Rihm, Roger

From: Rihm, Roger
Sent: Friday, March 25, 2011 8:27 AM
To: Hoc, PMT12
Cc: Brock, Kathryn
Subject: FW: Looking for some assistance
Attachments: Testimony_Japan Insert.docx

From: Rihm, Roger
Sent: Thursday, March 24, 2011 11:52 AM
To: Merzke, Daniel; Sanfilippo, Nathan; Andersen, James; Wittick, Brian
Subject: Looking for some assistance

Was wondering if one of you is sufficiently in the know to be able to help me on this, or if you can suggest someone who is.

Bill is testifying before Senate Energy Comm on Tuesday. I drafted his "statement for the record" and am now beginning to craft from that a shorter oral statement that he will make. In the longer statement I don't include a chronology/status of Japanese events as that statement is now out of my hands (gone to OCA/Commission) and it would be out of date by Tuesday. However, Bill does want to be able to give a brief overview and current status in his oral presentation. Attached is what Bill said when he testified before the Commission. It only gets me thru the first few days. I would like to add probably not more than an additional paragraph or two (at the most) that provides a couple of key highlights since then and then gives a current status. I would need this text on MONDAY.

Are any of you following events sufficiently closely to provide this or can you suggest who might be able to?

Thanks a lot!

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

Hours after the tsunami, it appears that operators at the site lost capability to inject cooling water into the reactor vessels on Units One, Two, and Three and into the spent fuel pools in several units. On Saturday, March 12th, a hydrogen explosion occurred in Unit One; and then the following Monday, March 14th, a hydrogen explosion in Unit Three. On Tuesday, the 15th of March, there were explosions in Unit Two and in Unit Four from hydrogen originating, we believe, from overheated fuel in the spent fuel pool. [Briefly summarize period of March 16 – 29/provide current status]

Rihm, Roger

From: Rihm, Roger
Sent: Friday, March 25, 2011 9:29 AM
To: Powell, Amy
Cc: Schmidt, Rebecca; Riley (OCA), Timothy; Landau, Mindy
Subject: EPP Testimony for Weds
Attachments: Testimony_EPP_March 30 2011.docx

Importance: High

We've given this a quick once over and asked NSIR for a bit more information (as noted in attached). Mike did not review and just asked us to proceed. I can imagine you may want to tone down some of the description of what went into our Japan 50-mile decision....

Trish Milligan from NSIR is prepared/planning to accompany Mike on Weds. Is that consistent with your views?

[note: there is something odd going on with the formatting of the attached when you make edits that is beyond my technical capabilities to fix permanently]

On the 3/29 testimony, do you have a revision I can use to continue to craft the oral statement to be sure I capture your changes?

Y/265

Good morning, Mr. Chairman and members of the Subcommittee. I am pleased to appear before you on behalf of the United States Nuclear Regulatory Commission to discuss our emergency planning and preparedness programs at nuclear power facilities in the United States, and to discuss the protective action guidance recently issued by the NRC to American citizens in Japan in response to the events at the Fukashima 1 nuclear power plant site.

NRC's primary mission is to regulate nuclear reactors, materials, and waste facilities in a manner that protects the health and safety of the public and promotes the common defense and security. Emergency preparedness is a key element of the "defense in depth" safety philosophy we employ for nuclear power plants. This philosophy ensures high quality in design, construction, and operation of nuclear power plants; requires redundant safety systems that reduce the chances that malfunctions will lead to accidents; and recognizes that in spite of all these precautions, accidents could occur. Through emergency planning and preparedness, mechanisms are in place to protect the public in the unlikely event that these barriers were to fail.

For planning purposes, we define two planning zones around nuclear power plant sites. The planning zones are based on a study of accidents, known as the WASH 1400 report, that examined a range of events from design basis accidents to catastrophic severe accidents. The study made a number of very conservative assumptions regarding the performance of safety equipment, the radionuclides in the core that could be released, and the timing of the release. The first zone is an area covering about 10 miles in all directions around nuclear power plants where the greatest potential for radiological effects from a release exists. Planning for this area is comprehensive and includes such protective actions as evacuation, sheltering, and potassium iodide, as appropriate, for members of the public. Consideration of these protective actions is prompted at very low projected dose levels. A second extended planning zone of about 50 miles is also established around each

plant to deal with potential lower-level, long-term risks primarily due to exposure from consumption of contaminated food, milk, and water. This comprehensive planning within the 10 and 50 mile EPZ provides a substantial basis for expansion of response efforts in the event that this is necessary. [OCA: we've asked NSIR to add a bit here about drills, etc. to "round out" the discussion of EPP program. Will pass along as soon as we get it.]

Let me now address the NRC's recent protective action recommendation for U.S citizens in Japan to evacuate out to 50 miles from the Fukashima Daiichi site. That decision was based on best information available at that time. The information flow from the Fukashima site was often confusing and conflicting. The NRC was receiving much of its information from the same open sources available to everyone; such as CNN. We based our assessment on the conditions as we understood them. Units 1, 2, and 3 appeared to have suffered significant damage as a result of reported hydrogen explosions; Unit 4 was in a refueling outage and its entire core had been transferred to the spent fuel pool a little more than 3 months earlier so there was fresh fuel in the spent fuel pool that was in danger of overheating if the water level dropped, and there were indications that was happening. Additionally, there were some radiation monitors that were showing very high levels of radiation on the plant site, which would pose challenges to plant crew attempting to stabilize the reactors, and there were some offsite readings indicating that fuel damage had occurred. This situation was unprecedented. This is a 6 unit site and 4 of the units were facing extraordinary challenges. The staff performed a series of calculations to assess possible offsite consequences. We understood that some of our assumptions were conservative. However, we were unable to discuss or verify our assumptions with the licensee or our Japanese counterparts. In the United States, the NRC has resident inspector staff at the plants that can report back to the Region and Headquarters on conditions as they are evolving, we are able to readily access "live-time" plant parameters and radiation monitors, as well as talk directly to plant staff and emergency management

officials which enabled us to refine our understanding and consequence assessments. With the Fukashima event we had to make our best decision with what we had available. The Emergency Preparedness framework provides for the expansion of the 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.

Caponiti, Kathleen

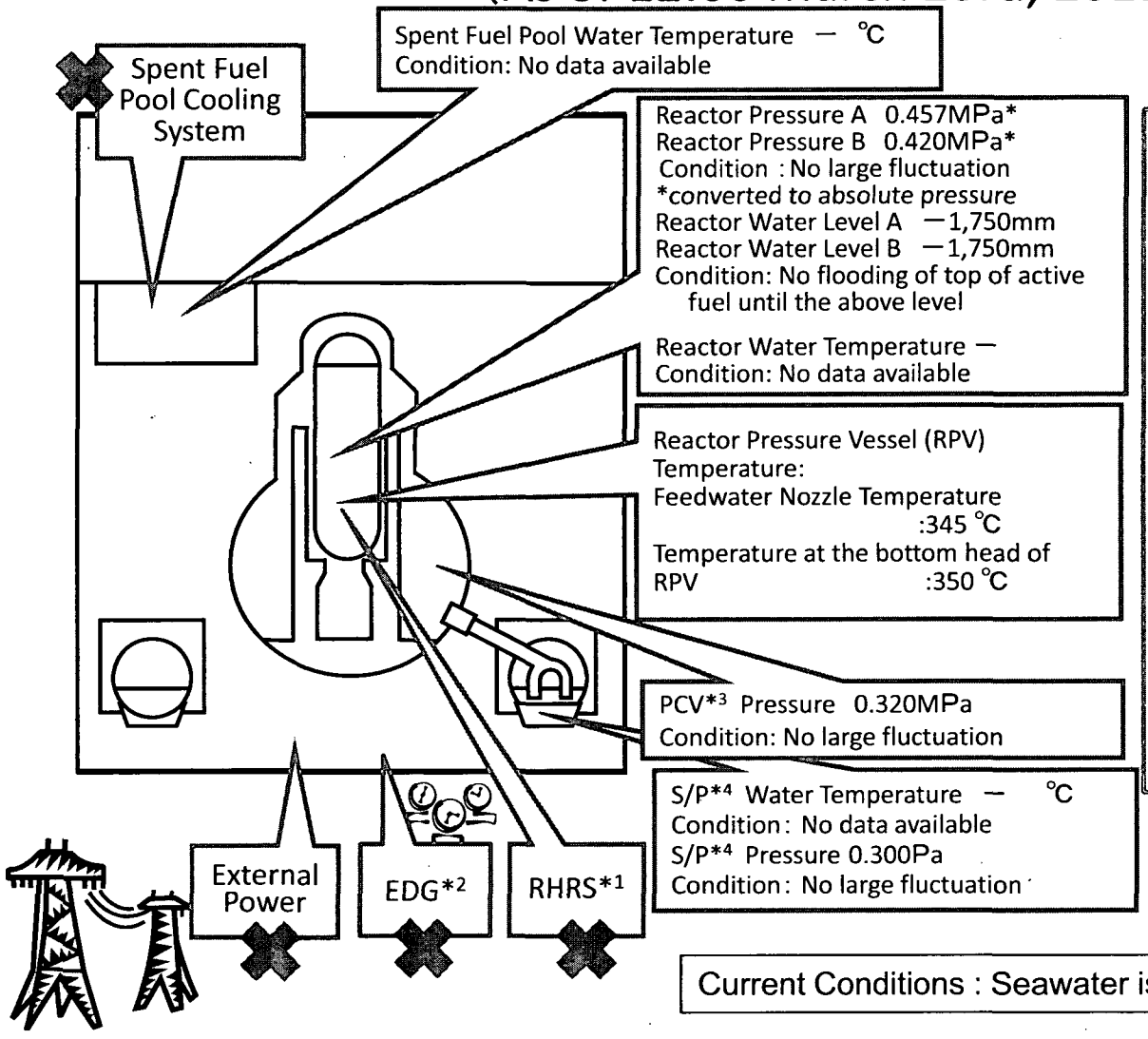
From: Orenak, Michael , NRR
Sent: Friday, March 25, 2011 2:59 PM
To: Bedi, Gurjendra; Billerbeck, John; Farnan, Michael; Huang, John; McMurtray, Anthony; Wolfgang, Robert
Subject: powerpoint on Japan
Attachments: NISA.Status AllUnits..1203.1200. 6pp.en20110323-3-2.pdf; NISA. Sequence and status. 2303.21pp.en20110323-3-1.pdf; Fukuchima_eng_20110320.pps

I just received this from the Symposium session chairs. Check out the interesting powerpoint presentation if you have time.

From: Robert Horvath [mailto:HorvathR@asme.org]
Sent: Friday, March 25, 2011 2:32 PM
To: jeallen@IEIAForum.org; Robert_Parry@fpl.com; Orenak, Michael; john.zudans@ch2m.com; Robert.Kershaw@aps.com
Cc: Claude Thibault
Subject:

4/26

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 1
(As of 12:00 March 23rd, 2011)



Major Events after the earthquake

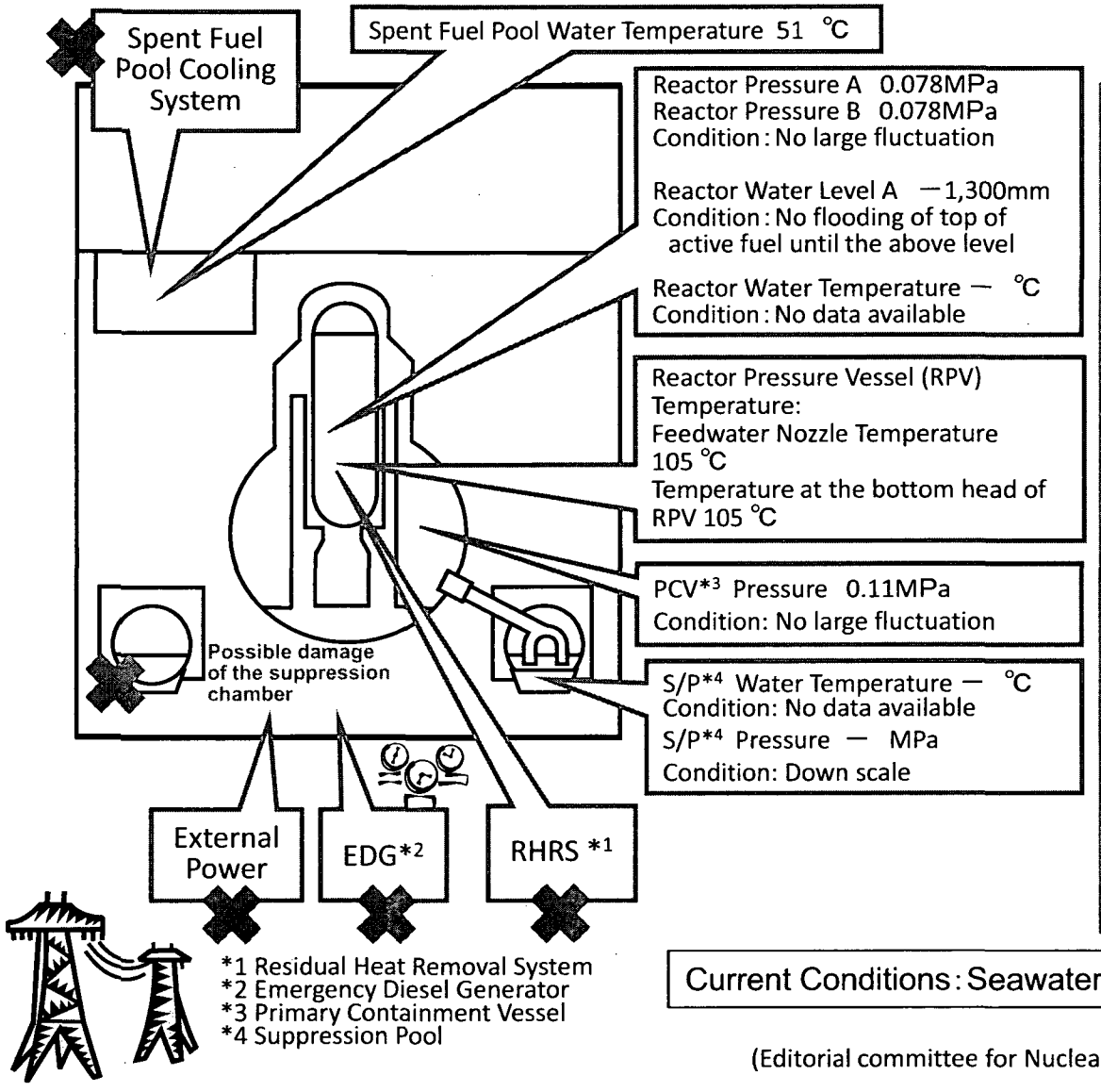
- 11th 14:46 : Under operation, Automatic shutdown by the earthquake
- 11th 15:42 : Report based on the Article 10 (Total loss of A/C power)
- 11th 16:36: Occurrence of the Article 15 event (Inability of water injection of the Emergency Core Cooling System)
- 12th 1:20 Occurrence of the Article 15 event (Unusual rise of the pressure in PCV)
- 12th 14:30 Started to vent
- 12th 15:36 Sound of explosion
- 12th 20:20 Started to inject seawater and borated water to core
- 23rd 02:33 The amount of injected water to the Rector Core was increased utilizing water supply line in addition to the Fire Extinguish line ($2m^3/h \rightarrow 18m^3/h$)

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

Current Conditions : Seawater is being injected to the core

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

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 2
(As of 12:00 March 23rd, 2011)



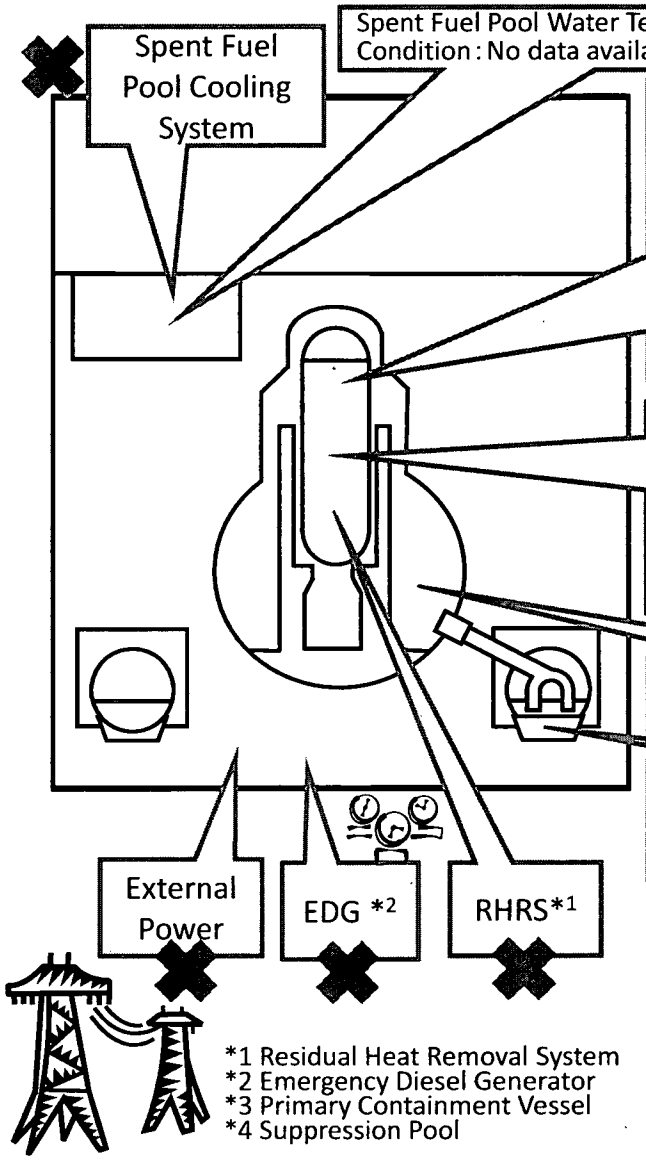
Major Events after the earthquake

- 11th 14:46 Under operation, Automatic shutdown by the earthquake
- 11th 15:42 Report based on the Article 10 (Total loss of A/C power)
- 11th 16:36 Occurrence of the Article 15 event (Inability of water injection of the Emergency Core Cooling System)
- 14th 13:25 Occurrence of the Article 15 event (Loss of reactor cooling functions)
- 14th 22:50 Occurrence of the Article 15 event (Unusual rise of the pressure in PCV)
- 15th 6:10 Sound of explosion
- 15th around 6:20 Possible damage of the suppression chamber
- 20th 15:05～17:20 Approximately 40 ton seawater injection to the Spent Fuel Pool (SFP) via Fuel Pool Cooling System (FPC)
- 20th 15:46 Power Center received electricity.
- 21st 18:22 White smoke generated. The smoke died down and almost invisible.
- 22nd 16:07 Injection of around 18 tons of seawater to the Spent Fuel Pool

Current Conditions : Seawater is being injected to the core

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

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 3
(As of 12:00 March 23rd, 2011)



Spent Fuel Pool Water Temperature — ℃
Condition : No data available

Reactor Pressure C -0.003MPa
Reactor Pressure A 0.135MPa
Condition : Tend to decrease

Reactor Water Level A —1,800mm
Reactor Water Level B —2,300mm
Condition : No flooding of top of active fuel until the above level

Reactor Water Temperature — ℃
Condition : No data available

Reactor Pressure Vessel (RPV) Temperature
Feedwater Nozzle Temperature : 304.8℃
Temperature at the bottom head of RPV :225.5℃

PCV*3 Pressure 0.100MPa
Condition: No large fluctuation

S/P*4 Water Temperature — ℃
Condition : No data available
S/P*4 Pressure — MPa
Condition: Down scale

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

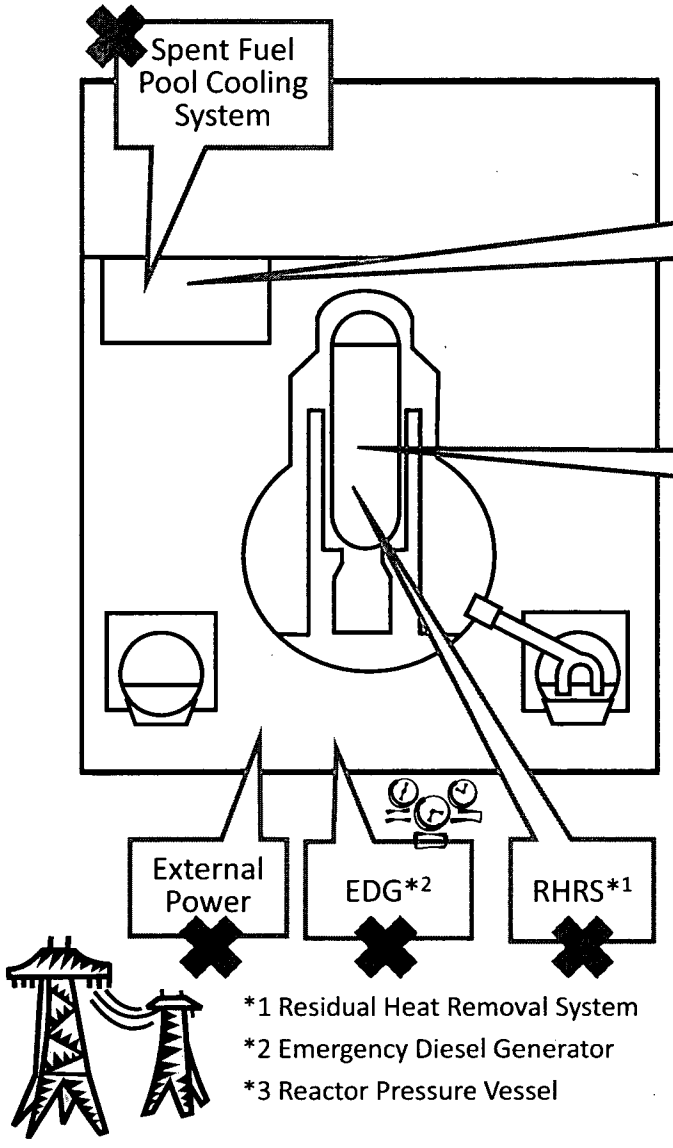
Major Events after the earthquake

11th 14:46 Under operation, Automatic shutdown by the earthquake
11th 5:42 Report based on the Article 10 (Total loss of A/C power)
13th 5:10 Occurrence of the Article 15 event (Inability of water injection of the Emergency Core Cooling System)
13th 9:20 Started to vent
14th 7:44 Occurrence of the Article 15 event (Unusual rise of the pressure in PCV)
14th 11:01 Sound of explosion
16th around 8:30 White smoke generated.
17th 9:48～10:01 Water discharge by the helicopters of Self-Defense Force (4 times)
19:05～20:07 Water spray from the ground by High pressure water-cannon trucks (Police: once, Self-Defense Force: 5 times)
18th before 14:00～14:38 Water spray from the ground by 6 fire engines of Self-Defense Force
~14:45 Water spray from the ground by a fire engine of the US Military
19th 0:00 ～01:00 Water spray by Tokyo Fire Department
19th 14:10 ～ 20th 3:40 Water spray by Tokyo Fire Department
20th 11:00 Pressure of PCV rose(320kPa).Afterward fell.
20th 20:39 ～ 21st 3:58 Water spray by Tokyo Fire Department
21st about 15:55 Grayish smoke generated and was confirmed to be died down at 17:55.
22nd 15:10 ～15:59 Water spray by Tokyo Fire Department
22nd 22:43 Lightening in the Central Control Room was recovered.

