Pages (362)

# Group AV

(Records Withheld In Part)

**From:** Taylor, Robert
**Sent:** Friday, October 28, 2011 8:22 AM
**To:** Marshall, Michael
**Cc:** Skeen, David
**Subject:** FW: FYI - REST OF THE STORY

Mike,

We are exploring the question the Chairman asked yesterday, regarding the journal article. It looks like Chuck Casto has already looked into it. I am forwarding his email for your awareness. I am having our folks review it as well to make sure we can respond to the Chairman's questions.

Regards,
Rob

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**From:** Casto, Chuck
**Sent:** Thursday, October 27, 2011 8:32 PM
**To:** Weber, Michael; Skeen, David; Taylor, Robert
**Cc:** Brock, Kathryn; Virgilio, Martin; Bowman, Gregory; Mamish, Nader; Foggie, Kirk; Burnell, Scott
**Subject:** Re: FYI - REST OF THE STORY

Folks

This journal is one of almost zero academic journals that will publish articles with little or no peer review. They publish online which serious journals will not before accepting articles. Some people argue that this journal is the ultimate in throwing things against the wall to see what sticks.

We need the researchers and peers to review these articles before we address them publically. Right now this is unvalidated research. We are having the same difficulty over here with this press article. There will be many 'studies' over the years. In the end 'A' level journals will publish the most valid research.

My opinion.

Casto

This email is being sent from an NRC mobile device.

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**From**: Weber, Michael
**To**: Skeen, David; Taylor, Robert
**Cc**: Brock, Kathryn; Virgilio, Martin; Bowman, Gregory; Mamish, Nader; Foggie, Kirk; Casto, Chuck; Burnell, Scott
**Sent**: Thu Oct 27 16:44:44 2011
**Subject**: FYI - REST OF THE STORY

The article below, which was distributed by Global Security Newswire, provides a high-level summary of the results of the article for which I previously distributed the link. The article suggests that the amount of radioactive released from Fukushima was actually larger than reported by Japan and approached roughly 40% of the amount of radioactivity released from Chernobyl.

# Radiation Release From Japan Nuclear Facility Could Eclipse Official Sum

Thursday, Oct. 27, 2011

The quantity of radioactive cesium 137 that has escaped Japan's crippled Fukushima Daiichi atomic facility could exceed by more than twofold the level determined in an official calculation, specialists said in a report quoted by Bloomberg on Thursday (see *GSN*, Oct. 27).

The six-reactor power plant was damaged by the March 11 earthquake and tsunami that left more than 20,000 people missing or dead in Japan. Radiation releases on a level not seen since the 1986 Chernobyl disaster forced the evacuation of about 80,000 residents from a 12-mile ring exclusion zone surrounding the site in Fukushima prefecture. Unlivable conditions could persist in the plant's vicinity for 20 years or longer, Tokyo indicated in August.

Measurements collected globally suggest the events resulted in the release of 35,800 terabecquerels of cesium into the environment, 42 percent of the amount to have escaped in the Chernobyl incident, U.S. and European experts said in a report published in *Atmospheric Chemistry and Physics*. The Japanese government in June said only 15,000 terabecquerels of the isotope, which breaks down at a rate of 50 percent every three decades, had moved out of the plant.

Roughly 20 percent of the cesium landed on Japanese territory, while air currents carried the other material out to sea, the document indicates (Tsuyoshi Inajima, Bloomberg, Oct. 27).

The assessment suggests the disaster's effect on the Japanese capital was much smaller in scope than it might have been, *Nature* quoted one expert as saying.

"There was a period when quite a high concentration went over Tokyo, but it didn't rain," said Andreas Stohl, an atmospheric researcher at the Norwegian Institute for Air Research. "It could have been much worse" (Geoff Brumfiel, *Nature*, Oct. 27).

No adjustments have been made to plant contaminant calculations issued by the Japanese Nuclear and Industrial Safety Agency and Tokyo Electric Power, the Fukushima site's operator. The quantity of contaminants moving out of the plant has fallen to one eight-millionth of the maximum level recorded in the crisis, the power company indicated last week.

Japanese Environment Minister Goshi Hosono in August said Tokyo would amend its computation.

"We don't need to add much to what was emitted in the early days," NISA atomic crisis official Yasuo Kosaku told Bloomberg. However, "the June estimate may have to be revised," he added.

Stohl said the expert assessment draws on a broader range of measurements than the Japanese government, which focused largely on information gathered within the country, *Nature* reported. The difference might help to explain the divergence in the two estimates, he said.

Personnel behind the government's figure "wanted to get something out quickly," said Stohl, who suggested their effort was understandable.

"Taking account of the radiation that has drifted out to the Pacific is essential for getting a real picture of the size and character of the accident," added Tomoya Yamauchi, a Kobe University radiation scientist who has been taking ground contamination readings in Fukushima prefecture.

The official and independent estimates are notably comparable when ambiguities in calculation procedures are taken into account, said Gunma University volcano specialist Yukio Hayakawa, who has also carried out computations related to the crisis (Brumfiel, *Nature*).

When the plant operator began firing water on the No. 4 reactor's spent fuel cooling pond as a temperature control measure, the release of cesium 137 "suddenly dropped," Bloomberg quoted the report's authors as saying. "This indicates that emissions were not only coming from the damaged reactor cores, but also from the spent fuel pool of unit 4," the document states (Inajima, Bloomberg).

The pond was apparently not harmed significantly, according to Japanese officials who discounted the area as a major cause of radioactive material emissions. "The release from unit 4 is not important," Masamichi Chino, a Japanese Atomic Energy Authority expert who aided in the preparation of the government calculation, said in remarks reported by *Nature*.

Still, the reading of the cooling pond's significance "looks convincing," said Lars-Erik De Geer, an atmospheric expert with the Swedish Defense Research Agency in Stockholm (Brumfiel, *Nature*).

Damage to the facility also led to the escape of 16.7 million terabecquerels of xenon 133, Bloomberg quoted the expert paper as saying. The radioactive isotope breaks down at a speed of 50 percent over 5.2 days and poses little threat, Tetsuo Ito, who heads the Atomic Energy Research Institute at Kinki University, said in a telephone discussion.

Separately, contaminants might have begun drifting from the site before the March 11 tsunami hit, 45 minutes following the earthquake, according to the report. "This early onset of emissions is interesting and may indicate some structural damage to the reactor units during the earthquake," it states.

The Japanese atomic agency stands by its view that the facility sustained no major harm during the earthquake, spokesman Tadashige Koitabashi said in a telephone interview. The official did not address the new assessment directly.

The tsunami compromised the plant's auxiliary power systems, halting its temperature mitigation mechanisms and prompting overheating in three reactors, according to the atomic agency and Tokyo Electric Power. Radioactive materials passed out of containment structures damaged by blasts at the facility (Inajima, Bloomberg).

Mike

Michael Weber
Deputy Executive Director for Materials, Waste, Research,
State, Tribal, and Compliance Programs
U.S. Nuclear Regulatory Commission

301-415-1705
Mail Stop O16E15

**From:** Monninger, John
**Sent:** Friday, October 28, 2011 7:36 AM
**To:** Hipschman, Thomas; Marshall, Michael; Bradford, Anna; Warren, Roberta
**Subject:** FW: FYI - REST OF THE STORY

FYI.

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**From:** Weber, Michael
**Sent:** Friday, October 28, 2011 7:00 AM
**To:** Jaczko, Gregory
**Cc:** Batkin, Joshua; Monninger, John
**Subject:** FYI - REST OF THE STORY

Good morning, Chairman. Note Chuck's preliminary reaction to the article by A. Stohl *et al.* published in the *Atmospheric Chemistry and Physics Discussions*. We're looking at the article.

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**From:** Casto, Chuck
**Sent:** Thursday, October 27, 2011 8:32 PM
**To:** Weber, Michael; Skeen, David; Taylor, Robert
**Cc:** Brock, Kathryn; Virgilio, Martin; Bowman, Gregory; Mamish, Nader; Foggie, Kirk; Burnell, Scott
**Subject:** Re: FYI - REST OF THE STORY

Folks

This journal is one of almost zero academic journals that will publish articles with little or no peer review. They publish online which serious journals will not before accepting articles. Some people argue that this journal is the ultimate in throwing things against the wall to see what sticks.

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My opinion.

Casto

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**From**: Weber, Michael
**To**: Skeen, David; Taylor, Robert
**Cc**: Brock, Kathryn; Virgilio, Martin; Bowman, Gregory; Mamish, Nader; Foggie, Kirk; Casto, Chuck; Burnell, Scott
**Sent**: Thu Oct 27 16:44:44 2011
**Subject**: FYI - REST OF THE STORY

The article below, which was distributed by Global Security Newswire, provides a high-level summary of the results of the article for which I previously distributed the link. The article suggests that the amount of radioactive released from Fukushima was actually larger than reported by Japan and approached roughly 40% of the amount of radioactivity released from Chernobyl.

**From:** Foggie, Kirk
**Sent:** Wednesday, October 26, 2011 4:06 PM
**To:** Marshall, Michael
**Cc:** Castleman, Patrick; Orders, William; Gilles, Nanette; Hart, Ken; Taylor, Robert; Abrams, Charlotte; Mitchell, Matthew
**Subject:** CSC question

Michael,

During today's weekly TA brief you ask me to provide you a definition for CSC in context to the discussion on the State Department Undersecretary visiting Japan to discuss CSC and how it affects the U.S. ability to negotiate contracts to assist in cleanup efforts in Japan.

CSC stands for the, Convention on Supplementary Compensation (CSC) for Nuclear Damage. The CSC - not yet in force - is an instrument to which all Member States may adhere regardless of whether they are parties to any existing nuclear liability conventions or have nuclear installations on their territories, though in the case where they are not party to either Paris or Vienna they must still implement national laws consistent with an annex to the CSC. In order to pass into force the CSC must be ratified by five countries with a minimum of 400 GW thermal of installed nuclear capacity. Fourteen countries have signed it, but most have not yet ratified it. The four ratifying member states are Argentina, Morocco, Romania, and the U.S. Currently the U.S. is the only ratifying party with significant nuclear generating capacity.

The Executive Branch has stated that it is especially important for the U.S. and Japan to have treaty relations pursuant to the CSC in order to eliminate concerns over potential liability as an obstacle to cooperation between Japanese and American firms in nuclear projects in Japan and elsewhere.

In the absence of treaty relations pursuant to the CSC, U.S. courts can be expected to consider taking jurisdiction over a nuclear incident outside the United States if there is any connection to the U.S. such as involvement in a nuclear project by an American firm or by the American component of a Japanese firm.

The CSC was designed to address liability issues associated with maritime shipments of nuclear material and to attract broad adherence from coastal countries near which nuclear material is shipped. Broad adherence to the CSC will minimize concerns over liability and thereby facilitate maritime shipments around the world and, in particular, in the Pacific and through the Panama Canal.

The Annex to the CSC Annex was written specifically to allow Japan to join the CSC without having to modify its Law on Compensation for Nuclear Damage to eliminate its current exemption of the operator for nuclear damage due to an extraordinary great natural disaster. This provision of the Japanese Law makes Japan ineligible to join the 1997 Vienna Convention or 2004 Paris Convention.

Kirk

**From:** Batkin, Joshua
**Sent:** Wednesday, October 26, 2011 2:17 PM
**To:** Powell, Amy
**Cc:** Weil, Jenny; Schmidt, Rebecca; Marshall, Michael; Taylor, Robert
**Subject:** RE: 50 miles and Yucca

This is perfect – clear, concise and easy to use. I added in the March 16 press release and sent it on. Thanks so much.

---

**From:** Powell, Amy
**Sent:** Wednesday, October 26, 2011 2:07 PM
**To:** Batkin, Joshua
**Cc:** Weil, Jenny; Schmidt, Rebecca
**Subject:** RE: 50 miles and Yucca

Here is our shot at a representative sample – let us know if you need anything else on this.

**50-mile evacuation:**
Written testimony for June 16, 2011 Senate EPW hearing discusses evacuation on p. 3:
http://www.nrc.gov/reading-rm/doc-collections/congress-docs/congress-testimony/2011/ML11166A256.pdf

June 17, 2011 letter to Sen. Webb re: assumptions used in recommending the 50mi evacuation of US citizens:
http://www.nrc.gov/reading-rm/doc-collections/congress-docs/correspondence/2011/webb-06-17-2011.pdf
(calculations attached to this letter were also shared with Rep. Issa in a 7/6/11 transmittal)

Response to QFR from Sen. Vitter following June 16, 2011 hearing with Commission (note – these responses are being sent to Committee TODAY) -attached

Link to DoS updated travel alert, relaxing 50 mile evacuation:
http://www.travel.state.gov/travel/cis_pa_tw/pa/pa_5574.html

**Unit 4 SNF pool:**
From transcript of House Energy and Commerce joint subcommittee hearing on March 16th (Full transcript is posted at http://www.nrc.gov/about-nrc/organization/commission/comm-gregory-jaczko/0317nrc-transcript-jaczko.pdf):

**Chairman Jaczko in opening remarks: {after providing updates on status of units 1-3):**

Now, in addition to the three reactors that were operating at the time of the incident, a fourth reactor is also right now under concern. This reactor was shut down at the time of the earthquake. What we believe at this time is that there has been a hydrogen explosion in this unit due to an uncovering of the fuel in the fuel pool.

We believe that secondary containment has been destroyed and there is no water in the spent-fuel pool. And we believe that radiation levels are extremely high, which could possibly impact the ability to take corrective measures.

For the two remaining units at this site, we have an IAEA report that the water level was down a little bit in this spent-fuel pool as well. And for the final reactor, we don't have any significant information at this time.

**From an exchange with Rep. Capps in the same hearing:**

REPRESENTATIVE LOIS CAPPS (D-CA): And Mr. Chairman, if you wouldn't mind granting me a little consideration – I represent Diablo Canyon nuclear facility and I have three packed questions, but something was stated earlier that I believe needs to be clarified just for the record. If I could ask the chairman, in addition to thanking him for his testimony, did you say that Unit 4 in Japan, in the incident there, that there was no water in Unit 4 surrounding the spent fuel and that Unit 3 was in danger of losing the water source?

MR. JACZKO: We believe, at this point, that Unit 4 may have lost a significant inventory, if not lost all of its water.

**From an exchange with Mr. Waxman in the same hearing:**

REP. WAXMAN: Well, you said that you're recommending an evacuation of U.S. citizens within 50 miles. What are the risks that are causing you to make this recommendation?

MR. JACZKO: Well, it's based on an assessment of the current conditions of the site. Because of the damage to the spent fuel pool, we believe that there's very significant radiation levels likely around the site.

And given that the reactors, the three reactors that were operating – given that they are operating with a – more of a backup to a backup, if you will, safety cooling system, if anything goes wrong with that, it would be very difficult for emergency workers to get into the site and perform emergency actions to help maintain that cooling.

So there is the likelihood that the cooling functions could be lost and if they are lost, it may be difficult to replace them and that could lead to a more significant damage to the fuel and potentially some type of release. So as a prudent measure with a comparable system situation here in the United States, we would likely be looking at an evacuation to a larger distance.

REP. WAXMAN: So it is the – is it the spent fuel problem in this Unit 4 where there's water covering the fuel rods – is that the greatest concern you have at the moment?

MR. JACZKO: Well, I think it's all of the factors together, really. It's the combination. And so you know, there's the possibility of this progressing further. And so as I said, in this country, we would probably take the prudent step of issuing evacuation to a larger distance.

REP. WAXMAN: High levels of radiation are being released from the pool – is that right?

MR. JACZKO: We believe that around the reactor's site, that there are high levels of radiation. Again, we have very limited data so I don't want to speculate –

REP. WAXMAN: And what would be the significance of that?

MR. JACZKO: The significance would – well, first and foremost, it would mean that it would be very difficult for emergency workers to get near to the reactors. The doses that they could experience would potentially be lethal doses in a very short period of time. So that is a very significant development and largely, is what prompted the agency to make the statement that it did.

REP. WAXMAN: And if they can't – if the emergency workers cannot get in there because of the danger to themselves, what would be the possibility, then, to deal with this problem of the spent fuels?

MR. JACZKO: Well, again, I don't want to speculate too much because again, we don't have direct information about the conditions on the ground. But it's certainly a difficult situation and one that needs to be addressed.

REP. WAXMAN: Well, you describe serious risks at these facilities. Can you describe what you think are the highest risks and why?

MR. JACZKO: At the sites in Japan?

REP. WAXMAN: Yeah. I think right now, as I think has been the situation from the beginning, the efforts are to continue to keep the reactors cool – the three reactors that were operating at the time of the earthquake. And that is, right now, being done with a variety of different systems. And again, in more a nontraditional way because they have lost a lot of their electrical power and their off-site power capabilities.

In addition, the other risk is really to the spent fuel that may be in the spent fuel pools for possibly up to six of the reactors at the site. So keeping those pools filled with water and keeping that fuel cool is also, then, the primary concerns.

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**From:** Batkin, Joshua
**Sent:** Tuesday, October 25, 2011 5:38 PM
**To:** Schmidt, Rebecca; Powell, Amy
**Subject:** 50 miles and Yucca

Hey, can you please pull a representative sample of the letters, QFRs and/or testimony we have provided (most especially to Issa, Inhofe and Vitter) on the unit 4 SFP and the 50 miles?

| | |
|---|---|
| **From:** | Bradford, Anna |
| **Sent:** | Friday, October 21, 2011 12:02 PM |
| **To:** | Coggins, Angela; Batkin, Joshua; Monninger, John; Hipschman, Thomas; Marshall, Michael |
| **Cc:** | Clark, Lisa; Warren, Roberta; Dhir, Neha; Fopma, Melody |
| **Subject:** | Fukushima cleanup |
| **Attachments:** | pre_report[1].pdf |

FYI, if you're interested, attached is a 20 page IAEA report on how the large area contaminated by Fukushima will be cleaned up. It says that many schools have been decontaminated voluntarily by parents of the students. Can you imagine getting that call from the PTA: "We need parents to pitch in this Saturday to help clean up radioactive contamination on the playground."

Anna Bradford
Policy Advisor for Nuclear Materials
Office of Chairman Jaczko
U.S. Nuclear Regulatory Commission
301-415-1827

NE/NEFW/2011
ORIGINAL: English

IAEA
International Atomic Energy Agency
*Atoms for Peace*

# Summary Report of the Preliminary Findings of the

# IAEA Mission on remediation of large contaminated areas off-site the Fukushima Dai-ichi NPP

## 7 – 15 October 2011, Japan

## 14. October 2011

**CONTENTS**

1. Introduction
2. Institutional Arrangements
3. Stakeholder involvement
4. Radiation protection considerations
5. Remediation implementation strategy
    5.1 Monitoring and mapping
    5.2 Data Management
    5.3 Agricultural areas
    5.4 Urban areas
    5.5 Forest areas
    5.6 Aquatic areas
    5.7 Waste management
6. Technical visits

Annexes

- TOR
- Mission programme
- List of Team Members and Japanese participants

The Team uses the term 'remediation' in accordance with the IAEA Safety Glossary. The Team understands that in the Japanese language there is only one word for both remediation and decontamination.

**Executive Summary**

In response to the request made by the Government of Japan, the IAEA organized a second fact-finding mission to support the remediation of large contaminated areas off-site the Fukushima Dai-chi Nuclear Power Plant (NPP). The Mission Team involved 12 international experts.

The Mission had the following three objectives:

(a) provide assistance to Japan in the plans to manage the remediation of large contaminated areas resulting from the accident at the Fukushima Dai-ichi NPP;

(b) review remediation-related strategies, plans and works, including contamination mapping, currently undertaken by Japan; and

(c) share its findings with the international community as lessons learned.

The Authorities of Japan have provided comprehensive information on their remediation program. The Mission was conducted through the assessment of the information provided to the Team, professional and open discussions with the relevant institutions in Japan, and visits to the affected areas and several demonstration sites.

This preliminary report presents an overview of the main results and conclusions of the Mission, including 9 (nine) acknowledgements and 12 (twelve) points of advice to improve strategy, plans and specific techniques for remediation, taking into account both the international standards and the experience from remediation programs in other countries. While Japan continues its current efforts of remediation, it is encouraged to take into account the Mission's advice for future full-scale remediation activities. The final report will be provided to Japan by 15 November 2011.

Based on the sequence of the ongoing activities, the Team focused on the remediation of the affected areas outside the 20 km restricted area. The Team agrees with the prioritization and the general strategy being implemented, and is of the opinion that additional missions would be beneficial at the appropriate time to (a) confirm the progress made and (b) to address the remediation challenges within the 20 km zone.

***Main findings***

The review team provides the following independent expert opinions, points of advice and acknowledgements.

*Acknowledgements*

The review team identified acknowledgements in recognition of good organization, arrangements or performance, which can contribute to the sharing of experience and exchange of lessons learned on an international basis.

Acknowledgement 1: The team appreciates that Japan has been going forward very quickly and with the allocation of the necessary resources (legal, economical and technological) to develop an efficient program for remediation, and therefore to bring relief to the people affected by the Fukushima Dai-ichi nuclear accident, with the priority being given to children and those areas where they typically spend most of their their time.

Acknowledgement 2: The Fukushima Decontamination Promotion Team, consisting of resident staff in Fukushima from the Ministry of Environment (MOE), the Local Emergency Response HQs and Japan Atomic Energy Agency (JAEA), shares information and coordinates with the relevant ministries and agencies, communicating with and providing technical support to the Fukushima prefecture and relevant municipalities. The Team welcomes Japanese efforts to establish a practical catalogue of remediation techniques.

