an NRC staff member to Hawaii to support the United States Armed Forces Pacific Command (USPACOM).

The NRC response in Japan and our Emergency Operations Center continue with the dedicated efforts of over 250 NRC staff on a rotating basis. [UPDATE IF STAFFING SITUATION CHANGES] The entire agency is coordinating and pulling together in response to this event so that we can provide assistance to Japan while continuing the normal activities necessary to fulfill our domestic responsibilities.

Let me also just note here in concluding this section of my remarks that the U.S. government has an extensive network of radiation monitors across this country. Monitoring equipment at nuclear power plants and in the U. S. Environmental Protection Agency's (EPA) system has identified trace amounts of radioactive isotopes consistent with the Japanese nuclear incident, but still far below levels of natural background radiation or of public health concern. has not identified any radiation levels of concern in this country. In fact, natural background radiation from sources such as rocks, the sun, and buildings, is 100,000 times more than doses attributed to any level of the radiation from this event that has been detected in the U.S. to date. Therefore, Wwe feel confident, based on current data, that there is no reason for concern in the United States regarding radioactive releases from Japan.

Continuing Confidence in the Safety of U.S. Nuclear Power Plants

I will now turn to the factors that assure us of ongoing domestic reactor safety. We

Comment [RSR1]: This sentence came from 3/22 NRC press release. On 3/31 EPA reported "levels slightly higher than those found by EPA monitors last week...but still far below levels of public health concern." In another week at time of testimony, we expect to continue to see safe levels, but I don't know if the 100,000 figure will still be correct.

have, since the beginning of the regulatory program in the United States, used a philosophy of Defense-in-Depth, which recognizes that nuclear reactors require the highest standards of design, construction, oversight, and operation, and does not rely on any single layer for protection of public health and safety. We begin with designs for every individual reactor in this country that take into account site-specific factors and include a detailed evaluation for any natural event, such as earthquakes, tornadoes, hurricanes, floods, and tsunamis, as they relate to that site.

There are multiple physical barriers to radiation in every reactor design. Additionally, there are both diverse and redundant safety systems that are required to be maintained in operable condition and frequently tested to ensure that the plant is in a high condition of readiness to respond to any scenario.

We have taken advantage of the lessons learned from previous operating experience to implement a program of continuous improvement for the U.S. reactor fleet. We have learned from experience across a wide range of situations, including most significantly, the Three Mile Island accident in 1979. As a result of those lessons learned, we have significantly revised emergency planning requirements and emergency operating procedures. We have addressed many human factors issues regarding how control room employees operate the plant, added new requirements for hydrogen control to help prevent explosions inside of containment, and created requirements for enhanced control room displays of the status of pumps and valves.

The NRC has a post-accident sampling system that enables the monitoring of radioactive material release and possible fuel degradation. One of the most significant changes after Three Mile Island was expansion of the Resident Inspector Program, which has at least two full-time NRC inspectors on site at each nuclear power plant. These inspectors have unfettered access to all licensees' activities.

As a result of operating experience and ongoing research programs, we have

developed requirements for severe accident management guidelines. These are components and procedures developed to ensure that, in the event all of the above precautions failed and a severe accident occurred, the plant would still protect public health and safety. The requirements for severe accident management have been in effect for many years and are frequently evaluated by the NRC inspection program.

As a result of the events of September 11, 2001, we identified important pieces of equipment that, regardless of the cause of a significant fire or explosion at a plant, we want licensees to have available and staged in advance, as well as new procedures, training requirements, and policies that would help deal with a severe situation.

Our program of continuous improvement based on operating experience will now include evaluation of the significant events in Japan as well as what we can learn from them. We already have begun enhancing inspection activities through temporary instructions to our inspection staff, including the resident inspectors and the region-based inspectors in our four Regional offices, to look at licensees' readiness to deal with both the design basis accidents and the beyond-design basis accidents. The information that we gather will be used to evaluate the industry's readiness for similar events, and will aid in our understanding of whether additional regulatory actions need to be taken in the immediate term.

We have also issued an information notice to the licensees to make them aware of the events in Japan, and the kinds of activities we believe they should be engaged in to verify their readiness. Specifically, we have requested them to verify that their capabilities to mitigate conditions that result from severe accidents, including the loss of significant operational and safety systems, are in effect and operational. Licensees are verifying the capability to mitigate a total loss of electric power to the nuclear plant. They also are verifying the capability to mitigate problems associated with flooding and the resulting impact on systems both inside and outside of the plant. Also, licensees are confirming the equipment that is needed is in place for the

potential loss of equipment due to seismic events appropriate for the site, because each site has its own unique seismic profiles.

During the past 20 years, there have been a number of new rulemakings that have enhanced the domestic fleet's preparedness against some of the problems we are seeing in Japan. The "station blackout" rule requires every plant in this country to analyze what the plant response would be if it were to lose all alternating current so that it could respond using batteries for a period of time, and then have procedures in place to restore alternating current to the site and provide cooling to the core.

The hydrogen rule requires modifications to reduce the impacts of hydrogen generated for beyond-design basis events and core damage. There are equipment qualification rules that require equipment, including pumps and valves, to remain operable under the kinds of environmental temperature and radiation conditions that you would see under a design basis accident. With regard to the type of containment design used by the most heavily damaged plants in Japan, the NRC has had a Boiling Water Reactor Mark I Containment Improvement Program since the late 1980s, which has required installation of hardened vent systems for containment pressure relief, as well as enhanced reliability of the automatic depressurization system.

The final factor I want to mention with regard to our belief in the ongoing safety of the U.S. fleet is the emergency preparedness and planning requirements in place that provide ongoing training, testing, and evaluations of licensees' emergency preparedness programs. In coordination with our federal partner, the Federal Emergency Management Administration (FEMA), these activities include extensive interaction with state and local governments, as those programs are evaluated and tested on a periodic basis.

The Path Ahead

Beyond the initial steps to address the experience from the events in Japan, the

Chairman, with the full support of the Commission, directed the NRC staff to establish a senior level agency task force to conduct a methodical and systematic review of our processes and regulations to determine whether the agency should make additional improvements to our regulatory system and make recommendations to the Commission for its policy direction. This activity will have both near-term and longer-term objectives.

For the near term effort, we are beginning a 90-day review. This review will evaluate all of the currently available information from the Japanese events to identify immediate or near-term operational or regulatory issues potentially affecting the 104 operating reactors in the U.S., including their spent fuel pools. Areas of investigation will include the ability to protect against natural disasters, response to station blackouts, severe accidents and spent fuel accident progression, radiological consequence analysis, and severe accident management issues regarding equipment. Over this 90-day period, we will develop recommendations, as appropriate, for changes to inspection procedures and licensing review guidance, and recommend whether generic communications, orders, or other regulatory requirements are needed.

This 90-day effort will include a 30-day "Quick Look Report" to the Commission to provide a snapshot of the regulatory response and the condition of the U.S. fleet based on information we have available at that time. Preparing a "Quick Look Report" will also ensure that the Commission is both kept informed of ongoing efforts and prepared to resolve any policy recommendations that surface. I believe we will have limited stakeholder involvement in the first 30 days to accomplish this. However over the 90-day and longer-term efforts we will seek additional stakeholder input. At the end of the 90-day period, a report will be provided to the Commission and to the public. The task force's longer-term review will begin as soon as the NRC has sufficient technical information from the events in Japan.

The task force will evaluate all technical and policy issues related to the event to

identify additional potential research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be pursued by the NRC. We also expect to evaluate potential interagency issues, such as emergency preparedness, and examine the applicability of any lessons learned to non-operating reactors and materials licensees. We expect to seek input from stakeholders during this process. A report with appropriate recommendations will be provided to the Commission within 6 months of the start of this evaluation. Both the 90-day and final reports will be made publicly available in accordance with normal Commission processes.