Current Conditions : Water spray to Spent Fuel Pool and sea water injection to the Reactor Core

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

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 4
(As of 12:00 March 23rd, 2011)



In periodic inspection outage

Water temperature in the pools is not available

No fuel is inside the reactor core

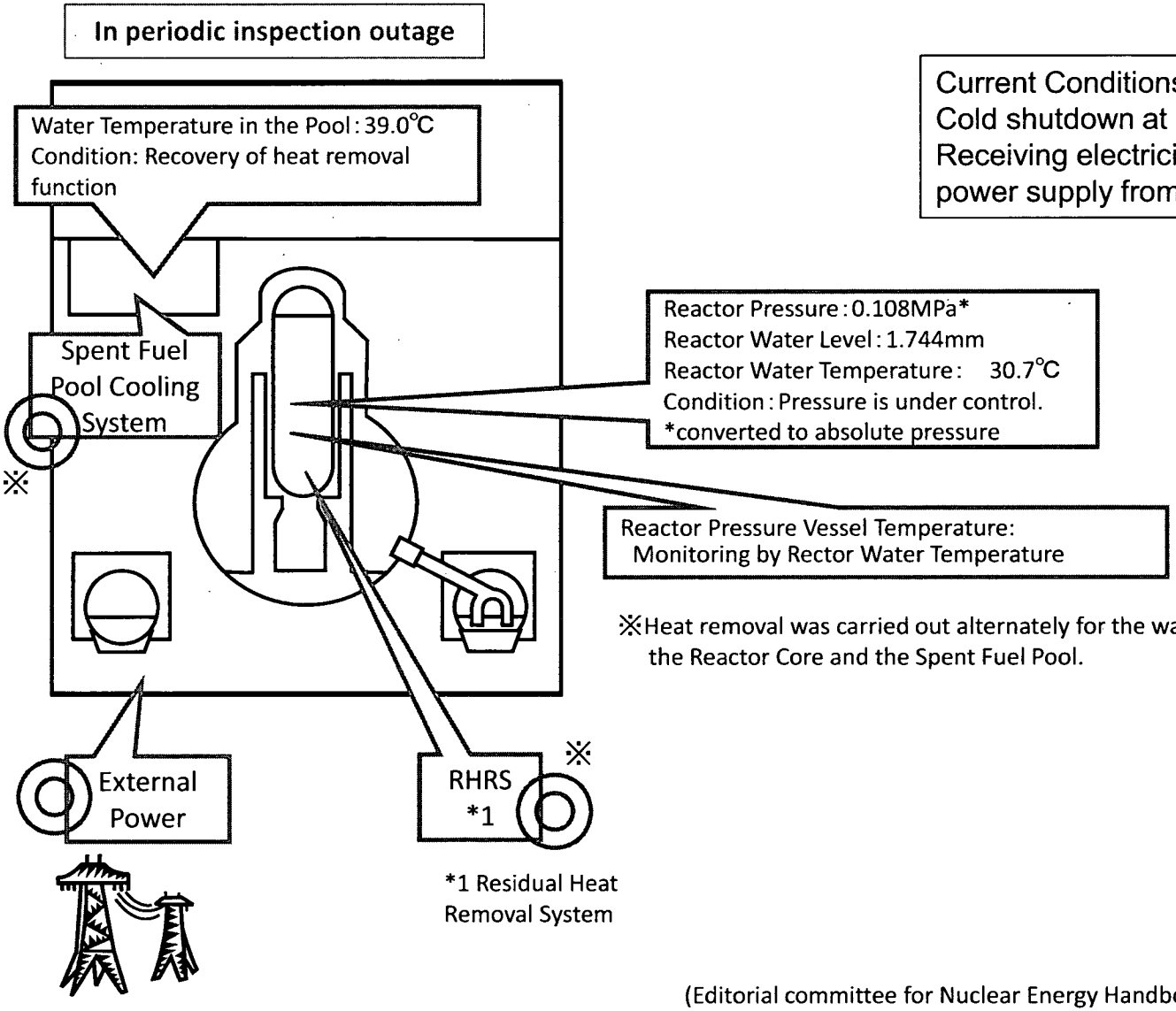
Major events after the earthquake

In periodic inspection outage when the earthquake occurred.
11th 15:42 Report based on the Article 10 (Total loss of A/C power)
14th 4:08 Water temperature in the Spent Fuel Pool, 84℃
15th 6:14 Damage of wall in the 4th floor confirmed
15th 9:38 Fire occurred in the 3rd floor. (12:25 extinguished)
16th 5:45 Fire occurred. TEPCO couldn't confirm any fire on the ground. (6:15)
20th 9:43 Water spray over the Spent Fuel Pool by Self-Defense Force
20th around 18:30~19:46 Water spray over the Spent Fuel Pool by Self-Defense Force
21st 6:37~8:41 Water spray over the Spent Fuel Pool by Self-Defense Force
21st about 15:00 Work for laying cable to Power Center was completed.
22nd 10:35 Power Center received electricity
22nd 17:17～20:32 Water spray by Concrete Pump Track
23rd 10:00～ Water spray by Concrete Pump Track

Current Conditions: No fuel is in RPV*3. Water was evaluated to remain in the Pool (by TEPCO)

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

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 5
(As of 12:00 March 23rd, 2011)



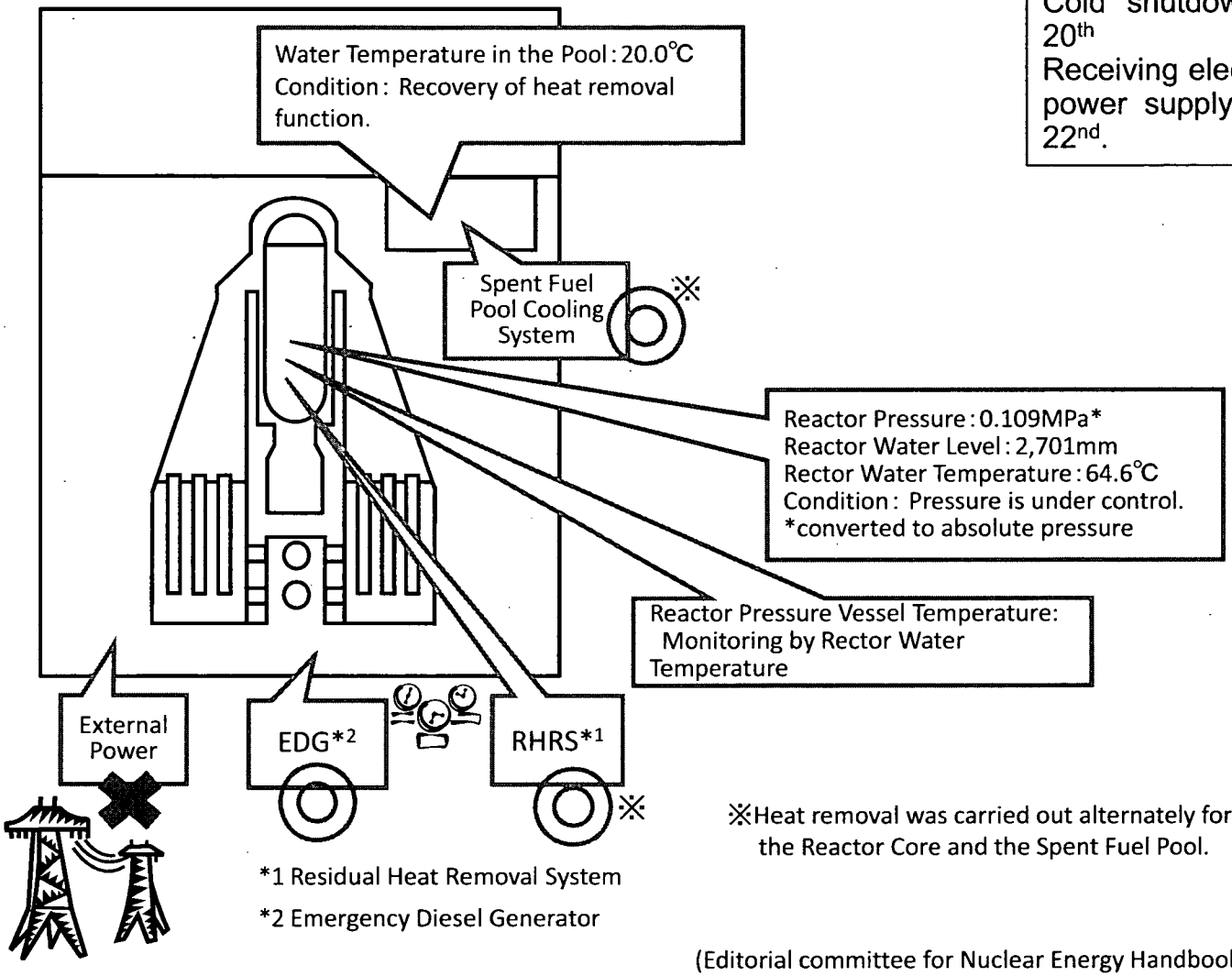
Current Conditions:
Cold shutdown at 14:30 March 20th.
Receiving electricity from external power supply from 11:36 March 21st.

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

Conditions of Fukushima Dai-ichi Nuclear Power Station Unit 6
(As of 12:00 March 23rd, 2011)

In periodic inspection outage

Current Conditions:
Cold shutdown at 19:27 March 20th
Receiving electricity from external power supply from 19:17 March 22nd.



*1 Residual Heat Removal System

*2 Emergency Diesel Generator

※Heat removal was carried out alternately for the water in the Reactor Core and the Spent Fuel Pool.

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

Merzke, Daniel

From: Merzke, Daniel
Sent: Friday, March 25, 2011 1:10 PM
To: Morris, Scott
Cc: McDermott, Brian
Subject: RE: Paper for Chairman?

Good news travels fast. I am. I met with Bill this morning to discuss options. He presented four options for the Ops Center: maintain full staffing, maintain current structure with reduced manning, utilize Marty's recommendation to maintain an RST for primary monitoring, or maintain an ET coordination center for monitoring and support. I'm trying to think up pros and cons now. Thanks for the offer. If I can think of anything you can help with, I'll ask.

Dan

From: Morris, Scott
Sent: Friday, March 25, 2011 1:07 PM
To: Merzke, Daniel
Cc: McDermott, Brian
Subject: Paper for Chairman?

Dan ... I heard that you got tagged to put together an options paper for the Chairman re: how we scale back from our response to the events in Japan ... is this accurate?

If so, let me know if you need any help.

Scott

Y/267

Merzke, Daniel

From: Merzke, Daniel
Sent: Friday, March 25, 2011 1:11 PM
To: Borchardt, Bill
Subject: RE: Question on Chairman Note

Got it. Thanks.

From: Borchardt, Bill
Sent: Friday, March 25, 2011 1:10 PM
To: Merzke, Daniel
Subject: RE: Question on Chairman Note

Good question.

I suggest we not get too specific but rather say that we would consider factors like AC power in each of the units, core temperature trends, status of the SFP.....etc in determining when conditions warrant allowing decreased staffing levels.

From: Merzke, Daniel
Sent: Friday, March 25, 2011 12:05 PM
To: Borchardt, Bill
Subject: Question on Chairman Note

Bill, we discussed scaling back our monitoring structure when we see a stabilization of plant conditions. I'm thinking the Chairman may want to know how we define that, i.e., what conditions we expect to see stabilized. Any thoughts, or am I thinking too deeply?

Dan

Y/262

Merzke, Daniel

From: Merzke, Daniel
Sent: Friday, March 25, 2011 1:52 PM
To: Muessle, Mary
Subject: RE: Ops Center and Site Team Staffing

Thanks, Mary.

From: Muessle, Mary
Sent: Friday, March 25, 2011 1:51 PM
To: Merzke, Daniel
Subject: FW: Ops Center and Site Team Staffing

Dan
This was the document that Marty sent that Bill was referring to.

Mary Muessle
Assistant for Operations - Acting
Office of the Executive Director for Operations
U.S. Nuclear Regulatory Commission
301-415-1703 office
301-415-2700 fax

From: Virgilio, Martin
Sent: Thursday, March 24, 2011 6:13 AM
To: Borchardt, Bill
Cc: Wiggins, Jim; Weber, Michael; Ash, Darren; Muessle, Mary; Evans, Michele; Leeds, Eric
Subject: Ops Center and Site Team Staffing

Bill

Attached are some thoughts on staffing and next steps for the NRC response to this event.

Marty

Y/ 369

Rihm, Roger

From: Rihm, Roger
Sent: Friday, March 25, 2011 1:58 PM
To: Weber, Michael
Subject: RE: Response - Task NSIR to support preparation of testimony

Sandy should be putting this on your calendar. Trish is "standing by" to go with you (and will put together backgrounder, as requested). I asked Trish for a bit more information in one area of the testimony and OCA is currently massaging it.

From: Weber, Michael
Sent: Friday, March 25, 2011 8:06 AM
To: Rihm, Roger
Cc: Muessle, Mary; Landau, Mindy; Cianci, Sandra
Subject: Response - Task NSIR to support preparation of testimony

Please proceed with the testimony. I would appreciate a backgrounder on the topics as Trish suggests. Is she accompanying to the hearing? Am I going to the hearing? As of yesterday, nothing was on my calendar.

From: Rihm, Roger
To: Weber, Michael
Cc: Landau, Mindy
Sent: Fri Mar 25 07:52:48 2011
Subject: FW: ACTION: Task NSIR to support preparation of testimony

Mike, I'm about to review this, do you want to weigh in too? Mindy has taken a quick look and suggests adding something about drills. I know OCA is anxious to get their hands on this.

See Trish's thoughts on questions below. Do you want her to prepare a backgrounder as she suggests? Brief you? Please advise so I can give her direction.

From: Milligan, Patricia
Sent: Thursday, March 24, 2011 5:15 PM
To: Rihm, Roger
Cc: Landau, Mindy
Subject: RE: ACTION: Task NSIR to support preparation of testimony

I think that Mike/Marty ought to be prepared to answer any questions about the planning basis and its application for multi unit sites ; questions about NRC KI program; questions about the adequacy of the current EP requirements given that "you can't evacuate"; why EP is not in license renewal.

Should I prepare a backgrounder for them?

From: Rihm, Roger
Sent: Tuesday, March 22, 2011 2:11 PM
To: Milligan, Patricia
Cc: Landau, Mindy
Subject: FW: ACTION: Task NSIR to support preparation of testimony
Importance: High

Y/270

- Please also give consideration to what background materials/briefing Marty or Mike might need in order to be able to respond to questions.

From: Rihm, Roger
Sent: Tuesday, March 22, 2011 1:59 PM
To: RidsEdoMailCenter Resource; Clayton, Kathleen
Cc: Milligan, Patricia; Landau, Mindy; Evans, Michele; Jaegers, Cathy
Subject: ACTION: Task NSIR to support preparation of testimony
Importance: High

Please prepare a green ticket to NSIR to accomplish the following:

Prepare testimony for Marty Virgilio (or Mike Weber) to give before the House Transportation and Infrastructure Committee, Subcommittee on Economic Development, Public Buildings, and Emergency Management on March 30, 2011. The subject is emergency planning and preparedness for commercial nuclear reactors. It should reference/briefly address our 50-mile evacuation recommendation for the ongoing Japanese events. It should be approximately 2 – 3 double-spaced pages in length. A draft should be provided electronically to Roger Rihm, OEDO, NLT COB March 24th to allow time for OEDO, OCA, and Commission review. Testimony will need to be finalized by COB March 28th.

Rihm, Roger

From: Rihm, Roger
Sent: Friday, March 25, 2011 2:07 PM
To: Borchardt, Bill
Cc: Taylor, Renee
Subject: Oral statement for Tuesday Attached EOM
Attachments: Testimony_Oral__March29_2011.docx

4/27

NRC Response to Recent Nuclear Events in Japan and the Continuing Safety of the U.S. Commercial Nuclear Reactor Fleet

The staff of the NRC 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. Notwithstanding the very high level of support being provided as a result of events in Japan, we continue to maintain our focus on our domestic responsibilities.

Overview of Events and 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 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 six units at the Fukushima Daiichi site; and it is those six units that have received the majority of our attention since that time.

At this time, it is our assessment that Units One, Two, and Three have experienced some degree of core damage, but that they are currently stable and being cooled with seawater. Units Two and Three appear to have some primary containment damage. There have been releases of radioactivity that are of continuing significant concern. The spent fuel pools on Units

One, Two, Three, and Four have experienced varying water levels, but also have been receiving seawater from helicopters and spray systems. Tokyo Electric Power Company has been working to restore electric power to the site and the reactors, and the situation, in general, continues to further stabilize, although many hurdles remain.

Shortly after 4:00 AM on Friday, March 11th, the NRC Emergency Operations Center made the first call to inform NRC management of the earthquake. We went into the monitoring mode at the Emergency Operations Center and the first concern for the NRC was possible impacts of a 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 Japan to help at the embassy. By Monday, March 14th, we had dispatched a total of 11 staff to Japan. We have subsequently rotated in additional 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. 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.

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 the country. We feel confident, based on current data from monitoring at nuclear power plants and through the Environmental Protection Agency's system, that there is no reason for concern in the U.S. 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 level of protection for public health and safety.

There are multiple physical barriers to fission product release at every reactor design, and beyond that, 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.

Beyond this, we've 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, we added new requirements for hydrogen control to help prevent explosions inside of containment, and we also created requirements for enhanced control room displays of the status of pumps and valves.

We have a post-accident sampling system that enables the monitoring of radioactive material release and possible fuel degradation. And, 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 facility who have unfettered access to all licensees' activities 24 hours a day, seven days a week.

As a result of operating experience and ongoing research programs, we have developed requirements for severe accident management guidelines.

Our program of continuous improvement based on operating experience will now include evaluation of the significant events in Japan. We've already begun enhancing inspection activities through temporary instructions to our inspection staff to look at licensees' readiness to deal with both design basis accidents and beyond-design basis accidents.

We've also issued an information notice to licensees to make them aware of the events in Japan, and directing them to verify their capabilities to mitigate conditions that result from severe accidents.

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. For example, 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. And then, regarding the type of containment design used by the most heavily damaged plants in Japan, we have 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 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. At the end of the 90-day period, a report will be provided to the Commission.

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. 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. At the same time, we are undertaking a 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 U.S. nuclear power plants.

Rihm, Roger

From: Rihm, Roger
Sent: Friday, March 25, 2011 2:38 PM
To: Cianci, Sandra; Landau, Mindy; Shane, Raeann
Subject: FW: House hearing on 3/30

FYI

From: Weber, Michael
Sent: Friday, March 25, 2011 2:37 PM
To: Itzkowitz, Marvin
Cc: Muessle, Mary; Andersen, James; Rihm, Roger
Subject: Response - House hearing on 3/30

Yes, please. I would value counsel.

Thanks

From: Itzkowitz, Marvin
To: Weber, Michael
Sent: Fri Mar 25 09:05:32 2011
Subject: House hearing on 3/30

Hi Mike,

For your hearing before the House Committee on Infrastructure (etc.) next week, do you wish counsel from our office to be in attendance with you? If you wish, we can arrange for the OGC manager who knows the most about emergency planning to be there. Your call. Just let me know.

All the best.

Marv

4/27

Rihm, Roger

From: Rihm, Roger
Sent: Friday, March 25, 2011 3:45 PM
To: Shane, Raeann
Cc: Landau, Mindy
Subject: FW: Congressional Hearing March 30 2011.docx
Attachments: Congressional Hearing March 30 2011.docx

Importance: High

Here's Trish's updated version (I've highlighted her additional text). We look forward to your version!

From: Milligan, Patricia
Sent: Friday, March 25, 2011 3:38 PM
To: Rihm, Roger; Landau, Mindy
Subject: Congressional Hearing March 30 2011.docx

Revised see what you think

11273

Good afternoon, Mr./Ms Chairman and members of the Subcommittee. I am pleased to appear before you on behalf of the United States Nuclear Regulatory Commission (NRC) to discuss our emergency planning and preparedness programs at nuclear power facilities in the United States and to discuss the protective action guidance recently issued by the NRC to American citizens in Japan in response to the serious problems at the Fukashima 1 nuclear power plant site.

NRC's primary mission is to regulate nuclear reactors, materials and waste facilities in a manner that protects the health and safety of the public and promotes the common defense and security. Emergency preparedness is a key element of the "defense in depth" safety philosophy we employ for nuclear power plants. This philosophy: ensures high quality in design, construction, and operation of nuclear power plants; requires redundant safety systems that reduce the chances that malfunctions will lead to accidents; and recognizes that in spite of all these precautions, accidents could occur. That is why, for example, containment structures and other safety features are required to minimize the potential for the release of fission products off site. Through emergency planning and preparedness, additional mechanisms are in place to protect the public in the unlikely event that these barriers were to fail.

The NRC emergency preparedness and planning regulations are extensive and require the licensee to develop and demonstrate an effective emergency plan prior to initial startup. The

nuclear power plant operator is required to provide extensive emergency response training to emergency plant workers; for example, severe accident management training to control room operators, and demonstrate personnel response in a rigorous drill and exercise program. This program includes an every other year full participation exercise that engages both the offsite and onsite response organizations. These exercises are evaluated by both FEMA (offsite) and NRC (onsite) staff. In addition, the NRC performs periodic emergency preparedness inspections of the facility. NRC resident inspectors also observe licensee on-site emergency drills and exercises. It is safe to say that over the 30 plus years of operating history and in 104 operating nuclear power plants, there have been thousands of drills and exercises designed to ensure optimium response to abnormal and emergency conditions.