Acknowledgement 3: The Mission Team acknowledges that the Act on Special Measures explicitly stipulates stakeholder involvement. The Mission Team appreciates that the Government is not waiting for the new Act to come into force, but has already started implementing this aspect.

Acknowledgement 4: The Team appreciates the strong commitment to remediation demonstrated at the Fukushima Prefecture and at local levels. The Team benefitted from visiting school sites, from which the contamination had been removed to a large extent by volunteers, mostly parents of the pupils. The Team in particular acknowledges the efforts of the municipal administration and large number of volunteers as an important and effective self-help method.

Acknowledgement 5: The Team acknowledges the practical measures taken by the JAEA in public information and its involvement in the program based on the needs of the local residents.

Acknowledgement 6: In the Team's view, the approach for using demonstration sites to test and assess various remediation methods is a very helpful way to support the decision-making process.

Acknowledgement 7: The Team acknowledges the impressive monitoring and mapping effort of the Japanese Authorities as a basis for a successful remediation program. The extensive, real-time monitoring system that is currently being set up and the transparent online availability of the resulting data are important measures to reassure the public and the international community.

Acknowledgement 8: The Team recognizes that in the early phase of the accident, conservatism was a good way to manage uncertainties and public concerns related to reference levels in the context of food and agriculture.

Acknowledgement 9: The Team appreciates the fact that some school sites were remediated mostly by volunteers with the technical support and guidance of JAEA. The team was informed that 400 school playgrounds have already been appropriately remediated (as of 30.09.2011).

*Advice*

Advice 1. The Japanese authorities involved in the remediation strategy are encouraged to cautiously balance the different factors that influence the net benefit of the remediation measures to ensure dose reduction. They are encouraged to avoid over-conservatism which could not effectively contribute to the reduction of exposure doses. This goal could be achieved through the practical implementation of the Justification and Optimization principles[1] under the prevailing circumstances. Involving more radiation protection experts (and the Regulatory Body) in the organizational structures that assist the decision makers might be beneficial in the fulfillment of this objective. The IAEA is ready to support Japan in considering revised, new and appropriate criteria.

[1] IAEA Safety Glossary 2007 STI/PUB/1355 (ISBN:978-9290-058908-9)

Advice 2. It is appropriate to consider to further strengthening coordination among the main actors, through the establishment of a more permanent liaison between the Organizational Structures of the Government of Japan and the Prefectural and Municipal authorities.

Advice 3: The central and local governments are encouraged to continue strengthening the involvement of and cooperation between various stakeholders. The Government might wish to strengthen the engagement of appropriate universities and/or academia in the process of further developing a stakeholder involvement strategy and implementation methods, which would be based on stakeholder needs and domestic cultural settings.

Advice 4: Access to the "Deliberate Evacuation Area" is free and unmarked. The team encourages considering the use of appropriate indications/markings in the routes and simple instructions for the public when entering or leaving these areas. These indications/markings are considered important tools for informing the public and avoiding unnecessary radiation exposures to individuals.

Advice 5: It is important to avoid classifying as "radioactive waste" such waste materials that do not cause exposures that would warrant special radiation protection measures. The Team encourages the relevant authorities to revisit the issue of establishing realistic and credible limits (clearance levels) regarding associated exposures. Residues that satisfy the clearance level can be used in various ways, such as the construction of structures, reclamations, banks and roads. The IAEA is ready to support Japan in considering revised, new and appropriate criteria.

Advice 6: The team draws the authorities' attention to the potential risk of misunderstandings that could arise if the population is only or mainly concerned with contamination concentrations (surface contamination levels Bq/m2 or volume concentrations Bq/m3) rather than dose levels. The investment of time and effort in removing contamination beyond certain levels (the so-called optimized levels) from everywhere, such as all forest areas and areas where the additional exposure is relatively low, does not automatically lead to reduction of doses for the public. It also involves a risk of generating unnecessarily huge amounts of residual material. The Team encourages authorities to maintain their focus on remediation activities that bring best results in reducing the doses to the public.

Advice 7: The management of the collected data should be formally described in a data management plan.

Advice 8: With respect to the remediation of agricultural areas, the team considers that for the next cropping season there is room for removing some of the conservatism (such as that in factors determining the transfer of radioactive caesium from soil to crops) by taking into account data and factors published by the IAEA and the results obtained from the demonstrations sites. The IAEA is ready to support Japan in considering new and more appropriate criteria.

Advice 9: With respect to waste in urban areas, the Team is of the opinion that it is obvious that most of the material contains very low levels of radioactivity. Taking into account the IAEA safety standards, and subject to safety assessment, this material might be remediated without temporary and/or interim storages. It is effective to utilize the existing infrastructure for municipal and industrial waste. The IAEA is ready to support Japan in considering revised, new and appropriate criteria.

Advice 10: Before investing substantial time and efforts in remediating forest areas, a safety assessment should be done to indicate if such remediation has benefit in reducing doses in order to invest in areas of greater benefits. This safety analysis should make use of the results of the demonstration tests

Advice 11: The mission team encourages the Japanese authorities to continue the useful monitoring of freshwater and marine systems.

Advice 12: The IAEA Mission team encourages Japanese authorities to actively pursue appropriate end-points for the waste in close cooperation with stakeholders. The national and local governments should cooperate in order to ensure the provision of these facilities. A lack of availability of such an infrastructure would unduly limit and hamper successful remediation activities, thus potentially jeopardizing public health and safety.

## 1. Introduction

The accident at Fukushima Dai-ichi NPP led to the radioactive contamination of large areas. The Government of Japan has formulated a program for the recovery of these areas.

As a major part of this recovery program in the areas off-site the Fukushima Dai-ichi NPP, Japan is launching a remediation effort. The final aim of the recovery strategy, and therefore of the remediation program, is to improve the living conditions of the people affected by the accident.

The IAEA organized the "IAEA International Fact Finding Expert Mission of The Fukushima Dai-ichi NPP Accident Following The Great East Japan Earthquake And Tsunami", held on 24 May – 2 June 2011. The conclusions of this mission were presented in the International Ministerial Conference held in Vienna last June.

In response to the request made by the Government of Japan, the IAEA organized this second fact finding mission to support the remediation of large contaminated off-site areas. For this second mission an Expert Team of 12 international experts was assembled.

This IAEA Mission is in line with the Action Plan on the Nuclear Safety that was approved by the Board of Governors in September 19th. In particular, the Mission is in connection with actions to strengthen the emergency response and to strengthen the protection of people and environment from ionizing radiation.

A final report will be provided to Japan by 15 November 2011.

## 2. Institutional Arrangements

On 26 September 2011, The Parliament (Diet) of Japan approved the *"Act on Special Measures concerning the Handling of Environment Pollution by Radioactive Materials Discharged by the Nuclear Power Station Accident Associated with the Tohoku District – Off the Pacific Ocean Earthquake that Occurred on March 11, 2011"*. This Act is the main instrument adopted to deal with the remediation program of the areas affected by radioactive pollution, and will enter into force on 1 January 2012. The Government plans to develop this Act through specific policy documents including the basic principles and standards.

The Act establishes, among others things, the main purposes of the remediation program; the distribution of roles and responsibilities among the involved institutions, namely Central Government

and Prefectural and Municipal Governments; the role of stakeholders; basic lines for monitoring, decontamination and waste management; and provision of financial resources.

To properly implement the remediation activities under the Act, the Ministry of Environment is in charge of developing the basic principles regarding the handling of the environmental radioactive pollution, in consultation with the relevant administrative bodies and stakeholders.

These principles should be formally approved by the Cabinet. In the meantime, the Nuclear Emergency Response Headquarters have established the "Basic Policy for Emergency Response on Decontamination Work" on 26 August , which is in line with the Act and permits to start activities for remediation in advance.

The "Policy and Guidelines for environmental remediation" and guidelines for the decision-making process on decontamination to be conducted by local authorities have been prepared reflecting comments from relevant ministries and agencies as well as from the local authorities, so those comments were reflected in the decision-making process.

The Emergency Evacuation Preparation Zone was lifted on 30 September 30, taking into account technical advice from the relevant body, namely the Nuclear Safety Commission, the conditions of the NPP and the results of the radiological monitoring in the area. This is one example of shifting from emergency exposure situation to existing exposure situation.

Acknowledgement 1: The team appreciates that Japan has been going forward very quickly and with the allocation of the necessary resources (legal, economical and technological) to develop an efficient program for remediation, and therefore to bring relief to the people affected by the Fukushima Dai-ichi nuclear accident, with the priority being given to children and those areas where they typically spend most of their their time.

Acknowledgement 2: The Fukushima Decontamination Promotion Team, consisting of resident staff in Fukushima from the Ministry of Environment (MOE), the Local Emergency Response HQs and Japan Atomic Energy Agency (JAEA), shares information and coordinates with the relevant ministries and agencies, communicating with and providing technical support to the Fukushima prefecture and relevant municipalities. The Team welcomes Japanese efforts to establish a practical catalogue of remediation techniques.

Advice 1. The Japanese authorities involved in the remediation strategy are encouraged to cautiously balance the different factors that influence the net benefit of the remediation measures to ensure dose reduction. They are encouraged to avoid over-conservatism which could not effectively contribute to the reduction of exposure doses. This goal could be achieved through the practical implementation of the Justification and Optimization principles[2] under the prevailing circumstances. Involving more radiation protection experts (and the Regulatory Body) in the organizational structures that assist the decision makers might be beneficial in the fulfillment of this objective. The IAEA is ready to support Japan in considering revised, new and appropriate criteria.

Advice 2. It is appropriate to consider to further strengthening coordination among the main actors, through the establishment of a more permanent liaison between the Organizational Structures of the Government of Japan and the Prefectural and Municipal authorities.

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[2] IAEA Safety Glossary 2007 STI/PUB/1355 (ISBN:978-9290-058908-9)

## 3. Stakeholder involvement

As stated in the IAEA safety standard "the decision making process shall provide for the involvement of a wide range of interested parties in the definition, implementation and verification of remediation programmes and for regular public information exchange on the implementation of these programmes." (WS-R-3)

Wide possibilities for the stakeholders to be involved and informed ensure that as remediation planning and implementation proceed, while stakeholder needs and concerns are properly addressed. This improves the credibility of the whole remediation process and increases the probability of success.

Managing expectations is essential from the onset of stakeholder engagement. It is important to clearly identify the objectives so that stakeholders can understand the extent of their involvement and responsibility.

Interactions with a wide variety of stakeholders should start as early as possible. When conducted well, the process normally yields indisputable benefits.

***Relevant structures and processes***

In the Japanese administrative system, municipalities and prefectures have strong autonomy and play significant roles in disaster management and environmental protection, including the remediation process. The national government provides legal framework, policies, standards, financial and technical support, and conducts remediation for areas which are in "emergency exposure situations"; in this case areas where citizens could be exposed to an annual dose above 20 mSv.

Local governments implement remediation plans for areas which are in"existing exposure situations", i.e. areas below 20 mSv/year. In these areas the ultimate decision whether to remediate or not rests with the landowner.

The "Act on Special Measures concerning the handling of Radioactive Pollution", which will enter into force 1.1.2012 but which the Government already implements to a large extent, recognizes explicitly stakeholder involvement. The purpose of the Act is to promptly reduce the impacts of environmental pollution by instituting measures taken by stakeholders, especially the national and local governments, as well as the relevant nuclear power producer.

Under the 'Basic Policy for Emergency Decontamination Work' established on 26.August 2011, several important policy, guidelines and documents have been issued. These include stipulations of how stakeholders are to be involved in the process.

***Practical involvement of stakeholders***

There is understandable anxiety in society about the current radiation situation. The Team noted that in the early phases of the accident many doubts were expressed about the accuracy and timeliness of the information provided by the central authorities.

The Team observed that revised ways and new efforts to inform and involve stakeholders, in particular the public, are implemented by the central authorities. At a local level, the Team was impressed by the strong commitment to the remediation efforts shown by the Fukushima prefecture and the municipalities.

The Mission Team recognized the following important players in the practical stakeholder involvement:

*Fukushima Decontamination Promotion Team* under the Ministry of Environment is tasked to communicate and coordinate activities with local municipalities, assisting them in their preparation of remediation plans, by dispatching experts and promoting model remediation projects in 12 municipalities affected by elevated radiation levels. JAEA, being a member of the Promotion Team plays an important role in interacting with the public and other stakeholders.

Having established a "Fukushima office", *JAEA* interfaces with relevant Fukushima prefecture organisations and citizens. With regard to technical issues, the Mission Team appreciated that JAEA provides a telephone hot-line for health consultations, dispatches experts to stakeholders (ministries, local Governments, city administration, etc.), sends researches to Fukushima prefecture schools from kindergartens to junior high schools at their request, holds briefings on radiation in schools, takes time and effort to answer questions from parents and teachers, and has prepared written material for the benefit of the local people. In the demonstration test sites described elsewhere in this report, the JAEA works in close cooperation with the residents and landowners, and carries out activities subject to their consent.

*Cities, villages and their citizen:* The Team benefitted from visiting two school sites, from which the contamination to a large extent had been removed in a well-organized manner by volunteers, mostly parents of the pupils. The Mission Team acknowledged the efforts of the city administration and large number of volunteers as an important and effective clean-up and self-help method.

**Preliminary conclusions**

Acknowledgement 3: The Mission Team acknowledges that the Act on Special Measures explicitly stipulates stakeholder involvement. The Mission Team appreciates that the Government is not waiting for the new Act to come into force, but has already started implementing this aspect.

Acknowledgement 4: The Team appreciates the strong commitment to remediation demonstrated at the Fukushima Prefecture and at local levels. The Team benefitted from visiting school sites, from which the contamination had been removed to a large extent by volunteers, mostly parents of the pupils. The Team in particular acknowledges the efforts of the municipal administration and large number of volunteers as an important and effective self-help method.

Acknowledgement 5: The Team acknowledges the practical measures taken by the JAEA in public information and its involvement in the program based on the needs of the local residents.

Advice 3: The central and local governments are encouraged to continue strengthening the involvement of and cooperation between various stakeholders. The Government might wish to strengthen the engagement of appropriate universities and/or academia in the process of further developing a stakeholder involvement strategy and implementation methods, which would be based on stakeholder needs and domestic cultural settings.

## 4. Radiation Protection

The Japanese government has defined a set of reference levels to control the exposure of the public. In areas where the annual effective dose is estimated to be above 20 mSv, the national government aims to reduce the estimated annual exposure dose to less than 20 mSv; in areas where an estimated annual exposure dose is less than 20 mSv, the national government will work with municipalities and local

residents to conduct effective remediation work, so that the estimated annual exposure dose will be less than 1 mSv.

Specific attention is being given to the exposure of children. Therefore, current efforts focus on measures to reduce exposures in schools and kindergartens, with the aim to reduce the exposure to children to an effective dose of 1 mSv per year during the time children are at or on the way to and from school.

*IAEA Safety Standards*

This approach is in accordance with the Recommendations of the International Commission of Radiation Protection and the Basic Safety Standards (BSS) of the IAEA. The BSS define the requirements on protection of people and environment. These requirements reflect a broad international consensus on the requirements for safety.

For post-accidental conditions, the Basic Safety Standards recommend a reference level in the range of 1-20 mSv/year. It is international consensus that the reference levels have to be defined taking into account the specific circumstances of an exposure situation. This includes the level of activity in the environment, environmental conditions and the life style.

Any reasonable steps shall be taken to prevent doses remaining above the reference level. The exposure has to be assessed for the more highly exposed individuals in the population.

*Radiation Protection Principles*

The BSS require that any measure taken is justified to ensure that it does more good than harm and it is commensurate with the risk.

Usually, remediation actions also have social and economic implications and decisions have to take into account all aspects of a specific situation. The optimization of protection and safety – as required by the BSS - is a process for ensuring that exposures and the number of exposed individuals are as low as reasonably achievable, with economic, societal and environmental factors taken into account to ensure that the level of protection will be the best possible under the prevailing circumstances. It requires both qualitative and quantitative judgments to be made.

*Exposure of remediation workers*

According to IAEA standards for an existing exposure situation and for the remediation of areas with residual radioactive material, the exposure of workers undertaking remedial actions is controlled in accordance with the relevant requirements for occupational exposure in planned exposure situations. With regards to the available information on dose rates and radioactivity concentration levels present in the areas of decontamination operations, the requirements for occupational exposure of remediation workers can be fulfilled.

*Residues*

Remediation work may generate residues that contain enhanced levels of activities. According to the Basic Safety Standards, it is the responsibility of the government to set reference levels for the disposal of residues in municipal landfills or for landfills to be designed in particular for the disposal of those residues. In view of the strong absorption of cesium by the soil, the definition of the reference level should in particular focus on the longer-lived Cs-137 rather than on the relatively short-lived Cs-134.

Planning, construction and operation of landfills for the residues is a key element for the successful continuation of remediation measures.

*Assessment of exposures*

The decision on measures to be taken is currently based on the external exposure, other pathways as e.g. the intake of food are not taken into consideration explicitly. Although, due to the strict activity limits for foodstuffs, the intake of food is very likely not an important pathway, its contribution to the dose should be explicitly assessed. This is to achieve a comprehensive and transparent overview on the radiation sources and their magnitude. It is also an important input for the optimization of any remediation measures.

*Information*

Information of the public is a key issue for the involvement of the population in the remediation process. It is good practice to provide information on actual exposure levels on public places and on roads.

Access to the 'Deliberate Evacuation Area' is free, however, appropriate indications when entering or leaving these areas may be considered as an important issue for information of the public.

The team encourages the respective authorities to optimize all remediation measures to the extent possible in the context of ensuring that all the steps are integrated in the optimum way, as it is mentioned in Advice 1.

Advice 4: Access to the "Deliberate Evacuation Area" is free and unmarked. The team encourages considering the use of appropriate indications/markings in the routes and simple instructions for the public when entering or leaving these areas. These indications/markings are considered important tools for informing the public and avoiding unnecessary radiation exposures to individuals.

## 5. Remediation strategy implementation

Major nuclear and/or radiological accidents can affect large areas of land that need to be assessed in terms of eventual need for further remediation, i.e. actions that may be applied to reduce the ongoing or future doses to members of the public.

A wide range of options for the remediation of these affected sites are available. The implementation of one of them or a combination of different approaches need to be carefully considered including planning, coordination of efforts - when different agencies have a role to play – site characterization, derivation of applicable criteria, selection of appropriate technologies and, last but not least, involvement of stakeholders in the decision making process.

Since radiation is a natural part of our environment, the key issue is to establish reasonable and credible limits (reference levels) regarding exposures that need to be reduced. This has direct implications e.g. to the amount of material, including residues, that has to be managed and possibly be disposed of. It is therefore important to avoid classifying those materials that do not cause exposures that would warrant special isolation measures as "radioactive waste".

The justification principle as expressed in the international standards stipulates that the introduction of a remediation strategy needs to produce more good than harm, in other words, the benefits need to exceed the associated burden and costs. The reduction of the radiation doses also need to be optimized, i.e. the residual levels of radiation in the environment should be as low as reasonably achievable with social and economical aspects factored in. The simple reduction of existing doses by the application of any clean-up strategy *per se* may not produce the desired benefits, especially if they create additional problems (such issues as waste and negative social impact) and excessive cost. In other words, the burden may be disproportional to the benefits the remediation will bring.

Another factor that is very important in the context of environmental remediation is that solutions are also site-specific. Lessons learned with other events shall always be taken into account in the decision making process but they may not be readily transferable from one situation to another.

Last but not least, decisions in these circumstances are not based only on technical matters and evidence. Several socio-psychological elements play an important role in the decision making process. Therefore, the key issues include stakeholder involvement, which is discussed in section 2 of this report.

*The remediation work in the affected areas*

The accident in Fukushima affected a large area comprising farmlands (agricultural areas), inhabited areas and forests.

The team notes that the main strategy adopted by the Japanese authorities relates to the concept of decontamination. At this stage, it is important to stress that decontamination is only one of the many available options to be used to achieve the reduction of doses in the case of radioactivity concentrations in the environment caused by an accidental release. Other options need to be considered and the one (or ones) to be selected need to derive from a process of optimization of the protection, which the team wishes to identify more in the decision making process.

In the decontamination efforts perpetrated by the Japanese counterparts, the team observed that the major strategy being considered is the removal of top soil (up to 5 cm of the soil layer) due to the well-known behaviour that radiocesium accumulates in this part of the soil. While this strategy has the benefit to reduce radionuclide concentrations in the upper layer of soils and consequently the dose, it also involves a risk of generating unnecessarily huge amounts of residual materials.

If removal of the top layers of the soil is one of the selected options for wider use, a similar system would be useful that is in place for naturally occurring radioactive material residues (so-called NORM residues) in many countries and is based on safety assessments. This would allow the removed material to be used in selected applications, e.g. together with clean material in the construction of structures, banks, reclamations or roads that will not pose undue risks to members of the public. This system is known as clearance and specifically in the present situation conditional clearance could be considered. This is recognized as an applicable strategy also in the IAEA Safety Standards. The classification of the material resulting from the remediation operations as radioactive waste should not be automatic. In fact, the Team finds that doing so could create unnecessary major challenges for the Japanese authorities without providing any benefit to the dose reduction of the public.