Conclusion

In conclusion, I want to reiterate that we continue to make our domestic responsibilities for licensing and oversight of the U.S. licensees our top priority and that the U.S. plants continue to operate safely. In light of the events in Japan, there is a near-term evaluation of their relevance to the U.S. fleet underway, and we are continuing to gather the information necessary for us to take a longer, more thorough look at the events in Japan and their lessons for us. Based on these efforts, we will take all appropriate actions necessary to ensure the continuing safety of the U.S. fleet.

Rihm, Roger

From: Rihm, Roger
Sent: Thursday, March 31, 2011 11:12 AM
To: Oesterle, Eric
Subject: electronic versions of what I gave you attached
Attachments: RE: ACTION: RESPONSE - News Article on SOARCA; RE: RESPONSE - HEARING INVITATION; seismic margin.docx; Hill staff ques_NRR responses.docx

These have not gone thru OPA. Use as you like!

I checked, and we did not prepare Qs and As for 3/16 hearing thru this office.

Roger S. Rihm

Communications and Performance Improvement Staff
Office of the Executive Director for Operations
US NRC
301.415.1717
roger.rihm@nrc.gov

Y/ 324

Rihm, Roger

From: Armstrong, Kenneth
Sent: Wednesday, March 30, 2011 8:04 AM
To: Rihm, Roger
Cc: Bowman, Gregory; Gibson, Kathy
Subject: RE: ACTION: RESPONSE - News Article on SOARCA
Attachments: image002.png; image003.jpg; Response to questions posed by AP (3-29-11).docx

Roger,

Please consider the updated responses (attached) for today's hearing. We addressed Brian wanting to see a Yes/No on Question 1 and incorporated additional information from NSIR in Question 6.

Thanks for your time,
Kenneth

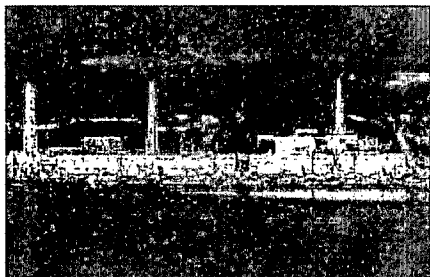
From: Weber, Michael
Sent: Tuesday, March 29, 2011 12:14 PM
To: Sheron, Brian
Cc: Virgilio, Martin; Leeds, Eric; Johnson, Michael; Wiggins, Jim; Rihm, Roger; Milligan, Patricia; Wittick, Brian; Brenner, Eliot; Hayden, Elizabeth; Schmidt, Rebecca; Powell, Amy; Muessele, Mary; Andersen, James; Bowman, Gregory
Subject: RESPONSE - News Article on SOARCA

Thanks, Brian. I'll need to be prepared to respond to this concern in tomorrow morning's hearing and the Chairman will need to be prepared to respond at his hearings tomorrow. Please work with OEDO staff (Roger Rihm/Brian Wittick) to ensure that we develop a short-response by COB today that we can use tomorrow in case this comes up.

David Lochbaum reported at this morning's hearing that 93 of the U.S. plants only had a 4-hour coping capacity for SBO. The rest could cope for 8 hours. Is this valid? Does this taken into consideration the B5b mitigating measures? Was SBO considered among the scenarios that resulted in the U.S. decision to establish the nominal exposure pathway EPZ at 10 miles?

AP IMPACT: Long blackouts pose risk to US reactors

AP Associated Press



AP – Only Unit 2 is covered with white concrete housing, seen on left of an iron tower on right, at the stricken ...

WASHINGTON – Long before the nuclear emergency in Japan, U.S. regulators knew that a power failure lasting for days at an American nuclear plant, whatever the cause, could lead to a radioactive leak. Even so, they have only required the nation's 104 nuclear reactors to develop plans for dealing with much shorter blackouts on the assumption that power would be restored quickly.

In one nightmare simulation presented by the Nuclear Regulatory Commission in 2009, it would take less than a day for radiation to escape from a reactor at a Pennsylvania nuclear power plant after an earthquake, flood or fire knocked out all electrical power and there was no way to keep the reactors cool after backup battery power ran out. That plant, the Peach Bottom Atomic Power Station outside Lancaster, has reactors of the same older make and model as those releasing radiation at Japan's Fukushima Dai-ichi plant, which is using other means to try to cool the reactors.

And like Fukushima Dai-ichi, the Peach Bottom plant has enough battery power on site to power emergency cooling systems for eight hours. In Japan, that wasn't enough time for power to be restored. According to the International Atomic Energy Agency and the Nuclear Energy Institute trade association, three of the six reactors at the plant still can't get power to operate the emergency cooling systems. Two were shut down at the time. In the sixth, the fuel was removed completely and put in the spent fuel pool when it was shut down for maintenance at the time of the disaster. A week after the March 11 earthquake, diesel generators started supplying power to two other two reactors, Units 5 and 6, the groups said.

The risk of a blackout leading to core damage, while extremely remote, exists at all U.S. nuclear power plants, and some are more susceptible than others, according to an Associated Press investigation. While regulators say they have confidence that measures adopted in the U.S. will prevent or significantly delay a core from melting and threatening a radioactive release, the events in Japan raise questions about whether U.S. power plants are as prepared as they could and should be.

"We didn't address a tsunami and an earthquake, but clearly we have known for some time that one of the weak links that makes accidents a little more likely is losing power," said Alan Kolaczowski, a retired nuclear engineer who worked on a federal risk analysis of Peach Bottom released in 1990 and is familiar with the updated risk analysis.

Risk analyses conducted by the plants in 1991-94 and published by the commission in 2003 show that the chances of such an event striking a U.S. power plant are remote, even at the plant where the risk is the highest, the Beaver Valley Power Station in Pennsylvania.

These long odds are among the reasons why the United States since the late 1980s has only required nuclear power plants to cope with blackouts for four or eight hours, depending on the risk. That's about how much time batteries would last. After that, it is assumed that power would be restored. And so far, that's been the case.

Equipment put in place after the Sept. 11, 2001, terrorist attacks could buy more time. Otherwise, the reactor's radioactive core could begin to melt unless alternative cooling methods were employed. In Japan, the utility has tried using portable generators and dumped tons of seawater, among other things, on the reactors in an attempt to keep them cool.

A 2003 federal analysis looking at how to estimate the risk of containment failure said that should power be knocked out by an earthquake or tornado it "would be unlikely that power will be recovered in the time frame to prevent core meltdown."

In Japan, it was a one-two punch: first the earthquake, then the tsunami.

Tokyo Electric Power Co., the operator of the crippled plant, found other ways to cool the reactor core and so far avert a full-scale meltdown without electricity.

"Clearly the coping duration is an issue on the table now," said Biff Bradley, director of risk assessment for the Nuclear Energy Institute. "The industry and the Nuclear Regulatory Commission will have to go back in light of what we just observed and rethink station blackout duration."

David Lochbaum, a former plant engineer and nuclear safety director at the advocacy group Union of Concerned Scientists, put it another way: "Japan shows what happens when you play beat-the-clock and lose."

Lochbaum plans to use the Japan disaster to press lawmakers and the nuclear power industry to do more when it comes to coping with prolonged blackouts, such as having temporary generators on site that can recharge batteries.

A complete loss of electrical power, generally speaking, poses a major problem for a nuclear power plant because the reactor core must be kept cool, and back-up cooling systems — mostly pumps that replenish the core with water — require massive amounts of power to work.

Without the electrical grid, or diesel generators, batteries can be used for a time, but they will not last long with the power demands. And when the batteries die, the systems that control and monitor the plant can also go dark, making it difficult to ascertain water levels and the condition of the core.

One variable not considered in the NRC risk assessments of severe blackouts was cooling water in spent fuel pools, where rods once used in the reactor are placed. With limited resources, the commission decided to focus its analysis on the reactor fuel, which has the potential to release more radiation.