For planning purposes, we define two planning zones around nuclear power plant sites. The planning zones are based on a study of accidents, known as the WASH 1400 report, that examined a range of events from design basis accidents to catastrophic severe accidents. The study made a number of very conservative assumptions regarding the performance of safety equipment, the radionuclides in the core that could be released as well as the timing of the release. The first zone is an area covering about 10 miles in all directions around nuclear power plants where the greatest potential for radiological effects from a release

exists. Planning for this area is comprehensive and includes such protective actions as evacuation, sheltering and potassium iodide, as appropriate, for members of the public. Consideration of these protective actions is prompted at very low projected dose levels. A second extended planning zone of about 50 miles is also established around each plant to deal with potential lower-level, long-term risks primarily due to exposure from consumption of contaminated food, milk, and water. This comprehensive planning within the 10 and 50 mile EPZ provides a substantial basis for expansion of response efforts in the event that this is necessary.

Let me now address the NRC's recent protective action recommendation for U.S citizens in Japan evacuate out to 50 miles from the Fukashima Daiichi site. That decision was based on best information available at that time. The information flow from the Fukashima site was often confusing and conflicting. The NRC was receiving its information from the same open sources available to everyone; such as CNN. We based our assessment on the conditions as we were able to determine; Units 1, 2, and 3 appeared to have suffered significant damage as a result of reported hydrogen explosions, Unit 4 was in a refueling outage and its entire core had been transferred to the spent fuel pool a little more than 3 months earlier so there was fresh fuel in the spent fuel pool that was in danger of overheating if level dropped, and there were

indications that was happening. Additionally, there were some radiation monitors that were showing very high levels of radiation on the plant site which would pose challenges to plant crew attempting to stabilize the reactors and there were some offsite readings indicating that fuel damage had occurred. This situation was unprecedented. This is a 6 unit site and 4 of the units were facing extraordinary challenges. The staff performed a series of calculations to assess possible offsite consequences. We understood that some of our assumptions were conservative. However, we were unable to discuss or verify our assumptions with the licensee or our Japanese counterparts. In the United States, the NRC has resident inspector staff at the plants that can report back to the Region and Headquarters on conditions as they are evolving, we are able to readily access "live-time" plant parameters and radiation monitors, as well as talk directly to plant staff and emergency management officials which enables us to refine our understanding and consequence assessments. With the Fukashima event we had to make our best decision with what we had available. The Emergency Preparedness framework provides for the expansion of the emergency planning zones as conditions require. Acting in accordance with this framework and with the limited information available at the time, the NRC determined that evacuation out to 50 miles for U.S. Citizens was an appropriate course of action.

Merzke, Daniel

From: Merzke, Daniel
Sent: Friday, March 25, 2011 3:29 PM
To: Virgilio, Martin; Weber, Michael; Ash, Darren; Evans, Michele
Cc: Borchardt, Bill; Muessle, Mary; Andersen, James
Subject: Draft Note to Chairman on Recommended Staffing for Japan Event
Attachments: Chairman Note for Japan Staffing.docx

The Chairman requested a paper by COB on Monday with options and recommendations for short- and long-term staffing of the site team and Operations Center supporting the Fukushima event. Attached is a first draft. If you can, please review and provide any comments to me Monday morning. Thank you.

Dan

Y1274

NOTE TO: Chairman Jaczko

FROM: R. W. Borchardt
Executive Director for Operations

SUBJ: STAFFING RECOMMENDATIONS FOR MONITORING POST-EARTHQUAKE EVENTS IN JAPAN

Purpose: The purpose of this Note is to provide options and recommendations for the short- and long-term staffing of the U.S. Nuclear Regulatory Commission (NRC) Operations Center and the site team in Japan responding to the event at the Fukushima Daiichi nuclear facility following the earthquake of March 11, 2011.

Background: On March 11, 2011, an earthquake hit Japan, resulting in the shutdown of more than 10 reactors. The ensuing tsunami caused the loss of normal and emergency AC power to six units at the Fukushima Daiichi site. Units One, Two, and Three, at that six-unit site, were in operation at the time. Units Four, Five, and Six were in previously scheduled outages. Hours after the tsunami, operators at the site lost capability to inject cooling water into the reactor vessels on Units One, Two, and Three and into the spent fuel pools in several units.

Subsequently, the NRC Operations Center went into the Monitoring Mode on March 11th, and two staff members who were experts in boiling water reactor (BWR) technology were dispatched to Japan to assist the U.S. Ambassador. Following the initial response, the NRC dispatched nine more staff members to assist the Japanese government, the Nuclear and Industrial Safety Agency (NISA), and the Tokyo Electric Power Company (TEPCO). The Operations Center has been manned 24 hours a day, seven days a week since the initiating event. During the week of March 21, 2011, 11 additional staff members were dispatched to Japan to relieve the original site team.

The NRC has three roles in our event response: to support the Japanese government and NISA, to gather and assess any information to determine what implications the event has for U.S. licensees, and to support the U.S. Ambassador in Japan.

Discussion:

Current Status

The site team consists of 12 staff members, led by Chuck Casto, Deputy Regional Administrator for Operations, RII. That team was dispatched during the week of March 21st.

The Operations Center has been staffed with a fully manned event response team consisting of three shifts since March 11th. Operations Center staff members are supporting the site team, responding to Commission questions, and maintaining liaison with other federal agencies responding to the event.

Future Staffing

Future staffing of the site team and Operations Center will be dependent on our assessment of plant conditions. As the response of NISA and TEPCO moves from mitigation of the event to stabilization/recovery, the NRC monitoring response would be expected to be reduced. The recovery phase would be identified by restoration of AC power to all affected units and stabilization of plant conditions. Stabilization of plant conditions would be defined by maintaining sufficient water inventory in all spent fuel pools and/or cooling capacity to each pool, adequate long-term cooling established to each reactor core, and radioactivity releases have been terminated or the source of radioactivity release is under control.

Near-Term

Site team Option 1 – Status Quo

This option would leave a 12-member team in Japan to continue fulfilling the three NRC roles of supporting the Japanese government, gathering and assessing information for applicability to U.S. licensees, and supporting the U.S. Ambassador.

Pros:

- Team members would maintain continuity for U.S. event response.
- More reliable information regarding plant conditions.
- More staff receiving first-hand experience in event response.

Cons:

- Site team members not available to perform primary responsibilities of oversight of domestic licensees.

Site team Option 2 – Reduced staffing

The plan for this option is to replace the current site team with a team of six staff members, in addition to the team leader. This reduction would be coincident with the expected transition of the Japanese response to the recovery phase. A reduction in staffing would also be influenced by the arrival of the consortium of U.S. federal agencies and industry representatives to support TEPCO. The reduced staffing would continue support to the U.S. Ambassador as well as interface with NISA. The team would include members with a good understanding of severe accident management and accident mitigation.

Pros:

- More staff available performing their primary responsibilities, in addition to supporting the development of lessons learned from the event.
- Enough staff still available in-country to gather information on plant conditions

Cons:

- Fewer staff in-country available for immediate response and support in the event conditions unexpectedly deteriorate.

For Operations Center short-term staffing, there are four options.

Option 1 – Status Quo

This option would leave the Operations Center fully staffed for the foreseeable future.

Pros:

- Staff available to provide immediate response to site team requests.
- Independent assessment of plant conditions readily available.
- Independent assessment of protective action recommendations readily available.

Cons:

- Significant portion of the overall staff dedicated to event response, and not to their domestic regulatory responsibilities.
- As conditions have become more stable, there is less short turn-around support needed for the site team and less work for the response team.

Option 2 – Reduced Manning

This option would maintain the current event response structure, but with the teams consisting of fewer staff. With conditions stabilizing at the site, there is less work required of the response teams.

Pros:

- Teams still readily available to respond to and support the site team.
- More staff focused on their primary regulatory responsibilities.

Cons:

- Less expertise available to provide an immediate response or assessment.

Option 3 – Maintain Reactor Safety Team, terminate Protective Measures Team and Executive Team

The option to terminate the Protective Measures Team (PMT) is based on the Department of Energy (DOE) and Naval Reactors (NR) assuming the lead for protective measures for U.S. citizens and the military in Japan. The Reactor Safety Team (RST) leader would direct Operations Center activities and contact line management and OEDO as necessary. The RST would remain manned until plant conditions have stabilized. PMT issues can be satisfied by NSIR and NRR.

Pros:

- Operations Center would still be manned to support the site team.
- RST is still available to provide immediate assessment of reactor safety issues.
- More staff focused on their primary regulatory responsibilities.

Cons:

- Staff not immediately available for independent protective measures recommendations
- No ET member present for overall coordination or decision-making.

Option 4 – 'Expanded' ET functions as a Coordination Center

This option would maintain the ET and stand down the other response teams. The ET would maintain a "call list" to elicit support for questions and issues identified by the site team. The team would consist of one member from each response team who would be able to respond to immediate questions. The team would be led by a Deputy Executive Director for Operations (DEDO), or Office Director.

Pros:

- Continuity maintained among decision-makers who maintain the overall picture.
- Most staff restored to their primary regulatory responsibilities.
- Ability to draw on staff technical resources as needed.

Cons:

- Risk of requiring support from staff after normal working hours.
- Potential for slower response time in supporting the site team.

Long-Term

Site Team Option 1 – Two staff remain in Japan

This option would require two staff members to remain in Japan to provide assistance to the U.S. Ambassador and liaison with NISA.

Pros:

- Staff in-country are expected to keep abreast of long-term recovery actions, as well as current plant conditions.

Cons:

- NRC mission does not encompass long-term recovery from significant events.
- Very little work expected from site team personnel during recovery phase.

Site Team Option 2 – Withdrawal from Japan

As the NRC mission does not involve long-term recovery from significant events, there would not be an expected role for the NRC during the recovery phase, and thus NRC staff would

withdraw from Japan. It would be expected that the U.S. consortium, or potentially DOE, would be available to provide information and support to the U.S. Ambassador as well as the Japanese government.

Pros:

- All staff available to perform primary regulatory responsibilities as well as support the development of lessons learned from the event.

Cons:

- Any further information concerning the event would have to be coordinated through the remaining federal agencies, or NISA.

For the Operations Center, staffing is predicated on supporting the site team and stabilization of plant conditions. Long-term staffing would not be expected. If any members of the site team were to remain long-term, they would be given a point of contact for any support assistance.

Recommendation:

For the short-term, I recommend Site Team Option 2, to reduce the staffing of the site team during the week of April 5th. By this time, the plant conditions are expected to be stabilized and the U.S. consortium is expected to be available to support TEPCO, while a team of six NRC staff members would still be available to provide support to the U.S. Ambassador and gather information on Fukushima plant status. When it is determined that plant conditions have stabilized, I recommend Option 4 for Operations Center staffing. A team consisting of members from each response team would be immediately available to respond to questions and provide support to the site team, led by a member of the ET. This will free up staff to focus more on their primary regulatory responsibilities of protecting the U.S. public health and safety, as well as development of lessons learned from the event. I also recommend fully staffing the Liaison Team (LT) during the week of March 28, 2011, due to the planned Congressional hearings.

For the long-term, I recommend Site Team Option 2, withdrawing all NRC personnel from Japan, as NRC expertise is primarily focused on event response and mitigation, and not on long-term recovery. By this time, other U.S. agencies in Japan, such as DOE, or the Department of Defense, should be available to assist the U.S. Ambassador. The NRC can continue to support NISA from the continental U.S. At this point, I recommend returning to Normal Mode in the Operations Center and standing down all response teams.

Merzke, Daniel

From: Merzke, Daniel
Sent: Monday, March 28, 2011 10:00 AM
To: Borchardt, Bill
Subject: Draft Note to Chairman on Japan Staffing
Attachments: Chairman Note for Japan Staffing.docx

Bill, here's my latest version with comments incorporated, including task force staffing. Let me know if you have further comments.

Dan

Y/275

NOTE TO: Chairman Jaczko

FROM: R. W. Borchardt
Executive Director for Operations

SUBJ: STAFFING RECOMMENDATIONS FOR MONITORING POST-EARTHQUAKE EVENTS IN JAPAN

Purpose: The purpose of this Note is to provide options for the near- and long-term staffing of the U.S. Nuclear Regulatory Commission (NRC) Operations Center and the site team in Japan responding to the event at the Fukushima Daiichi nuclear facility following the earthquake of March 11, 2011. Another purpose is to provide current plans for staffing the near- and long-term reviews (tasking memorandum dated March 23, 2011).

Background: On March 11, 2011, an earthquake hit Japan, resulting in the shutdown of more than 10 reactors. The ensuing tsunami caused the loss of normal and emergency AC power to six units at the Fukushima Daiichi site. Units One, Two, and Three, at that six-unit site, were in operation at the time. Units Four, Five, and Six were in previously scheduled outages. Hours after the tsunami, operators at the site lost capability to inject cooling water into the reactor vessels on Units One, Two, and Three and into the spent fuel pools in several units.

Subsequently, the NRC Operations Center went into the Monitoring Mode on March 11th, and two staff members who were experts in boiling water reactor (BWR) technology were dispatched to Japan to assist the U.S. Ambassador. Following the initial response, the NRC dispatched nine more staff members to assist the Japanese government, the Nuclear and Industrial Safety Agency (NISA), and the Tokyo Electric Power Company (TEPCO). The Operations Center has been manned 24 hours a day, seven days a week since the initiating event. During the week of March 21, 2011, 11 additional staff members were dispatched to Japan to relieve the original site team.

The NRC has three roles in our event response: to support the Japanese government and NISA, to gather and assess any information to determine what implications the event has for U.S. licensees, and to support the U.S. Ambassador in Japan.

Discussion:

Current Status

The site team consists of 12 staff members, led by Chuck Casto, Deputy Regional Administrator for Operations, RII. That team was dispatched during the week of March 21st.

The Operations Center has been staffed with a fully manned event response team consisting of three shifts since March 11th. Operations Center staff members are supporting the site team, responding to Commission questions, and maintaining liaison with other federal agencies responding to the event.

Future Staffing

Future staffing of the site team and Operations Center will be dependent on our assessment of plant conditions. As the response of NISA and TEPCO moves from mitigation of the event to stabilization/recovery, the NRC monitoring response would be expected to be reduced. The recovery phase would be identified by restoration of AC power to all affected units and stabilization of plant conditions. Stabilization of plant conditions would be defined by maintaining sufficient water inventory in all spent fuel pools and/or cooling capacity to each pool, adequate long-term cooling established to each reactor core, and radioactivity releases have been terminated or the source of radioactivity release is under control.

Near-Term

Site team Option 1 – Status Quo

This option would leave a 12-member team in Japan to continue fulfilling the three NRC roles of supporting the Japanese government, gathering and assessing information for applicability to U.S. licensees, and supporting the U.S. Ambassador.

Pros:

- Team members would maintain continuity for U.S. event response.
- More reliable information regarding plant conditions.
- More staff receiving first-hand experience in event response.

Cons:

- Site team members not available to perform primary responsibilities of oversight of domestic licensees.

Site team Option 2 – Reduced staffing

The plan for this option is to replace the current site team with a team of six staff members, in addition to the team leader. This reduction would be coincident with the expected transition of the Japanese response to the recovery phase. A reduction in staffing would also be influenced by the arrival of the consortium of U.S. federal agencies and industry representatives to support TEPCO. The reduced staffing would continue support to the U.S. Ambassador as well as interface with NISA. The team would include members with a good understanding of severe accident management and accident mitigation.

Pros:

- More staff available performing their primary responsibilities, in addition to supporting the development of lessons learned from the event.
- Enough staff still available in-country to gather information on plant conditions

Cons:

- Fewer staff in-country available for immediate response and support in the event conditions unexpectedly deteriorate.

For Operations Center short-term staffing, there are four options.

Option 1 – Status Quo

This option would leave the Operations Center fully staffed for the foreseeable future.

Pros:

- Staff available to provide immediate response to site team requests.
- Independent assessment of plant conditions readily available.
- Independent assessment of protective action recommendations readily available.

Cons:

- Significant portion of the overall staff dedicated to event response, and not to their domestic regulatory responsibilities.
- As conditions have become more stable, there is less short turn-around support needed for the site team and less work for the response team.

Option 2 – Reduced Manning

This option would maintain the current event response structure, but with the teams consisting of fewer staff. With conditions stabilizing at the site, there is less work required of the response teams.

Pros:

- Teams still readily available to respond to and support the site team.
- More staff focused on their primary regulatory responsibilities.

Cons:

- Less expertise available to provide an immediate response or assessment.

Option 3 – Maintain Reactor Safety Team, terminate Protective Measures Team and Executive Team

The option to terminate the Protective Measures Team (PMT) is based on the Department of Energy (DOE) and Naval Reactors (NR) assuming the lead for protective measures for U.S. citizens and the military in Japan. The Reactor Safety Team (RST) leader would direct Operations Center activities and contact line management and OEDO as necessary. The RST would remain manned until plant conditions have stabilized. PMT issues can be satisfied by NSIR and NRR. The Liaison Team (LT) would be fully staffed during the day shift only.

Pros:

- Operations Center would still be manned to support the site team.
- RST is still available to provide immediate assessment of reactor safety issues.
- More staff focused on their primary regulatory responsibilities.

Cons:

- Staff not immediately available for independent protective measures recommendations
- No ET member present for overall coordination or decision-making.

Option 4 – 'Expanded' ET functions as a Coordination Center

This option would maintain the ET and stand down the other response teams. The ET would maintain a "call list" to elicit support for questions and issues identified by the site team. The team would consist of one member from each response team who would be able to respond to immediate questions. The team would be led by a Deputy Executive Director for Operations (DEDO), Office Director, or designee, with the goal to utilize the same managers to the extent possible to maintain continuity.

Pros:

- Continuity maintained among decision-makers who maintain the overall picture.
- Most staff restored to their primary regulatory responsibilities.
- Ability to draw on staff technical resources as needed.

Cons:

- Risk of requiring support from staff after normal working hours.
- Potential for slower response time in supporting the site team.

Long-Term

Site Team Option 1 – Two staff remain in Japan

This option would require two staff members to remain in Japan to provide assistance to the U.S. Ambassador and liaison with NISA.

Pros:

- Staff in-country are expected to keep abreast of long-term recovery actions, as well as current plant conditions.

Cons:

- NRC mission does not encompass long-term recovery from significant events.
- Very little work expected from site team personnel during recovery phase.

Site Team Option 2 – Withdrawal from Japan

As the NRC mission does not involve long-term recovery from significant events, there would not be an expected role for the NRC during the recovery phase, and thus NRC staff would withdraw from Japan. It would be expected that the U.S. consortium, or potentially DOE, would be available to provide information and support to the U.S. Ambassador as well as the Japanese government.

Pros:

- All staff available to perform primary regulatory responsibilities as well as support the development of lessons learned from the event.

Cons:

- Any further information concerning the event would have to be coordinated through the remaining federal agencies, or NISA.

For the Operations Center, staffing is predicated on supporting the site team and stabilization of plant conditions. Long-term staffing would not be expected. If any members of the site team were to remain long-term, they would be given a point of contact for any support assistance.

Task Force Staffing

It is incumbent upon the NRC to conduct a thorough, systematic, and methodical review of the events at the Fukushima Daiichi plant. Thus, a Task Force of senior managers and staff is being chartered to perform that review. The Task Force will examine all the information and parameters from the event to develop lessons learned and to determine if any regulatory changes for NRC licensees need to be made to ensure adequate plant safety.

Near Term Review (90 days)

- Oversight provided by Marty Virgilio
- Task force
    - Charlie Miller (team Leader)
    - 2 additional SES (Grobe, Holahan)
    - 2 support staff (technical, administrative)
    - Fulltime, dedicated effort
    - Interact with line staff as needed
    - Limited stakeholder involvement

Long Term Review

- Starts after Near Term Review is complete and Japan Info is available
    - SES Steering Committee (NRR, RES, Region, OGC, NRO, NMSS)
    - Issue specific task groups reporting to Steering Committee
    - Collateral duty for all participants
    - Multi year effort with periodic reports

- Wide stakeholder involvement

Merzke, Daniel

From: Merzke, Daniel
Sent: Monday, March 28, 2011 1:19 PM
To: Borchardt, Bill
Subject: Revised Chairman Note on Japan
Attachments: Chairman Note for Japan Staffing.docx

Bill, attached is the latest version with Mike's comments incorporated. I think it's about ready for prime time. Let me know if you have any further comments.

Dan

Y1276

NOTE TO: Chairman Jaczko

FROM: R. W. Borchardt
Executive Director for Operations

SUBJ: STAFFING RECOMMENDATIONS FOR MONITORING POST-EARTHQUAKE EVENTS IN JAPAN

Purpose: The purpose of this Note is to provide options for the near- and long-term staffing of the U.S. Nuclear Regulatory Commission (NRC) Operations Center and the site team in Japan responding to the event at the Fukushima Daiichi nuclear facility following the earthquake of March 11, 2011. Another purpose is to provide current plans for staffing the near- and long-term reviews (tasking memorandum dated March 23, 2011).

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Subsequently, the NRC Operations Center went into the Monitoring Mode on March 11th, and two staff members who were experts in boiling water reactor (BWR) technology were dispatched to Japan to assist the U.S. Ambassador. Following the initial response, the NRC dispatched nine more staff members to assist the Japanese government, the Nuclear and Industrial Safety Agency (NISA), and the Tokyo Electric Power Company (TEPCO). The Operations Center has been manned 24 hours a day, seven days a week since the initiating event. During the week of March 21, 2011, 11 additional staff members were dispatched to Japan to relieve the original site team.

The NRC has three roles in our event response: to support the Japanese government and NISA, to gather and assess any information to determine what implications the event has for U.S. licensees, and to support the U.S. Ambassador in Japan.

Discussion:

Current Status

The site team consists of 12 staff members, led by Chuck Casto, Deputy Regional Administrator for Operations, RII. That team was dispatched during the week of March 21st.

The Operations Center has been staffed with an event response team consisting of three shifts since March 11th. Operations Center staff members are supporting the site team, responding to Commission questions, and maintaining liaison with other federal agencies responding to the event.

Future Staffing

Future staffing of the site team and Operations Center will be dependent on our assessment of plant conditions and the needs of the team in Japan and the U.S. Government. As the response of NISA and TEPCO moves from mitigation of the event to stabilization/recovery, the NRC monitoring response would be expected to be reduced. The recovery phase would be identified by restoration of AC power to all affected units, re-establishment of sustainable cooling for the reactors and spent fuel pools, and stabilization of plant conditions. Stabilization of plant conditions would be defined by maintaining sufficient water inventory in all spent fuel pools and/or cooling capacity to each pool, adequate long-term cooling established to each reactor core, and radioactivity releases have been terminated or the source of radioactivity release is under control.

Near-Term

Site team Option 1 – Status Quo

This option would leave a 12-member team in Japan to continue fulfilling the three NRC roles of supporting the Japanese government, gathering and assessing information for applicability to U.S. licensees, and supporting the U.S. Ambassador and U.S. Government needs.