It has been also reported to the team that the application of phytoremediation did not produce the desired results. The team recognizes the limitation of this technique in removing considerable amounts of radionuclides from the soil. On the other hand, the team noted that that the only trial so far was restricted to the cultivation of sun-flower.

The team recognizes and values the strategy of involving local people to help themselves with the decontamination of their properties. However, it has been noticed that for more complex work the need of specialized services will be required and this will obviously add costs to the remedial actions. Whenever local residents become involved in the cleanup of their properties it is important to observe that appropriate training, supervision and technical assistance are given. Radiation protection measures and monitoring should also be in place, when integrating local people in remediation work.

Acknowledgement 6: In the Team's view, the approach for using demonstration sites to test and assess various remediation methods is a very helpful way to support the decision-making process.

Advice 5: It is important to avoid classifying as "radioactive waste" such waste materials that do not cause exposures that would warrant special radiation protection measures. The Team encourages the relevant authorities to revisit the issue of establishing realistic and credible limits (clearance levels) regarding associated exposures. Residues that satisfy the clearance level can be used in various ways, such as the construction of structures, reclamations, banks and roads. The IAEA is ready to support Japan in considering revised, new and appropriate criteria.

Advice 6: The team draws the authorities' attention to the potential risk of misunderstandings that could arise if the population is only or mainly concerned with contamination concentrations (surface contamination levels Bq/m2 or volume concentrations Bq/m3) rather than dose levels. The investment of time and effort in removing contamination beyond certain levels (the so-called optmized levels) from everywhere, such as all forest areas and areas where the additional exposure is relatively low, does not automatically lead to reduction of doses for the public. It also involves a risk of generating unnecessarily huge amounts of residual material. The Team encourages authorities to maintain their focus on remediation activities that bring best results in reducing the doses to the public.

### 5.1 Monitoring and Mapping

The monitoring of radiation levels and the mapping of the distribution and level of radioactive contamination are necessary tools for both the preparation and the verification of a successful remediation effort. The Japanese government has outlined the responsibilities of the different government agencies regarding radiation monitoring and mapping in the Comprehensive Monitoring Plan from 2. August 2011. The overall responsibility and coordination falls to the Ministry of Education, Culture, Sport, Science and Technology (MEXT), but the Ministry of the Environment (MOE), Ministry of Health Labour and Welfare (MHLW), Ministry of Agriculture Forestry and Fisheries (MAFF) and Ministry of Land, Infrastructure, Transport and Tourism (MLIT), as well as a number of other agencies and organisations, are also involved. The Japanese Atomic Energy Agency (JAEA) is playing a key role as keeper of the data base, technology provider and liaison to the universities.

Radiation levels are monitored at different scales using the appropriate technology for each case: airborne and vehicle based surveys for the large scale overview (up to 160 km from Fukushima Dai-ichi NPP), soil samples (2200 locations, every about 2 km up to 80 km from the NPP) and hand-held dosimeters and spectrometers for local radiation maps and decontamination test sites. Typically, the data are given as aerial dose rate 1 m above ground, but often the surface dose rate and the concentration in Bq/kg or Bq/$m^2$ are also used.

Three airborne surveys around Fukushima Dai-ichi NPP have been carried out in April, May and June 2011 by MEXT (in cooperation with the DOE). These surveys have been expanded to further prefectures since then and the next airborne survey planned for November 2011 will cover the entire Eastern part of Japan, from Aichi to Aomori prefecture. The importance of this mapping effort and the impact that it has already had is perhaps best illustrated by the creation of the deliberate evacuation area North-West outside of the 20 km exclusion zone, which was based on these results.

MEXT is currently in the process to set up a real-time monitoring system, that will eventually cover all of Japan with about 2700 monitoring stations. The first 20 have been deployed in Fukushima prefecture and the information is available online at www.r-monitor.jp. Almost every school, from nursery to university, will be equipped with an online monitor. This system represents an unprecedented amount of readily available, real-time information for the citizens of Japan.

JAEA is making efforts to fill the gap between large area airborne monitoring and hand-held dosimeters through the introduction of an unmanned aerial vehicle (UAV) system, which can be used in areas that are impossible to reach by car. In addition, JAEA is developing and improving detector technology for local applications. The use of modern technologies (e.g. GPS) that have only become available in the last 25 years since Chernobyl is already of great importance for radiological mapping. JAEA should be encouraged, together with research institutes and universities, to continue on this path and to expand the use of modern technology.

There are additional examples of monitoring efforts, e.g. local maps with 1 km grid provided by municipalities with copies freely available at city hall and solar powered LED dose rate displays visible from the car, similar to those that give the temperature or indicate your speed. These activities are not yet all coordinated and MEXT only collects the data down to prefecture level. More and closer coordination of the monitoring and mapping would enable the spreading and application of the best ideas and practices and the collection of locally generated data.

Acknowledgement 7: The Team acknowledges the impressive monitoring and mapping effort of the Japanese Authorities as a basis for a successful remediation program. The extensive, real-time monitoring system that is currently being set up and the transparent online availability of the resulting data are important measures to reassure the public and the international community.

### 5.2 Data Management

The environmental monitoring data from Japan after the Fukushima Dai-ichi accident are not only a crucial input for any remediation activity, but they also represent an immensely valuable scientific resource for future analysis. The collected data will be more complex and detailed then those collected following the Chernobyl accident 25 years ago, due to the technological progress in the intervening time.

The management of the collected data should be formally described in a data management plan. In a scientific experiment such a plan would be drawn up in advance. In this case, however the time for action is now, as there is a transition from emergency measures to long-term monitoring.

The data management plan has to cover a series of items, including technical details of the database, metadata, archiving and preservation, quality assurance, data security and access policy. In particular, the data management plan has to conform to applicable legislation, e.g. the "Law Concerning Access to Information Held by Administrative Organs" from 2001.

Individual pieces of a data management plan already exist or are emerging: quality assurance was discussed at the Conference for the Preparation of the Distribution Map of Radiation organised by MEXT in August 2011 and the real-time access to monitoring data since September 2011 constitutes a de-facto policy of transparency. However, a formal and comprehensive data management plan does not yet exist.

Advice 7: The management of the collected data should be formally described in a data management plan.

### 5.3 Agricultural areas

The Team was informed that the target for remediation of farm land is the reduction of the radioactive air dose level by 50% in the next two years. In the long term this level should be reduced to under 1mSv/year. This refers only to the areas where the current radioactive air dose level is between 1 and 20 mSv/year.

Since the provisional regulation value for radioactivity in rice is 500 Bq/kg, the conservative transfer factor of 0.1 implies that the limit of cultivation for the rice field soil is 5000 Bq/kg. The transfer factor of 0.1 was derived using data from long term research on the transfer of cesium from soil to rice. However, the first preliminary results from the demonstration sites established by the Japanese authorities in the affected areas indicate that the actual transfer factor is likely significantly lower. This would also be consistent with the transfer factors in the IAEA Tecdoc 1616 from 2009. The Team is of the opinion that the conservatism in the transfer factor can be removed when the tests are completed and realistic factors have been firmly established.

More testing is needed to fine-tune the reference level for the coming cropping season, and this for a wide range of soils and crops in the affected area.

Planning agricultural countermeasures to remediate affected farmland is a task that needs to take into account radiological, food safety, ecological, socio-economic and cultural issues within a holistic and interdisciplinary frame.

An area-wide landscape approach is crucial as soil redistribution in mountainous catchments, such as in specific areas of Fukushima prefecture, can lead to the redistribution of radionuclides from the uplands to rice paddies and river systems in the lowlands through erosion of soil from steep uncovered hillslopes or forest tracks, in particular after extreme rainfall events.

Besides physical remediation, such as topsoil removal and deep ploughing, which are currently the most important focus of the remediation of agricultural land, the adaptation of potassium (K) and nitrogen (N) fertilization techniques, land use/management and agricultural water management practices may be agronomic options to minimize radioactive cesium in the local foodchain.

To identify the best agronomic options to remediate affected agricultural land, it is advised to link radioactivity levels of soil with soil properties. In particular, information on K status of the soil will be essential to predict the efficiency of K fertilizer application in reducing the transfer of cesium from soil to crop.

The Team agrees with the purpose of continuing in the same intensive and successful way to screen radioactivity levels in foodstuff samples. However, foodstuff analysis should be integrated in all test sites as a parameter to assess the efficiency of the remediation. In addition, it will encourage people to start farming their lands again, and will further increase the confidence of the local, national and international consumers.

Acknowledgement 8: The Team recognizes that in the early phase of the accident, conservatism was a good way to manage uncertainties and public concerns related to reference levels in the context of food and agriculture.

Advice 8: With respect to the remediation of agricultural areas, the team considers that for the next cropping season there is room for removing some of the conservatism (such as that in factors determining the transfer of radioactive caesium from soil to crops) by taking into account data and

factors published by the IAEA and the results obtained from the demonstrations sites. The IAEA is ready to support Japan in considering new and more appropriate criteria.

### 5.4 Urban areas

The Team's visits to sites have shown that decontamination of urban areas is actively pursued in contamination affected areas. The priorities are clearly established starting with the deliberate evacuation area and so called "hot spot" areas, kindergartens and schools, then community centers followed by individual settlements.

The contributions of different urban surfaces to human external doses and the associated opportunities for dose reduction are determined by settlement and building design, the construction materials, the habits of the populations, the mode of radionuclide deposition (dry or wet), the radionuclide and physico-chemical composition of the fallout, and time.

The analysis of the sources of external exposure in different population groups living in contaminated areas indicated that a significant fraction of the dose that would be received by people results from sources located in soil, on coated surfaces like asphalt and concrete and to a smaller extent on building walls and roofs.

The sites visited have shown the utilization of proven technologies for the decontamination of roofs, building walls, play grounds, swimming pools, parking lots, and asphalt covered areas. Thorough measurements and mapping of the contamination are carried out to ensure the most effective results and the elimination of hot spots. The most effective decontamination technologies that are pursued involve the removal of the upper soil layer. The tests performed indicate the use of different methods to achieve a significant reduction of dose rates.

It should be noted that in order to ensure high decontamination effectiveness and keep the associated costs low, validated models of urban decontamination were already developed by the international community and provided with sets of model parameters and practical recommendations for cleanup. The mission team was not in a position to understand to what extent these models are utilized.

The contaminated material that is removed and collected was temporally stored at sites because of the removal option used and the absence of interim storages. The current practice is either to bury the material in near surface trench and to cover it with a layer of clean topsoil or to collect it in a pile on the ground and to cover it with plastic sheets and sand bags to provide additional shielding. Both measures were considered as temporary measures before transport to interim storage.

The measurements indicate that a large part of the contaminated material collected from clean-up actions at urban demonstration sites is only slightly contaminated. The adequate pathways for such material could be found outside of the category of radioactive waste.

The portion of the removed material that qualifies as radioactive waste generated from urban decontamination should be disposed of in accordance with established regulatory requirements.

Acknowledgement 9: The Team appreciates the fact that some school sites were remediated mostly by volunteers with the technical support and guidance of JAEA. The team was informed that 400 school playgrounds have already been appropriately remediated (as of 30.09.2011).

Advice 9: With respect to waste in urban areas, the Team is of the opinion that it is obvious that most of the material contains very low levels of radioactivity. Taking into account the IAEA safety standards, and subject to safety assessment, this material might be remediated without temporary and/or interim storages. It is effective to utilize the existing municipal infrastructure for industrial waste. The IAEA is ready to support Japan in considering revised, new and appropriate criteria.

### 5.5 Forest areas

Based on lessons learned from the Chernobyl accident, forest countermeasures are labour-intensive and expensive, cannot be implemented quickly and have to be planned carefully. They are likely to be long-term activities and their beneficial effects take time to be realized.

The forest countermeasures tested in the aftermath of the Chernobyl accident can be broadly categorized into: (a) management; and (b) technological countermeasures.

Among management-based countermeasures, restrictions of various activities normally carried out in forests have been successfully implemented:

- Restricted access, including restrictions on public and forest-worker access.
- Restricted harvesting of food products by the public. The most commonly obtained food products include berries and mushrooms.
- Restricted collection of firewood by the public.
- Alteration of hunting practices.
- Fire prevention that is important in order to avoid secondary contamination of the environment.

The technologically-based countermeasures include the use of machinery and/or chemical treatments to alter the distribution or transfer of cesium in the forest. However, the cost-effectiveness of many technological countermeasures is questionable, especially when applied on a large scale. Thus, it is to be expected that such countermeasures will be restricted to small-scale cases only, if they are feasible at all. Such cases might include small areas of urban woodland, such as parkland, which is likely to be visited by many more people, rather than extensive and remote forest areas.

Technological countermeasures might include the mechanical removal of leaf litter or scraping of soil layers, clear cutting and ploughing, and the application of calcium and potassium containing fertilizers. However, any of these methods can damage the ecological functioning of the forest when applied outside of the normal schedule of forestry operations. These factors and the high economic costs of such operations, means that the practical use of such techniques as countermeasures remains largely speculative. Therefore, such measures have not been applied after the Chernobyl accident other than in small-scale experiments.

The results of cost-benefit calculations indicate that the management options likely to result in the least overall detriment are those which limit access and consumption of forest foods. Options, which involve technological intervention, application of chemicals, or altering the harvesting patterns in forests are unlikely to be used in practice.

The Mission Team understands that authorities in Japan are considering three possible options for remediation of the forest areas. The option that is considering remediation of the forest in the neighbourhoods of urban settlement and agriculture lands looks most realistic for implementation

Advice 10: Before investing substantial time and efforts in remediating forest areas, a safety assessment should be done to indicate if such remediation has benefit in reducing doses in order to invest in areas of greater benefits. This safety analysis should make use of the results of the demonstration tests

### 5.5 Aquatic areas

Aquatic environments include rivers, irrigation reservoirs, fish ponds, lakes and coastal areas. The last are being directly affected by the release of radionuclides from the affected NPP. Freshwater environments receive radionuclides from erosion and runoff of the soils in the watersheds. This contribution has a long term source of activity; the accumulation of the relevant radionuclides will preferentially take place in sediments. Organisms feeding from them may incorporate cesium to different degrees depending on the individual species and environmental conditions.

The monitoring of river water, sediments and fish is being conducted by different organizations; a limit for fish of 500 Bq/kg is being applied. Remediation of these areas was not addressed in detail by the Japanese counterparts during the meeting with the mission team. However, the exposure to members of the public through this pathway generally is of minor importance.

Advice 11: The mission team encourages the Japanese authorities to continue the useful monitoring of freshwater and marine systems.

### 5.6 Waste Management

Large volumes of contaminated material will be generated from massive clean-up/remediation activities in urban, agriculture, forest and aquatic areas that are affected mostly by radioactive caesium release. The generated material is to be collected, characterized for clearance or processing as required, storage and final disposal. It would include soil, organic material, vehicles, building and road material, aqueous liquids, trees and stumps contaminated with Cs-134 and Cs-137. The quantity of contaminated material from clean-up depends on the extent and depth of the contamination, the characteristics of the affected environment (urban, forest, agriculture, etc.) and the decision on the kind of management of the contamination in the affected area, e.g. stabilization, interdiction or clean-up. Clean-up criteria and methods applied determine generated volumes.

The authorities in Japan are considering nine reference decontamination cases that are based on annual effective dose and the type of area. The preliminary estimate of the volume of contaminated material from clean-up is anywhere between 5 and 29 million $m^3$. The contaminated debris (wood, concrete, and metal) from the destruction caused by the tsunami that has already been collected amounts to 2.3 million tonnes which needs to be added to this volume.

The current waste management strategy is considering the collection of contaminated material in dispersed temporary storages prior to consolidation in a smaller number of interim storages, pursuing large scale incineration of combustible material in available municipal solid waste incinerators equipped with electro-static precipitators and bag house. An inventory of collected material is planned to be done to keep track of the activity and the actually generated amounts. It is also understood that various volume reduction technologies for rubble, soil and other contaminated materials are under consideration to minimize volumes for storage and disposal.

The main challenge in waste management strategy implementation as well as in the implementation of clean-up campaigns is the management of very large volumes of generated material and the determination of site locations for interim storages for such volumes, the time frame for storage prior to disposal and the establishment of disposal locations.

It should be noted that a major proportion of the very large volumes of generated material that is to be collected will likely be only slightly contaminated. At the outset, it is imperative to have clear criteria for what constitutes radioactive waste and which kind of waste can be cleared (either conditionally or unconditionally) from the regulatory control. The adequate characterization of collected material will then allow the distinction between material that can be unconditionally cleared, conditionally cleared and material that has to be managed as nuclear waste. The pathways for management of these three categories are significantly different depending on the results of safety assessment for each case.

The unconditionally cleared material can be considered for recycling and reuse or conveniently managed as municipal solid waste utilizing existing infrastructure for transportation, handling and disposal in municipal solid waste landfills. The management of conditionally cleared material would require certain arrangements for handling and disposal in designated municipal landfills equipped with systems for leachate collection, control of gases and adequate monitoring.

Only the fraction designated as radioactive waste would be required to meet the corresponding requirements for transportation, adequate processing, packaging, facilities for storage and disposal.

At present, it is not possible to estimate the relative proportions of these three categories of contaminated material and the consequences of the adoption of the proposed management options. For example, it is not clear to what extent municipal solid waste landfills can accommodate additional quantities from clean-up campaigns, how many existing landfills could be designated to receive conditionally cleared material, or to what extent municipal solid waste management infrastructure is available to handle additional volumes.

Pursuing a management strategy for all of these contaminated materials as radioactive waste due to over-conservatism would lead to enormous challenges in the timely establishment of a completely new infrastructure with regard to human resources, transportation and large facilities for processing and storage. It would also imply huge costs to meet the requirements for radioactive waste management and it would probably result in delays in the clean-up to allow displaced citizens to return and continue with their lives as early as possible.

The other major issue in strategy implementation is the determination of site locations for interim storage. The storage facilities for nuclear waste management are to provide safe and secure storage pending easy retrieval of waste for disposal to a suitable repository.

Advice 12: The IAEA Mission team encourages the Japanese authorities to actively pursue appropriate end-points for the waste in close cooperation with stakeholders. The national and local governments should cooperate in order to ensure the provision of these facilities. A lack of availability of such infrastructure would unduly limit and hamper successful remediation activities, thus potentially jeopardizing public health and safety.

## 6. Technical meeting and visits

On 7 October 2011, the IAEA Mission Team held a preliminary meeting with all of Japan's relevant Government Offices, Ministries and Agencies involved in the effort to develop strategy and plans to

implement countermeasures to remediate the areas affected by the consequences of the nuclear accident in the Fukushima Dai-ichi nuclear power plant. The meeting was held in the Ministry Office of Foreign Affairs (MOFA) building.

On 8 October, the IAEA Mission Team held a day-long meeting with the Japanese counterparts in charge of assisting the lives of victims around the Fukushima Dai-ichi nuclear power plant. This meeting was also held in the MOFA building.

On 9 October, the IAEA Mission Team travelled to Fukushima to get first-hand experience of the work carried out in the area, as well as to meet local government officials.

On their arrival in Fukushima, the IAEA Mission Team met members of the Fukushima Decontamination Team as well as staff from the Japan Atomic Energy Agency's (JAEA) Fukushima office and representatives from the Fukushima Prefecture for a briefing on the environmental remediation efforts underway in the area.

In the afternoon of the same day, the IAEA Mission Team visited the area surrounding the Haramachi thermal power plant in the city of Minami-Soma. The city, once a renowned holiday destination, was badly affected by the tsunami that hit Japan's east coast on 11 March 2011.

The IAEA Mission Team then visited a remediation model site located in the hills inland from the city of Minami-Soma, where methods and technologies for the remediation of forestry areas are being tested.

On 10 October 2011, the IAEA Mission Team visited four locations where model remediation projects are being carried out by the Fukushima Decontamination Team and JAEA. These include the Tominari Elementary school and the Shimooguni Central Assembly Hall, both located in the city of Date.

On the same day, the IAEA Mission Team also visited two sites where verification studies for the application of remediation technologies in agriculture are being conducted. Both sites are located in the territory of the village of Iitate.

At one agricultural site, rice has been planted in a paddy where a layer of earth with elevated levels of radiocaesium was removed from the top soil. In a near-by site known as Iitate village clear centre, the IAEA Mission Team received a briefing on a series of tests that are being carried out on the combustion of crops and soil with elevated levels of radioactivity.

In all of these demonstration sites, experts are evaluating the efficiency of a number of methods and technologies that can be used in environmental remediation strategies.

In the morning of 11 October 2011, the IAEA Mission Team paid a courtesy visit to the Governor of the Fukushima Prefecture.

In the afternoon of the same day, the IAEA Mission Team visited the accident site at TEPCO's Fukushima Dai-ichi nuclear power plant.

Following the conclusion of the visit to the Fukushima Prefecture, the IAEA Mission Team returned to Tokyo where it continued to meet with Japanese officials and draft its preliminary report.

On 12 October, the team met with officials from MEXT, the Atomic Energy Commission of Japan and the Nuclear Safety Commission.

**From:** Castleman, Patrick
**Sent:** Wednesday, September 14, 2011 4:04 PM
**To:** Monninger, John; Marshall, Michael; Orders, William; Franovich, Mike; Gilles, Nanette; Hart, Ken; Ulses, Anthony; Tonacci, Mark
**Subject:** Japan Evacuation

All, I took another look at the 14-page progress report, and, on a closer read, the situation is indeed as John described. The "thumb" is evacuated (deliberate evacuation area) except for a few people in each town who decided to remain. Then there are the "Specific Spots Recommended for Evacuation" outside the mandatory and deliberate evacuation zones—these are the ones where there are specific houses that need to be vacated.