An analysis of individual plant risks released in 2003 by the NRC shows that for 39 of the 104 nuclear reactors, the risk of core damage from a blackout was greater than 1 in 100,000. At 45 other plants the risk is greater than 1 in 1 million, the threshold NRC is using to determine which severe accidents should be evaluated in its latest analysis.

The Beaver Valley Power Station, Unit 1, in Pennsylvania had the greatest risk of core melt — 6.5 in 100,000, according to the analysis. But that risk may have been reduced in subsequent years as NRC regulations required plants to do more to cope with blackouts. Todd Schneider, a spokesman for FirstEnergy Nuclear Operating Co., which runs Beaver Creek, told the AP that batteries on site would last less than a week.

In 1988, eight years after labeling blackouts "an unresolved safety issue," the NRC required nuclear power plants to improve the reliability of their diesel generators, have more backup generators on site, and better train personnel to restore power. These steps would allow them to keep the core cool for four to eight hours if they lost all electrical power. By contrast, the newest generation of nuclear power plant, which is still awaiting approval, can last 72 hours without taking any action, and a minimum of seven days if water is supplied by other means to cooling pools.

Despite the added safety measures, a 1997 report found that blackouts — the loss of on-site and off-site electrical power — remained "a dominant contributor to the risk of core melt at some plants." The events of Sept. 11, 2001, further solidified that nuclear reactors might have to keep the core cool for a longer period without power. After 9/11, the commission issued regulations requiring that plants have portable power supplies for relief valves and be able to manually operate an emergency reactor cooling system when batteries go out.

The NRC says these steps, and others, have reduced the risk of core melt from station blackouts from the current fleet of nuclear plants.

For instance, preliminary results of the latest analysis of the risks to the Peach Bottom plant show that any release caused by a blackout there would be far less rapid and would release less radiation than previously thought, even without any actions being taken. With more time, people can be evacuated. The NRC says improved computer models, coupled with up-to-date information about the plant, resulted in the rosier outlook.

"When you simplify, you always err towards the worst possible circumstance," Scott Burnell, a spokesman for the Nuclear Regulatory Commission, said of the earlier studies. The latest work shows that "even in situations where everything is broken and you can't do anything else, these events take a long time to play out," he said. "Even when you get to releasing into environment, much less of it is released than actually thought."

Exelon Corp., the operator of the Peach Bottom plant, referred all detailed questions about its preparedness and the risk analysis back to the NRC. In a news release issued earlier this month, the company, which operates 10 nuclear power plants, said "all Exelon nuclear plants are able to safely shut down and keep the fuel cooled even without electricity from the grid."

Other people, looking at the crisis unfolding in Japan, aren't so sure.

In the worst-case scenario, the NRC's 1990 risk assessment predicted that a core melt at Peach Bottom could begin in one hour if electrical power on- and off-site were lost, the diesel generators — the main back-up source of power for the pumps that keep the core cool with water — failed to work and other mitigating steps weren't taken.

"It is not a question that those things are definitely effective in this kind of scenario," said Richard Denning, a professor of nuclear engineering at Ohio State University, referring to the steps NRC has taken to prevent incidents. Denning had done work as a contractor on severe accident analyses for the NRC since 1975. He retired from Battelle Memorial Institute in 1995.

"They certainly could have made all the difference in this particular case," he said, referring to Japan. "That's assuming you have stored these things in a place that would not have been swept away by tsunami."

From: Chang, Richard

Sent: Tuesday, March 29, 2011 7:35 AM

To: Schaperow, Jason; Tinkler, Charles; Santiago, Patricia; Ghosh, Tina; Armstrong, Kenneth

Subject: FYI- News Article on SOARCA

http://news.yahoo.com/s/ap/20110329/ap_on_re_us/us_us_japan_nuclear_blackouts_2

Richard Chang
Program Manager
RES/DSA/SPB
301-251-7980

Use of Margin in Seismic Analysis

- Currently operating reactors (licensed prior to 1997) had their seismic regulatory basis in the General Design Criteria 2 in Appendix A to Part 50. That standard required that the design bases include "sufficient margin." This was an undefined term that varied across facilities.
- Proposed new reactors (submitted after 1997) have to demonstrate a seismic margin of 1.67 times the site-specific 10,000 year ground motion that defines the Safe-Shutdown earthquake ground motion (SSE). That is, the high confidence of low probability of failure for a plant (where failure is defined by some type of core damage) should be at least 1.67 times the ground motion acceleration of the design basis safe-shutdown earthquake (SSE). (*HCLPF=the high confidence (more than 95% confidence) of low probability (less than 5%)*)
- For the ongoing and planned GI 199 analyses we anticipate evaluating the seismic margin in the existing facilities using the same techniques as we are using for new facilities.

Other helpful info: The seismic margin in existing plants arises from several factors including (1) the use of a relatively infrequent design basis earthquake scenario, (2) the use of conservative design spectral shape, and (3) the application of conservative design philosophy in the codes and standards used by the nuclear industry. The "design spectral shape" is the relative strength of different frequencies of vibration in the ground motion.)

Rihm, Roger

EDU **From:** Rihm, Roger
Sent: Friday, April 01, 2011 2:03 PM
To: Schmidt, Rebecca
Subject: RE: testimony for next week

Having trouble connecting with the right people in NSIR to get me incident response capability overview (maybe they're busy doing other things!) I can insert the 50 mile discussion (abbreviated version) from Mike Weber's 3/30/11 testimony, but need NSIR for other piece. Don't know if I'll have everything today. Has the draft I provided to Amy on Thursday gone to the Commission?

From: Schmidt, Rebecca
Sent: Friday, April 01, 2011 10:30 AM
To: Landau, Mindy; Rihm, Roger
Cc: Virgilio, Martin; Powell, Amy
Subject: testimony for next week

Just talked to Peter the staffer working on the hearing. He would like us to add information in our written testimony about the operations center and its capabilities if something happened in the US. He is looking for something specific about our knowledge of US plant designs, connections with the plant control room in an emergency situation, communications with the utility ops center etc. In addition, he would like us to put something in about the 50 mile radius—decisionmaking process. FYI—he is also thinking about requesting Don Cool be there with marty to answer specific questions. I think Don did a great job answering his questions earlier and he thought he would do a good job at the hearing.

Rihm, Roger

From: Rihm, Roger
Sent: Friday, April 01, 2011 10:50 AM
To: Schmidt, Rebecca
Cc: Powell, Amy
Subject: RE: testimony for next week

I'm on it!

From: Schmidt, Rebecca
Sent: Friday, April 01, 2011 10:30 AM
To: Landau, Mindy; Rihm, Roger
Cc: Virgilio, Martin; Powell, Amy
Subject: testimony for next week

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Y/226

Andersen, James

From: Leeds, Eric
Sent: Friday, April 01, 2011 12:49 PM
To: Andersen, James
Cc: Sanfilippo, Nathan; Wittick, Brian; Frazier, Alan; Virgilio, Martin; Weber, Michael; Ruland, William; Brown, Frederick; Miller, Charles; Grobe, Jack; Holahan, Gary
Subject: RE: ACRS Briefing on Japan

Good. Thanks, Jim. The more I think about, the more I think it's a good thing to do. This provides a forum to establish a baseline on the event with the members and get their feedback/concerns to help shape the follow-up brief that I'm sure we'll have to provide in the coming months.

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

From: Andersen, James
Sent: Friday, April 01, 2011 12:00 PM
To: Leeds, Eric
Cc: Sanfilippo, Nathan; Wittick, Brian; Frazier, Alan; Virgilio, Martin; Weber, Michael
Subject: ACRS Briefing on Japan

Eric, just to close the loop. I talked with Bill and he was okay with doing the briefing as we discussed, open, similar to his briefing of the Commission. I have provided that information to the Chairman's office and they are okay as well. I also talked with Ed Hackett and he will inform the ACRS Chairman about our proposal. I understand NRR will coordinate the briefing and it is scheduled for next Thursday. Please let me know if you have any questions.