Pros:

- Team members would maintain continuity and constructive relationships for U.S. event response.
- More reliable information regarding plant conditions.
- More staff receiving first-hand experience in event response.

Cons:

- Site team members not available to perform primary responsibilities of oversight of domestic licensees.

Site team Option 2 – Reduced staffing

The plan for this option would reduce the current site team down to six staff members, in addition to the team leader. This reduction would be coincident with the expected transition of the Japanese response to the recovery phase. A reduction in staffing would also be influenced by the operation of the consortium of U.S. federal agencies and industry representatives to support TEPCO. The reduced staffing would continue support to the U.S. Ambassador as well as interface with NISA. The team would include members with a good understanding of severe accident management and accident mitigation.

Pros:

- Reduced impact on other agency priorities.
- Enough staff still available in-country to gather information on plant conditions, coordinate with Japanese and U.S. Government counterparts, and support the Ambassador.

Cons:

- Decreased in-country capability, fewer staff in-country available for immediate response and support in the event conditions deteriorate.

For Operations Center short-term staffing, there are five options.

Option 1 – Status Quo

This option would leave the Operations Center staffed at present levels for the foreseeable future.

Pros:

- Staff available to provide immediate response to site team and other U.S. Government requests.
- Independent assessment of plant conditions readily available.
- Independent assessment of protective action recommendations readily available.

Cons:

- Continues to divert about ½% of agency staff from their domestic responsibilities (35 – 40 people per shift with three shifts per day).
- As conditions have become more stable, there is less short turn-around support needed for the site team and less work for the response team.

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This option would maintain the current event response team structure, but reduce the size of the teams with the Protective Measures Team (PMT), Reactor Safety Team (RST), and Liaison Team (LT) decreased to 2 – 3 staff. The Executive Team (ET) would be reduced to the Response Advisor in the Operations Center with reach-back to the EDO and DEDOs, as necessary. Significant work related to, but not directly in response to, the emergency at Fukushima Daiichi would be assigned to the line functions. With conditions stabilizing at the site, there is less work required of the response teams.

Pros:

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Pros:

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- RST is still available to provide immediate assessment of reactor safety issues.
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Cons:

- Staff not immediately available for independent protective measures recommendations
- No ET member present for overall coordination or decision-making.

Option 4 – 'Expanded' ET functions as a Coordination Center

This option would maintain the ET and stand down the other response teams. The ET would maintain a "call list" back to the line organization to elicit support for questions and issues identified by the site team during "daylight" hours in Japan (1800 – 1000: two shifts a day). The team would consist of one member from each response team who would be able to respond to immediate questions. The team would be led by a Deputy Executive Director for Operations (DEDO), Office Director, or designee, with the goal to utilize the same managers to the extent possible to maintain continuity.

Pros:

- Continuity maintained among decision-makers who maintain the overall picture.
- Most staff restored to their primary regulatory responsibilities.
- Ability to draw on staff technical resources as needed.

Cons:

- Risk of requiring support from staff after normal working hours.
- Potential for slower response time in supporting the site team.

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This option would terminate staffing of the Operations Center (other than normal HOO/HERO staffing) and rely on the line organization to provide the support to the site team.

Pros:

- Return to normal operations.

Cons:

- Reduces the level and consistency of support for site team operations and coordination within the Federal Government.

Long-Term

Site Team Option 1 – Two staff remain in Japan

This option would require two staff members to remain in Japan to provide assistance to the U.S. Ambassador and liaison with NISA.

Pros:

- Staff in-country are expected to keep abreast of long-term recovery actions, as well as current plant conditions.

Cons:

- NRC mission does not encompass long-term recovery in a foreign country from significant events.

Site Team Option 2 – Withdrawal from Japan

As the NRC mission does not involve long-term recovery from significant foreign events, there would not be an expected role for the NRC during the recovery phase, and thus NRC staff would withdraw from Japan. It would be expected that the U.S. consortium, or potentially DoD or DOE, would be available to provide information and support to the U.S. Ambassador, other Government Agencies, as well as the Japanese government.

Pros:

- All staff available to perform primary regulatory responsibilities as well as support the development of lessons learned from the event.

Cons:

- Any further information concerning the event would have to be coordinated through the remaining federal agencies, or NISA.

For the Operations Center, staffing is predicated on supporting the site team and stabilization of plant conditions. Long-term staffing would not be expected. If any members of the site team were to remain long-term, they would be given a point of contact for any support assistance.

Task Force Staffing

The NRC has decided to conduct a thorough, systematic, and methodical review of the events at the Fukushima Daiichi plant. Thus, a Task Force of senior managers and staff is being chartered to perform that review. The Task Force will examine all the information and parameters from the event to develop lessons learned and to determine if any regulatory changes for NRC licensees need to be made to ensure adequate plant safety.

Near Term Review (90 days)

- Oversight provided by Marty Virgilio
- Task force
    - Charlie Miller (team Leader)
    - 2 additional SES (Grobe, Holahan)
    - 2 support staff (technical, administrative)
    - Fulltime, dedicated effort
    - Interact with line staff as needed
    - Limited stakeholder involvement

Long Term Review

- Starts after Near Term Review is complete and Japan Info is available
    - SES Steering Committee (NRR, RES, Region, OGC, NRO, NMSS)
    - Issue specific task groups reporting to Steering Committee
    - Collateral duty for all participants
    - Multi year effort with periodic reports
    - Wide stakeholder involvement

Merzke, Daniel

From: Merzke, Daniel
Sent: Monday, March 28, 2011 1:32 PM
To: Borchardt, Bill
Subject: Final Chairman Note on Japan Staffing
Attachments: Chairman Note for Japan Staffing.docx

Bill, here's the final version of the Note with changes made as we discussed.

Dan

Y1277

NOTE TO: Chairman Jaczko

FROM: R. W. Borchardt
Executive Director for Operations

SUBJ: STAFFING RECOMMENDATIONS FOR MONITORING POST-EARTHQUAKE EVENTS IN JAPAN

Purpose: The purpose of this Note is to provide options for the near- and long-term staffing of the U.S. Nuclear Regulatory Commission (NRC) Operations Center and the site team in Japan responding to the event at the Fukushima Daiichi nuclear facility following the earthquake of March 11, 2011. Another purpose is to provide current plans for staffing the near- and long-term reviews (tasking memorandum dated March 23, 2011).

Background: On March 11, 2011, an earthquake hit Japan, resulting in the shutdown of more than 10 reactors. The ensuing tsunami caused the loss of normal and emergency AC power to six units at the Fukushima Daiichi site. Units One, Two, and Three, at that six-unit site, were in operation at the time. Units Four, Five, and Six were in previously scheduled outages. Hours after the tsunami, operators at the site lost capability to inject cooling water into the reactor vessels on Units One, Two, and Three and into the spent fuel pools in several units.

Subsequently, the NRC Operations Center went into the Monitoring Mode on March 11th, and two staff members who were experts in boiling water reactor (BWR) technology were dispatched to Japan to assist the U.S. Ambassador. Following the initial response, the NRC dispatched nine more staff members to assist the Japanese government, the Nuclear and Industrial Safety Agency (NISA), and the Tokyo Electric Power Company (TEPCO). The Operations Center has been manned 24 hours a day, seven days a week since the initiating event. During the week of March 21, 2011, 11 additional staff members were dispatched to Japan to relieve the original site team.

The NRC has three roles in our event response: to support the Japanese government and NISA, to gather and assess any information to determine what implications the event has for U.S. licensees, and to support the U.S. Ambassador in Japan.

Discussion:

Current Status

The site team consists of 12 staff members, led by Chuck Casto, Deputy Regional Administrator for Operations, RII. That team was dispatched during the week of March 21st.

The Operations Center has been staffed with an event response team consisting of three shifts since March 11th. Operations Center staff members are supporting the site team, responding to Commission questions, and maintaining liaison with other federal agencies responding to the event.

Future Staffing

Future staffing of the site team and Operations Center will be dependent on our assessment of plant conditions and the needs of the team in Japan and the U.S. Government. As the response of NISA and TEPCO moves from mitigation of the event to stabilization/recovery, the NRC monitoring response would be expected to be reduced. The recovery phase would be identified by restoration of AC power to all affected units, re-establishment of sustainable cooling for the reactors and spent fuel pools, and stabilization of plant conditions. Stabilization of plant conditions would be defined by maintaining sufficient water inventory in all spent fuel pools and/or cooling capacity to each pool, adequate long-term cooling established to each reactor core, and radioactivity releases have been terminated or the source of radioactivity release is under control.

Near-Term

Site team Option 1 – Status Quo

This option would leave a 12-member team in Japan to continue fulfilling the three NRC roles of supporting the Japanese government, gathering and assessing information for applicability to U.S. licensees, and supporting the U.S. Ambassador and U.S. Government needs.

Pros:

- Team members would maintain continuity and constructive relationships for U.S. event response.
- More reliable information regarding plant conditions.
- More staff receiving first-hand experience in event response.

Cons:

- Site team members not available to perform primary responsibilities of oversight of domestic licensees.

Site team Option 2 – Reduced staffing

The plan for this option would reduce the current site team down to six staff members, in addition to the team leader. This reduction would be coincident with the expected transition of the Japanese response to the recovery phase. A reduction in staffing would also be influenced by the operation of the consortium of U.S. federal agencies and industry representatives to support TEPCO. The reduced staffing would continue support to the U.S. Ambassador as well as interface with NISA. The team would include members with a good understanding of severe accident management and accident mitigation.

Pros:

- Reduced impact on other agency priorities.
- Enough staff still available in-country to gather information on plant conditions, coordinate with Japanese and U.S. Government counterparts, and support the Ambassador.

Cons:

- Decreased in-country capability, fewer staff in-country available for immediate response and support in the event conditions deteriorate.
-

For Operations Center short-term staffing, there are five options.

Option 1 – Status Quo

This option would leave the Operations Center staffed at present levels for the foreseeable future.

Pros:

- Staff available to provide immediate response to site team and other U.S. Government requests.
- Independent assessment of plant conditions readily available.
- Independent assessment of protective action recommendations readily available.

Cons:

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Fields, Leslie

From: Burrows, Sheryl
Sent: Monday, March 28, 2011 8:36 AM
To: Fields, Leslie
Subject: FW: Japan Nuclear Incident Explanation Presentation
Attachments: Fukuchima_eng_20110320.pps

From: Pittiglio, Clayton
Sent: Sunday, March 27, 2011 6:32 PM
To: Burrows, Sheryl
Subject: FW: Japan Nuclear Incident Explanation Presentation

fyi

From: dave.krause@dplmc.com [mailto:dave.krause@dplmc.com]
Sent: Friday, March 25, 2011 10:40 AM
To: Fredrichs, Thomas; Pittiglio, Clayton; Simmons, Anneliese
Cc: njc@abzinc.com
Subject: Japan Nuclear Incident Explanation Presentation

Tom, Larry & Anneliese,

Nick Capik of ABZ (a nuclear decommissioning engineering firm) sent me this presentation, which does an excellent job of explaining the construction and the impact of the tsunami for one of the affected nuclear plants in Japan. To view the presentation and advance each page, left click your mouse.

Dave Krause
Duff & Phelps Investment Management Co.

Y/278


AREVA

The Fukushima Daiichi Incident

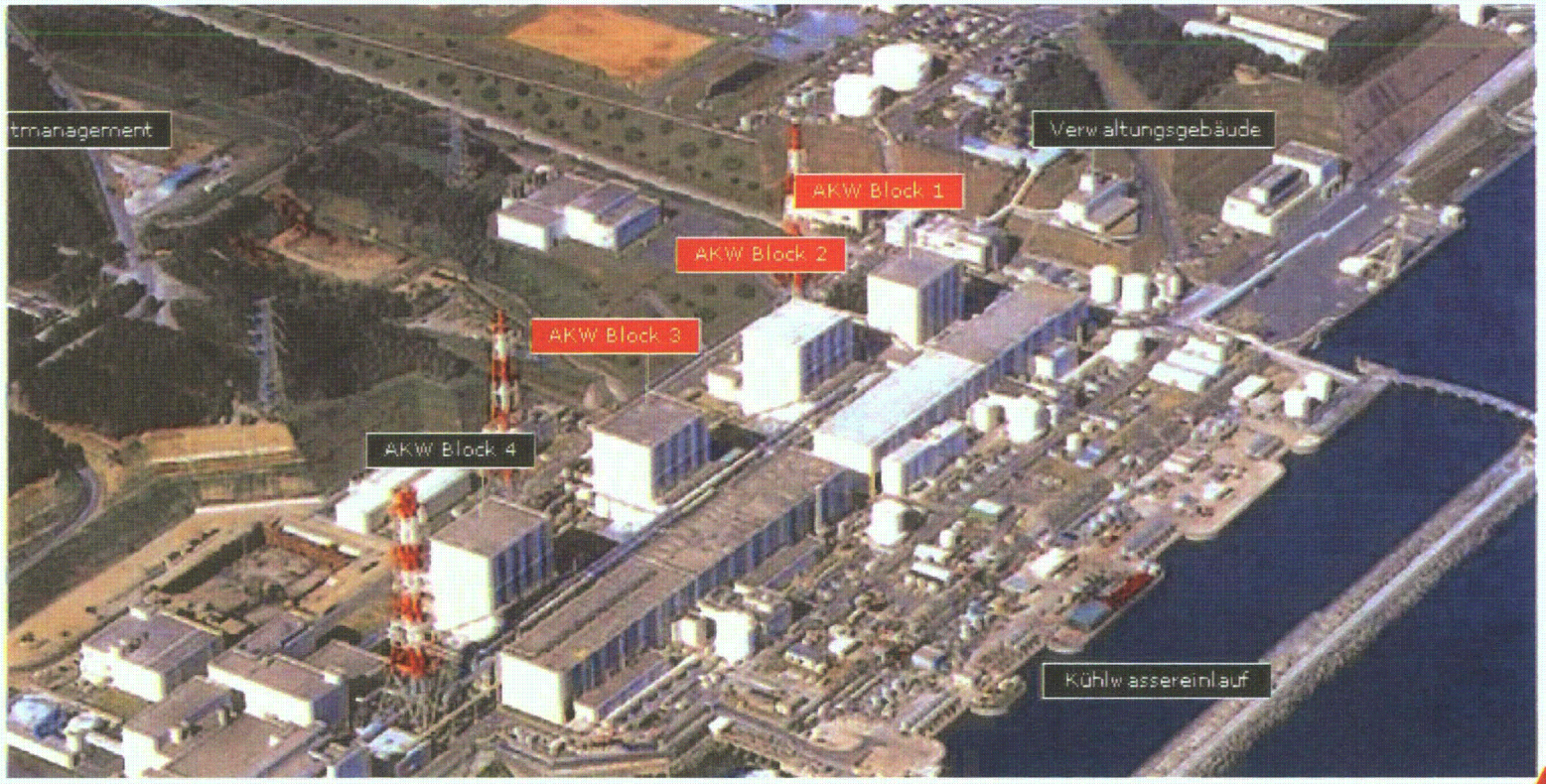
1. Plant Design
2. Accident Progression
3. Radiological releases
4. Spent fuel pools
5. Sources of Information

Matthias Braun
PEPA4-G, AREVA–NP GmbH
Matthias.Braun@AREVA.com

AREVA

The Fukushima Daiichi Incident
1. Plant Design

- **Fukushima Daiichi (Plant I)**
  - **Unit I - GE Mark I BWR (439 MW), Operating since 1971**
  - **Unit II-IV - GE Mark I BWR (760 MW), Operating since 1974**



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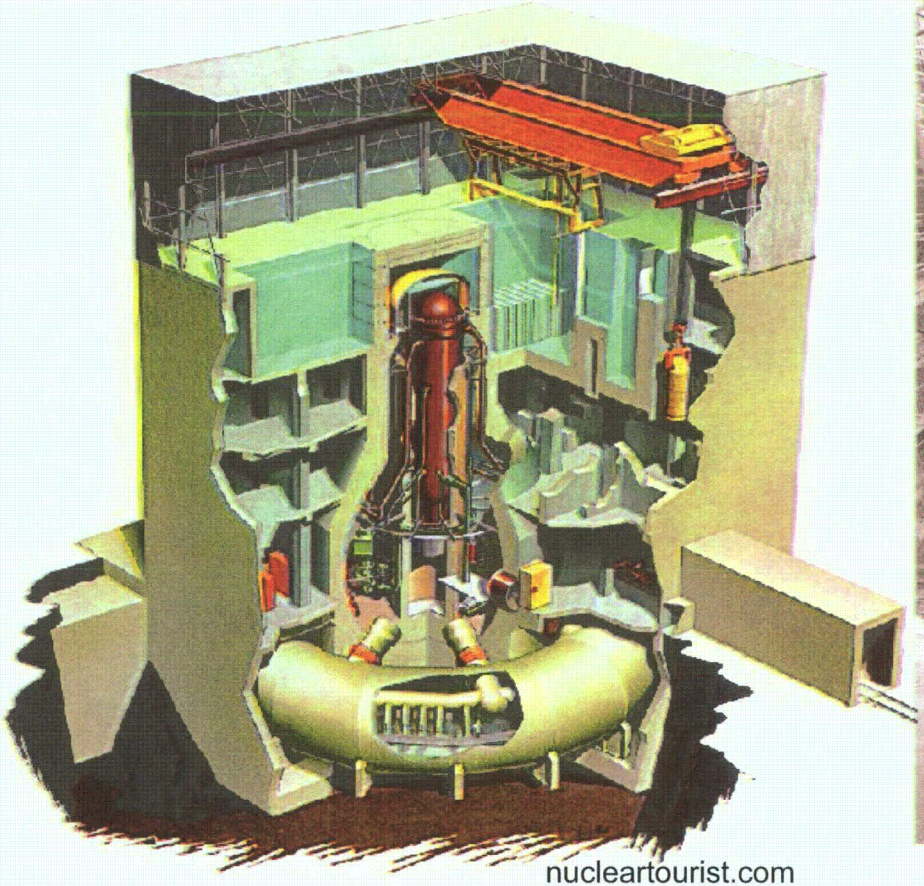
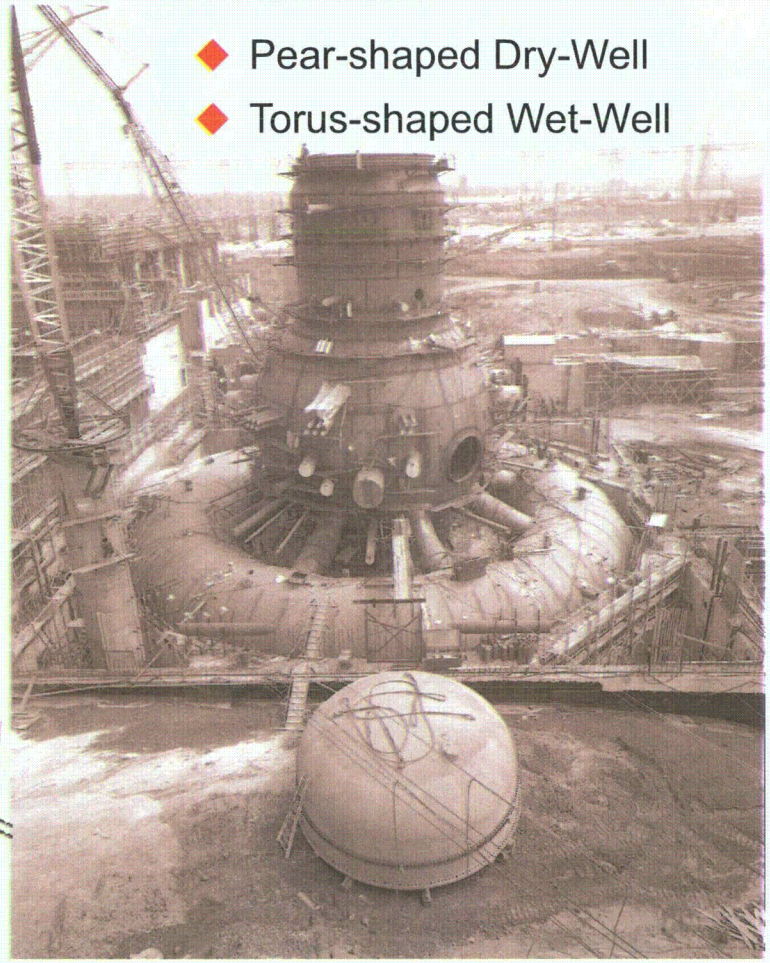
The Fukushima Daiichi Incident
1. Plant Design

- Building structure
  - Concrete Building
  - Steel-framed Service Floor



nucleartourist.com

- Containment
  - Pear-shaped Dry-Well
  - Torus-shaped Wet-Well



en.wikipedia.org/wiki/Browns_Ferry_Nuclear_Power_Plant

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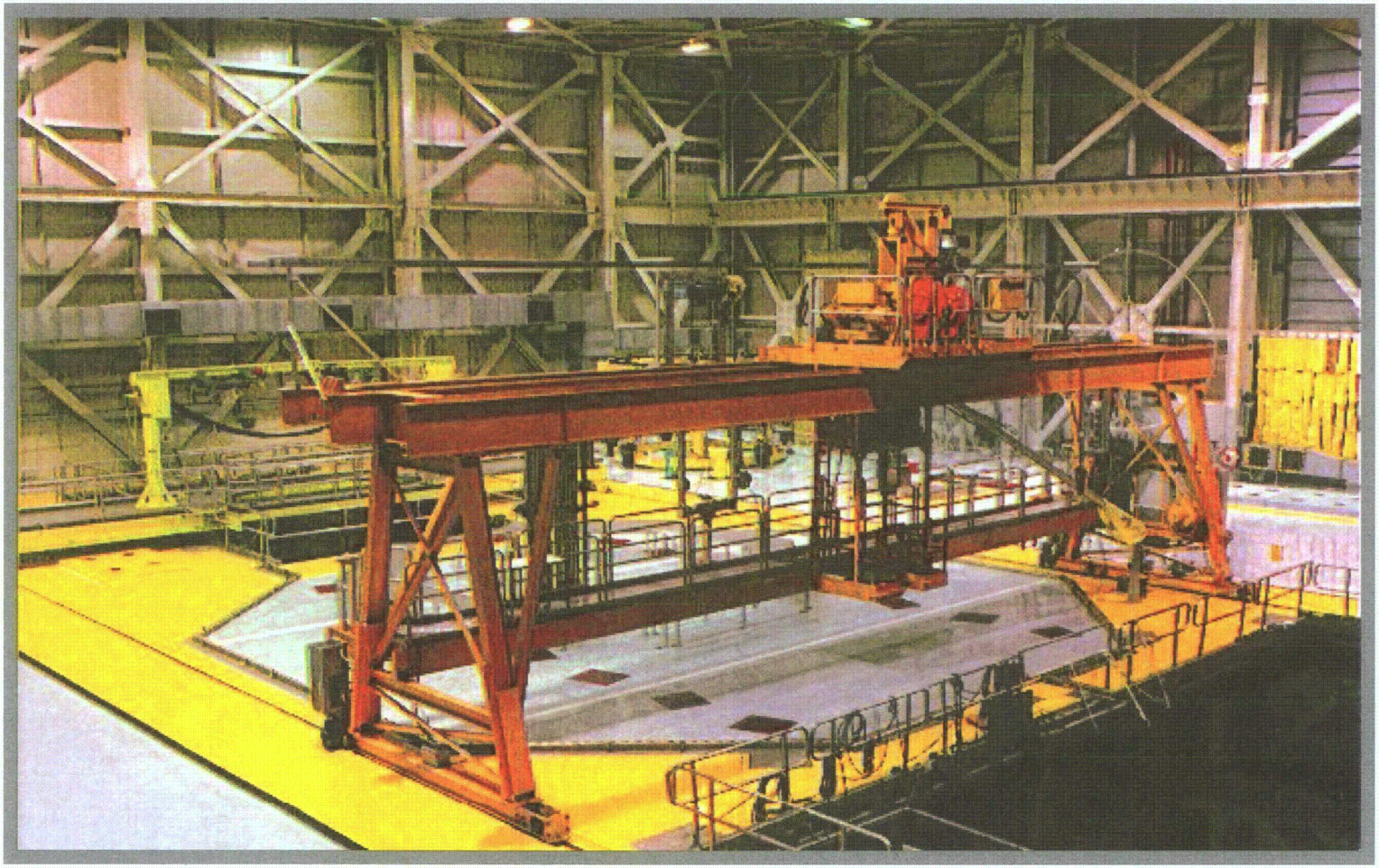
The Fukushima Daiichi Incident
1. Plant Design