**From:** Monninger, John
**Sent:** Thursday, September 08, 2011 4:45 PM
**To:** Gibbs, Catina
**Cc:** Batkin, Joshua; Marshall, Michael; Speiser, Herald; Coggins, Angela
**Subject:** Call with John Holdren - Friday, 9/9

Catina,

Dave Skeen and the Japan Task Force should be reaching out to you to arrange a conference call on Friday, 9/9 between the Chairman and John Holdren (OSTP). The subject of the call is the Dept of State Travel Advisory for US citizens in Japan. Contacts other than Dave Skeen for arranging the call include Kathryn Brock and Matt Mitchell.

Thanks,
John M.

IAEA
Atoms for Peace

# Board of Governors
# General Conference

**GOV/2011/59-GC(55)/14**
Date: 5 September 2011

**General Distribution**
Original: English

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Item 3(b) of the Board's provisional agenda
(GOV/2011/46)
Item 14(b) of the Conference's provisional agenda
(GC(55)/1; Add.1 and 2)

# Draft IAEA Action Plan on Nuclear Safety

*Report by the Director General*

## Summary


- In accordance with paragraphs 23 and 24 of the Declaration adopted by the Ministerial Conference on Nuclear Safety held on 20-24 June 2011, the Director General was requested to prepare and present to the Board of Governors and the General Conference at their September 2011 meetings a report on the Ministerial Conference and a draft Action Plan, building on the Ministerial Declaration, the conclusions and recommendations of the working sessions of the Ministerial Conference and the expertise and knowledge available therein, and to facilitate consultations among Member States on the draft Action Plan.
- The attached draft Action Plan is the result of an extensive process of consultations with Member States and responds to the request contained in the Ministerial Declaration.


## Recommended Action

- It is recommended that the Board approve the Action Plan and that the Board recommend that the General Conference endorse the Board's decision.

# Draft IAEA Action Plan on Nuclear Safety

In June 2011 a Ministerial Conference on Nuclear Safety was convened to direct, under the leading role of the IAEA, the process of learning and acting upon lessons following the accident at TEPCO's Fukushima Daiichi Nuclear Power Station in order to strengthen nuclear safety, emergency preparedness and radiation protection of people and the environment worldwide. At the conference a Ministerial Declaration was adopted which inter alia:

- "Requested the IAEA Director General to prepare a Report on the June 2011 IAEA Ministerial Conference on Nuclear Safety and a draft Action Plan, building on the Declaration of the Ministerial Conference and the conclusions and recommendations of the three Working Sessions, and the expertise and knowledge available therein, and to promote coordination and cooperation, as appropriate, with other relevant international organizations to follow up on the outcomes of the Conference, as well as facilitate consultations among Member States on the draft Action Plan";
- "Requested the IAEA Director General to present the Report and the draft Action Plan covering all the relevant aspects relating to nuclear safety, emergency preparedness and response, and radiation protection of people and the environment, as well as the relevant international legal framework, to the IAEA Board of Governors and the General Conference at their forthcoming meetings in 2011";
- "Called upon the IAEA Board of Governors and the General Conference to reflect the outcome of the Ministerial Conference in their decisions and to support the effective, prompt and adequately resourced implementation of the Action Plan".

In considering this Action Plan, it is important to note that:

- The responsibility for ensuring the application of the highest standards of nuclear safety and for providing a timely, transparent and adequate response to nuclear emergencies, including addressing vulnerabilities revealed by accidents, lies with each Member State and operating organization.
- The IAEA Safety Standards provide the basis for what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation, and will continue to be objective, transparent and technologically neutral.
- Transparency in all aspects of nuclear safety through timely and continuous sharing and dissemination of objective information, including information on nuclear emergencies and their radiological consequences, is of particular importance to improve safety and to meet the high level of public expectation. Nuclear accidents may have transboundary effects; therefore it is important to provide adequate responses based on scientific knowledge and full transparency.
- As understanding of the accident develops, additional analysis of the root causes will be carried out. Further lessons may be learned and, as appropriate, be incorporated into the proposed actions by updating the Action Plan. The High Level Conference to be organized by Japan and the IAEA in 2012 will provide an opportunity for learning further lessons and for enhancing transparency.

- The Agency's prompt and effective implementation of activities under the Action Plan will be funded through prioritization and continuing efficient use of resources from the regular budget, and through voluntary contributions of extrabudgetary resources.

The purpose of the Action Plan is to define a programme of work to strengthen the global nuclear safety framework. The plan consists of actions building on the Ministerial Declaration, the conclusions and recommendations of the Working Sessions, and the experience and knowledge therein, including the INSAG letter report (GOVINF/2011/11), and the facilitation of consultations among Member States.

The success of this Action Plan in strengthening nuclear safety is dependent on its implementation through the full cooperation and participation of Member States and will require also the involvement of many other stakeholders[1]. They are therefore encouraged to work cooperatively to implement the Action Plan to maximize the benefit of the lessons learned from the accident and to produce concrete results as soon as possible. Progress on the implementation of the Action Plan will be reported to the September 2012 meeting of the Board of Governors and the 2012 General Conference and subsequently on an annual basis as may be necessary. In addition, the extraordinary meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS) in 2012 will provide an opportunity to consider further measures to strengthen nuclear safety.

Strengthening nuclear safety in light of the accident is addressed through a number of measures proposed in this Action Plan including 12 main actions, each with corresponding sub-actions, focusing on: safety assessments in the light of the accident at TEPCO's Fukushima Daiichi Nuclear Power Station; IAEA peer reviews; emergency preparedness and response; national regulatory bodies; operating organizations; IAEA Safety Standards; international legal framework; Member States planning to embark on a nuclear power programme; capacity building; protection of people and the environment from ionizing radiation; communication and information dissemination; and research and development.

## Safety assessments in the light of the accident at TEPCO's Fukushima Daiichi Nuclear Power Station

### *Undertake assessment of the safety vulnerabilities of nuclear power plants in the light of lessons learned to date from the accident*

- Member States to promptly undertake a national assessment of the design of nuclear power plants against site specific extreme natural hazards and to implement the necessary corrective actions in a timely manner.
- The IAEA Secretariat, taking into account existing experiences, to develop a methodology and make it available for Member States that may wish to use it in carrying out their national assessments.
- The IAEA Secretariat, upon request, to provide assistance and support to Member States in the implementation of a national assessment of the design of nuclear power plants against site specific extreme natural hazards.
- The IAEA Secretariat, upon request, to undertake peer reviews of national assessments and to provide additional support to Member States.

[1] Stakeholders include, amongst others, governments, relevant international organizations and associations, regulatory bodies, operating organizations, nuclear industry, radioactive waste management organizations, technical support and safety organizations, research organizations, education and training institutions and other relevant bodies.

**IAEA peer reviews**

***Strengthen IAEA peer reviews in order to maximize the benefits to Member States***

- The IAEA Secretariat to strengthen existing IAEA peer reviews by incorporating lessons learned and by ensuring that these reviews appropriately address regulatory effectiveness, operational safety, design safety, and emergency preparedness and response; Member States to provide experts for peer review missions.
- The IAEA Secretariat, in order to enhance transparency, to provide summary information on where and when IAEA peer reviews have taken place, and to make publicly available in a timely manner the results of such reviews with the consent of the State concerned.
- Member States to be strongly encouraged to voluntarily host IAEA peer reviews, including follow-up reviews, on a regular basis; the IAEA Secretariat to respond in a timely manner to requests for such reviews.
- The IAEA Secretariat to assess, and enhance as necessary, the effectiveness of the IAEA peer reviews.

**Emergency preparedness and response**

***Strengthen emergency preparedness and response***

- Member States to conduct a prompt national review and thereafter regular reviews of their emergency preparedness and response arrangements and capabilities, with the IAEA Secretariat providing support and assistance through Emergency Preparedness Review (EPREV) missions, as requested.
- The IAEA Secretariat, Member States and relevant international organizations to review and strengthen the international emergency preparedness and response framework, taking into account recommendations given in the final report of the International Action Plan for Strengthening the International Preparedness and Response System for Nuclear and Radiological Emergencies, and encouraging greater involvement of the relevant international organizations in the Joint Radiation Emergency Management Plan of the International Organizations.
- The IAEA Secretariat, Member States and relevant international organizations to strengthen the assistance mechanisms to ensure that necessary assistance is made available promptly. Consideration to be given to enhancing and fully utilizing the IAEA Response and Assistance Network (RANET), including expanding its rapid response capabilities.
- Member States to consider, on a voluntary basis, establishing national rapid response teams that could also be made available internationally through RANET.
- The IAEA Secretariat, in case of a nuclear emergency and with the consent of the State concerned, to conduct timely fact-finding missions and to make the results publicly available.

**National regulatory bodies**

***Strengthen the effectiveness of national regulatory bodies***

- Member States to conduct a prompt national review and thereafter regular reviews of their regulatory bodies, including an assessment of their effective independence, adequacy of human and financial resources and the need for appropriate technical and scientific support, to fulfil their responsibilities.
- The IAEA Secretariat to enhance the Integrated Regulatory Review Service (IRRS) for peer review of regulatory effectiveness through a more comprehensive assessment of national regulations against IAEA Safety Standards.
- Each Member State with nuclear power plants to voluntarily host, on a regular basis, an IAEA

IRRS mission to assess its national regulatory framework. In addition, a follow-up mission to be conducted within three years of the main IRRS mission.

**Operating organizations**

***Strengthen the effectiveness of operating organizations with respect to nuclear safety***

- Member States to ensure improvement, as necessary, of management systems, safety culture, human resources management, and scientific and technical capacity in operating organizations; the IAEA Secretariat to provide assistance to Member States upon request.
- Each Member State with nuclear power plants to voluntarily host at least one IAEA Operational Safety Review Team (OSART) mission during the coming three years, with the initial focus on older nuclear power plants. Thereafter, OSART missions to be voluntarily hosted on a regular basis.
- The IAEA Secretariat to strengthen cooperation with WANO by amending their Memorandum of Understanding to enhance information exchange on operating experience and on other relevant safety and engineering areas and, in consultation with other relevant stakeholders, to explore mechanisms to enhance communication and interaction among operating organizations.

**IAEA Safety Standards**

***Review and strengthen IAEA Safety Standards and improve their implementation***

- The Commission on Safety Standards and the IAEA Secretariat to review, and revise as necessary using the existing process in a more efficient manner, the relevant IAEA Safety Standards[2] in a prioritised sequence.
- Member States to utilize as broadly and effectively as possible the IAEA Safety Standards in an open, timely and transparent manner. The IAEA Secretariat to continue providing support and assistance in the implementation of IAEA Safety Standards.

**International legal framework**

***Improve the effectiveness of the international legal framework***

- States parties to explore mechanisms to enhance the effective implementation of the Convention on Nuclear Safety, the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, the Convention on the Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, and to consider proposals made to amend the Convention on Nuclear Safety and the Convention on the Early Notification of a Nuclear Accident.
- Member States to be encouraged to join and effectively implement these Conventions.
- Member States to work towards establishing a global nuclear liability regime that addresses the concerns of all States that might be affected by a nuclear accident with a view to providing appropriate compensation for nuclear damage. The IAEA International Expert Group on Nuclear Liability (INLEX) to recommend actions to facilitate achievement of such a global regime. Member States to give due consideration to the possibility of joining the international nuclear liability instruments as a step toward achieving such a global regime.

[2] This review could include, inter alia, regulatory structure, emergency preparedness and response, nuclear safety and engineering (site selection and evaluation, assessment of extreme natural hazards including their combined effects, management of severe accidents, station blackout, loss of heat sink, accumulation of explosive gases, nuclear fuel behaviour and ways to ensure the safety of spent fuel storage).

**Member States planning to embark on a nuclear power programme**

***Facilitate the development of the infrastructure necessary for Member States embarking on a nuclear power programme***

- Member States to create an appropriate nuclear infrastructure based on IAEA Safety Standards and other relevant guidance, and the IAEA Secretariat to provide assistance as may be requested.

- Member States to voluntarily host Integrated Nuclear Infrastructure Reviews (INIR) and relevant peer review missions, including site and design safety reviews, prior to commissioning the first nuclear power plant.

**Capacity Building**

***Strengthen and maintain capacity building***

- Member States with nuclear power programmes and those planning to embark on such a programme to strengthen, develop, maintain and implement their capacity building programs, including education, training and exercises at the national, regional and international levels; to continuously ensure sufficient and competent human resources necessary to assume their responsibility for safe, responsible and sustainable use of nuclear technologies; the IAEA Secretariat to assist as requested. Such programmes to cover all the nuclear safety related areas, including safe operation, emergency preparedness and response and regulatory effectiveness and to build upon existing capacity building infrastructures.

- Member States with nuclear power programmes and those planning to embark on such a programme, to incorporate lessons learned from the accident into their nuclear power programme infrastructure; the IAEA Secretariat to assist as requested.

**Protection of people and the environment from ionizing radiation**

***Ensure the on-going protection of people and the environment from ionizing radiation following a nuclear emergency***

- Member States, the IAEA Secretariat and other relevant stakeholders to facilitate the use of available information, expertise and techniques for monitoring, decontamination and remediation both on and off nuclear sites and the IAEA Secretariat to consider strategies and programmes to improve knowledge and strengthen capabilities in these areas.

- Member States, the IAEA Secretariat and other relevant stakeholders to facilitate the use of available information, expertise and techniques regarding the removal of damaged nuclear fuel and the management and disposal of radioactive waste resulting from a nuclear emergency.

- Member States, the IAEA Secretariat and other relevant stakeholders to share information regarding the assessment of radiation doses and any associated impacts on people and the environment.

**Communication and information dissemination**

***Enhance transparency and effectiveness of communication and improve dissemination of information***

- Member States, with the assistance of the IAEA Secretariat, to strengthen the emergency notification system, and reporting and information sharing arrangements and capabilities.

- Member States, with the assistance of the IAEA Secretariat, to enhance the transparency and effectiveness of communication among operators, regulators and various international

organizations, and strengthen the IAEA's coordinating role in this regard, underlining that the freest possible flow and wide dissemination of safety related technical and technological information enhances nuclear safety.

- The IAEA Secretariat to provide Member States, international organizations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear emergency on its potential consequences, including analysis of available information and prognosis of possible scenarios based on evidence, scientific knowledge and the capabilities of Member States.

- The IAEA Secretariat to organize international experts meetings to analyse all relevant technical aspects and learn the lessons from the Fukushima Daiichi nuclear power station accident.

- The IAEA Secretariat to facilitate and to continue sharing with Member States a fully transparent assessment of the accident at TEPCO's Fukushima Daiichi Nuclear Power Station, in cooperation with Japan.

- The IAEA Secretariat and Member States, in consultation with the OECD/NEA and the IAEA International Nuclear and Radiological Event Scale (INES) Advisory Committee to review the application of the INES scale as a communication tool.

**Research and development**

***Effectively utilize research and development***

- Relevant stakeholders, with assistance provided by the IAEA Secretariat as appropriate, to conduct necessary research and development in nuclear safety, technology and engineering[3], including that related to existing and new design-specific aspects.

- Relevant stakeholders and the IAEA Secretariat to utilize the results of research and development and to share them, as appropriate, to the benefit of all Member States.

[3] For example, extreme natural hazards, management of severe accidents, station blackout, loss of heat sink, feed and bleed system, containment venting system, structural integrity of containment building and spent fuel pool structure and behaviour of fuel assembly, and post-accident monitoring system under extreme harsh environment

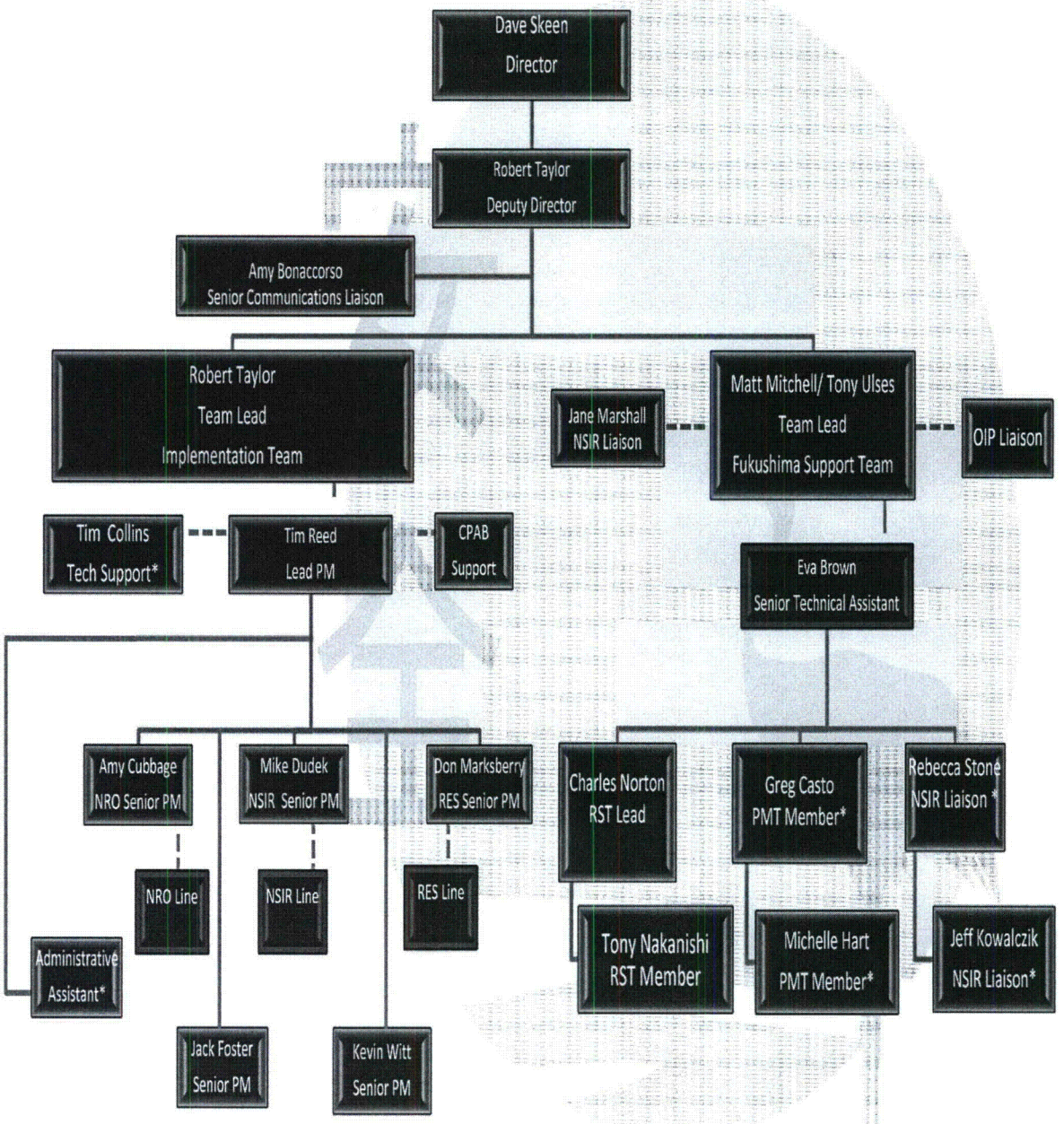
**From:** Bowman, Gregory
**Sent:** Thursday, September 01, 2011 11:54 AM
**To:** Hipschman, Thomas; Marshall, Michael; Castleman, Patrick; Gilles, Nanette; Orders, William; Franovich, Mike
**Subject:** FYI - Organization Chart for Fukushima Lessons Learned Project Directorate
**Attachments:** PD Org Chart.pptx

We got a request for the organization chart for the Fukushima Lessons Learned Project Directorate. That's the group that is responsible for developing the 21- and 45-day papers required by the SRM for SECY-11-0093, and also for providing support to the team in Japan.

The chart is attached. If you have any questions, please give me a call.