Jim A.

Rihm, Roger

From: Rihm, Roger
Sent: Friday, April 01, 2011 1:09 PM
To: McDermott, Brian
Subject: FW: testimony for next week
✓ **Attachments:** Testimony_April6_2011.docx

Importance: High

Brian, I've been dealing with Trish over the past week or so on testimony, but haven't heard from her or Michelle re: emails below. Can other staff assist me if Trish is not available (or the appropriate person)?

From: Rihm, Roger
Sent: Friday, April 01, 2011 12:50 PM
To: Milligan, Patricia; Evans, Michele
Subject: FW: testimony for next week
Importance: High

Are you on board?

From: Rihm, Roger
Sent: Friday, April 01, 2011 10:49 AM
To: Milligan, Patricia
Cc: Evans, Michele; Landau, Mindy
Subject: FW: testimony for next week
Importance: High

Trish, would you be the appropriate person to add to the attached testimony on the highlighted topics below? If not, can you forward or advise me who to speak with? (You see they also want something about the 50 mile radius decision, which I assume I can lift from the testimony you prepared for Mike Weber this past week.)

I think the attached is already with the Commission for review, so we will need to try to add the additional material today, if possible.

Please get back to me to confirm you've seen this and can assist me today. Thank you!

From: Schmidt, Rebecca
Sent: Friday, April 01, 2011 10:30 AM
To: Landau, Mindy; Rihm, Roger
Cc: Virgilio, Martin; Powell, Amy
Subject: testimony for next week

Just talked to Peter the staffer working on the hearing. He would like us to add information in our written testimony about the operations center and its capabilities if something happened in the US. He is looking for something specific about our knowledge of US plant designs, connections with the plant control room in an emergency situation, communications with the utility ops center etc. In addition, he would like us to put something in about the 50 mile radius—decisionmaking process. FYI—he is also thinking about requesting Don Cool be there with marty to answer specific questions. I think Don did a great job answering his questions earlier and he thought he would do a good job at the hearing.

**TESTIMONY OF MARTIN VIRILIO
DEPUTY EXECUTIVE DIRECTOR FOR REACTOR AND PREPAREDNESS PROGRAMS
UNITED STATES NUCLEAR REGULATORY COMMISSION
TO THE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON INVESTIGATIONS
UNITED STATES HOUSE OF REPRESENTATIVES**

**NRC RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN AND THE CONTINUING
SAFETY OF THE U.S. COMMERCIAL NUCLEAR REACTOR FLEET**

APRIL 6, 2011

The staff of the U.S. Nuclear Regulatory Commission is deeply saddened by the tragedy in Japan. I and many of my colleagues on the NRC staff have had many years of very close and personal interaction with our regulatory counterparts and we would like to extend our condolences to them.

Introduction

The NRC is mindful that our primary responsibility is to ensure the adequate protection of the public health and safety of the American people. We have been very closely monitoring the activities in Japan and reviewing all currently available information. Review of this information, combined with our ongoing inspection and licensing oversight, allows us to say with confidence that the U.S. plants continue to operate safely. There has been no reduction in the licensing or oversight function of the NRC as it relates to any of the U.S. licensees.

We have a long history of conservative regulatory decision-making. We have been using risk insights to help inform our regulatory process, and, over more than 35 years of civilian nuclear power in this country, we have never stopped making improvements to our regulatory framework as we learn from operating experience.

Notwithstanding the very high level of support being provided to respond to events in Japan, we continue to maintain our focus on our domestic responsibilities.

I'd like to begin with a brief overview of our immediate and continuing response. I

then want to spend the bulk of my time discussing the reasons for our confidence in the safety of the U. S. commercial nuclear reactor fleet, and the path forward that we will take to ensure we learn any lessons we need to from events in Japan.

The NRC's immediate and Continuing Response to Events in Japan

On Friday, March 11th an earthquake hit Japan, resulting in the shutdown of more than 10 reactors. From what we know now, it appears possible that the reactors' response to the earthquake went according to design. The ensuing tsunami, however, appears to have caused the loss of normal and emergency AC power to the six units at the Fukushima Daiichi site; it is those six units that have received the majority of our attention since that time. Units One, Two, and Three at the site were in operation at the time of the earthquake. Units Four, Five, and Six were in previously scheduled outages.

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On that same day, we began interactions with our Japanese regulatory counterparts and dispatched two experts to help at the U.S. embassy in Japan. By Monday, we had dispatched a total of 11 staff to Japan. We have subsequently rotated in additional replacement staff to continue our on-the-ground assistance in Japan. The areas of focus for this team are: 1) to assist the Japanese government with technical support as part of the USAID response; and 2) to support the U.S. ambassador. The NRC's Chairman, Dr. Gregory Jaczko, traveled to Toyko on March 28th for several days to convey directly to his Japanese counterparts a message of support and cooperation, and to discuss the current situation.

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While our focus now is on helping Japan in any way that we can, the experience will also help us assess the implications for U.S. citizens and the U.S. reactor fleet in as timely a manner as possible.

We have an extensive range of stakeholders with whom we have ongoing interaction, including the White House, Congressional staff, our state regulatory counterparts, a number of other federal agencies, and international regulatory bodies around the world. We recently sent an NRC staff member to Hawaii to support the United States Armed Forces Pacific Command (USPACOM).

The NRC response in Japan and our Emergency Operations Center continue with the dedicated efforts of over 250 NRC staff on a rotating basis. [UPDATE IF STAFFING SITUATION CHANGES] The entire agency is coordinating and pulling together in response to this event so that we can provide assistance to Japan while continuing the normal activities necessary to fulfill our domestic responsibilities.

Let me also just note here in concluding this section of my remarks that the U.S. government has an extensive network of radiation monitors across this country. Monitoring equipment at nuclear power plants and in the U. S. Environmental Protection Agency's (EPA) system has identified trace amounts of radioactive isotopes consistent with the Japanese nuclear incident, but still far below levels of natural background radiation or of public health concern. has not identified any radiation levels of concern in this country. In fact, natural background radiation from sources such as rocks, the sun, and buildings, is 100,000 times more than doses attributed to any level of the radiation from this event that has been detected in the U.S. to date. Therefore, ~~W~~we feel confident, based on current data, that there is no reason for concern in the United States regarding radioactive releases from Japan.

Continuing Confidence in the Safety of U.S. Nuclear Power Plants

I will now turn to the factors that assure us of ongoing domestic reactor safety. We

Comment [RSR1]: This sentence came from 3/22 NRC press release. On 3/31 EPA reported "levels slightly higher than those found by EPA monitors last week... but still far below levels of public health concern." In another week at time of testimony, we expect to continue to see safe levels, but I don't know if the 100,000 figure will still be correct.

have, since the beginning of the regulatory program in the United States, used a philosophy of Defense-in-Depth, which recognizes that nuclear reactors require the highest standards of design, construction, oversight, and operation, and does not rely on any single layer for protection of public health and safety. We begin with designs for every individual reactor in this country that take into account site-specific factors and include a detailed evaluation for any natural event, such as earthquakes, tornadoes, hurricanes, floods, and tsunamis, as they relate to that site.

There are multiple physical barriers to radiation in every reactor design. Additionally, there are both diverse and redundant safety systems that are required to be maintained in operable condition and frequently tested to ensure that the plant is in a high condition of readiness to respond to any scenario.

We have taken advantage of the lessons learned from previous operating experience to implement a program of continuous improvement for the U.S. reactor fleet. We have learned from experience across a wide range of situations, including most significantly, the Three Mile Island accident in 1979. As a result of those lessons learned, we have significantly revised emergency planning requirements and emergency operating procedures. We have addressed many human factors issues regarding how control room employees operate the plant, added new requirements for hydrogen control to help prevent explosions inside of containment, and created requirements for enhanced control room displays of the status of pumps and valves.