- Service Floor



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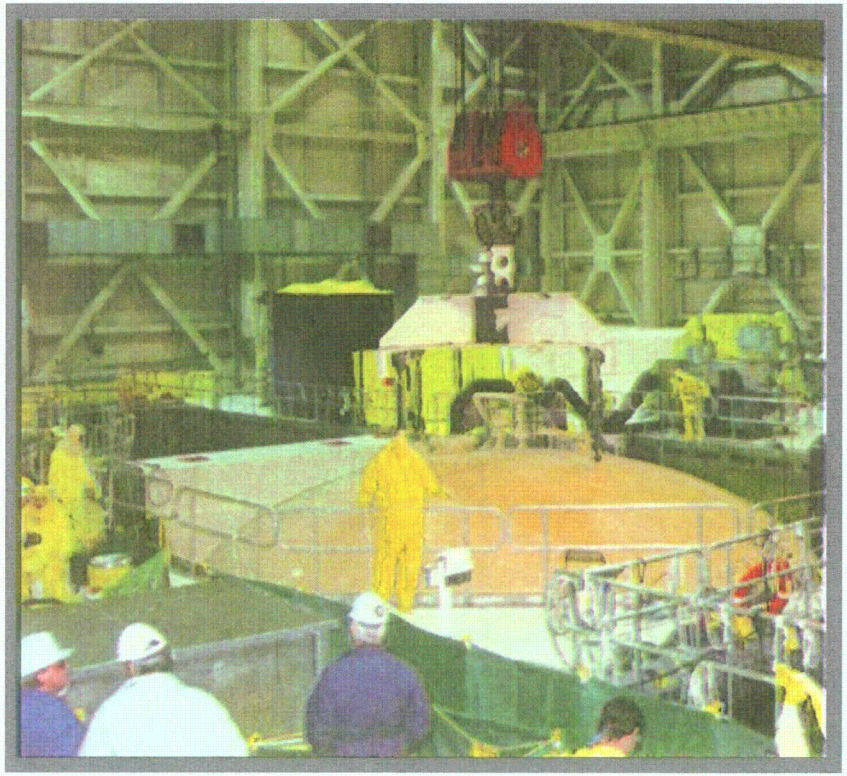
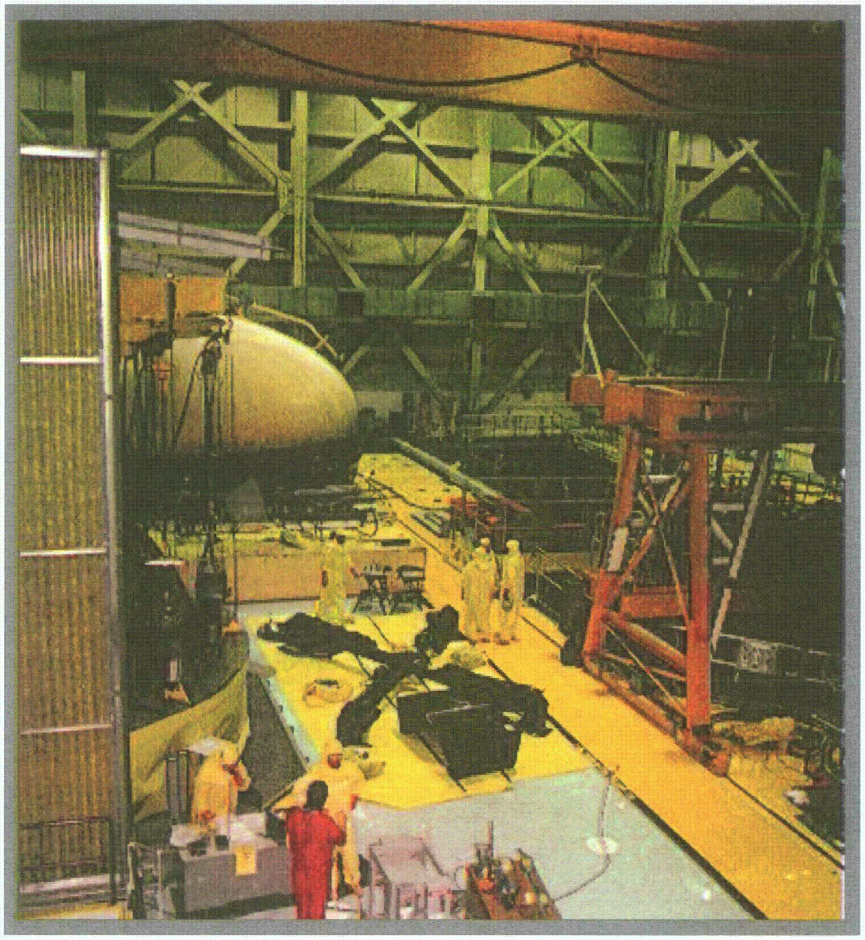
The Fukushima Daiichi Incident
1. Plant Design

- Lifting the Containment closure head





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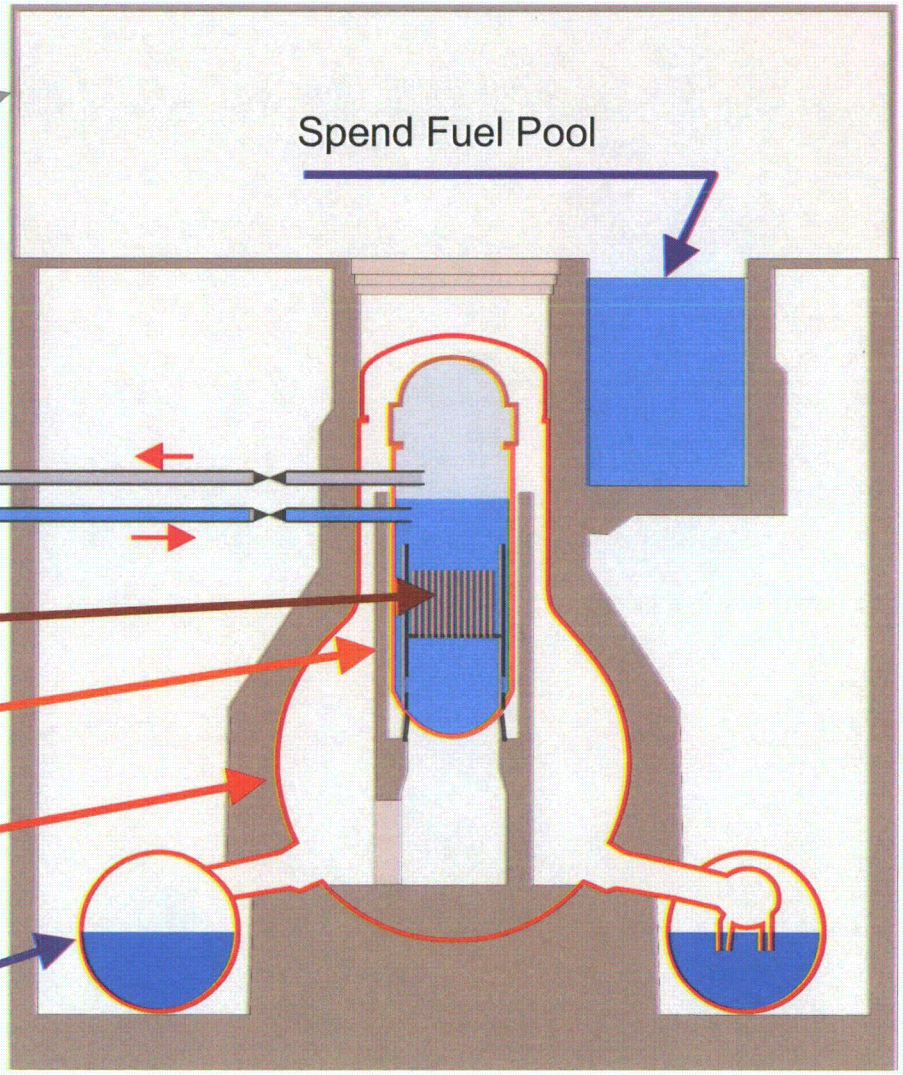
The Fukushima Daiichi Incident

1. Plant Design

- Reactor Service Floor (Steel Construction)
- Concrete Reactor Building (secondary Containment)
- Reactor Core
- Reactor Pressure Vessel
- Containment (Dry well)
- Containment (Wet Well) / Condensation Chamber

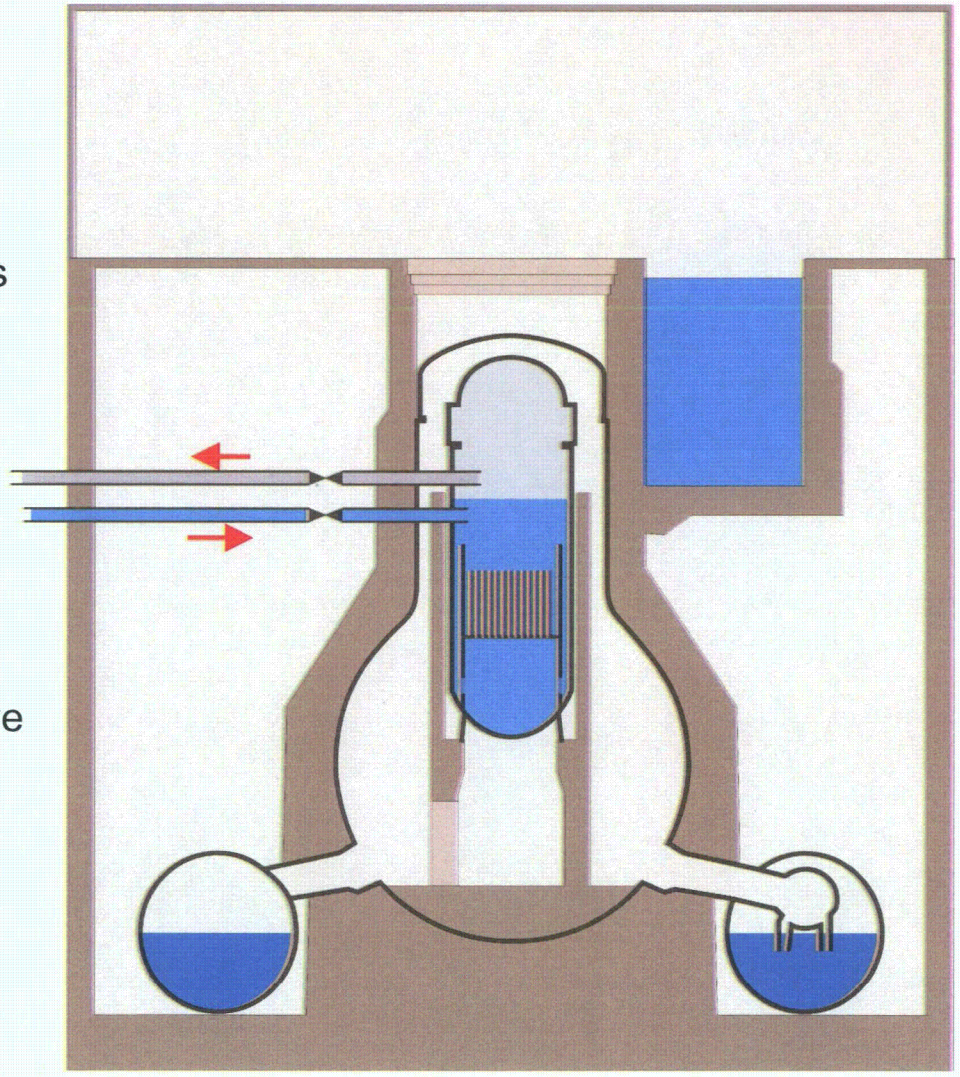


AREVA

The Fukushima Daiichi Incident

2. Accident progression

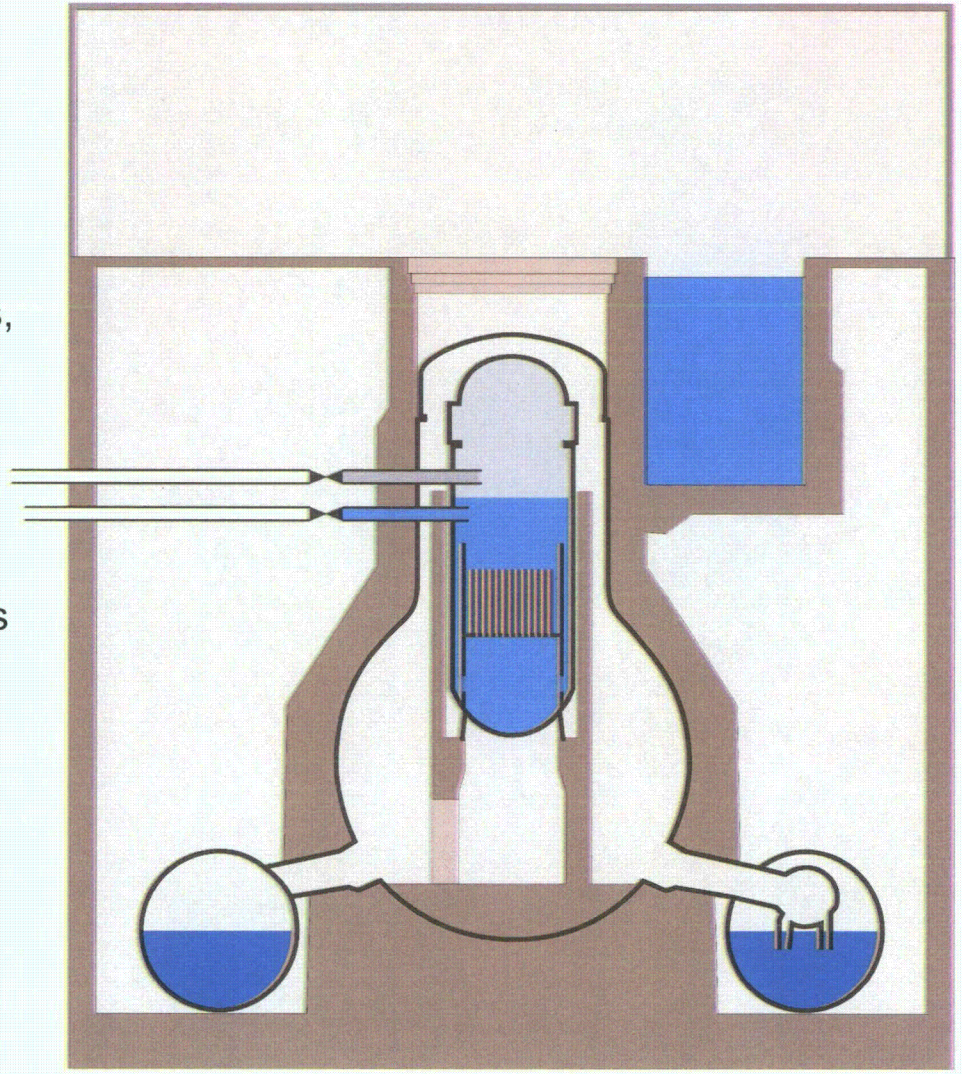
- 11.3.2011 14:46 - Earthquake
  - Magnitude 9
  - Power grid in northern Japan fails
  - Reactors itself are mainly undamaged
- SCRAM
  - Power generation due to Fission of Uranium stops
  - Heat generation due to radioactive Decay of Fission Products
    - After Scram ~6%
    - After 1 Day ~1%
    - After 5 Days ~0.5%



The Fukushima Daiichi Incident

2. Accident progression

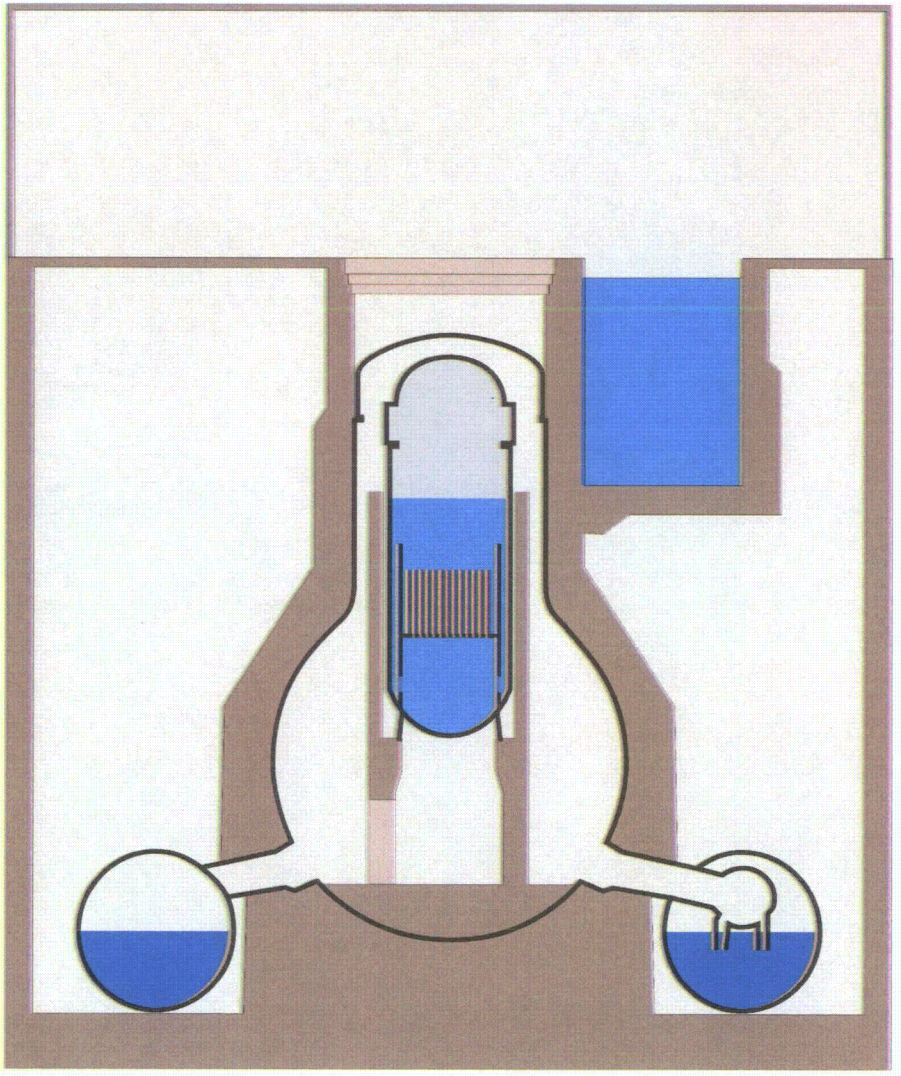
- Containment Isolation
  - Closing of all non-safety related Penetrations of the containment
  - Cuts off Machine hall
  - If containment isolation succeeds, a large early release of fission products is highly unlikely
- Diesel generators start
  - Emergency Core cooling systems are supplied
- Plant is in a stable save state



The Fukushima Daiichi Incident

2. Accident progression

- 11.3. 15:41 Tsunami hits the plant
  - Plant Design for Tsunami height of up to 6.5m
  - Actual Tsunami height >7m
  - Flooding of
    - Diesel Generators and/or
    - Essential service water building cooling the generators
- Station Blackout
  - Common cause failure of the power supply
  - Only Batteries are still available
  - Failure of all but one Emergency core cooling systems