Greg

# Organizational Chart – Japan Lessons-Learned Project Directorate




* Indicates occasional support position

**From:** RST01_F Resource
**Sent:** Wednesday, July 20, 2011 1:57 PM
**To:** A Green; A Rock; Al Coons; Aleshia Duncan; alexancg; Anthony Herbold; Appleman Binkert; B Green; B Russo; Bill King; Bill King2; Bruce Howard; C Lay; C Noser; C Ops; Charles Burrows; Charles Donnell; Christopher Firman; Christopher Meadow; Conrad Burnside; D Drakeley; D May; D Murakami; Damian Peko; Dan Feighert; Danielle Moen; Darrell Hammons; Devin Bush G LTJG RIA-Midwest MPLS.N47922; DHS Ops; DOE NNSA; DOT; DTRA; DTRA; E Wright; Elmer Naples; EOP; EPA; EPA2; Eric Sinibaldi; F Lewis; G Szeto; G Whitmire; George Higdon; gregopk; Gregory Simonson; Gretchen McCoy; H; Harry Sherwood; HHS; I Clark; Intel DIA; J Barnes; J Bartlett; J Moeller; J Noonkester; J Szymanski; J Tippets; James Purvis; Jason CIA; Jason Pepin; Jeremy Demott; Jeremy Morrow; Jeremyft1; Jim Kish; Johanna Berkey; John Holdren; Joyce Connery; K Donald; K Gonzalez; K Ousley; Karyn Keller; Kyle Viayra; L Mayer; Lee Nickel; Lisa; Lisa Hammond; Lukas McMichael; M Huchla; M Kerber; M Lansley; M Thon; M Thon2; maceck; MARFORPAC CAT All Hazards Div; MARFORPAC CAT G2; Mark Shaffer; markwb2; Marshall Shull; Michelle Ralston; Nan Calhoun; Navy; NICC; NMIC; NOC; NOC Duty Director; Nulcear SSA; P Gardner; pentagon; Peter Lyons; Phillip Barks; R Roesler; R Schueneman; Rebecca Thomson; roberhh; Ron Cherry; Ron McCabe; S Buntman; S Levy; scotc1; seiden; state; Stephen Trautman; Steve Colman; Steve Horwitz; T Roberts; Thomas Conran; Thomas Zerr; Tim Greten; Trent Hughes; Troy Heytens; USDA, John; USMC; Vanessa Quinn; Victoria Kinsey; W Cluff; W Young; Will Friese; William Webb; A Brown; A Estes; A Hough; A Tribble; B goldberg; B Moffat; B Perry; B Woo; BMPC; Brinser, Andrew; C Fiore; C Good; C Kim; Carlos Islas; CPF CATN5; Craig Gaddis; Curtis Smith; D Fletcher; D Putthoff; D Scully; D Smith; D Souza; D Wade; D Williams; David Graves; David Herman; DOE DART; E kaye; E Price; E Shelland; E Train; Elder, Troy; Eric Wright; F Bantell; Guathier, Ronald; H Zito; Hickam; Hickam; Idar, Deanne J CIV OSD POLICY ; J Blankenburg; J Kreykes; J McCallister; J Rhodes; J Rivera; J Scarbrough; J Soderbeck; J Stewart; J Trussler; James Williams; Joel Pero; Joy Rempe; JR Haley; JTF505-MAIN-JOC-J2; JTF505-MAIN-JOC-J2-INTEL-ANAY; K Tomlinson; Koluch, SSgt Eric; L Bolling; L Elkins; L Heinrich; L Walter; Laurel Steinhurst ; Lela Doyle; M Howsare; M Kabbur; M Nguyen; M Taafe; Marina Llewellyn; Mark Russo; Michael Anderson; Michael Eberlein; Monaghan, Dylan; NCMI Ops; Office of Secretary of Defense Watch Officer ; Olson, Niels; P Almquist; P Higginbotham; P Higgins; P Lyons; P Somboonpakron; PACOM; Paul Scheinert; Powers, Jeffrey; R Backley; R Fisher; R Garrett; R Neff; R Stephenson; R Tashma; Reid Tanaka; Richard, Sgt William; Robert Duke; Robert P; S Aoki; S Jerabek; Scott Simonson; Shirey, Sgt Eric; Simmers, Keith; Spencer Nordgran; Spurlock, Kenneth; Stephen Bell; Stephen Greco; Steven Schlaseman; T Lowman; T Miller; T True; Thomas Vavoso; Tovar, SSgt Eric; (b)(6); USFJ; USFJ Intel; V Raphael; Valerie Makino; Vaughn, Sgt Jerrod; Walter Hokett; Wanda Ayuso; William Brysacz; Batkin, Joshua; Borchardt, Bill; Bradford, Anna; Castleman, Patrick; Coggins, Angela; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Gilles, Nanette; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Marshall, Jane; Marshall, Michael; Mitchell, Matthew; Monninger, John; Orders, William; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Skeen, David; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Taylor, Robert; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
**Cc:** Riley (OCA), Timothy; Droggitis, Spiros
**Subject:** USNRC Emergency Operations Center Status Update 072011
**Attachments:** Attachment - NRC Daily Assessment of Daiichi 072011.pdf; USNRC Earthquake-Tsunami Update 072011 1400 EDT.pdf

~~*******NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY********~~

Good Afternoon,

Attached is the Status Update for Wednesday, July 20, 2011.

**Important:** The combination of relatively static site conditions and measured progress on the Roadmap has resulted in **the NRC discontinuing daily issuance of the Status Update**. This does not change the NRC's commitment to the continued support the U.S. Embassy in Japan and the GOJ. **The NRC will continue to monitor conditions at Fukushima Daiichi, including progress on the Roadmap, and will issue updates to the Status Update whenever there is a significant item of interest to report**.

**Please note the** NRC Headquarters response to these events has moved from the Operations Center to a core team of managers and experts. To contact any member of the team please e-mail the support team at RST01_F.Resource@nrc.gov
Thank you.

If you no longer wish to receive these emails, please reply to this message and we will remove you. Thank you.

~~*******NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY********~~

# NRC's Periodic Stoplight Report of Conditions at Fukushima Daiichi Nuclear Power Plant

| | |
|---|---|
| Reactor One | • core damaged and uncovered<br>• primary containment breached<br>• injecting via feed water 3.7 $m^3$/hr<br>• Reactor metal temperatures trending down |
| Reactor Two | • core damaged and uncovered<br>• primary containment breached<br>• injecting via feed water 3.8 $m^3$/hr<br>• Reactor metal temperatures trending down |
| Reactor Three | • core damaged and uncovered<br>• primary containment breached<br>• injecting via feed water 9.0 $m^3$/hr<br>• Reactor metal temperatures fluctuating |
| SFP One | • SFP intact, water level maintained with installed fuel pool cooling system |
| SFP Two | • SFP intact, water level maintained with installed fuel pool cooling system<br>• closed loop cooling installed |
| SFP Three | • SFP intact, water level maintained with installed spent fuel pool system<br>• closed loop cooling installed<br>• caustic water conditions/concrete water interaction |
| SFP Four | • SFP intact, water level maintained with spray<br>• installation of structural reinforcement underway |
| Reactors 5 & 6 | • cold shutdown |

## General Site

Major TEPCO Identified Site Concerns

- Control of Radioactive Material Release
  - Measurement & Analysis
- Water Management
  - Water storage limitations
- Site containment
  - Building enclosure
- Removal of debris for access to Units 3 and 4

NRC Focus Areas

RST Focus

- Severe Accident Management Guidelines/Extreme Damage Mitigation Guidelines
- Post-Accident Safety Analysis/FSAR Development

PMT Focus

- Modify travel advisory
- Radiation Monitoring

Adequate | Challenged

## Japan News Headlines

- Stabilization roadmap revised (07/20)
- Stable treatment of radioactive water holds key to successful implementation of Step 2 (07/20)
- Tokyo Shimbun: Roadmap fails to offer steps for removing fuel from reactors (07/20)
- Nikkei: Construction of sub terrain water walls to begin this fall (07/20)
- Shipment of Fukushima beef prohibited (07/20)
- Nikkei: Miyagi to check cattle from all ranchers (07/20)
- Asahi: Radiation-laced rice straw in Miyagi shipped to six prefectures (07/20)
- Beef prices plunge in Tokyo (07/20)
- NRC chief says U.S. to enhance nuclear plant safety measures in five years (07/20)

## Events

Stoplights published Monday, Wednesday, and Friday

**From:** Monninger, John
**Sent:** Monday, July 18, 2011 8:58 AM
**To:** Marshall, Michael
**Subject:** FW: NRC Near-Term Task Force Report
**Attachments:** 07-15-11_NRC_NRC Near-Term Task Force Report.pdf

FYI.

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**From:** Pace, Patti
**Sent:** Monday, July 18, 2011 8:50 AM
**To:** Batkin, Joshua; Coggins, Angela; Monninger, John; Hipschman, Thomas; Loyd, Susan; Montes, David
**Subject:** FW: NRC Near-Term Task Force Report

FYI – Letter from Marv Fertel, NEI about Task Force Report.

Patti Pace
Assistant to Chairman Gregory B. Jaczko
U.S. Nuclear Regulatory Commission
301-415-1820 (office)
301-415-3504 (fax)

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**From:** CHAIRMAN Resource
**Sent:** Monday, July 18, 2011 8:08 AM
**To:** Batkin, Joshua; Gibbs, Catina; Pace, Patti
**Subject:** FW: NRC Near-Term Task Force Report

SECY Correspondence will handle.

---

**From:** FERTEL, Marvin [mailto:msf@nei.org]
**Sent:** Friday, July 15, 2011 4:53 PM
**Subject:** NRC Near-Term Task Force Report

July 15, 2011

The Honorable Gregory B. Jaczko
Chairman
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Mail Stop 016 C1
Rockville, MD 20852

**Subject:** NRC Near-Term Task Force Report

**Project Number: 689**

Dear Chairman Jaczko:

The nuclear energy industry is reviewing the NRC Near-Term Task Force's Recommendations for Enhancing Reactor Safety in the 21st Century and we look forward to providing comments to the staff on the recommendations. In general, the industry agrees with many of the issues identified by the task force. While there are some near-term actions that are clear from the available information, the basis for many of the recommendations clearly was disadvantaged by the fact that detailed information from the accident was, as the task force noted, "unavailable, unreliable and ambiguous."

The task force report lacks the rigorous analysis of issues that traditionally accompanies regulatory requirements proposed by the NRC. Better information from Japan and more robust analysis is necessary to ensure the effectiveness of actions taken by the NRC and avoid unintended consequences at America's nuclear energy facilities. The report also discusses at length proposals to modify the existing regulatory framework for nuclear energy facilities. If the commission decides to pursue some or all of the task force proposals related to the regulatory framework, these activities should be separated from the specific Fukushima Daiichi lessons learned recommendations.

Marvin S. Fertel
President and Chief Executive Officer

Nuclear Energy Institute
1776 I Street NW, Suite 400
Washington, DC 20006
www.nei.org

P: 202-739-8125
F: 202-293-3451
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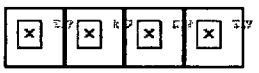

NUCLEAR ENERGY INSTITUTE

Marvin S. Fertel
PRESIDENT AND
CHIEF EXECUTIVE OFFICER

July 15, 2011

The Honorable Gregory B. Jaczko
Chairman
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Mail Stop 016 C1
Rockville, MD 20852

**Subject:** NRC Near-Term Task Force Report

**Project Number: 689**

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The task force report lacks the rigorous analysis of issues that traditionally accompanies regulatory requirements proposed by the NRC. Better information from Japan and more robust analysis is necessary to ensure the effectiveness of actions taken by the NRC and avoid unintended consequences at America's nuclear energy facilities. The report also discusses at length proposals to modify the existing regulatory framework for nuclear energy facilities. If the commission decides to pursue some or all of the task force proposals related to the regulatory framework, these activities should be separated from the specific Fukushima Daiichi lessons learned recommendations.

The nuclear energy industry has taken seriously the accident at Fukushima Daiichi and continues to compile lessons learned that can be applied at U.S. reactors. As the NRC task force has concluded throughout the 90-day review, U.S. nuclear energy facilities are safe. Since the March accident, the industry has conducted detailed inspections at our facilities and taken steps necessary to enhance safety as well as responded to NRC-mandated actions at the facilities. As the NRC confirmed, every

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company operating a nuclear plant has verified its ability to safely manage the facility even in an extreme event, regardless of its cause.
We will continue to work with the NRC to identify potential enhancements in safety that should be made. In this regard, the continued assessment of information from Japan and the sharing of information compiled by the NRC, the industry and others that are assessing the accident will be critical to reaching the correct lessons learned for identifying the appropriate regulatory and industry action.

In that respect, it is incumbent upon the commission to move forward both expeditiously and responsibly in identifying the lessons learned from the accident. The competent, professional NRC staff should analyze the lessons learned and obtain broad stakeholder input in the most meaningful way. The industry is fully committed to participate in stakeholder forums on this report, beginning at the July 28 public meeting at the NRC.

NEI and our industry partners are coordinating the industry's Fukushima response activities and are developing recommendations for the industry in seven "building blocks"—integrated organizations created to develop and execute action plans in specified areas of focus. The industry has already taken measures to enhance safety and preparedness. Nonetheless, the industry will ensure that no gaps exist in our response activities and that there is no duplication of effort among the industry organizations and companies. We recognize that to maintain the highest standard of safety and security, we must continually evolve and improve the industry's standards of practice, and adapt to events and new information that affect our industry.

The industry is concerned that the task force's use of phrases such as "patchwork of regulatory requirements" undermines the comprehensive body of regulatory requirements imposed by the NRC, the agency's extensive inspection and oversight process, and the excellent safety performance at the industry's 104 reactors. As the task force report notes, operation of U.S. nuclear energy facilities does not pose a risk to public safety. In fact, the NRC has not identified any significant adverse trends in safety at U.S. reactors in its last 10 years of reporting.

The industry certainly agrees that the safety benefits of new requirements should be used to prioritize and integrate any new requirements with those currently being considered by the agency, such as work hours for plant workers, cyber security and fire protection. In doing so, the NRC should use its formal process for evaluating the resource implications of new or revised regulatory requirements both on the agency staff and nuclear energy facility staff. It might be useful if the NRC prioritized activities in an integrated schedule that includes all new requirements being developed or implemented over the next five years.

The task force report stated that all of its recommendations should be considered within the "adequate protection" standard. However, the basis for the recommendations contained in the task force report requires more expansive and detailed analyses to ensure that they actually address the lessons learned from the Fukushima accident. After the necessary and appropriate analyses are conducted by the NRC staff, the commission should expect the staff to justify the value of any new or revised requirements consistent with NRC standard practice. If any proposed new requirements are justified within the adequate protection standard, the commission should review these on a case-by-case basis.

The industry is fully committed to enhancing safety at America's nuclear energy facilities. NEI and its members look forward to participating in the rigorous and systematic process for public comment and review of the task force recommendations. There are differences between the Japanese and U.S. approaches both in operation of nuclear energy facilities and the regulatory oversight of these facilities. The agency should recognize these as well as still-emerging information from Japan as we move forward to address the lessons learned.

Sincerely,

Marvin S. Fertel

c: The Honorable Kristine L. Svinicki, Commissioner, U.S. Nuclear Regulatory Commission
The Honorable William D. Magwood, IV, Commissioner, U.S. Nuclear Regulatory Commission
The Honorable George Apostolakis, Commissioner, U.S. Nuclear Regulatory Commission
The Honorable William C. Ostendorff, Commissioner, U.S. Nuclear Regulatory Commission
Mr. R. William Borchardt, Executive Director for Operations, U.S. Nuclear Regulatory Commission

**From:** RST01_F Resource
**Sent:** Wednesday, July 06, 2011 11:56 AM
**To:** A Green; A Rock; Al Coons; Aleshia Duncan; alexancg; Anthony Herbold; Appleman Binkert; B Green; B Russo; Bill King; Bill King2; Bruce Howard; C Lay; C Noser; C Ops; Charles Burrows; Charles Donnell; Christopher Firman; Christopher Meadow; Conrad Burnside; D Drakeley; D May; D Murakami; Damian Peko; Dan Feighert; Danielle Moen; Darrell Hammons; Devin Bush G LTJG RIA-Midwest MPLS.N47922; DHS Ops; DOE NNSA; DOT; DTRA; DTRA; E Wright; Elmer Naples; EOP; EPA; EPA2; Eric Sinibaldi; F Lewis; G Szeto; G Whitmire; George Higdon; gregopk; Gregory Simonson; Gretchen McCoy; H; Harry Sherwood; HHS; I Clark; Intel DIA; J Barnes; J Bartlett; J Moeller; J Noonkester; J Szymanski; J Tippets; James Purvis; Jason CIA; Jason Pepin; Jeremy Demott; Jeremy Morrow; Jeremyft1; Jim Kish; Johanna Berkey; John Holdren; Joyce Connery; K Donald; K Gonzalez; K Ousley; Karyn Keller; Kyle Viayra; L Mayer; Lee Nickel; Lisa; Lisa Hammond; Lukas McMichael; M Huchla; M Kerber; M Lansley; M Thon; M Thon2; maceck; MARFORPAC CAT All Hazards Div; MARFORPAC CAT G2; Mark Shaffer; markwb2; Marshall Shull; Michelle Ralston; Nan Calhoun; Navy; NICC; NMIC; NOC; NOC Duty Director; Nulcear SSA; P Gardner; pentagon; Peter Lyons; Phillip Barks; R Roesler; R Schueneman; Rebecca Thomson; roberhh; Ron Cherry; Ron McCabe; S Buntman; S Levy; scotc1; seiden; state; Stephen Trautman; Steve Colman; Steve Horwitz; T Roberts; Thomas Conran; Thomas Zerr; Tim Greten; Trent Hughes; Troy Heytens; USDA, John; USMC; Vanessa Quinn; Victoria Kinsey; W Cluff; W Young; Will Friese; William Webb; A Brown; A Estes; A Hough; A Tribble; B goldberg; B Moffat; B Perry; B Woo; BMPC; Brinser, Andrew; C Fiore; C Good; C Kim; Carlos Islas; CPF CATN5; Craig Gaddis; Curtis Smith; D Fletcher; D Putthoff; D Scully; D Smith; D Souza; D Wade; D Williams; David Graves; David Herman; DOE DART; E kaye; E Price; E Shelland; E Train; Elder, Troy; Eric Wright; F Bantell; Guathier, Ronald; H Zito; Hickam; Hickam; Idar, Deanne J CIV OSD POLICY ; J Blankenburg; J Kreykes; J McCallister; J Rhodes; J Rivera; J Scarbrough; J Soderbeck; J Stewart; J Trussler; James Williams; Joel Pero; Joy Rempe; JR Haley; JTF505-MAIN-JOC-J2; JTF505-MAIN-JOC-J2-INTEL-ANAY; K Tomlinson; Koluch, SSgt Eric; L Bolling; L Elkins; L Heinrich; L Walter; Laurel Steinhurst ; Lela Doyle; M Howsare; M Kabbur; M Nguyen; M Taafe; Marina Llewellyn; Mark Russo; Michael Anderson; Michael Eberlein; Monaghan, Dylan; NCMI Ops; Office of Secretary of Defense Watch Officer ; Olson, Niels; P Almquist; P Higginbotham; P Higgins; P Lyons; P Somboonpakron; PACOM; Paul Scheinert; Powers, Jeffrey; R Backley; R Fisher; R Garrett; R Neff; R Stephenson; R Tashma; Reid Tanaka; Richard, Sgt William; Robert Duke; Robert P; S Aoki; S Jerabek; Scott Simonson; Shirey, Sgt Eric; Simmers, Keith; Spencer Nordgran; Spurlock, Kenneth; Stephen Bell; Stephen Greco; Steven Schlaseman; T Lowman; T Miller; T True; Thomas Vavoso; Tovar, SSgt Eric; (b)(6) ; USFJ; USFJ Intel; V Raphael; Valerie Makino; Vaughn, Sgt Jerrod; Walter Hokett; Wanda Ayuso; William Brysacz; Batkin, Joshua; Borchardt, Bill; Bradford, Anna; Castleman, Patrick; Coggins, Angela; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Gilles, Nanette; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Marshall, Jane; Marshall, Michael; Mitchell, Matthew; Monninger, John; Orders, William; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Skeen, David; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Taylor, Robert; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
**Cc:** Droggitis, Spiros; Riley (OCA), Timothy
**Subject:** USNRC Emergency Operations Center Status Update 070611
**Attachments:** USNRC Earthquake-Tsunami Update 070611 1200 EDT.pdf; Attachment - NRC Daily Assessment of Daiichi 070611.pdf

~~*******NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY********~~

Good Morning,

Attached is the Status Update for Wednesday, July 6, 2011. There were no changes since the previous status update.

**Important:** With conditions at Fukushima Daiichi stabilizing and progress being made on the Roadmap, the NRC has determined that it is time to reassess the frequency of our issuance of the Status Update. Since the March 11th earthquake and tsunami, the NRC has reported nearly daily on the conditions at the site, including efforts by TEPCO and the Government of Japan (GOJ) to reach stability, and the NRC's support activities. Over the last few weeks, the GOJ and TEPCO have continued to make progress on implementing the Roadmap. The efforts in the Roadmap are key milestones toward site stability and, as such, require substantial engineering and scientific work to implement. Accordingly, the combination of relatively static site conditions and measured progress on the Roadmap have resulted in minimal changes to the Status Update over the last few weeks. Therefore, **the NRC is discontinuing daily issuance of the Status Update**. This does not change the NRC's commitment to the continued support the U.S. Embassy in Japan and the GOJ. **The NRC will continue to monitor conditions at Fukushima Daiichi, including progress on the Roadmap, and will issue updates to the Status Update whenever there is a significant item of interest to report**.

**Please note the** NRC Headquarters response to these events has moved from the Operations Center to a core team of managers and experts. To contact any member of the team please e-mail the support team at RST01_F.Resource@nrc.gov
Thank you.

If you no longer wish to receive these emails, please reply to this message and we will remove you. Thank you.