The NRC has a post-accident sampling system that enables the monitoring of radioactive material release and possible fuel degradation. One of the most significant changes after Three Mile Island was expansion of the Resident Inspector Program, which has at least two full-time NRC inspectors on site at each nuclear power plant. These inspectors have unfettered access to all licensees' activities.

As a result of operating experience and ongoing research programs, we have

developed requirements for severe accident management guidelines. These are components and procedures developed to ensure that, in the event all of the above precautions failed and a severe accident occurred, the plant would still protect public health and safety. The requirements for severe accident management have been in effect for many years and are frequently evaluated by the NRC inspection program.

As a result of the events of September 11, 2001, we identified important pieces of equipment that, regardless of the cause of a significant fire or explosion at a plant, we want licensees to have available and staged in advance, as well as new procedures, training requirements, and policies that would help deal with a severe situation.

Our program of continuous improvement based on operating experience will now include evaluation of the significant events in Japan as well as what we can learn from them. We already have begun enhancing inspection activities through temporary instructions to our inspection staff, including the resident inspectors and the region-based inspectors in our four Regional offices, to look at licensees' readiness to deal with both the design basis accidents and the beyond-design basis accidents. The information that we gather will be used to evaluate the industry's readiness for similar events, and will aid in our understanding of whether additional regulatory actions need to be taken in the immediate term.

We have also issued an information notice to the licensees to make them aware of the events in Japan, and the kinds of activities we believe they should be engaged in to verify their readiness. Specifically, we have requested them to verify that their capabilities to mitigate conditions that result from severe accidents, including the loss of significant operational and safety systems, are in effect and operational. Licensees are verifying the capability to mitigate a total loss of electric power to the nuclear plant. They also are verifying the capability to mitigate problems associated with flooding and the resulting impact on systems both inside and outside of the plant. Also, licensees are confirming the equipment that is needed is in place for the

potential loss of equipment due to seismic events appropriate for the site, because each site has its own unique seismic profiles.

During the past 20 years, there have been a number of new rulemakings that have enhanced the domestic fleet's preparedness against some of the problems we are seeing in Japan. The "station blackout" rule requires every plant in this country to analyze what the plant response would be if it were to lose all alternating current so that it could respond using batteries for a period of time, and then have procedures in place to restore alternating current to the site and provide cooling to the core.

The hydrogen rule requires modifications to reduce the impacts of hydrogen generated for beyond-design basis events and core damage. There are equipment qualification rules that require equipment, including pumps and valves, to remain operable under the kinds of environmental temperature and radiation conditions that you would see under a design basis accident. With regard to the type of containment design used by the most heavily damaged plants in Japan, the NRC has had a Boiling Water Reactor Mark I Containment Improvement Program since the late 1980s, which has required installation of hardened vent systems for containment pressure relief, as well as enhanced reliability of the automatic depressurization system.

The final factor I want to mention with regard to our belief in the ongoing safety of the U.S. fleet is the emergency preparedness and planning requirements in place that provide ongoing training, testing, and evaluations of licensees' emergency preparedness programs. In coordination with our federal partner, the Federal Emergency Management Administration (FEMA), these activities include extensive interaction with state and local governments, as those programs are evaluated and tested on a periodic basis.

The Path Ahead

Beyond the initial steps to address the experience from the events in Japan, the

Chairman, with the full support of the Commission, directed the NRC staff to establish a senior level agency task force to conduct a methodical and systematic review of our processes and regulations to determine whether the agency should make additional improvements to our regulatory system and make recommendations to the Commission for its policy direction. This activity will have both near-term and longer-term objectives.

For the near term effort, we are beginning a 90-day review. This review will evaluate all of the currently available information from the Japanese events to identify immediate or near-term operational or regulatory issues potentially affecting the 104 operating reactors in the U.S., including their spent fuel pools. Areas of investigation will include the ability to protect against natural disasters, response to station blackouts, severe accidents and spent fuel accident progression, radiological consequence analysis, and severe accident management issues regarding equipment. Over this 90-day period, we will develop recommendations, as appropriate, for changes to inspection procedures and licensing review guidance, and recommend whether generic communications, orders, or other regulatory requirements are needed.

This 90-day effort will include a 30-day "Quick Look Report" to the Commission to provide a snapshot of the regulatory response and the condition of the U.S. fleet based on information we have available at that time. Preparing a "Quick Look Report" will also ensure that the Commission is both kept informed of ongoing efforts and prepared to resolve any policy recommendations that surface. I believe we will have limited stakeholder involvement in the first 30 days to accomplish this. However over the 90-day and longer-term efforts we will seek additional stakeholder input. At the end of the 90-day period, a report will be provided to the Commission and to the public. The task force's longer-term review will begin as soon as the NRC has sufficient technical information from the events in Japan.

The task force will evaluate all technical and policy issues related to the event to

identify additional potential research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be pursued by the NRC. We also expect to evaluate potential interagency issues, such as emergency preparedness, and examine the applicability of any lessons learned to non-operating reactors and materials licensees. We expect to seek input from stakeholders during this process. A report with appropriate recommendations will be provided to the Commission within 6 months of the start of this evaluation. Both the 90-day and final reports will be made publicly available in accordance with normal Commission processes.

Conclusion

In conclusion, I want to reiterate that we continue to make our domestic responsibilities for licensing and oversight of the U.S. licensees our top priority and that the U.S. plants continue to operate safely. In light of the events in Japan, there is a near-term evaluation of their relevance to the U.S. fleet underway, and we are continuing to gather the information necessary for us to take a longer, more thorough look at the events in Japan and their lessons for us. Based on these efforts, we will take all appropriate actions necessary to ensure the continuing safety of the U.S. fleet.

Rihm, Roger

From: Rihm, Roger
Sent: Friday, April 01, 2011 3:06 PM
To: McDermott, Brian
Cc: Marshall, Jane
Subject: RE: testimony for next week
✓ **Attachments:** Testimony_April6_2011_Rev2.docx

Thanks, Brian. I was on the phone with Jane and sent her the very latest version of Marty's testimony, in which I included text on the 50 mile evacuation that Mike Weber used earlier this week. I just need NSIR to add at the end of the testimony a paragraph or two addressing the highlighted text below.

A little earlier this afternoon, I let OCA know I was having difficulty making contact with appropriate NSIR staff. OCA has not given me a specific deadline, but I know there is a commission review loop, etc. required. In any case, I asked Jane to add to the version I sent (also attached here) and to send to me and Rebecca Schmidt in OCA when she has something. If it can't be by 5PM today, so be it.

Thanks for your prompt attention to this matter!

Roger S. Rihm

Communications and Performance Improvement Staff
Office of the Executive Director for Operations
US NRC
301.415.1717
roger.rihm@nrc.gov

From: McDermott, Brian
Sent: Friday, April 01, 2011 2:59 PM
To: Rihm, Roger; Marshall, Jane
Subject: RE: testimony for next week

Roger,

We'll get you something today by 5pm.

Brian

From: Rihm, Roger
Sent: Friday, April 01, 2011 1:14 PM
To: Marshall, Jane
Cc: McDermott, Brian
Subject: FW: testimony for next week
Importance: High

Jane, I understand I should be working with you on this. Attached is what we want to modify to accommodate the highlighted request below. Can you provide a paragraph or two?

From: Rihm, Roger
Sent: Friday, April 01, 2011 10:49 AM
To: Milligan, Patricia

Cc: Evans, Michele; Landau, Mindy
Subject: FW: testimony for next week
Importance: High

Trish, would you be the appropriate person to add to the attached testimony on the highlighted topics below? If not, can you forward or advise me who to speak with? (You see they also want something about the 50 mile radius decision, which I assume I can lift from the testimony you prepared for Mike Weber this past week.)