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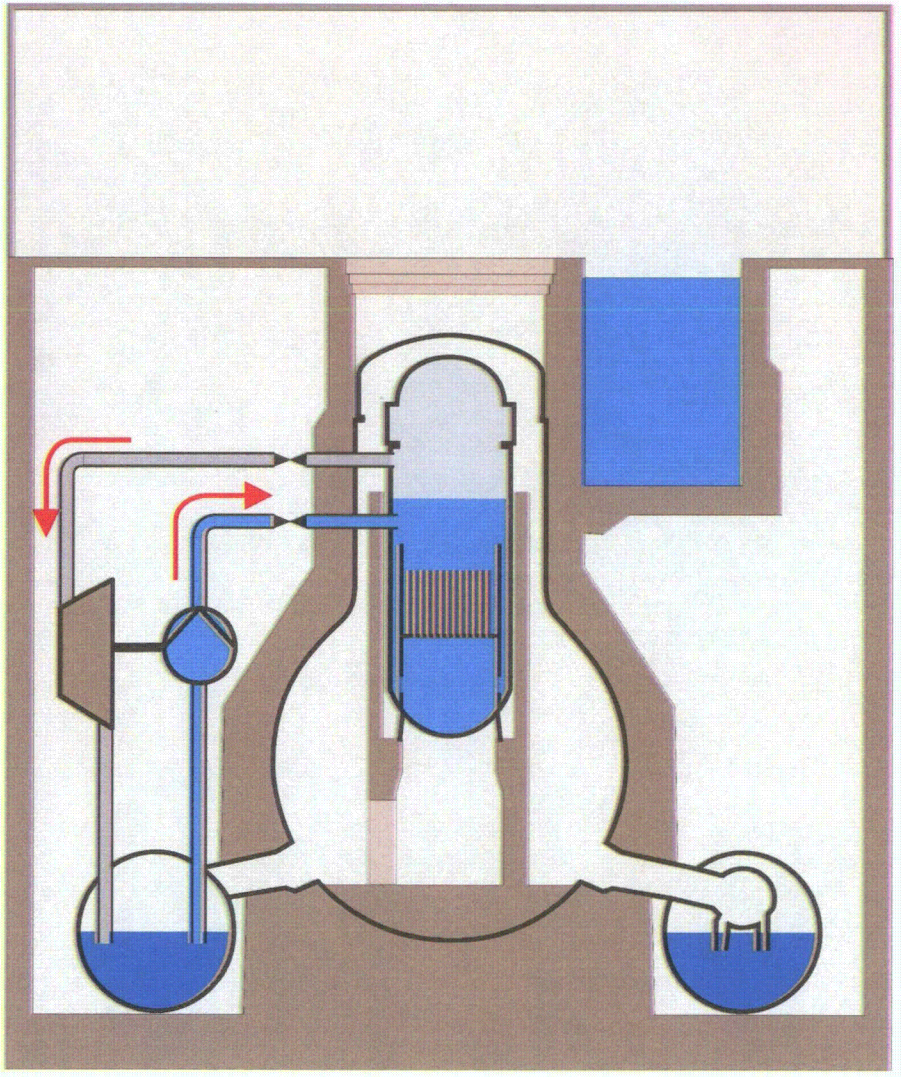
The Fukushima Daiichi Incident

2. Accident progression

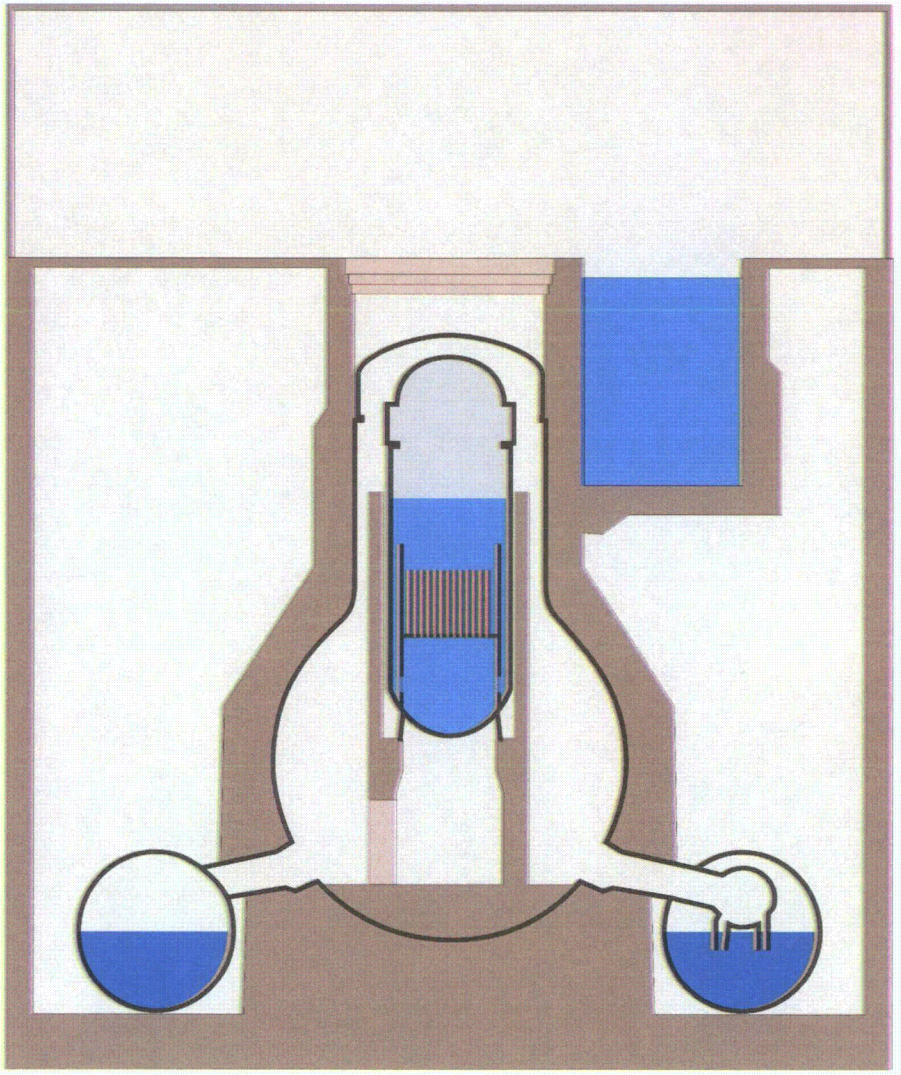
- Reactor Core Isolation Pump still available
  - Steam from the Reactor drives a Turbine
  - Steam gets condensed in the Wet-Well
  - Turbine drives a Pump
  - Water from the Wet-Well gets pumped in Reactor
  - Necessary:
    - Battery power
    - Temperature in the wet-well must be below 100°C
- As there is no heat removal from the building, the Core isolation pump cant work infinitely



The Fukushima Daiichi Incident

2. Accident progression

- Reactor Isolation pump stops
  - 11.3. 16:36 in Unit 1 (Batteries empty)
  - 14.3. 13:25 in Unit 2 (Pump failure)
  - 13.3. 2:44 in Unit 3 (Batteries empty)
- Decay Heat produces still steam in Reactor pressure Vessel
  - Pressure rising
- Opening the steam relieve valves
  - Discharge Steam into the Wet-Well
- Descending of the Liquid Level in the Reactor pressure vessel



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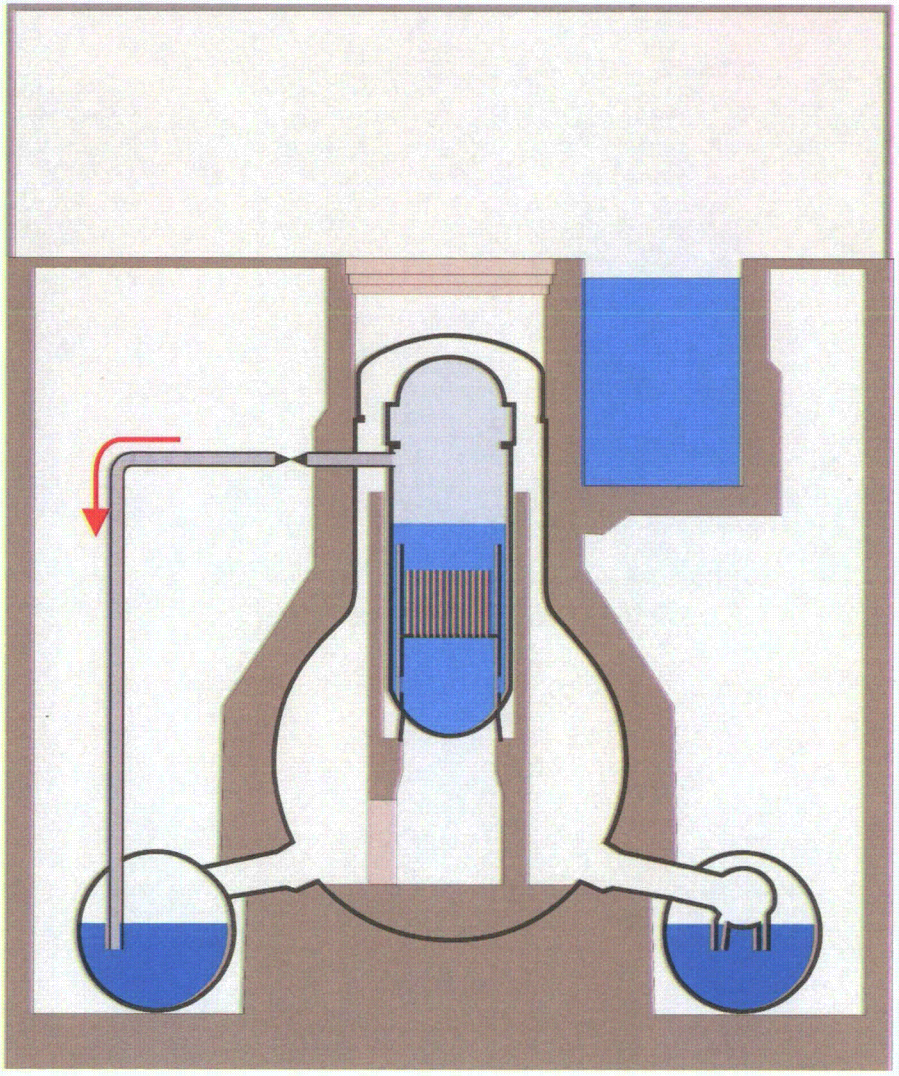

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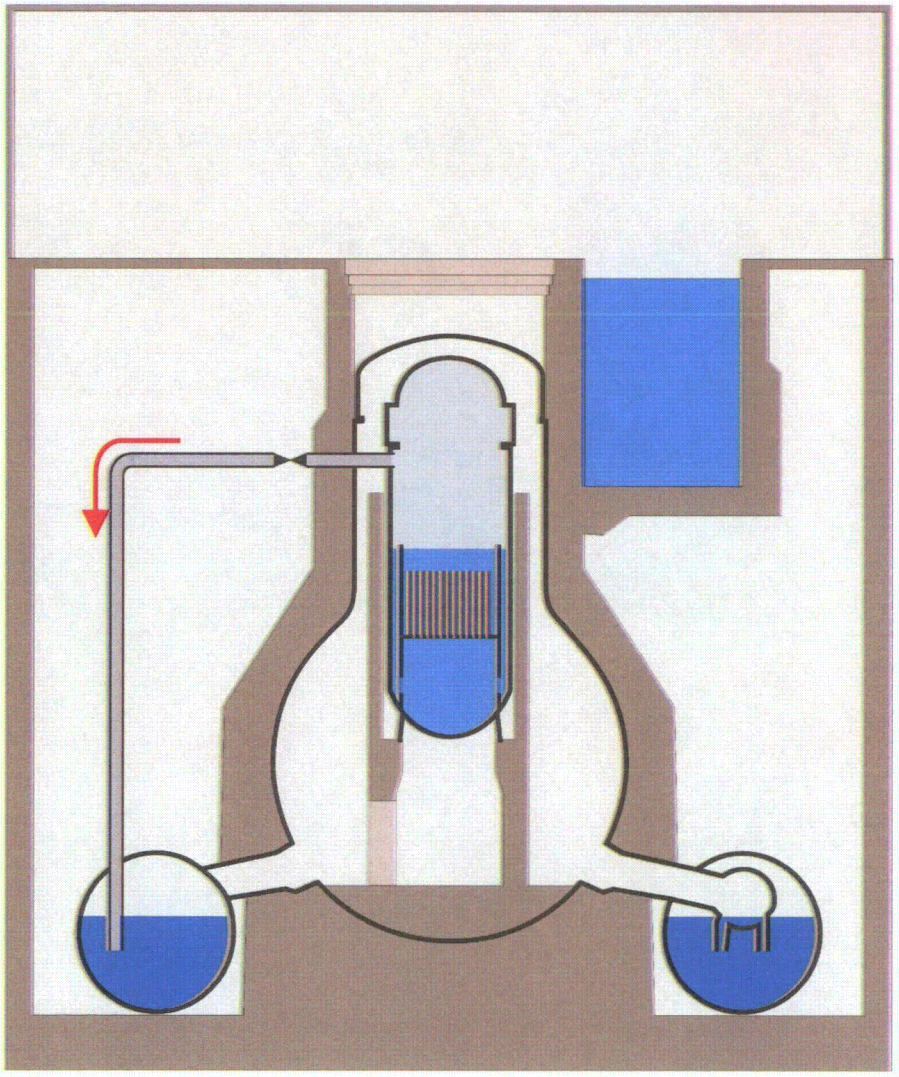

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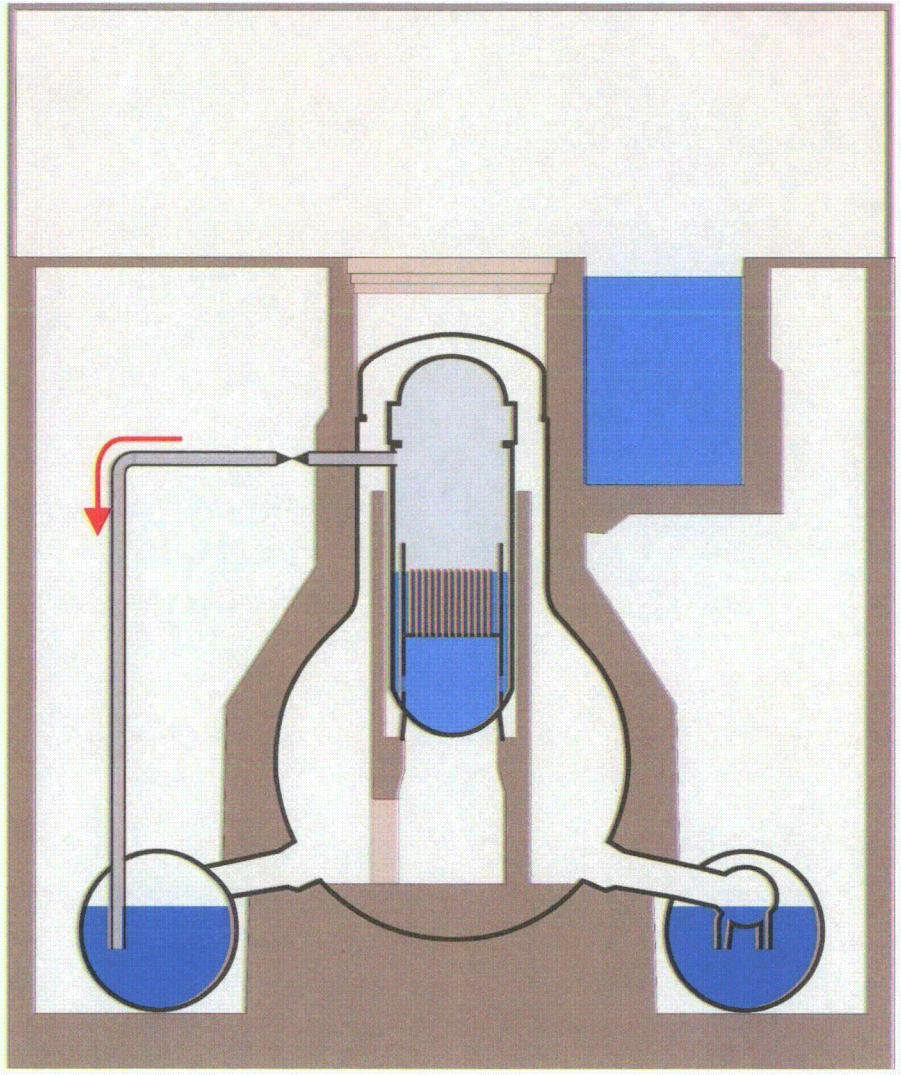

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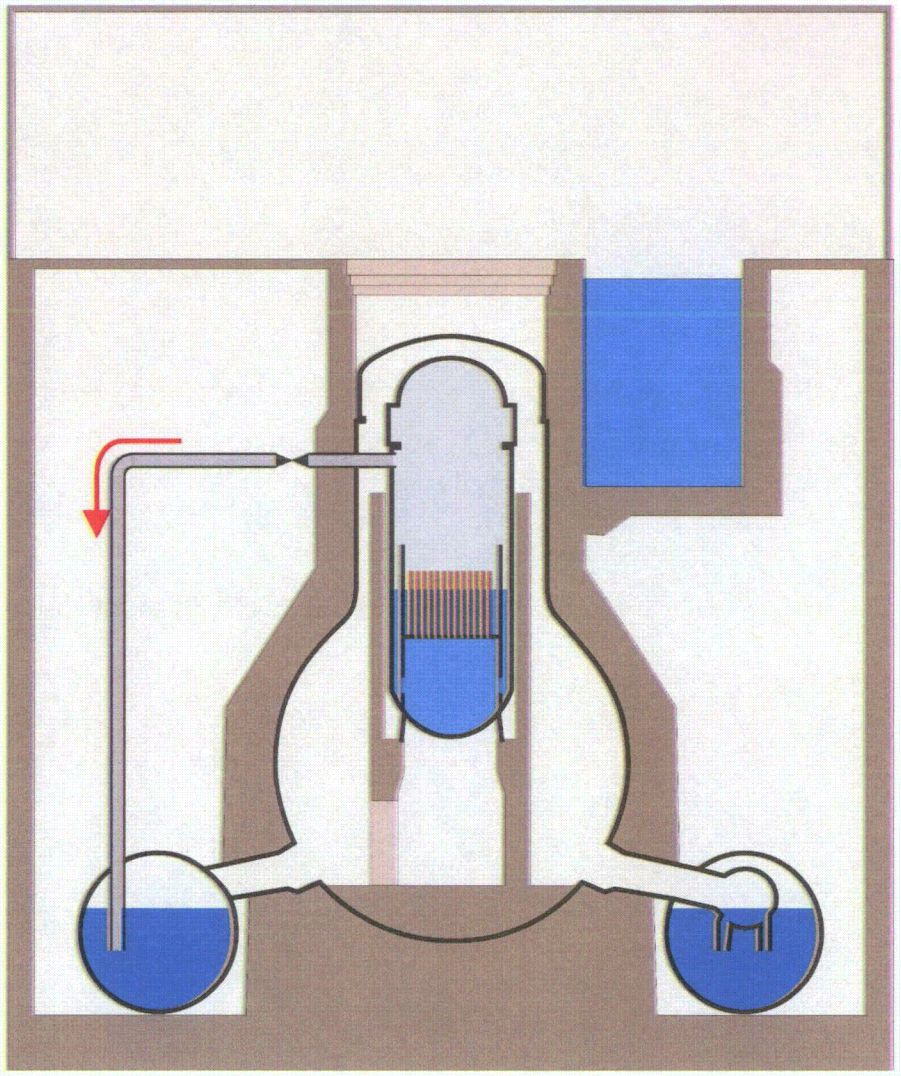


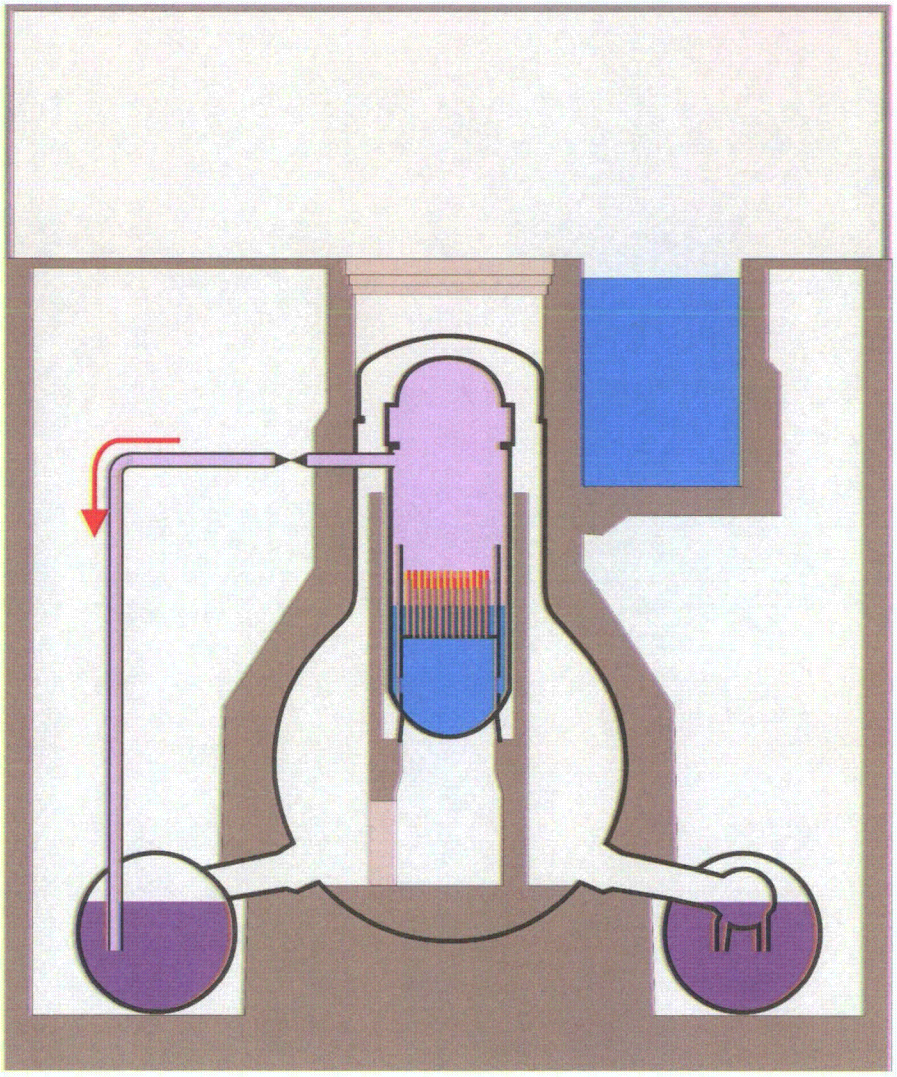
The Fukushima Daiichi Incident

2. Accident progression

- Measured, and here referenced Liquid level is the collapsed level. The actual liquid level lies higher due to the steam bubbles in the liquid

- ~50% of the core exposed
  - Cladding temperatures rise, but still no significant core damage