~~*******NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY********~~

# NRC's Periodic Stoplight Report of Conditions at Fukushima Daiichi Nuclear Power Plant

| | |
|---|---|
| **Reactor One** | • core damaged and uncovered<br>• primary containment breached<br>• injecting via feed water 3.8 $m^3$/hr<br>• Reactor metal temperatures trending down |
| **Reactor Two** | • core damaged and uncovered<br>• primary containment breached<br>• injecting via feed water 3.4 $m^3$/hr<br>• Reactor metal temperatures trending down |
| **Reactor Three** | • core damaged and uncovered<br>• primary containment breached<br>• injecting via feed water 8.9 $m^3$/hr<br>• Reactor metal temperatures fluctuating |
| **SFP One** | • SFP intact water level maintained with installed fuel pool cooling system |
| **SFP Two** | • SFP intact, water level maintained with installed fuel pool cooling system<br>• closed loop cooling installed |
| **SFP Three** | • SFP intact water level maintained with installed spent fuel pool system<br>• closed loop cooling installed<br>• caustic water conditions/concrete water interaction |
| **SFP Four** | • SFP intact, water level maintained with spray<br>• installation of structural reinforcement underway |
| **Reactors 5 & 6** | • cold shutdown |

## General Site

**Major TEPCO Identified Site Concerns**

- Control of Radioactive Material Release
  - Measurement & Analysis
- Water Management
  - Water storage limitations
- Site containment
  - Building enclosure
- Structural Integrity of 1F4 Spent Fuel Pool

**NRC Focus Areas**

RST Focus

- Severe Accident Management Guidelines/Extreme Damage Mitigation Guidelines
- Post-Accident Safety Analysis/FSAR Development

PMT Focus

- Modify travel advisory
- Radiation Monitoring

| Adequate | Challenged | Active Failure |
|---|---|---|

## Japan News Headlines

- Mainichi: TEPCO to operate closed cycle water treatment systems for each reactor (07/06)
- Asahi: Nuclear reactors undergoing regular inspections in Hokkaido and Fukui still in test-run status (07/06)
- Nikkei: Hosono appointed as secretary general of GOJ nuclear emergency response headquarters (07/06)
- Cabinet approves draft second supplementary budget (07/06)
- LDP begins to review party policy on nuclear energy (07/06)
- Genkai mayor OK's restart of N-reactors (07/05)

## Events

Stoplights published Monday, Wednesday, and Friday

**From:** RST01_F Resource
**Sent:** Tuesday, July 05, 2011 12:00 PM
**To:** A Green; A Rock; Al Coons; Aleshia Duncan; alexancg; Anthony Herbold; Appleman Binkert; B Green; B Russo; Bill King; Bill King2; Bruce Howard; C Lay; C Noser; C Ops; Charles Burrows; Charles Donnell; Christopher Firman; Christopher Meadow; Conrad Burnside; D Drakeley; D May; D Murakami; Damian Peko; Dan Feighert; Danielle Moen; Darrell Hammons; Devin Bush G LTJG RIA-Midwest MPLS.N47922; DHS Ops; DOE NNSA; DOT; DTRA; DTRA; E Wright; Elmer Naples; EOP; EPA; EPA2; Eric Sinibaldi; F Lewis; G Szeto; G Whitmire; George Higdon; gregopk; Gregory Simonson; Gretchen McCoy; H; Harry Sherwood; HHS; I Clark; Intel DIA; J Barnes; J Bartlett; J Moeller; J Noonkester; J Szymanski; J Tippets; James Purvis; Jason CIA; Jason Pepin; Jeremy Demott; Jeremy Morrow; Jeremyft1; Jim Kish; Johanna Berkey; John Holdren; Joyce Connery; K Donald; K Gonzalez; K Ousley; Karyn Keller; Kyle Viayra; L Mayer; Lee Nickel; Lisa; Lisa Hammond; Lukas McMichael; M Huchla; M Kerber; M Lansley; M Thon; M Thon2; maceck; MARFORPAC CAT All Hazards Div; MARFORPAC CAT G2; Mark Shaffer; markwb2; Marshall Shull; Michelle Ralston; Nan Calhoun; Navy; NICC; NMIC; NOC; NOC Duty Director; Nulcear SSA; P Gardner; pentagon; Peter Lyons; Phillip Barks; R Roesler; R Schueneman; Rebecca Thomson; roberhh; Ron Cherry; Ron McCabe; S Buntman; S Levy; scotc1; seiden; state; Stephen Trautman; Steve Colman; Steve Horwitz; T Roberts; Thomas Conran; Thomas Zerr; Tim Greten; Trent Hughes; Troy Heytens; USDA, John; USMC; Vanessa Quinn; Victoria Kinsey; W Cluff; W Young; Will Friese; William Webb; A Brown; A Estes; A Hough; A Tribble; B goldberg; B Moffat; B Perry; B Woo; BMPC; Brinser, Andrew; C Fiore; C Good; C Kim; Carlos Islas; CPF CATN5; Craig Gaddis; Curtis Smith; D Fletcher; D Putthoff; D Scully; D Smith; D Souza; D Wade; D Williams; David Graves; David Herman; DOE DART; E kaye; E Price; E Shelland; E Train; Elder, Troy; Eric Wright; F Bantell; Guathier, Ronald; H Zito; Hickam; Hickam; Idar, Deanne J CIV OSD POLICY ; J Blankenburg; J Kreykes; J McCallister; J Rhodes; J Rivera; J Scarbrough; J Soderbeck; J Stewart; J Trussler; James Williams; Joel Pero; Joy Rempe; JR Haley; JTF505-MAIN-JOC-J2; JTF505-MAIN-JOC-J2-INTEL-ANAY; K Tomlinson; Koluch, SSgt Eric; L Bolling; L Elkins; L Heinrich; L Walter; Laurel Steinhurst ; Lela Doyle; M Howsare; M Kabbur; M Nguyen; M Taafe; Marina Llewellyn; Mark Russo; Michael Anderson; Michael Eberlein; Monaghan, Dylan; NCMI Ops; Office of Secretary of Defense Watch Officer ; Olson, Niels; P Almquist; P Higginbotham; P Higgins; P Lyons; P Somboonpakron; PACOM; Paul Scheinert; Powers, Jeffrey; R Backley; R Fisher; R Garrett; R Neff; R Stephenson; R Tashma; Reid Tanaka; Richard, Sgt William; Robert Duke; Robert P; S Aoki; S Jerabek; Scott Simonson; Shirey, Sgt Eric; Simmers, Keith; Spencer Nordgran; Spurlock, Kenneth; Stephen Bell; Stephen Greco; Steven Schlaseman; T Lowman; T Miller; T True; Thomas Vavoso; Tovar, SSgt Eric; (b)(6) ; USFJ; USFJ Intel; V Raphael; Valerie Makino; Vaughn, Sgt Jerrod; Walter Hokett; Wanda Ayuso; William Brysacz; Batkin, Joshua; Borchardt, Bill; Bradford, Anna; Castleman, Patrick; Coggins, Angela; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; Flory, Shirley; Franovich, Mike; Gibbs, Catina; Gilles, Nanette; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Marshall, Jane; Marshall, Michael; Mitchell, Matthew; Monninger, John; Orders, William; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Skeen, David; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Taylor, Robert; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
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**Subject:** USNRC Emergency Operations Center Status Update 070511
**Attachments:** USNRC Earthquake-Tsunami Update 070511 1200 EDT.pdf; Attachment - NRC Daily Assessment of Daiichi 070511.pdf

*********NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY**********

Good Afternoon,

Attached is the Status Update for Tuesday, July 5, 2011. **The next USNRC Status Update will be distributed at 1200 EDT on Wednesday, July 6, 2011.** Typically, the attachment to this update will only be provided on Mondays, Wednesdays, and Fridays. However, due to the Holiday yesterday, the attachment is also included.

**Please note the** NRC Headquarters response to these events has moved from the Operations Center to a core team of managers and experts. To contact any member of the team please e-mail the support team at RST01_F.Resource@nrc.gov
Thank you.

If you no longer wish to receive these emails, please reply to this message and we will remove you. Thank you.

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| Reactor Three | • core damaged and uncovered<br>• primary containment breached<br>• injecting via feed water 9.0 $m^3$/hr<br>• Reactor metal temperatures fluctuating |
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| Reactors 5 & 6 | • cold shutdown |

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  - Measurement & Analysis
- Water Management
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  - Building enclosure
- Structural Integrity of 1F4 Spent Fuel Pool

NRC Focus Areas

RST Focus

- Severe Accident Management Guidelines/Extreme Damage Mitigation Guidelines
- Post-Accident Safety Analysis/FSAR Development
- MELCOR analysis

PMT Focus

- Modify travel advisory
- Radiation Monitoring

| Adequate | Challenged | Active Failure |
|---|---|---|

## Japan News Headlines

- Genkai mayor OK's restart of N-reactors (07/05)
- TEPCO in water purification push (07/04)
- Panel: Higher utility bills on the way (07/04)
- Cooling of Fukushima Daiichi's No. 5 unit resumes after hose replaced (07/03)
- New nuke minister inspects radiation monitoring (07/03)

## Events

Stoplights published Monday, Wednesday, and Friday

**From:** Bowman, Gregory
**Sent:** Thursday, June 09, 2011 7:33 AM
**To:** Hipschman, Thomas; Marshall, Michael; Castleman, Patrick; Gilles, Nanette; Orders, William; Franovich, Mike
**Subject:** FYI - Industry's Plan for Responding to Fukushima
**Attachments:** The Way Forward 060611 (public) FinalA2.pdf; FSC Charter 060811.docx

Attached is the industry's strategic plan for responding to Fukushima. Marty asked that we pass this along for information. If you have any questions, please let me know.

**From:** Skeen, David
**Sent:** Tuesday, June 07, 2011 10:39 AM
**To:** Orders, William; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Bubar, Patrice; Nieh, Ho; Sosa, Belkys; Marshall, Michael; Hipschman, Thomas; Batkin, Joshua
**Cc:** Taylor, Robert; Andersen, James
**Subject:** FYI - English translation of Japan Report to IAEA regarding Fukushima Accident

All,

Per our discussion on this morning's status call with the Commissioner Assistants, here is the link to the English translation of Japan's report submitted to the IAEA in advance of the upcoming ministerial meeting in Vienna, scheduled for June 20 – 24.

http://www.kantei.go.jp/foreign/kan/topics/201106/iaea_houkokusho_e.html

Please let me know if you have any trouble viewing the report.

Dave
x-3484

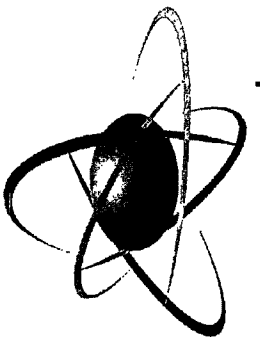
**From:** Gilles, Nanette
**Sent:** Wednesday, June 01, 2011 6:24 PM
**To:** Monninger, John
**Cc:** Marshall, Michael; Hipschman, Thomas; Sosa, Belkys
**Subject:** Nuclear and Radiation Studies Board Slides
**Attachments:** GeorgeApostolakis.ppt

John – Per our conversation – here are the slides that the Commissioner presented at the Nuclear and Radiation Studies Board Meeting last week.

Nan

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

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



U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

# Nuclear Regulatory Commission Response to Fukushima


## Commissioner George Apostolakis

## U.S. Nuclear Regulatory Commission

CmrApostolakis@nrc.gov


## Nuclear and Radiation Studies Board

## The National Academies

## May 26, 2011

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UNITED STATES NUCLEAR REGULATORY COMMISSION
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# NRC Incident Response

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

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# NRC Inspection Activities

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

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*Protecting People and the Environment*

# Inspection Results for TI 2515/183

- Inspections completed in April 2011
- The inspection reports and a summary of the findings are available on NRC's web site
- Observations "indicate a potential industry trend of failure to maintain equipment and strategies required to mitigate some design and beyond design basis events"
- However, "no functions were compromised that would have resulted in damage to the fuel elements or containment"

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*Protecting People and the Environment*

# NRC Bulletin 2011-01, "Mitigating Strategies"

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

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# Near-Term Task Force (90 days)

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

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# Task Force Areas of Focus

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

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# Task Force Current Assessment

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

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# Longer-Term Review (9 months)

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

**From:** Bradford, Anna
**Sent:** Friday, May 20, 2011 2:55 PM
**To:** Hipschman, Thomas; Marshall, Michael
**Subject:** FW: Presentation to NREP Conference
**Attachments:** NREP Presentation.pdf

Just in case you didn't get this.

Anna Bradford
Policy Advisor for Nuclear Materials
Office of Chairman Jaczko
U.S. Nuclear Regulatory Commission
301-415-1827

---

**From:** Merzke, Daniel
**Sent:** Wednesday, May 18, 2011 2:59 PM
**To:** Bradford, Anna; Thoma, John; Baggett, Steven; Tadesse, Rebecca; Kock, Andrea
**Cc:** Bubar, Patrice; Warren, Roberta
**Subject:** Presentation to NREP Conference

Staff was asked today to provide to some of the Commission offices the recent presentation given by Trish Milligan to the National Radiological Emergency Preparedness Conference, which discussed the NRC recommendation to evacuate U.S. citizens out to 50 miles away from Fukushima. The presentation is heavy on pictures. It can be also found in ADAMS, under Accession # ML111150579. Please let me know if you have any questions.

Dan

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# Nuclear Accident in Japan: NRC Early Protective Action Recommendations

## National Radiological Emergency Preparedness Conference

## April 18, 2011

Patricia A. Milligan, CHP
Senior Technical Advisor for Preparedness & Response
Office of Nuclear Security and Incident Response

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United States Nuclear Regulatory Commission
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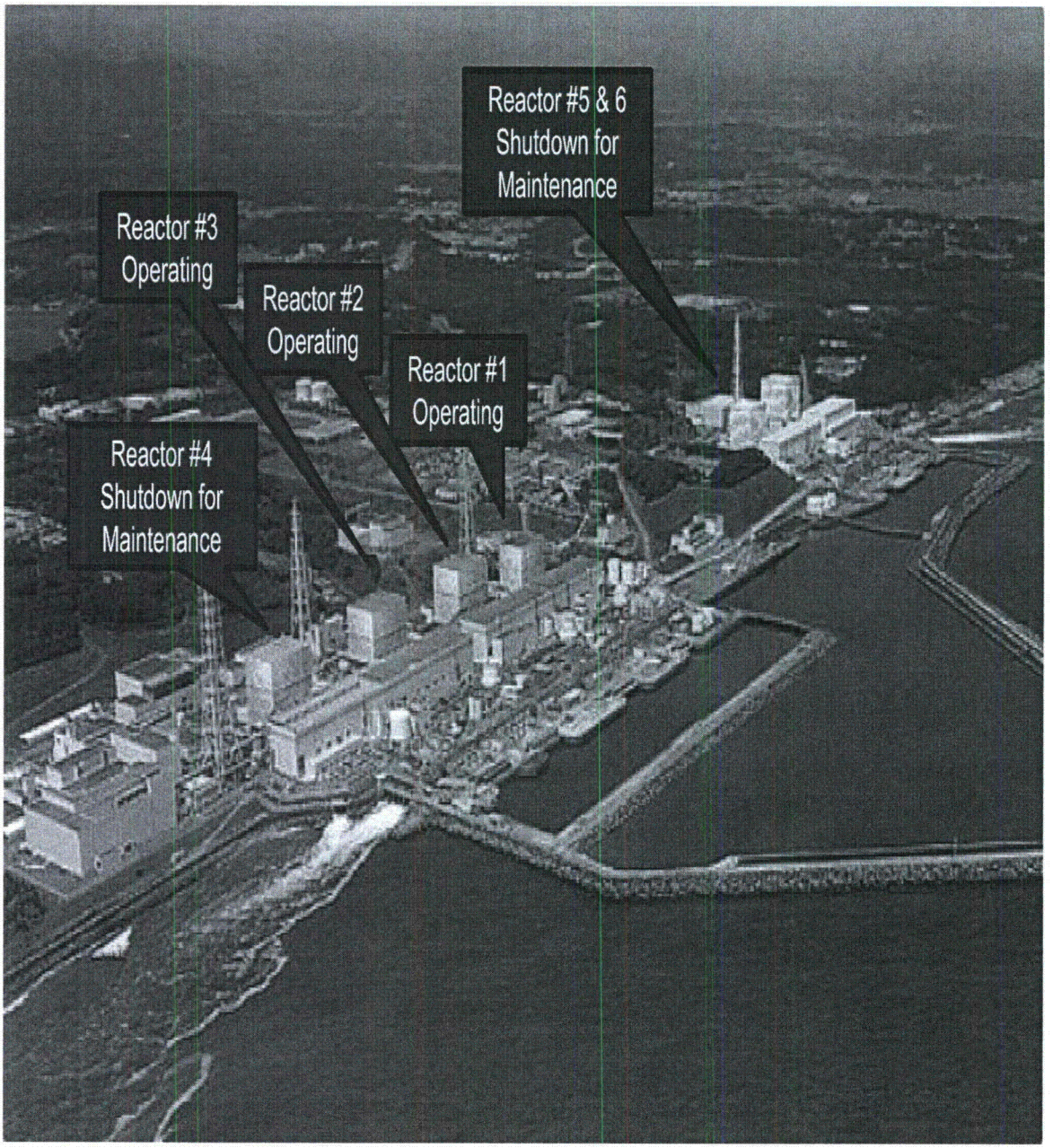
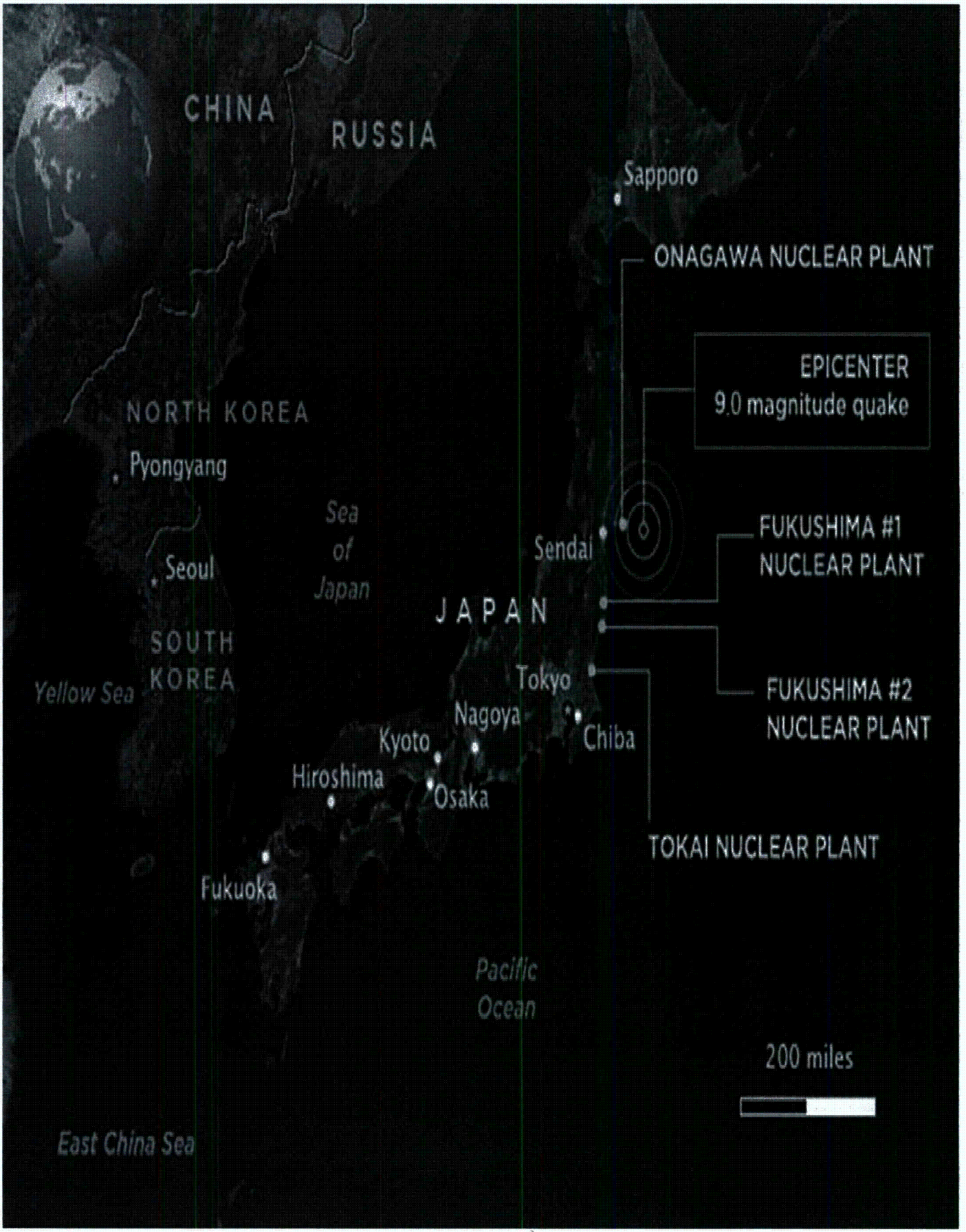
# Status of site prior to earthquake




CHINA
RUSSIA
Sapporo
ONAGAWA NUCLEAR PLANT
EPICENTER
9.0 magnitude quake
NORTH KOREA
Pyongyang
Sea
of
Japan
Sendai
FUKUSHIMA #1
NUCLEAR PLANT
Seoul
JAPAN
SOUTH
KOREA
Yellow Sea
Tokyo
FUKUSHIMA #2
NUCLEAR PLANT
Nagoya
Chiba
Kyoto
Hiroshima
Osaka
TOKAI NUCLEAR PLANT
Fukuoka
Pacific
Ocean
200 miles
East China Sea

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# NPP site post Tsunami March 11, 2011

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# Plant Response

## Earthquake

- Earthquake Caused Automatic Shutdown of 3 Operating Units
- Offsite Power Lost
- Initial indications are that Emergency Diesels were operating