I think the attached is already with the Commission for review, so we will need to try to add the additional material today, if possible.

Please get back to me to confirm you've seen this and can assist me today. Thank you!

From: Schmidt, Rebecca
Sent: Friday, April 01, 2011 10:30 AM
To: Landau, Mindy; Rihm, Roger
Cc: Virgilio, Martin; Powell, Amy
Subject: testimony for next week

Just talked to Peter the staffer working on the hearing. He would like us to add information in our written testimony about the operations center and its capabilities if something happened in the US. He is looking for something specific about our knowledge of US plant designs, connections with the plant control room in an emergency situation, communications with the utility ops center etc. In addition, he would like us to put something in about the 50 mile radius—decisionmaking process. FYI—he is also thinking about requesting Don Cool be there with marty to answer specific questions. I think Don did a great job answering his questions earlier and he thought he would do a good job at the hearing.

**TESTIMONY OF MARTIN VIRGILIO
DEPUTY EXECUTIVE DIRECTOR FOR REACTOR AND PREPAREDNESS PROGRAMS
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**NRC RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN AND THE CONTINUING
SAFETY OF THE U.S. COMMERCIAL NUCLEAR REACTOR FLEET**

APRIL 6, 2011

The staff of the U.S. Nuclear Regulatory Commission is deeply saddened by the tragedy in Japan. I and many of my colleagues on the NRC staff have had many years of very close and personal interaction with our regulatory counterparts and we would like to extend our condolences to them.

Introduction

The NRC is mindful that our primary responsibility is to ensure the adequate protection of the public health and safety of the American people. We have been very closely monitoring the activities in Japan and reviewing all currently available information. Review of this information, combined with our ongoing inspection and licensing oversight, allows us to say with confidence that the U.S. plants continue to operate safely. There has been no reduction in the licensing or oversight function of the NRC as it relates to any of the U.S. licensees.

We have a long history of conservative regulatory decision-making. We have been using risk insights to help inform our regulatory process, and, over more than 35 years of civilian nuclear power in this country, we have never stopped making improvements to our regulatory framework as we learn from operating experience.

Notwithstanding the very high level of support being provided to respond to events in Japan, we continue to maintain our focus on our domestic responsibilities.

I'd like to begin with a brief overview of our immediate and continuing response.

including our recommendation for U.S. Citizens in Japan to evacuate out to 50 miles from the Fukushima-Daiichi site. I then want to spend the bulk of my time discussing will discuss the reasons for our confidence in the safety of the U. S. commercial nuclear reactor fleet, and the path forward that we will take to ensure we learn any lessons we need to from events in Japan. Finally, I will give you an overview of NRC incident response capabilities here in the U.S.

The NRC's immediate and Continuing Response to Events in Japan

On Friday, March 11th an earthquake hit Japan, resulting in the shutdown of more than 10 reactors. From what we know now, it appears possible that the reactors' response to the earthquake went according to design. The ensuing tsunami, however, appears to have caused the loss of normal and emergency AC power to the six units at the Fukushima Daiichi site; it is those six units that have received the majority of our attention since that time. Units One, Two, and Three at the site were in operation at the time of the earthquake. Units Four, Five, and Six were in previously scheduled outages.

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On that same day, we began interactions with our Japanese regulatory counterparts and dispatched two experts to help at the U.S. embassy in Japan. By Monday, we had dispatched a total of 11 staff to Japan. We have subsequently rotated in additional replacement staff to continue our on-the-ground assistance in Japan. The areas of focus for this team are: 1) to assist the Japanese government with technical support as part of the

USAID response; and 2) to support the U.S. ambassador. The NRC's Chairman, Dr. Gregory Jaczko, traveled to Toyko on March 28th for several days to convey directly to his Japanese counterparts a message of support and cooperation, and to discuss the current situation.

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While our focus now is on helping Japan in any way that we can, the experience will also help us assess the implications for U.S. citizens and the U.S. reactor fleet in as timely a manner as possible.

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The decision regarding the 50 mile evacuation recommendation was made in order to provide timely information to the U.S. Ambassador in Japan, and to best protect the health and safety of U.S. citizens in Japan. We based our assessment on the conditions as we understood them at the time. 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. In order to determine the proper evacuation distance, the NRC staff performed a series of calculations using NRC's RASCAL computer code to assess possible offsite consequences. The computer models used meteorological model data appropriate for the Fukushima Daiichi vicinity. Source terms were based on hypothetical, but not unreasonable

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estimates of fuel damage, containment, and other release conditions. These calculations demonstrated that the Environmental Protection Agency's Protective Action Guidelines could be exceeded at a distance of 50 miles from the Fukushima site, if a large-scale release occurred from the reactors or spent fuel pools. We understood that some of our assumptions were conservative, but believed that it was better to err on the side of protection, especially in the case of a seemingly rapidly deteriorating situation. The U.S. Emergency Preparedness framework provides for the expansion of emergency planning zones as conditions require. Acting in accordance with this framework, and with the best information available at the time, the NRC determined that evacuation out to 50 miles for U.S. citizens was an appropriate course of action, and we made that recommendation to other U.S. Government agencies.

Let me also just note here in concluding this section of my remarks that the U.S. government has an extensive network of radiation monitors across this country. Monitoring equipment at nuclear power plants and in the U. S. Environmental Protection Agency's (EPA) system has identified trace amounts of radioactive isotopes consistent with the Japanese nuclear incident, but still far below levels of natural background radiation or of public health concern. has not identified any radiation levels of concern in this country. In fact, natural background radiation from sources such as rocks, the sun, and buildings, is 100,000 times more than doses attributed to any level of the radiation from this event that has been detected in the U.S. to date. Therefore, ~~W~~we feel confident, based on current data, that there is no reason for concern in the United States regarding radioactive releases from Japan.

Continuing Confidence in the Safety of U.S. Nuclear Power Plants

I will now turn to the factors that assure us of ongoing domestic reactor safety. We have, since the beginning of the regulatory program in the United States, used a philosophy of Defense-in-Depth, which recognizes that nuclear reactors require the highest standards of design, construction, oversight, and operation, and does not rely on any single layer for

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There are multiple physical barriers to radiation in every reactor design. Additionally, there are both diverse and redundant safety systems that are required to be maintained in operable condition and frequently tested to ensure that the plant is in a high condition of readiness to respond to any scenario.

We have taken advantage of the lessons learned from previous operating experience to implement a program of continuous improvement for the U.S. reactor fleet. We have learned from experience across a wide range of situations, including most significantly, the Three Mile Island accident in 1979. As a result of those lessons learned, we have significantly revised emergency planning requirements and emergency operating procedures. We have addressed many human factors issues regarding how control room employees operate the plant, added new requirements for hydrogen control to help prevent explosions inside of containment, and created requirements for enhanced control room displays of the status of pumps and valves.

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As a result of operating experience and ongoing research programs, we have developed requirements for severe accident management guidelines. These are components and procedures developed to ensure that, in the event all of the above precautions failed and a severe accident occurred, the plant would still protect public health

and safety. The requirements for severe accident management have been in effect for many years and are frequently evaluated by the NRC inspection program.

As a result of the events of September 11, 2001, we identified important pieces of equipment that, regardless of the cause of a significant fire or explosion at a plant, we want licensees to have available and staged in advance, as well as new procedures, training requirements, and policies that would help deal with a severe situation.

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enhanced the domestic fleet's preparedness against some of the problems we are seeing in Japan. The "station blackout" rule requires every plant in this country to analyze what the plant response would be if it were to lose all alternating current so that it could respond using batteries for a period of time, and then have procedures in place to restore alternating current to the site and provide cooling to the core.