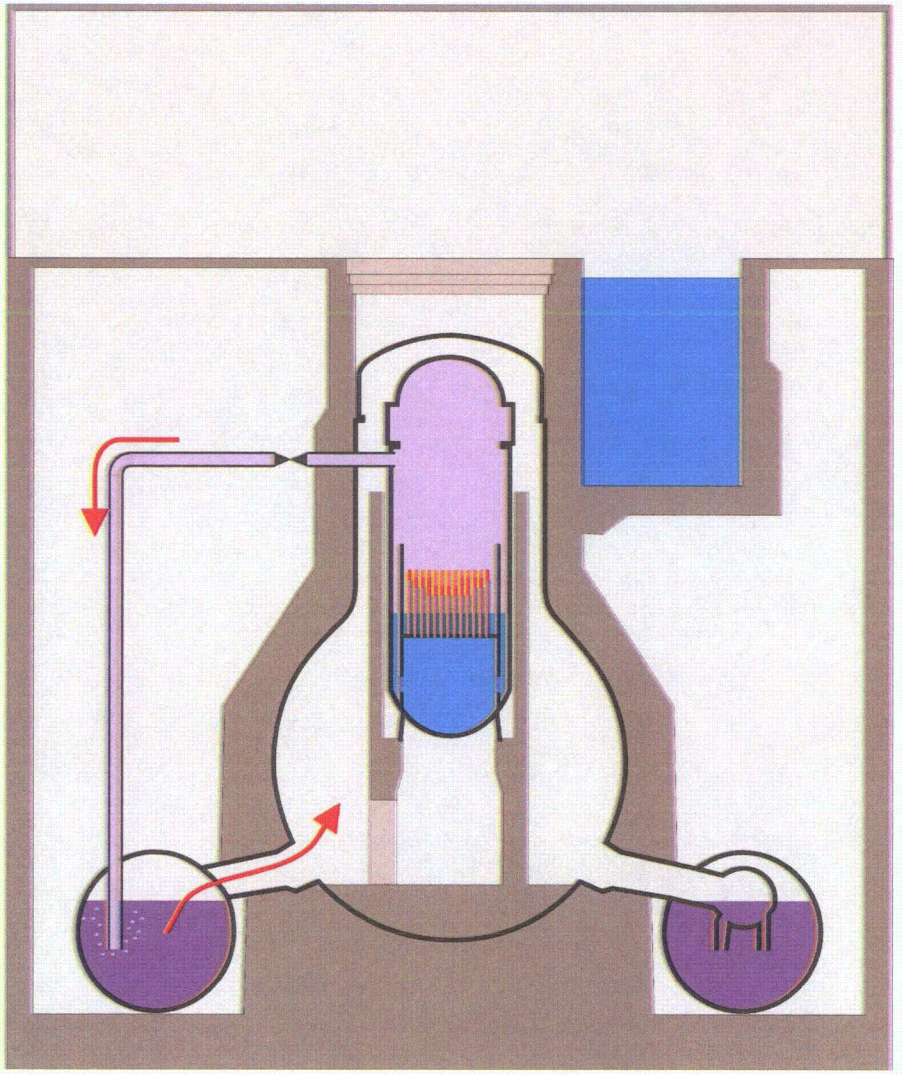
- ~2/3 of the core exposed
  - Cladding temperature exceeds ~900°C
  - Balooning / Breaking of the cladding
  - Release of fission products form the fuel rod gaps



The Fukushima Daiichi Incident

2. Accident progression

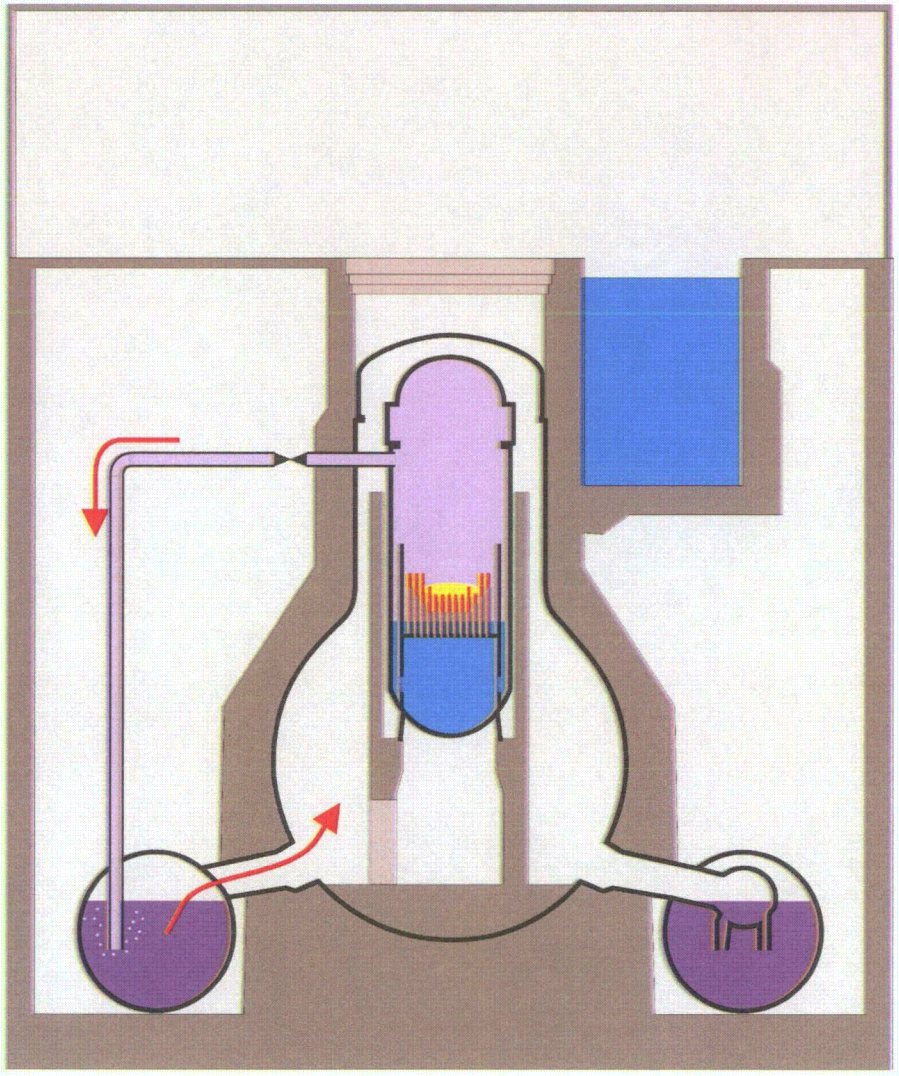
- ~3/4 of the core exposed
  - Cladding exceeds ~1200°C
  - Zirconium in the cladding starts to burn under Steam atmosphere
  - **$Zr + 2H_20 \rightarrow ZrO_2 + 2H_2$**
  - Exothermal reaction further heats the core
  - Generation of hydrogen
    - Unit 1: 300-600kg
    - Unit 2/3: 300-1000kg
  - Hydrogen gets pushed via the wet-well, the wet-well vacuum breakers into the dry-well



The Fukushima Daiichi Incident

2. Accident progression

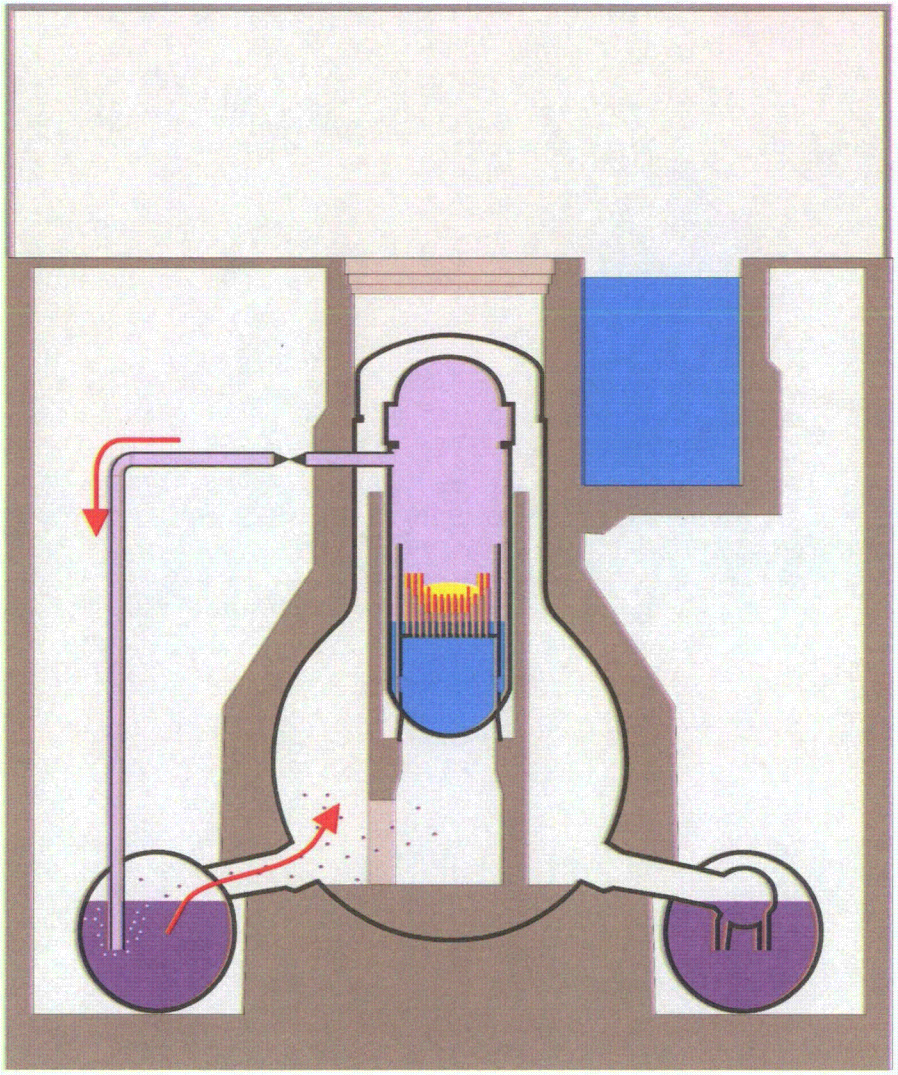
- at ~1800°C [Unit 1,2,3]
  - Melting of the Cladding
  - Melting of the steel structures
- at ~2500°C [Block 1,2]
  - Breaking of the fuel rods
  - debris bed inside the core
- at ~2700°C [Block 1]
  - Melting of Uranium-Zirconium eutectics
- Restoration of the water supply stops accident in all 3 Units
  - Unit 1: 12.3. 20:20 (27h w.o. water)
  - Unit 2: 14.3. 20:33 (7h w.o. water)
  - Unit 3: 13.3. 9:38 (7h w.o. water)



The Fukushima Daiichi Incident

2. Accident progression

- Release of fission products during melt down
  - Xenon, Cesium, Iodine,…
  - Uranium/Plutonium remain in core
  - Fission products condensate to airborne Aerosols
- Discharge through valves into water of the condensation chamber
  - Pool scrubbing binds a fraction of Aerosols in the water
- Xenon and remaining aerosols enter the Dry-Well
  - Deposition of aerosols on surfaces further decontaminates air

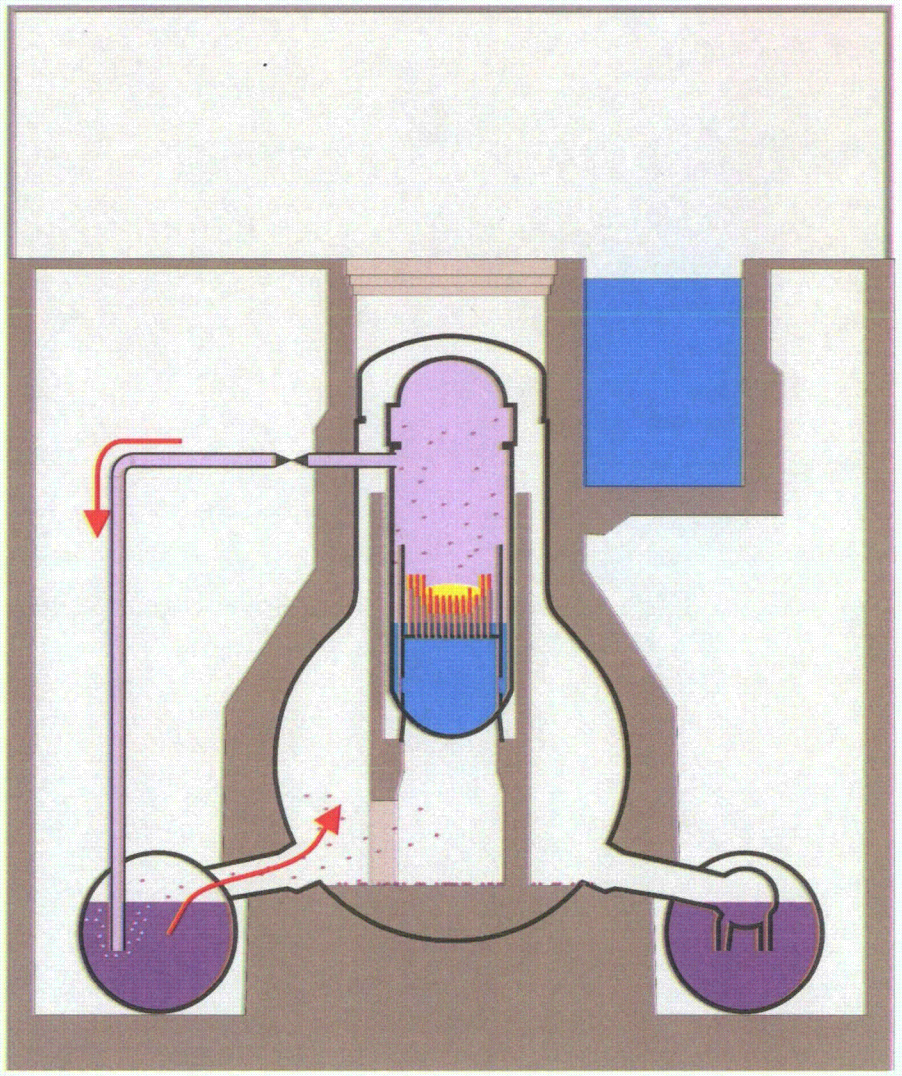


AREVA

The Fukushima Daiichi Incident

2. Accident progression

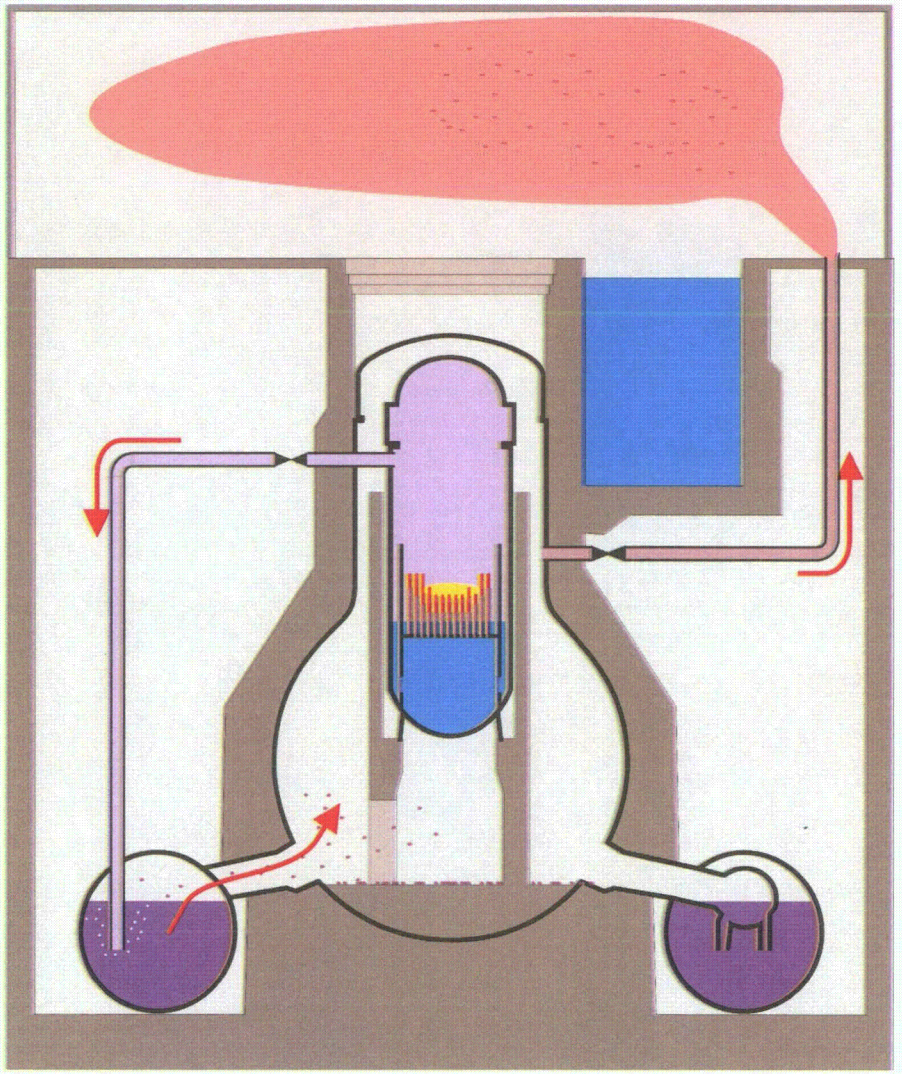
- Containment
  - Last barrier between Fission Products and Environment
  - Wall thickness ~3cm
  - Design Pressure 4-5bar
- Actual pressure up to 8 bars
  - Normal inert gas filling (Nitrogen)
  - Hydrogen from core oxidation
  - Boiling condensation chamber (like a pressure cooker)
- Depressurization of the containment
  - Unit 1: 12.3. 4:00
  - Unit 2: 13.3 00:00
  - Unit 3: 13.3. 8.41



The Fukushima Daiichi Incident

2. Accident progression

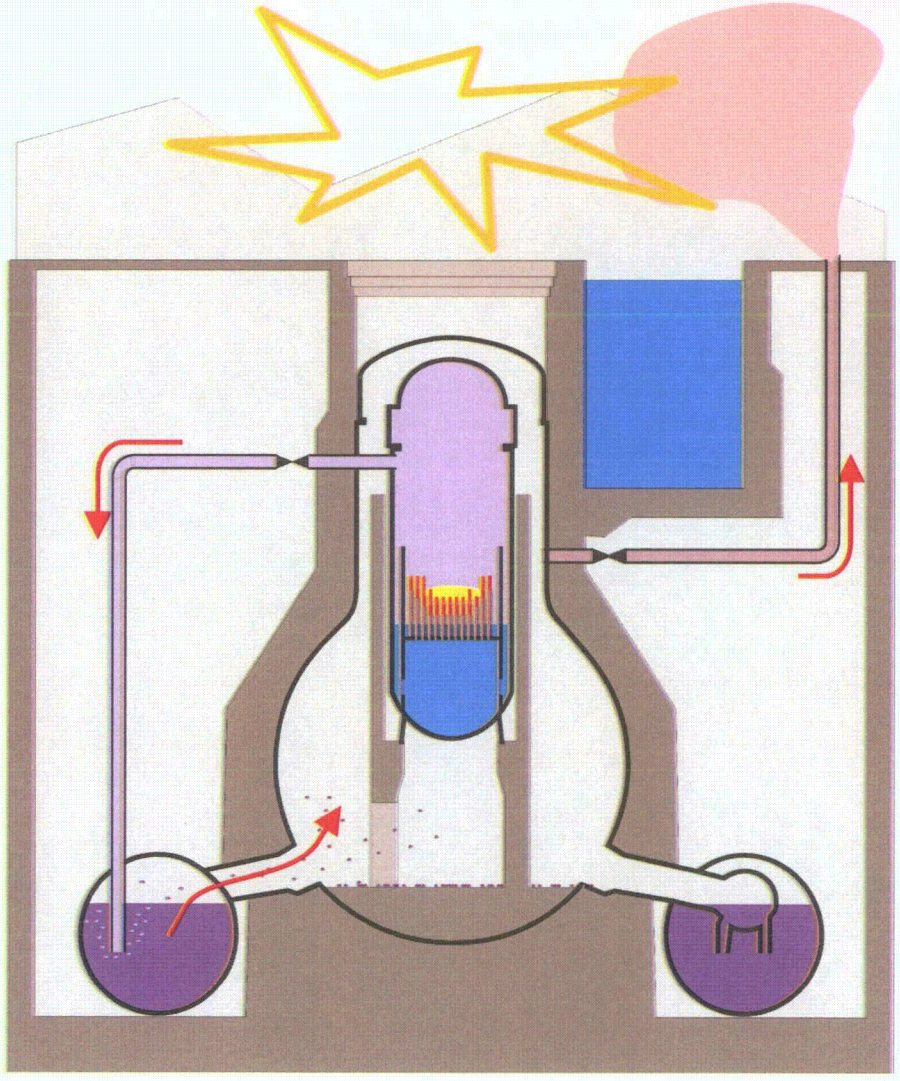
- Positive und negative Aspects of depressurizing the containment
  - Removes Energy from the Reactor building (only way left)
  - Reducing the pressure to ~4 bar
  - Release of small amounts of Aerosols (Iodine, Cesium ~0.1%)
  - Release of all noble gases
  - Release of Hydrogen
- Gas is released into the reactor service floor
  - Hydrogen is flammable



The Fukushima Daiichi Incident

2. Accident progression

- Unit 1 und 3
  - Hydrogen burn inside the reactor service floor
  - Destruction of the steel-frame roof
  - Reinforced concrete reactor building seems undamaged
  - Spectacular but minor safety relevant