## 14m Tsunami (less than 1 hour later)

- All Emergency Back-up Power Lost
- 8-10 hours later Station Batteries Depleted

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# NRC Response

- Ops Center 24/7
- Team of experts to Tokyo
  - First team deployed on March 12
  - Additional teams have been deployed
- Support to U.S. Ambassador and Japanese
- Coordinating Environmental Monitoring with DOE & EPA
- PARs

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# March 12, 2011 early in the day

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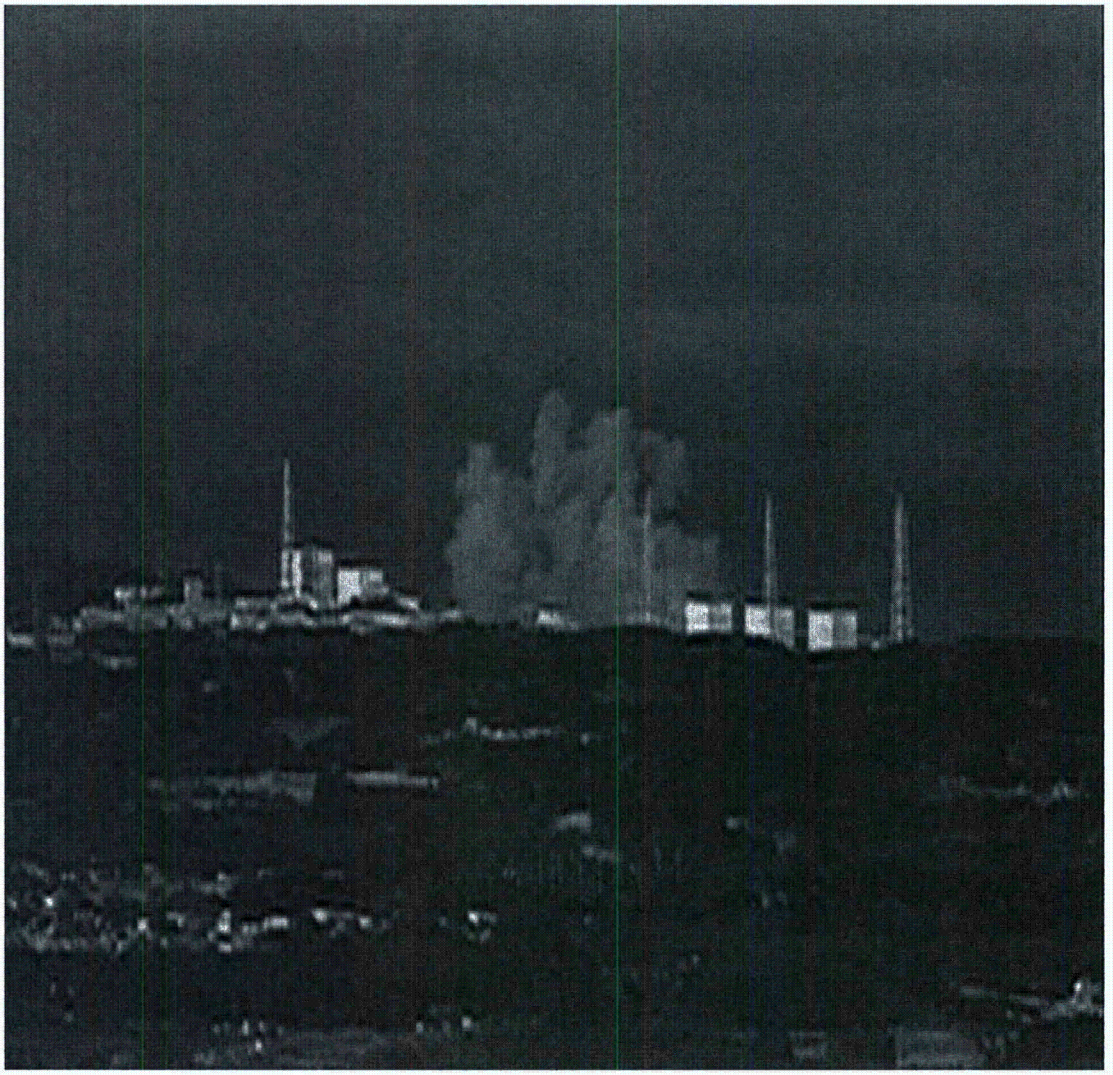
# March 12, 2011- later in the day



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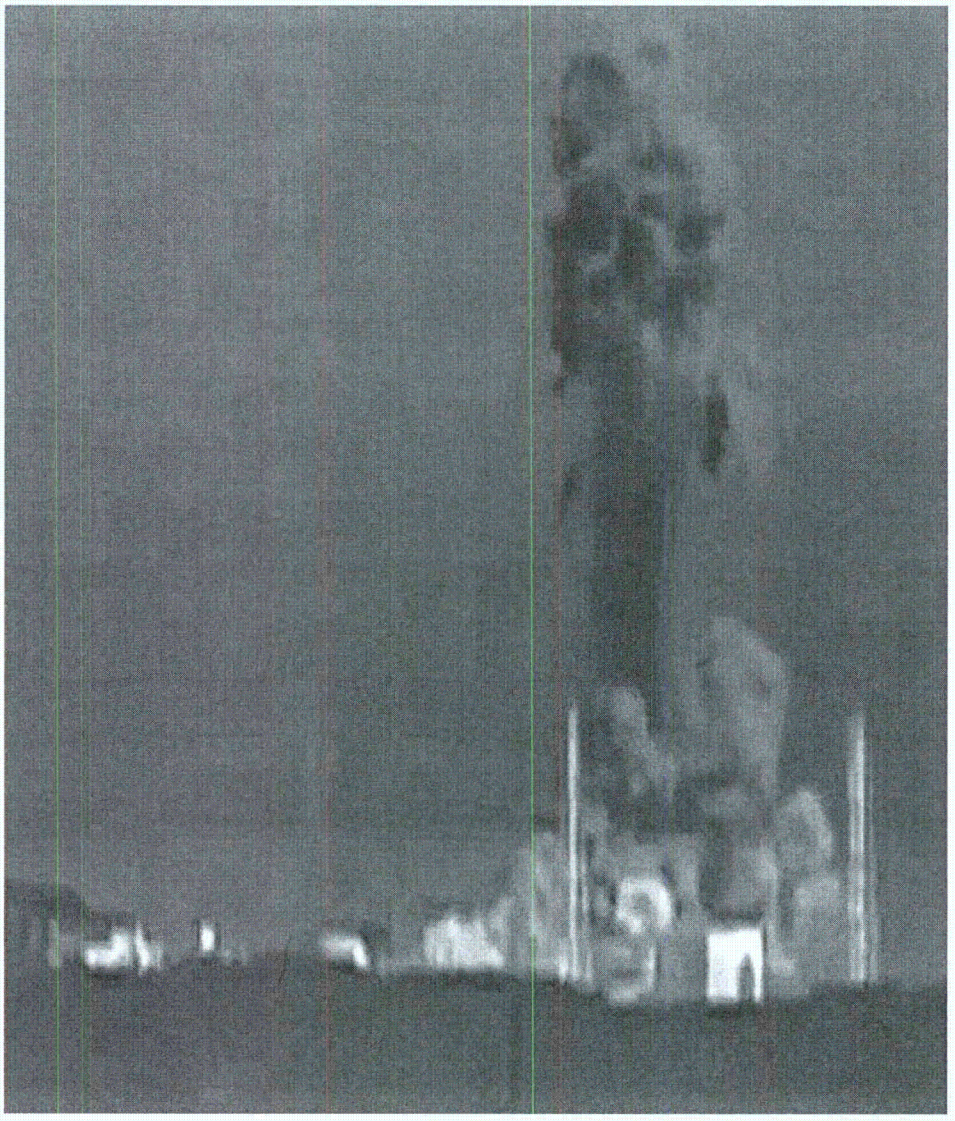
# March 14, 2011



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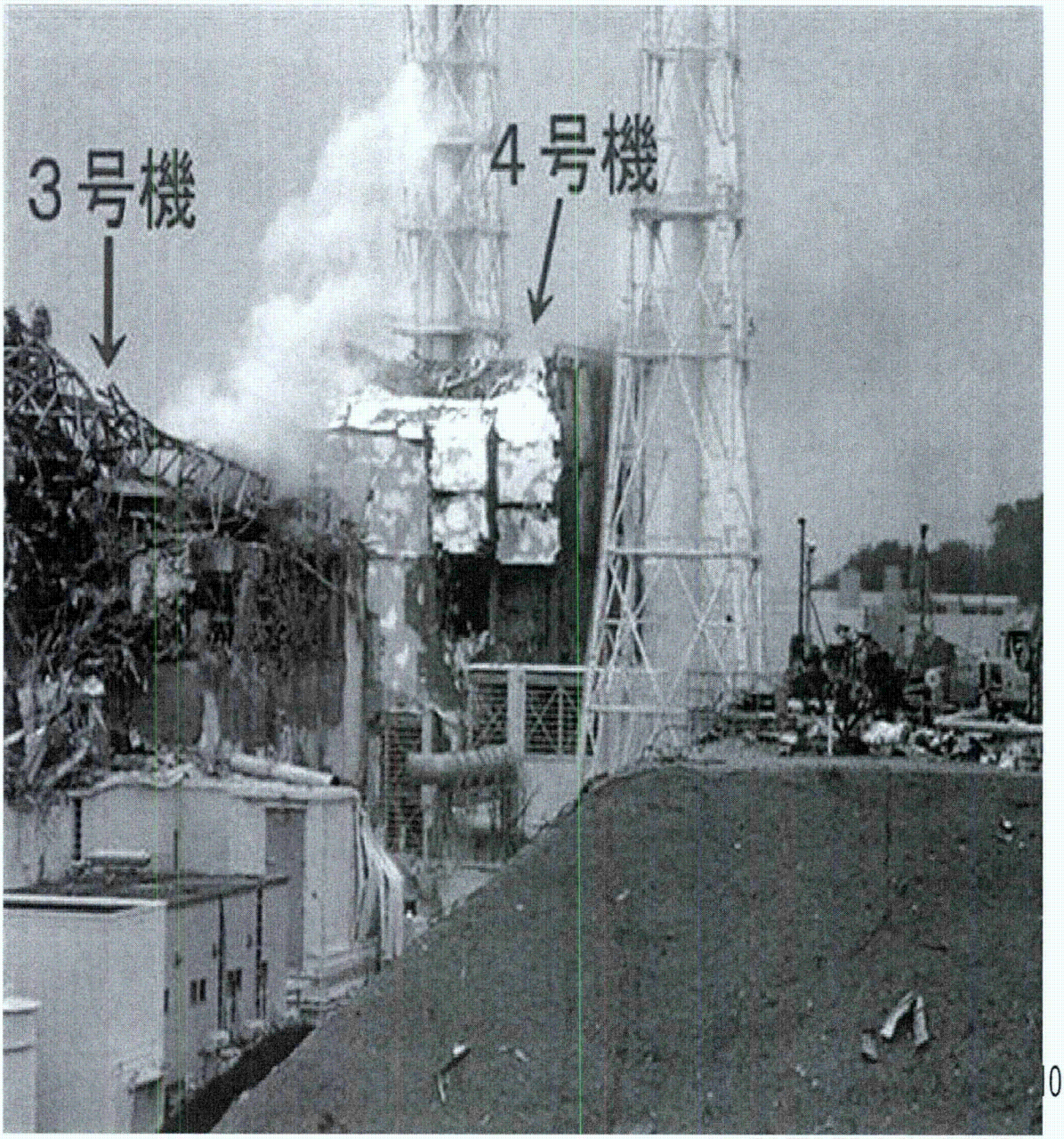
# March 15, 2011



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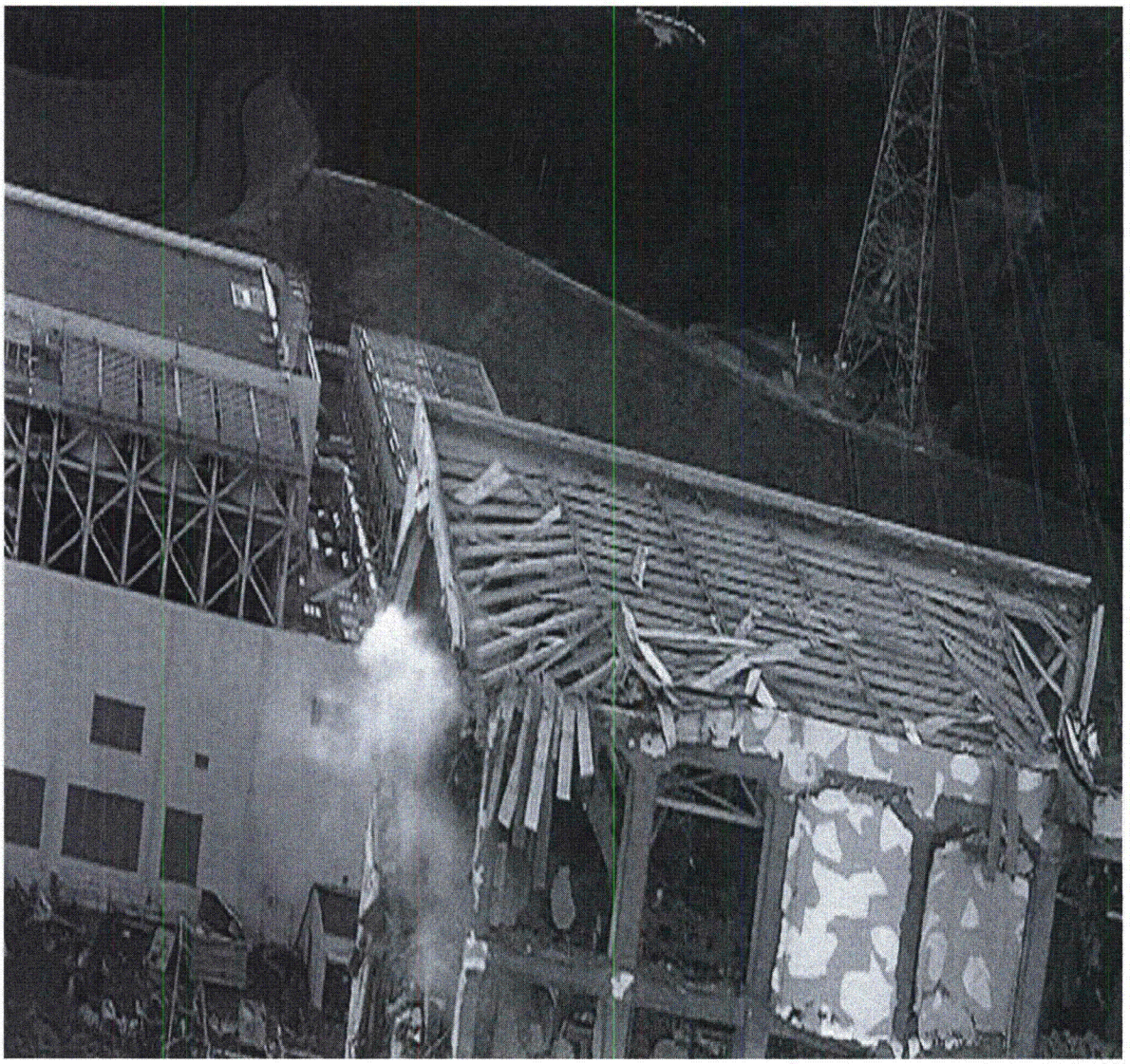
# March 16, 2011



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# Emergency Planning Zones and Protective Action Recommendations Why 50 miles?

- Limited and uncertain data was available
- Significant challenges to 3 units and at least 2 spent fuel pools on site
- Potential for large offsite release existed
- Elevated dose rates on site presented challenges to crews attempting to stabilize reactor
- Limited offsite data suggested serious damage to fuel
- Winds shifting from out to sea to land

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# Emergency Planning Zones and Protective Action Recommendations

## Why 50 miles?

- US government cannot affect the outcomes in Japan
- US government can only take actions to protect its citizens
- Evacuation recommendation to 50 miles afforded protection to US citizens in uncertain and challenging conditions

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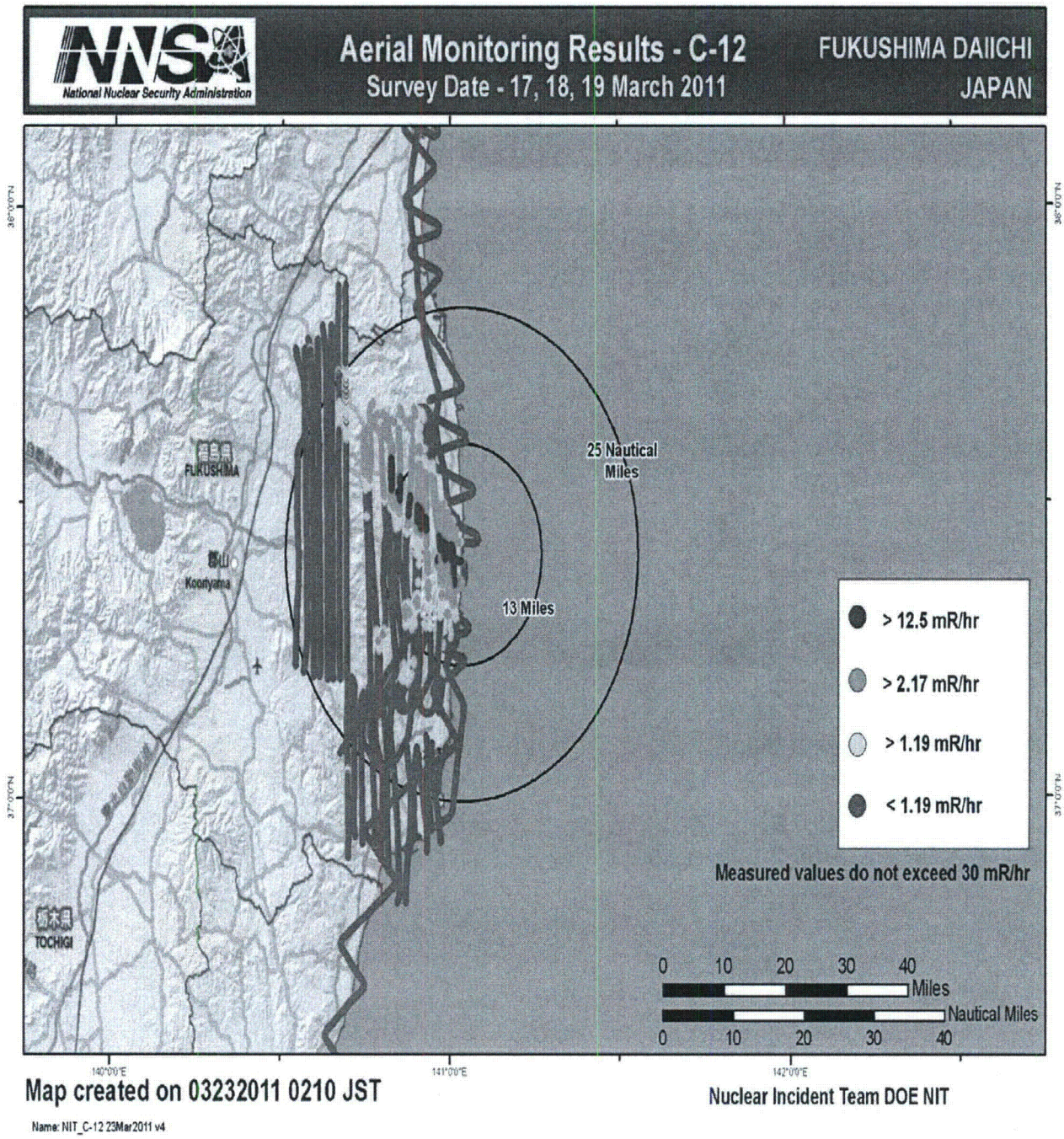

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# Emergency Planning Zones and Protective Action Recommendations

- Two emergency planning zones (EPZ) around each nuclear power plant
  - 10 mile EPZ – plume exposure planning zone
  - 50 mile EPZ – ingestion exposure planning zone

- EPZ size established:
  - to protect against most accident sequences
  - to provide a substantial basis for expansion of response efforts as needed beyond the EPZ distances

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# Basis for Emergency Planning

- What is the basis for the existing Emergency Planning Zones (EPZs) the nuclear power plants in US?
  - Emergency planning in the US is based on a range of accidents including most severe
  - Two EPZs (10/50 miles) around each NPP
  - Exact size and shape of EPZ is a result of detailed planning which includes consideration of the specific conditions at each site, unique geographical features of the area, and demographic information.

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# Domestic Considerations

- No U.S. Health Effects from radiation fall out from Fukushima
- U.S. Plants Designed for External Events
- NRC has initiated additional inspections at all U.S. Plants
- NRC conducting Near-Term and Long-Term Reviews.

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# NRC Near Term Review

- Evaluate Fukushima Daiichi Events
- Domestic Operating Reactors and Spent Fuel Pools
  - External Events
  - Station Blackout
  - Severe Accident Mitigation
  - Emergency Preparedness
  - Combustible Gas Control

- Staff will brief the Commission in public meetings on May 12 and June 16 ; final recommendations in public meeting July 19.