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The final factor I want to mention with regard to our belief in the ongoing safety of the U.S. fleet is the emergency preparedness and planning requirements in place that provide ongoing training, testing, and evaluations of licensees' emergency preparedness programs. In coordination with our federal partner, the Federal Emergency Management Administration (FEMA), these activities include extensive interaction with state and local governments, as those programs are evaluated and tested on a periodic basis.

The Path Ahead

Beyond the initial steps to address the experience from the events in Japan, the Chairman, with the full support of the Commission, directed the NRC staff to establish a senior level agency task force to conduct a methodical and systematic review of our processes and regulations to determine whether the agency should make additional

improvements to our regulatory system and make recommendations to the Commission for its policy direction. This activity will have both near-term and longer-term objectives.

For the near term effort, we are beginning a 90-day review. This review will evaluate all of the currently available information from the Japanese events to identify immediate or near-term operational or regulatory issues potentially affecting the 104 operating reactors in the U.S., including their spent fuel pools. Areas of investigation will include the ability to protect against natural disasters, response to station blackouts, severe accidents and spent fuel accident progression, radiological consequence analysis, and severe accident management issues regarding equipment. Over this 90-day period, we will develop recommendations, as appropriate, for changes to inspection procedures and licensing review guidance, and recommend whether generic communications, orders, or other regulatory requirements are needed.

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The task force will evaluate all technical and policy issues related to the event to identify additional potential research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be pursued by the NRC. We also expect to evaluate potential interagency issues, such as emergency

preparedness, and examine the applicability of any lessons learned to non-operating reactors and materials licensees. We expect to seek input from stakeholders during this process. A report with appropriate recommendations will be provided to the Commission within 6 months of the start of this evaluation. Both the 90-day and final reports will be made publicly available in accordance with normal Commission processes.

Conclusion

In conclusion, I want to reiterate that we continue to make our domestic responsibilities for licensing and oversight of the U.S. licensees our top priority and that the U.S. plants continue to operate safely. In light of the events in Japan, there is a near-term evaluation of their relevance to the U.S. fleet underway, and we are continuing to gather the information necessary for us to take a longer, more thorough look at the events in Japan and their lessons for us. Based on these efforts, we will take all appropriate actions necessary to ensure the continuing safety of the U.S. fleet.

Rihm, Roger

From: Rihm, Roger
Sent: Friday, April 01, 2011 3:14 PM
To: Schmidt, Rebecca
Cc: Marshall, Jane; Powell, Amy; Landau, Mindy
Subject: Revised Testimony for Marty
✓ **Attachments:** Testimony_April6_2011_Rev2.docx

Importance: High

Rebecca, I've attached a revision of the draft I sent Amy yesterday that now incorporates the 50 mile evacuation discussion. I only recently made contact with Jane Marshall in NSIR (who had been in the EOC today) and it is her staff that will respond to the other items the committee staffer has asked to be included. They will try to get something before the day is over, but that may not be possible. I've asked Jane to send the further revised testimony to you and me when she has something prepared.

Note: the basis of the attached testimony was Bill's remarks from earlier this week. I had sent to Amy yesterday showing strikeout, etc. to highlight changes being made from that version for Marty. The attached continues to track changes.

Hope this timing works for you!

V/330

**TESTIMONY OF MARTIN VIRGILIO
DEPUTY EXECUTIVE DIRECTOR FOR REACTOR AND PREPAREDNESS PROGRAMS
UNITED STATES NUCLEAR REGULATORY COMMISSION
TO THE COMMITTEE ON ENERGY AND COMMERCE
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**NRC RESPONSE TO RECENT NUCLEAR EVENTS IN JAPAN AND THE CONTINUING
SAFETY OF THE U.S. COMMERCIAL NUCLEAR REACTOR FLEET**

APRIL 6, 2011

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Notwithstanding the very high level of support being provided to respond to events in Japan, we continue to maintain our focus on our domestic responsibilities.

I'd like to begin with a brief overview of our immediate and continuing response.

including our recommendation for U.S. Citizens in Japan to evacuate out to 50 miles from the Fukushima-Daiichi site. I then want to spend the bulk of my time discussing will discuss the reasons for our confidence in the safety of the U. S. commercial nuclear reactor fleet, and the path forward that we will take to ensure we learn any lessons we need to from events in Japan. Finally, I will give you an overview of NRC incident response capabilities here in the U.S.

The NRC's immediate and Continuing Response to Events in Japan

On Friday, March 11th an earthquake hit Japan, resulting in the shutdown of more than 10 reactors. From what we know now, it appears possible that the reactors' response to the earthquake went according to design. The ensuing tsunami, however, appears to have caused the loss of normal and emergency AC power to the six units at the Fukushima Daiichi site; it is those six units that have received the majority of our attention since that time. Units One, Two, and Three at the site were in operation at the time of the earthquake. Units Four, Five, and Six were in previously scheduled outages.

Shortly after 4:00 AM EDT on Friday, March 11th, the NRC Emergency Operations Center made the first call, informing NRC management of the earthquake and the potential impact on U.S. plants. We went into the monitoring mode at the Emergency Operations Center and the first concern for the NRC was possible impacts of the tsunami on U.S. plants and radioactive materials on the West Coast, and in Hawaii, Alaska, and U.S. Territories in the Pacific.

On that same day, we began interactions with our Japanese regulatory counterparts and dispatched two experts to help at the U.S. embassy in Japan. By Monday, we had dispatched a total of 11 staff to Japan. We have subsequently rotated in additional replacement staff to continue our on-the-ground assistance in Japan. The areas of focus for this team are: 1) to assist the Japanese government with technical support as part of the

USAID response; and 2) to support the U.S. ambassador. The NRC's Chairman, Dr. Gregory Jaczko, traveled to Tokyo on March 28th for several days to convey directly to his Japanese counterparts a message of support and cooperation, and to discuss the current situation.

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While our focus now is on helping Japan in any way that we can, the experience will also help us assess the implications for U.S. citizens and the U.S. reactor fleet in as timely a manner as possible.

We have an extensive range of stakeholders with whom we have ongoing interaction, including the White House, Congressional staff, our state regulatory counterparts, a number of other federal agencies, and international regulatory bodies around the world. We recently sent an NRC staff member to Hawaii to support the United States Armed Forces Pacific Command (USPACOM).

The NRC response in Japan and our Emergency Operations Center continue with the dedicated efforts of over 250 NRC staff on a rotating basis. [UPDATE IF STAFFING SITUATION CHANGES] The entire agency is coordinating and pulling together in response to this event so that we can provide assistance to Japan while continuing the normal activities necessary to fulfill our domestic responsibilities.

The decision regarding the 50 mile evacuation recommendation was made in order to provide timely information to the U.S. Ambassador in Japan, and to best protect the health and safety of U.S. citizens in Japan. We based our assessment on the conditions as we understood them at the time. 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. In order to determine the proper evacuation distance, the NRC staff performed a series of calculations using NRC's RASCAL computer code to assess possible offsite consequences. The computer models used meteorological model data appropriate for the Fukushima Daiichi vicinity. Source terms were based on hypothetical, but not unreasonable

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estimates of fuel damage, containment, and other release conditions. These calculations demonstrated that the Environmental Protection Agency's Protective Action Guidelines could be exceeded at a distance of 50 miles from the Fukushima site, if a large-scale release occurred from the reactors or spent fuel pools. We understood that some of our assumptions were conservative, but believed that it was better to err on the side of protection, especially in the case of a seemingly rapidly deteriorating situation. The U.S. Emergency Preparedness framework provides for the expansion of emergency planning zones as conditions require. Acting in accordance with this framework, and with the best information available at the time, the NRC determined that evacuation out to 50 miles for U.S. citizens was an appropriate course of action, and we made that recommendation to other U.S. Government agencies.