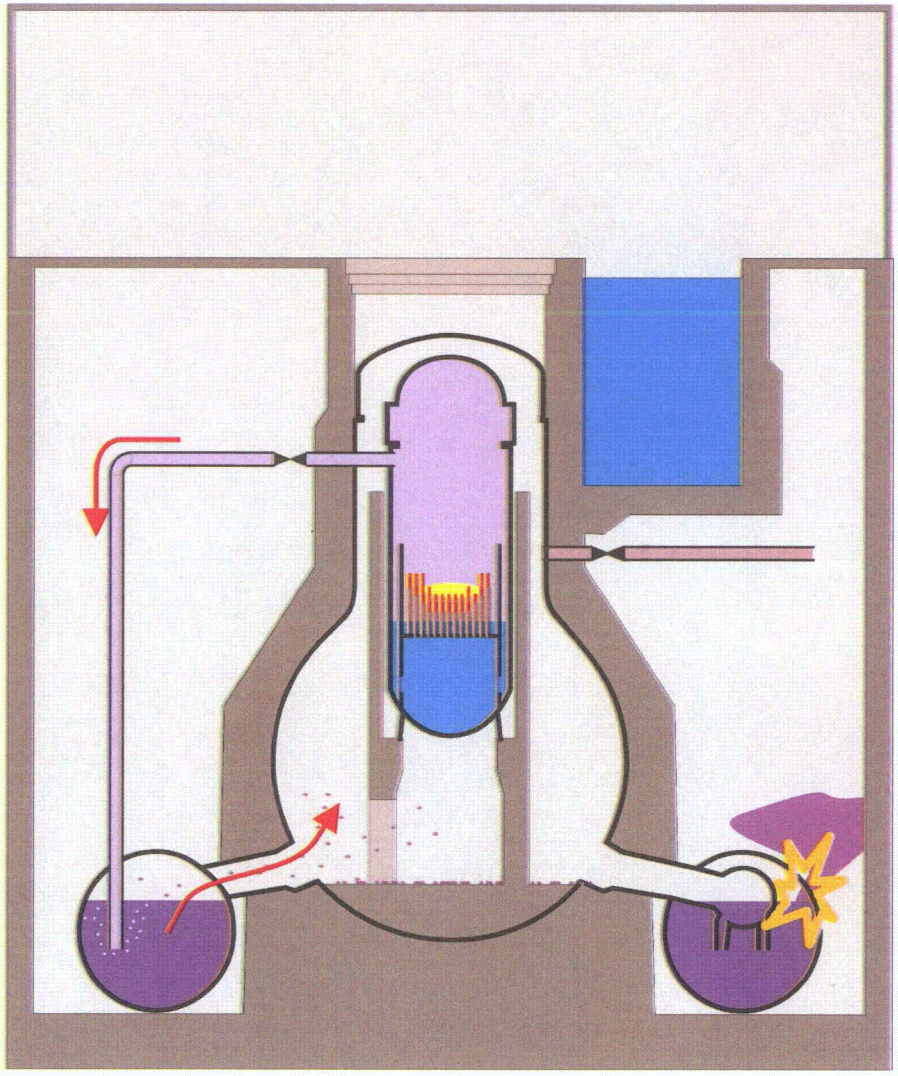


AREVA

The Fukushima Daiichi Incident

2. Accident progression

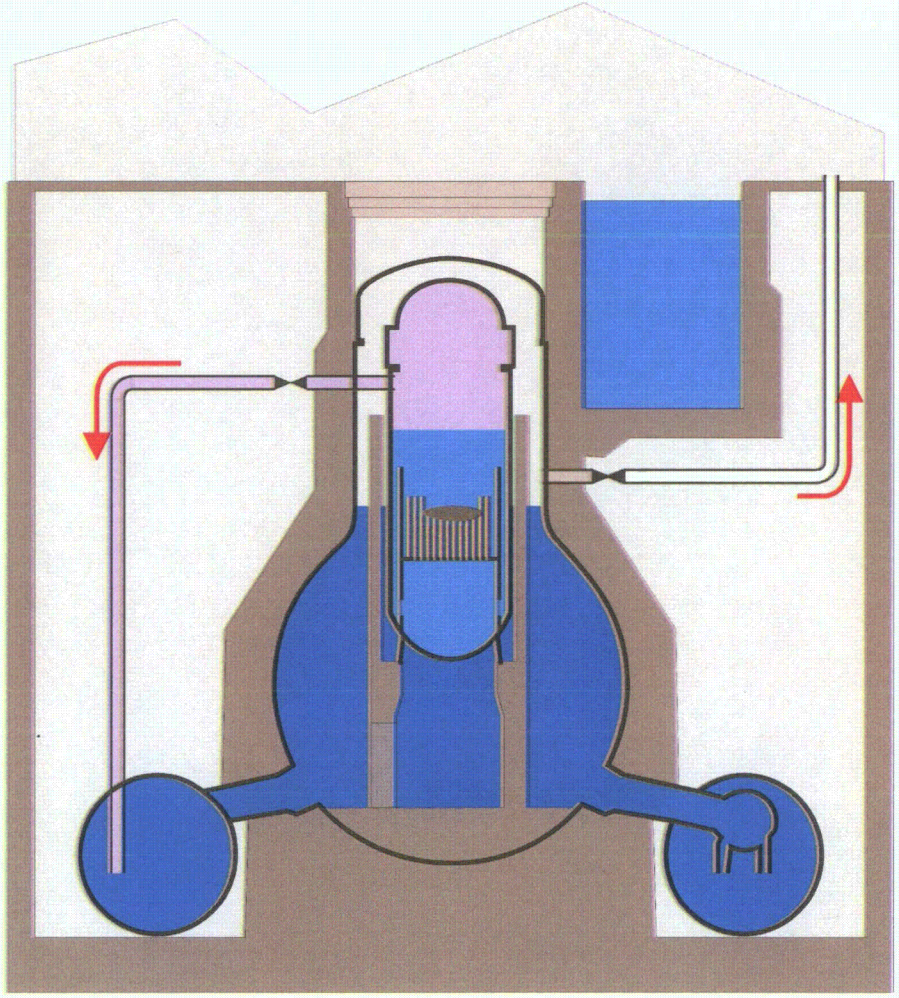
- Unit 2
  - Hydrogen burn inside the reactor building
  - Probably damage to the condensation chamber (highly contaminated water)
  - Uncontrolled release of gas from the containment
  - **Release of fission products**
  - Temporal evacuation of the plant
  - High local dose rates on the plant site due to wreckage hinder further recovery work
- No clear information's why Unit 2 behaved differently



AREVA

The Fukushima Daiichi Incident
2. Accident progression

- Current status of the Reactors
  - Core Damage in Unit 1,2, 3
  - Building damage due to various burns Unit 1-4
  - Reactor pressure vessels floode in all Units with mobile pumps
  - At least containment in Unit 1 flooded
- Further cooling of the Reactors by releasing steam to the atmospher
- Only small further releases of fission products can be expected



AREVA

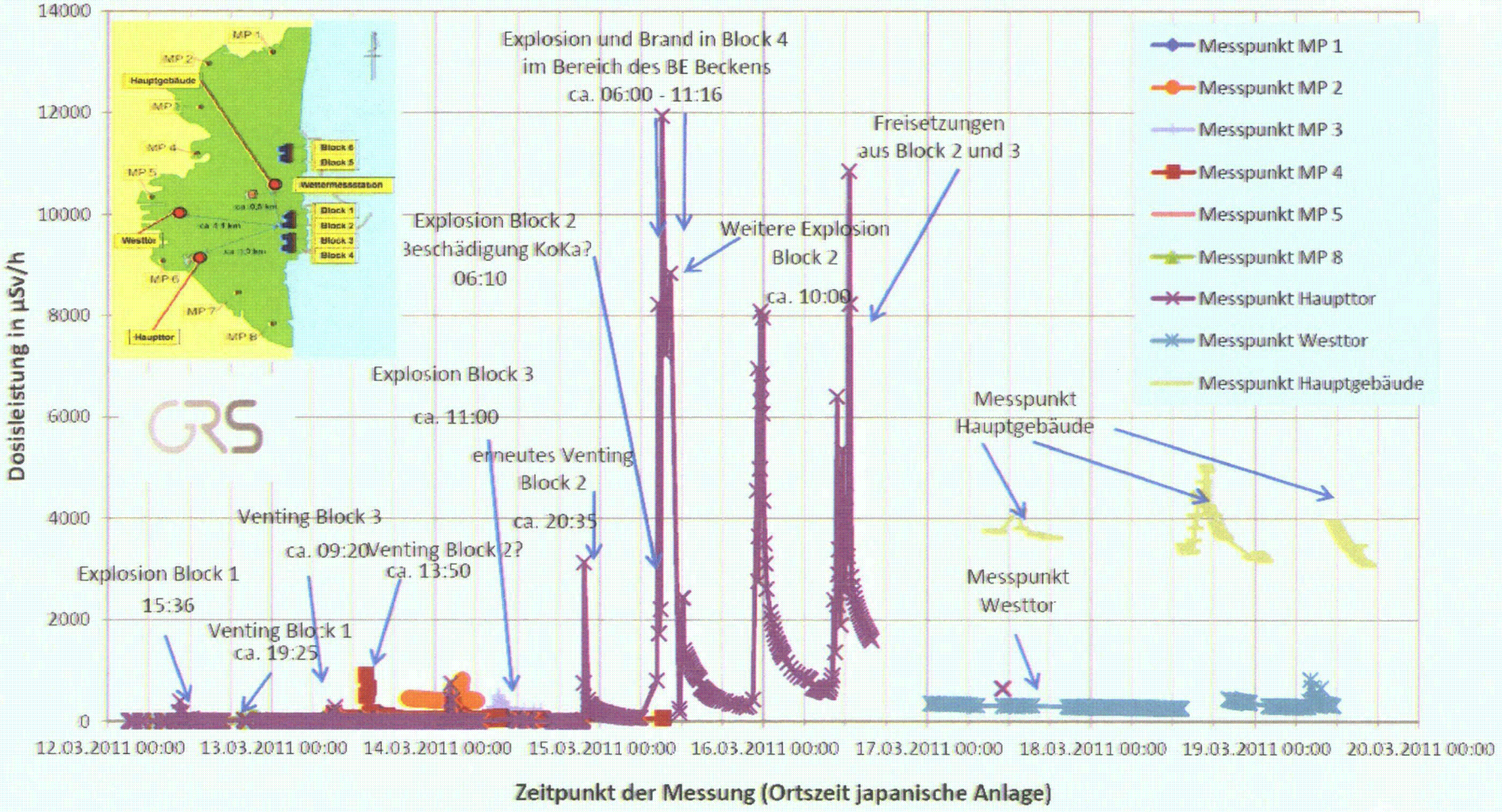
The Fukushima Daiichi Incident
3. Radiological releases

- Directly on the plant site
  - Before Explosion in Unit Block 2
    - Below 2mSv / h
    - Mainly due to released radioactive noble gases
    - Measuring posts on west side. Maybe too small values measured due to wind
  - After Explosion in Unit 2 (Damage of the Containment)
    - Temporal peak values 12mSv / h
    - (Origin not entirely clear)
    - Local peak values on site up to 400mSv /h (wreckage / fragments?)
    - Currently stable dose on site at 5mSv /h
    - Inside the buildings a lot more
  - Limiting time of exposure of the workers necessary

AREVA

The Fukushima Daiichi Incident

3. Radiological releases



AREVA

The Fukushima Daiichi Incident
3. Radiological releases

- Outside the Plant site
  - As reactor building mostly intact
    => reduced release of Aerosols (not Chernobyl-like)
  - Fission product release in steam
    => fast Aerosol grows, large fraction falls down in the proximity of the plant
  - Main contribution to the radioactive dose outside plant are the radioactive noble gases
  - Carried / distributed by the wind, decreasing dose with time
  - No „Fall-out" of the noble gases, so no local high contamination of soil

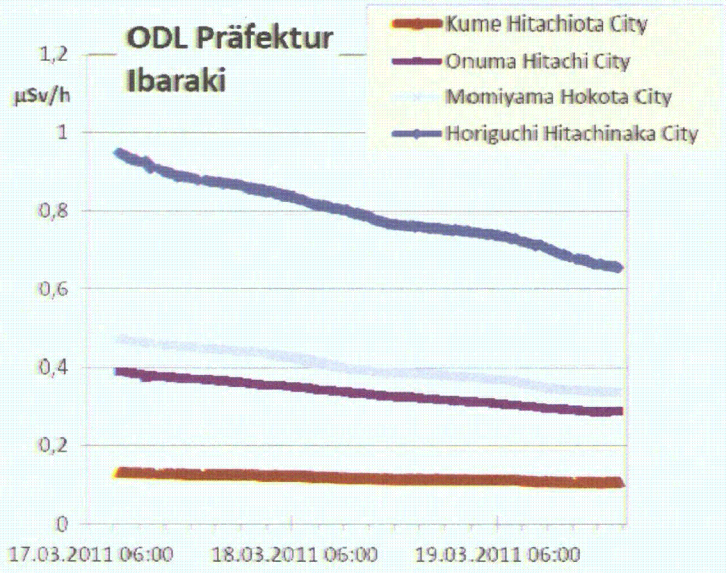
- ~20km around the plant
  - Evacuations were adequate
  - Measured dose up to 0.3mSv/h for short times
  - Maybe destruction of crops / dairy products this year
  - Probably no permanent evacuation of land necessary

AREVA

The Fukushima Daiichi Incident

3. Radiological releases

GRS.de



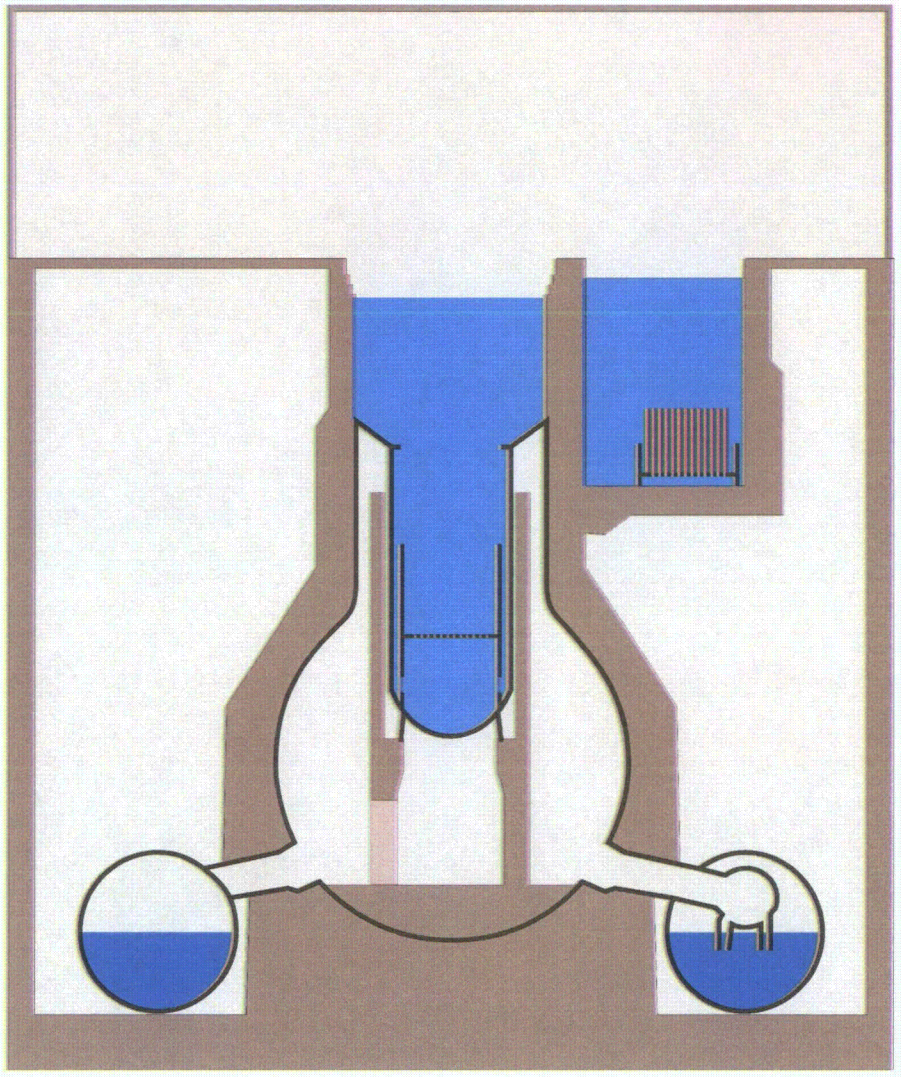
- ~50km around the plant
  - Control of Crop / Dairy products
  - Usage of Iodine pills (Caution, pills can interfere with heart medicine)

AREVA

The Fukushima Daiichi Incident

4. Spend fuel pools

- Spend fuel stored in Pool on Reactor service floor
  - Due to maintenance in Unit 4 entire core stored in Fuel pool
  - Dry-out of the pools
    - Unit 4: in 10 days
    - Unit 1-3,5,6 in few weeks
  - **Leakage of the pools due to Earthquake?**
- Consequences
  - Core melt „on fresh air “
  - Nearly no retention of fission products
  - Large release



The Fukushima Daiichi Incident

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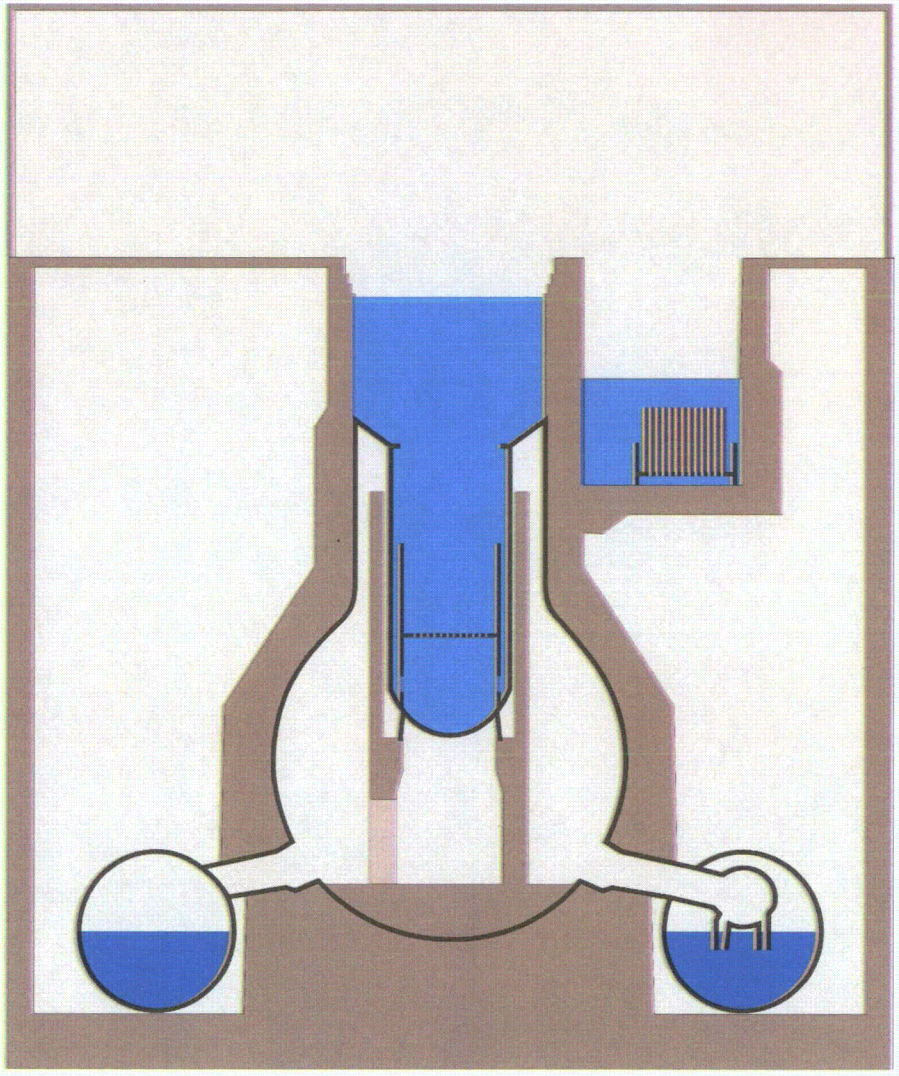

AREVA

The Fukushima Daiichi Incident

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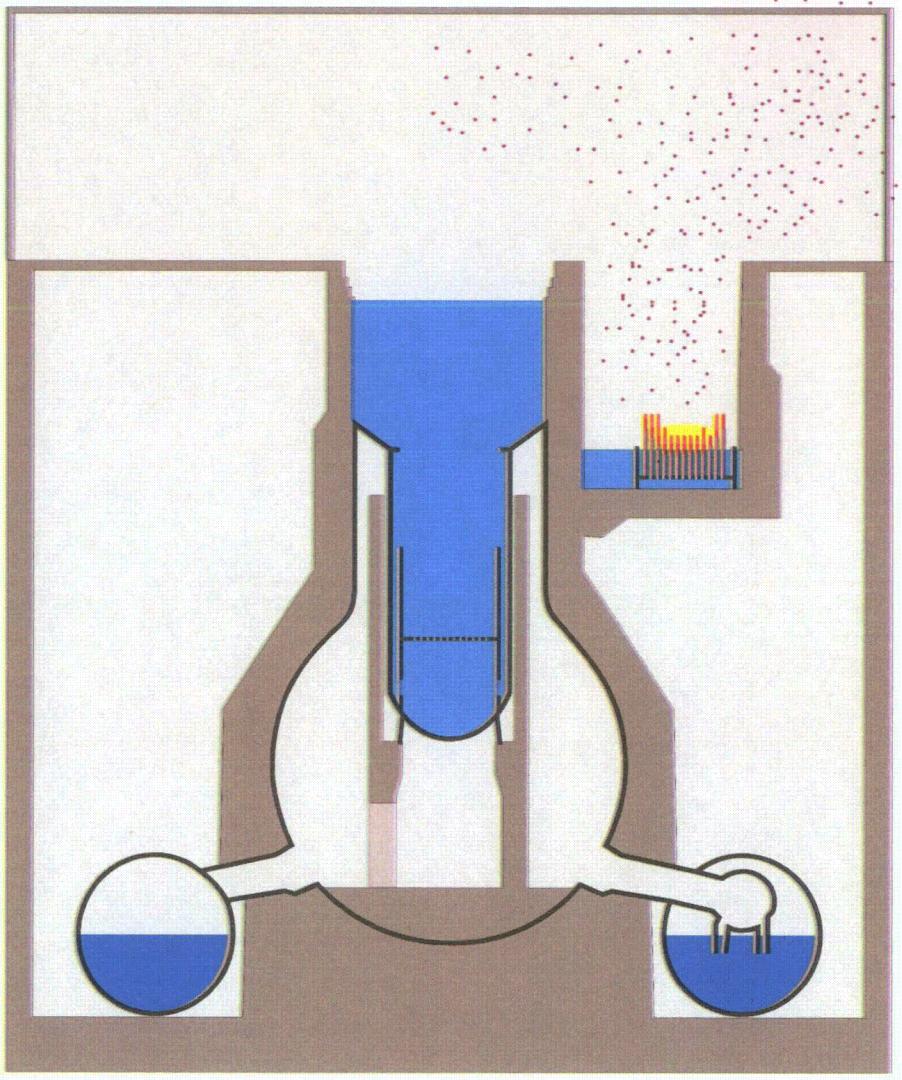
    - Unit 1-3,5,6 in few weeks
  - **Leakage of the pools due to Earthquake?**
- Consequences
  - Core melt „on fresh air “
  - Nearly no retention of fission products
  - Large release
- **It is currently unclear if release from fuel pool already happened**



The Fukushima Daiichi Incident
5. Sources of Information

- Good sources of Information
  - Gesellschaft für Reaktorsicherheit [GRS.de]
    - Up to date
    - Radiological measurements published
    - German translation of japanese/englisch web pages
  - Japan Atomic Industrial Forum [jaif.or.jp/english/]
    - Current Status of the plants
    - Measurement values of the reactors (pressure liquid level)
  - Tokyo Electric Power Company [Tepco.co.jp]
    - Status of the recovery work
    - Casualties
- May too few information are released by TEPCO, the operator of the plant