Let me also just note here in concluding this section of my remarks that the U.S. government has an extensive network of radiation monitors across this country. Monitoring equipment at nuclear power plants and in the U. S. Environmental Protection Agency's (EPA) system has identified trace amounts of radioactive isotopes consistent with the Japanese nuclear incident, but still far below levels of natural background radiation or of public health concern. has not identified any radiation levels of concern in this country. In fact, natural background radiation from sources such as rocks, the sun, and buildings, is 100,000 times more than doses attributed to any level of the radiation from this event that has been detected in the U.S. to date. Therefore, ~~W~~we feel confident, based on current data, that there is no reason for concern in the United States regarding radioactive releases from Japan.

Continuing Confidence in the Safety of U.S. Nuclear Power Plants

I will now turn to the factors that assure us of ongoing domestic reactor safety. We have, since the beginning of the regulatory program in the United States, used a philosophy of Defense-in-Depth, which recognizes that nuclear reactors require the highest standards of design, construction, oversight, and operation, and does not rely on any single layer for

Comment [RSR1]: This sentence came from 3/22 NRC press release. On 3/31 EPA reported "levels slightly higher than those found by EPA monitors last week... but still far below levels of public health concern." In another week at time of testimony, we expect to continue to see safe levels, but I don't know if the 100,000 figure will still be correct.

protection of public health and safety. We begin with designs for every individual reactor in this country that take into account site-specific factors and include a detailed evaluation for any natural event, such as earthquakes, tornadoes, hurricanes, floods, and tsunamis, as they relate to that site.

There are multiple physical barriers to radiation in every reactor design. Additionally, there are both diverse and redundant safety systems that are required to be maintained in operable condition and frequently tested to ensure that the plant is in a high condition of readiness to respond to any scenario.

We have taken advantage of the lessons learned from previous operating experience to implement a program of continuous improvement for the U.S. reactor fleet. We have learned from experience across a wide range of situations, including most significantly, the Three Mile Island accident in 1979. As a result of those lessons learned, we have significantly revised emergency planning requirements and emergency operating procedures. We have addressed many human factors issues regarding how control room employees operate the plant, added new requirements for hydrogen control to help prevent explosions inside of containment, and created requirements for enhanced control room displays of the status of pumps and valves.

The NRC has a post-accident sampling system that enables the monitoring of radioactive material release and possible fuel degradation. One of the most significant changes after Three Mile Island was expansion of the Resident Inspector Program, which has at least two full-time NRC inspectors on site at each nuclear power plant. These inspectors have unfettered access to all licensees' activities.

As a result of operating experience and ongoing research programs, we have developed requirements for severe accident management guidelines. These are components and procedures developed to ensure that, in the event all of the above precautions failed and a severe accident occurred, the plant would still protect public health

and safety. The requirements for severe accident management have been in effect for many years and are frequently evaluated by the NRC inspection program.

As a result of the events of September 11, 2001, we identified important pieces of equipment that, regardless of the cause of a significant fire or explosion at a plant, we want licensees to have available and staged in advance, as well as new procedures, training requirements, and policies that would help deal with a severe situation.

Our program of continuous improvement based on operating experience will now include evaluation of the significant events in Japan as well as what we can learn from them. We already have begun enhancing inspection activities through temporary instructions to our inspection staff, including the resident inspectors and the region-based inspectors in our four Regional offices, to look at licensees' readiness to deal with both the design basis accidents and the beyond-design basis accidents. The information that we gather will be used to evaluate the industry's readiness for similar events, and will aid in our understanding of whether additional regulatory actions need to be taken in the immediate term.

We have also issued an information notice to the licensees to make them aware of the events in Japan, and the kinds of activities we believe they should be engaged in to verify their readiness. Specifically, we have requested them to verify that their capabilities to mitigate conditions that result from severe accidents, including the loss of significant operational and safety systems, are in effect and operational. Licensees are verifying the capability to mitigate a total loss of electric power to the nuclear plant. They also are verifying the capability to mitigate problems associated with flooding and the resulting impact on systems both inside and outside of the plant. Also, licensees are confirming the equipment that is needed is in place for the potential loss of equipment due to seismic events appropriate for the site, because each site has its own unique seismic profiles.

During the past 20 years, there have been a number of new rulemakings that have

enhanced the domestic fleet's preparedness against some of the problems we are seeing in Japan. The "station blackout" rule requires every plant in this country to analyze what the plant response would be if it were to lose all alternating current so that it could respond using batteries for a period of time, and then have procedures in place to restore alternating current to the site and provide cooling to the core.

The hydrogen rule requires modifications to reduce the impacts of hydrogen generated for beyond-design basis events and core damage. There are equipment qualification rules that require equipment, including pumps and valves, to remain operable under the kinds of environmental temperature and radiation conditions that you would see under a design basis accident. With regard to the type of containment design used by the most heavily damaged plants in Japan, the NRC has had a Boiling Water Reactor Mark I Containment Improvement Program since the late 1980s, which has required installation of hardened vent systems for containment pressure relief, as well as enhanced reliability of the automatic depressurization system.

The final factor I want to mention with regard to our belief in the ongoing safety of the U.S. fleet is the emergency preparedness and planning requirements in place that provide ongoing training, testing, and evaluations of licensees' emergency preparedness programs. In coordination with our federal partner, the Federal Emergency Management Administration (FEMA), these activities include extensive interaction with state and local governments, as those programs are evaluated and tested on a periodic basis.

The Path Ahead

Beyond the initial steps to address the experience from the events in Japan, the Chairman, with the full support of the Commission, directed the NRC staff to establish a senior level agency task force to conduct a methodical and systematic review of our processes and regulations to determine whether the agency should make additional

improvements to our regulatory system and make recommendations to the Commission for its policy direction. This activity will have both near-term and longer-term objectives.

For the near term effort, we are beginning a 90-day review. This review will evaluate all of the currently available information from the Japanese events to identify immediate or near-term operational or regulatory issues potentially affecting the 104 operating reactors in the U.S., including their spent fuel pools. Areas of investigation will include the ability to protect against natural disasters, response to station blackouts, severe accidents and spent fuel accident progression, radiological consequence analysis, and severe accident management issues regarding equipment. Over this 90-day period, we will develop recommendations, as appropriate, for changes to inspection procedures and licensing review guidance, and recommend whether generic communications, orders, or other regulatory requirements are needed.

This 90-day effort will include a 30-day "Quick Look Report" to the Commission to provide a snapshot of the regulatory response and the condition of the U.S. fleet based on information we have available at that time. Preparing a "Quick Look Report" will also ensure that the Commission is both kept informed of ongoing efforts and prepared to resolve any policy recommendations that surface. I believe we will have limited stakeholder involvement in the first 30 days to accomplish this. However over the 90-day and longer-term efforts we will seek additional stakeholder input. At the end of the 90-day period, a report will be provided to the Commission and to the public. The task force's longer-term review will begin as soon as the NRC has sufficient technical information from the events in Japan.

The task force will evaluate all technical and policy issues related to the event to identify additional potential research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be pursued by the NRC. We also expect to evaluate potential interagency issues, such as emergency

preparedness, and examine the applicability of any lessons learned to non-operating reactors and materials licensees. We expect to seek input from stakeholders during this process. A report with appropriate recommendations will be provided to the Commission within 6 months of the start of this evaluation. Both the 90-day and final reports will be made publicly available in accordance with normal Commission processes.

Conclusion

In conclusion, I want to reiterate that we continue to make our domestic responsibilities for licensing and oversight of the U.S. licensees our top priority and that the U.S. plants continue to operate safely. In light of the events in Japan, there is a near-term evaluation of their relevance to the U.S. fleet underway, and we are continuing to gather the information necessary for us to take a longer, more thorough look at the events in Japan and their lessons for us. Based on these efforts, we will take all appropriate actions necessary to ensure the continuing safety of the U.S. fleet.