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# NRC Longer Term Review

- Begin as soon as NRC has sufficient technical information from the events in Japan -no later than the completion of the 90 day near term report
- Include specific information on the sequence of events and the status of equipment during the duration of the event.
- Evaluate all technical and policy issues related to the event to identify potential research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be conducted by NRC.
- Evaluate potential interagency issues such as emergency preparedness.
- Applicability of the lessons learned to non-operating reactor and non-reactor facilities should also be explored.
- Provide a report with recommendations, as appropriate, to the Commission within six months from the start of the evaluation for Commission policy direction.

**From:** Monninger, John
**Sent:** Friday, May 20, 2011 7:07 AM
**To:** Batkin, Joshua; Loyd, Susan; Coggins, Angela; Hipschman, Thomas; Marshall, Michael
**Subject:** RE:

Yes, okay. Overall, the strategic approach discussed in addressing the Fukishima accident is the same that we are pursuing.

It is probably an overstatement to say "The United States has an effective, multifaceted regulatory regime that has already addressed many of the mistakes and weaknesses that Fukushima seems to have exposed, including earthquake and tsunami preparedness and the modification of older reactors to meet new and evolving safety standards." Older reactors do at times meet new and evolving safety standards, but in general, I would say they stick to their original licensing basis that is 1960's/1970's era safety standards. We have some successes in updating older designs, but they are limited. New reactors are fully evaluated against the new safety standards. This is same issue brought up in the IRRS about conducting periodic reviews (10 years) and bringing the plants up to the latest standards.

There is a strong counter argument to "Though effective in promoting safe operations, the American system can be overly bureaucratic and suffers from federal micromanagement. Many industry-driven safety advances, such as those engineered into new reactor designs, must traverse the federal bureaucracy before they can be brought to market." Look at the fundamental issues being raised on the AP1000 at this late stage of licensing. The issues clearly impact the new safety systems that industry is bring, but it is through the federal review that those deficiencies were identified.

---

**From:** Batkin, Joshua
**Sent:** Thursday, May 19, 2011 6:48 PM
**To:** Loyd, Susan; Coggins, Angela; Monninger, John
**Cc:** Brenner, Eliot; Hayden, Elizabeth
**Subject:** Re:

Not bad. I could have done without the gratuitous 'federal micromanagement" remark but I like 'trust but modify'.

Joshua C. Batkin
Chief of Staff
Chairman Gregory B. Jaczko
(301) 415-1820

---

**From:** Loyd, Susan
**To:** Batkin, Joshua; Coggins, Angela; Monninger, John
**Cc:** Brenner, Eliot; Hayden, Elizabeth
**Sent:** Thu May 19 16:52:14 2011
**Subject:**

Josh:
Your buddy, Jack Spencer, now is a semi-fan of the NRC!

http://www.heritage.org/Research/Reports/2011/05/US-Nuclear-Policy-After-Fukushima-Trust-But-Modify

Susan K. Loyd
Communications Director
Office of the Chairman
U.S. Nuclear Regulatory Commission
Tele: 301-415-1838
Susan.Loyd@nrc.gov

**From:** Hart, Ken
**Sent:** Wednesday, May 18, 2011 3:53 PM
**To:** Skeen, David; Taylor, Robert
**Cc:** Baggett, Steven; Bavol, Rochelle; Castleman, Patrick; Franovich, Mike; Gilles, Nanette; Hart, Ken; Hipschman, Thomas; Batkin, Joshua; Laufer, Richard; Lisann, Elizabeth; Marshall, Michael; Orders, William; Sharkey, Jeffry; Shea, Pamela; Thoma, John; Vietti-Cook, Annette
**Subject:** Weekly Updates on Japan Support Activities

The Reactor TAs decided that a one briefing per week would be sufficient and would like to hold it on **Tuesday mornings at 10:00 a.m.** They would like to retain the teleconference format so they can access the briefing from any location.

Thanks, Ken Hart

**From:** Greenleaf, Toni <TGreenle@nas.edu>
**Sent:** Monday, May 16, 2011 11:23 AM
**To:** Yates, James; Wingo, Erin; Llanos, Laura
**Cc:** Whetstone, Shauntee
**Subject:** Public Agenda for the Nuclear and Radiation Studies Board Meeting, May 26, 2011
**Attachments:** NRSB public agenda, May 16, 2011 draft.pdf

To ALL INTERESTED PARTIES:

along an agenda (attached and listed below) for the May 26 NRSB meeting for your information. The afternoon presentations will concentrate on the recent ***Fukushima Daiichi Nuclear Accident***.

Space is limited so please let us know if you plan to attend, RSVP to nrsb@nas.edu or reply to this email.

Thank you for your continued interest in the activities of the Nuclear and Radiation Studies Board.

Website: www.nas.edu/nrsb

*Toni Greenleaf*
Nuclear and Radiation Studies Board
202/334-3066
Fax: 202/334-3077

## NUCLEAR AND RADIATION STUDIES BOARD
## Eighteenth Meeting: May 26-27, 2011
**Keck Center**
**500 5th Street, NW, Washington, DC 20001**

May 16, 2011 Draft

**Thursday, May 26, 2011**

## OPEN SESSION
## KECK 100

10:50 am **Call to Order and Welcome**
Jay Davis, NRSB Chair

n **Safety and effectiveness of backscatter imaging for security screenings at Airports**
Peter Rez, Department of Physics, Arizona State University (Confirmed) (via videoconference from London)

11:20 am Questions and discussion

**Adjourn morning open session**

**:h available in Keck Refectory (3rd floor)**

se report back to Keck 100 by 12:25 pm

## Fukushima Daiichi Nuclear Accident

**Call to order and welcome**
s, NRSB chair

**Overview of the Fukushima Daiichi Accident**
imura, Vice Dean of School of Engineering, Associate Member of Science Council of Japan, Department of Nuclear Engineering and Management, University of Tokyo (Confirmed)

stions and discussion

**spheric dispersion of radioactive releases from the Fukushima accident**
jiyama, Program Leader, National Atmospheric Release Advisory Center, Lawrence Livermore National Laboratory (Invited)

tions and discussion

**ntial worker and public health impacts from the Fukushima accident**
uchi, Deputy Branch Chief, and Steve Simon, Staff Scientist, Radiation Epidemiology Branch, National Cancer Institute (Confirmed)

tions and discussion

**ear Regulatory Commission's response to the Fukushima accident**
postolakis, Member, U.S. Nuclear Regulatory Commission (Confirmed)

tions and discussion

**ear industry's response to the Fukushima accident**
el, President, Nuclear Energy Institute (Confirmed)

tions and discussion

**ukushima nuclear disaster and its implications for nuclear power safety**
ochran and Matt McKinzie, Senior Scientists, Natural Resources Defense Council (Confirmed)

uestions and discussion

**Fukushima accident and implications for nuclear power safety**
an, Senior Scientist, Global Security Program, Union of Concerned Scientists (Confirmed)

uestions and discussion

**pportunity for public comment**

**djourn the afternoon open session**

THE NATIONAL ACADEMIES
*Advisers to the Nation on Science, Engineering, and Medicine*

**NUCLEAR AND RADIATION STUDIES BOARD**
**Eighteenth Meeting: May 26-27, 2011**
**Keck Center**
**500 5th Street, NW, Washington, DC 20001**

May 16, 2011 Draft

**Thursday, May 26, 2011**

## OPEN SESSION
## KECK 100

| | |
|---|---|
| 10:50 am | **Call to Order and Welcome**<br>Jay Davis, NRSB Chair |
| 10:55 am | **Safety and effectiveness of backscatter imaging for security screenings at Airports**<br>Peter Rez, Department of Physics, Arizona State University (Confirmed) (via videoconference from London) |
| 11:20 am | Questions and discussion |
| 11:30 pm | **Adjourn morning open session** |
| | **Lunch available in Keck Refectory (3rd floor)** |
| | **Please report back to Keck 100 by 12:25 pm** |

## Fukushima Daiichi Nuclear Accident

| | |
|---|---|
| 12:30 pm | **Call to order and welcome**<br>Jay Davis, NRSB chair |
| 12:35 pm | **Overview of the Fukushima Daiichi Accident**<br>Naoto Sekimura, Vice Dean of School of Engineering, Associate Member of Science Council of Japan, Department of Nuclear Engineering and Management, University of Tokyo (Confirmed) |
| 1:15 pm | Questions and discussion |

| | |
|---|---|
| 1:25 pm | **Atmospheric dispersion of radioactive releases from the Fukushima accident**<br>Gayle Sugiyama, Program Leader, National Atmospheric Release Advisory Center, Lawrence Livermore National Laboratory (Invited) |
| 1:50 pm | Questions and discussion |
| 2:00 pm | **Potential worker and public health impacts from the Fukushima accident**<br>Kiyo Mabuchi, Deputy Branch Chief, and Steve Simon, Staff Scientist, Radiation Epidemiology Branch, National Cancer Institute (Confirmed) |
| 2:25 pm | Questions and discussion |
| 2:35 pm | **Nuclear Regulatory Commission's response to the Fukushima accident**<br>George Apostolakis, Member, U.S. Nuclear Regulatory Commission (Confirmed) |
| 3:00 pm | Questions and discussion |
| 3:10 pm | Break |
| 3:25 pm | **Nuclear industry's response to the Fukushima accident**<br>Marv Fertel, President, Nuclear Energy Institute (Confirmed) |
| 3:50 pm | Questions and discussion |
| 4:00 pm | **Fukushima nuclear disaster and its implications for nuclear power safety**<br>Tom Cochran and Matt McKinzie, Senior Scientists, Natural Resources Defense Council (Confirmed) |
| 4:25 pm | Questions and discussion |
| 4:35 pm | **Fukushima accident and implications for nuclear power safety**<br>Ed Lyman, Senior Scientist, Global Security Program, Union of Concerned Scientists (Confirmed) |
| 5:00 pm | Questions and discussion |
| 5:10 pm | **Opportunity for public comment** |
| 5:30 pm | **Adjourn the afternoon open session** |

**From:** Batkin, Joshua
**Sent:** Friday, May 13, 2011 6:18 PM
**To:** Nieh, Ho; Sharkey, Jeffry; Sosa, Belkys; Bubar, Patrice
**Cc:** Coggins, Angela
**Subject:** Japan heads up

Just wanted to personally make sure you were aware of a minor change to the state department's travel advisory for fukushima they will announce by monday. After an interagency concurrence process that included us, State will state that it is safe to transit a rail line and highway within the exclusion zone. State will link to DOE dose data on their website. No press release from us. Let me know if you have any questions. Thanks, Josh

Joshua C. Batkin
Chief of Staff
Chairman Gregory B. Jaczko
(301) 415-1820

**From:** Monninger, John
**Sent:** Wednesday, May 11, 2011 11:03 AM
**To:** Pace, Patti
**Cc:** Coggins, Angela; Batkin, Joshua; Hipschman, Thomas; Marshall, Michael
**Subject:** Video Link for Chairman

Patti,

During the call with the NRC Japan site team today, the site team mentioned a video clip of the Unit 3 spent fuel pool. The Chairman is interested in viewing the video. The link to the video is below. Can you please arrange for him to view the video.

http://www.tepco.co.jp/en/news/110311/images/110510_1.zip

Thanks,
John M.

**From:** LIA08 Hoc
**Sent:** Thursday, May 05, 2011 12:47 PM
**Cc:** LIA08 Hoc
**Subject:** USNRC Emergency Operations Center Status Update 05032011 1200 EDT
**Attachments:** USNRC Earthquake-Tsunami Update 050511 1200 EDT.docx

*********NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY**********

Good Afternoon,

Attached is the Status Update for May 5, 2011. **The next USNRC Status Update will be distributed at 1200 EDT on May 6, 2011.**

Thank You

*********NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY**********

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

**From:** LIA08 Hoc
**Sent:** Wednesday, May 04, 2011 1:10 PM
**Cc:** LIA08 Hoc
**Subject:** USNRC Emergency Operations Center Status Update 05032011 1200 EDT Revision 01
**Attachments:** USNRC Earthquake-Tsunami Update 050411 Revision 01 1200 EDT.docx

~~*******NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY********~~

Good Afternoon,

Attached is the Status Update for May 4, 2011. **The next USNRC Status Update will be distributed at 1200 EDT on May 5, 2011.**
**Revision 01**

Thank You

*******NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY********

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

**From:** LIA08 Hoc
**Sent:** Wednesday, May 04, 2011 12:50 PM
**Cc:** LIA08 Hoc
**Subject:** USNRC Emergency Operations Center Status Update 05032011 1200 EDT
**Attachments:** USNRC Earthquake-Tsunami Update 050411 Revision 1200 EDT.docx

*********NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY**********

Good Afternoon,

Attached is the Status Update for May 4, 2011. **The next USNRC Status Update will be distributed at 1200 EDT on May 5, 2011.**

Thank You

*********NOTE: THE ATTACHED IS FOR OFFICIAL USE ONLY**********

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

**From:** Trocine, Leigh
**Sent:** Tuesday, May 03, 2011 11:23 AM
**To:** Baggett, Steven; Marshall, Michael
**Cc:** Sosa, Belkys; Hipschman, Thomas
**Subject:** FW: Response to Question on Seismic Design for Fukushima Daiichi

Hi Steve and Michael,

Please see below for Belkys and Tom.

Cheers,
Leigh

---

**From:** Trocine, Leigh
**Sent:** Tuesday, May 03, 2011 11:20 AM
**To:** Snodderly, Michael
**Cc:** Gilles, Nanette; Franovich, Mike; Castleman, Patrick; Orders, William; Marshall, Michael; Hipschman, Thomas; Kammerer, Annie; Sosa, Belkys; Andersen, James
**Subject:** RE: Response to Question on Seismic Design for Fukushima Daiichi

Hi Mike,

(b)(5)

Cheers,
Leigh

---

**From:** Snodderly, Michael
**Sent:** Friday, April 22, 2011 4:29 PM
**To:** Bowman, Gregory
**Cc:** Gilles, Nanette; Franovich, Mike; Castleman, Patrick; Orders, William; Marshall, Michael; Hipschman, Thomas; Kammerer, Annie; Sosa, Belkys
**Subject:** Seismic Design for Fukushima Daiichi

Greg,

(b)(5)

Thanks,

Mike Snodderly
Technical Assistant for Reactors
to Commissoner Apostolakis
U. S. Nuclear Regulatory Commission

Phone: 301-415-2241
Email: michael.snodderly@nrc.gov

**From:** LIA08 Hoc
**Sent:** Tuesday, May 03, 2011 11:20 AM
**Cc:** LIA08 Hoc
**Subject:** USNRC Emergency Operations Center Status Update 05032011 1200 EDT
**Attachments:** USNRC Earthquake-Tsunami Update 050311 Revision 1200 EDT.pdf

*********NOTE: THE ATTACHED IS FOR OFFICAL USE ONLY**********

Good Afternoon,

Attached is the Status Update for Tuesday, May 3, 2011. **The next USNRC Status Update will be distributed at 1200 EDT on Tuesday, May 4, 2011.**

Thank You

*********NOTE: THE ATTACHED IS FOR OFFICAL USE ONLY**********

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

**From:** LIA08 Hoc
**Sent:** Monday, May 02, 2011 12:50 PM
**Cc:** LIA08 Hoc
**Subject:** USNRC Emergency Operations Center Status Update 05022011 1200 EDT
**Attachments:** USNRC Earthquake-Tsunami Update 050211 Revision 1200 EDT.docx

*********NOTE: THE ATTACHED IS FOR OFFICAL USE ONLY**********

Good Afternoon,

Attached is the Status Update for Monday, May 2, 2011. **The next USNRC Status Update will be distributed at 1200 EDT on Tuesday, May 3, 2011.**

Thank You

*********NOTE: THE ATTACHED IS FOR OFFICAL USE ONLY**********

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

Attachment Tepco Presentation April 18.pdf(1045060 bytes ) cannot be converted to PDF format.

**From:** Bradford, Anna
**Sent:** Friday, April 22, 2011 2:33 PM
**To:** Hipschman, Thomas; Marshall, Michael
**Subject:** FW: Source Term Inquiry Follow-up
**Attachments:** Re: Japan source term information

FYI, in case you didn't get this.

Anna Bradford
Policy Advisor for Nuclear Materials
Office of Chairman Jaczko
U.S. Nuclear Regulatory Commission
301-415-1827

---

**From:** Hoc, PMT12
**Sent:** Friday, April 22, 2011 12:58 PM
**To:** Castleman, Patrick; Baggett, Steven; Orders, William; Snodderly, Michael; Kock, Andrea; Bradford, Anna; Batkin, Joshua; Monninger, John
**Cc:** Kokajko, Lawrence; OST01 HOC; LIA08 Hoc; RST01 Hoc; Watson, Bruce; PMT_japan Resource
**Subject:** Source Term Inquiry Follow-up

On 4/21, Commission TAs inquired if any action is being taken to modify the source term. As per a message later that same day (attached), NARAC has been asked to perform calculations based on updated release rates re-created from the accident.

V/r,

Kimberly Gambone
PMT/PAAD

**From:** Monninger, John
**Sent:** Friday, April 22, 2011 12:05 PM
**To:** Hipschman, Thomas
**Cc:** Coggins, Angela; Batkin, Joshua; Marshall, Michael
**Subject:** Fukushima Video

Tom,

When you have a moment, please look at the video of the inside of the reactor building at the Fukushima site shot by a robot. Overall, it looks like a bunch of the MCCs are opened up and some debris on the floor. Of interest to me, is the video (8 minute) between 1:45 and 2:20 showing what appears to be something bubbling on the reactor building floor. Can you also see the bubbling from below or is it dripping from above? Any thoughts? My thought is that it is bubbling from below. Maybe air coming through the floor from lower levels of the reactor building being filled with water? But the lower levels are not air tight, so it would seem strange for air to be bubbling through the floor. I don't see any steam, so it is hard to think that it is something boiling. I'm assuming it is a grade level floor for the reactor building, because I don't believe they would have readily available access to other floors to get the robots too. Anything else you can discern from the video. Any potential shots of primary containment/drywell? The 2nd video (4 minute) towards the end also appears to show something towards the end on the left side looking like water dripping from above.

http://news.cnet.com/8301-17938_105-20055952-1.html

Thanks,
John M.

**From:** Bradford, Anna
**Sent:** Friday, April 15, 2011 8:38 AM
**To:** Monninger, John; Hipschman, Thomas; Marshall, Michael
**Subject:** FW: Global Assessment Slides (Draft)
**Attachments:** JapenGlobalAssessmentApril15 (2).pptx

FYI.

Anna Bradford
Policy Advisor for Nuclear Materials
Office of Chairman Jaczko
U.S. Nuclear Regulatory Commission
301-415-1827

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**From:** Merzke, Daniel
**Sent:** Friday, April 15, 2011 8:37 AM
**To:** Bradford, Anna; Thoma, John; Baggett, Steven; Tadesse, Rebecca; Kock, Andrea
**Cc:** Vietti-Cook, Annette; Muessle, Mary; Andersen, James
**Subject:** Global Assessment Slides (Draft)

I'm forwarding per an earlier request this week the latest **draft** slides of the Global Assessment. I have not seen an associated paper on the subject; if I find it, I'll forward it to you.

Dan

# NRC INTERIM COMPREHENSIVE ASSESSMENT of FUKUSHIMA EVENT

# Background

- Consortium of U.S. nuclear organizations completed assessment
  - NRC; Department of Energy; Naval Reactors; Institute of Nuclear Power Operations; Electric Power Research Institute; General Electric
- Collaborated to complete technical assessments for safety issues for reactors and spent fuel pools
- All major technical assessments completed
- Provided results to TEPCO and NISA

# Assessment Conclusions

- U.S. Protective Action decisions remain conservative through all scenarios
  - Tokyo is not seriously threatened
- Unknown Ocean impacts
- Active radiation releases ongoing
- Accident conditions static but fragile
- Mitigating features temporary and highly unconventional

# Assessment of Conditions

- Fuel Damage estimates: U-1 67%; U-2 44%; U-3 30% (est.)
- Reliance on steam cooling for reactors
- Time to react on a loss of injection is short – less than 10 hours for Unit 1
- Current situation results in a 1-10 to 1-100 probability of release
- Probability driven by seismic events without diversity or redundancy of injection system
- Can get 1-100,000 probability with training & preplanning of fire equipment and diverse & redundant injection system
- Containment flooding remains primary suggestion – especially for Units 1 & 3
- Flooding reduces consequences by one-to-two orders of magnitude

# Next Steps

- Feed and bleed assessment recommends more actions to mitigate additional events
  - Diversity and redundancy in feeding system
  - Automation of Giraffes and feeding systems
  - Additional feeding system injection points
  - Additional venting system

- Stability requires more actions
  - Completing actions to Phase 1 and Phase 2 stability
    - For example - decay heat removal system

| | |
|---|---|
| **From:** | Franovich, Mike |
| **Sent:** | Thursday, April 14, 2011 7:21 PM |
| **To:** | Snodderly, Michael; Castleman, Patrick; Orders, William; Hipschman, Thomas; Marshall, Michael |
| **Subject:** | NISA-JNES slides |
| **Attachments:** | NISA-JNES-Fukushima Status 4-4-11.pdf |

In case you have not seen these slides, may be of interest to you and your principals. Note Unit 1 had soaked batteries (presumably this killed HPCI control). Also note issues with the isolation condenser.

# The 2011 off the Pacific coast of Tohoku Pacific Earthquake and the seismic damage to the NPPs

4th April, 2011

Nuclear and Industrial Safety Agency (NISA)
Japan Nuclear Energy Safety Organization (JNES)

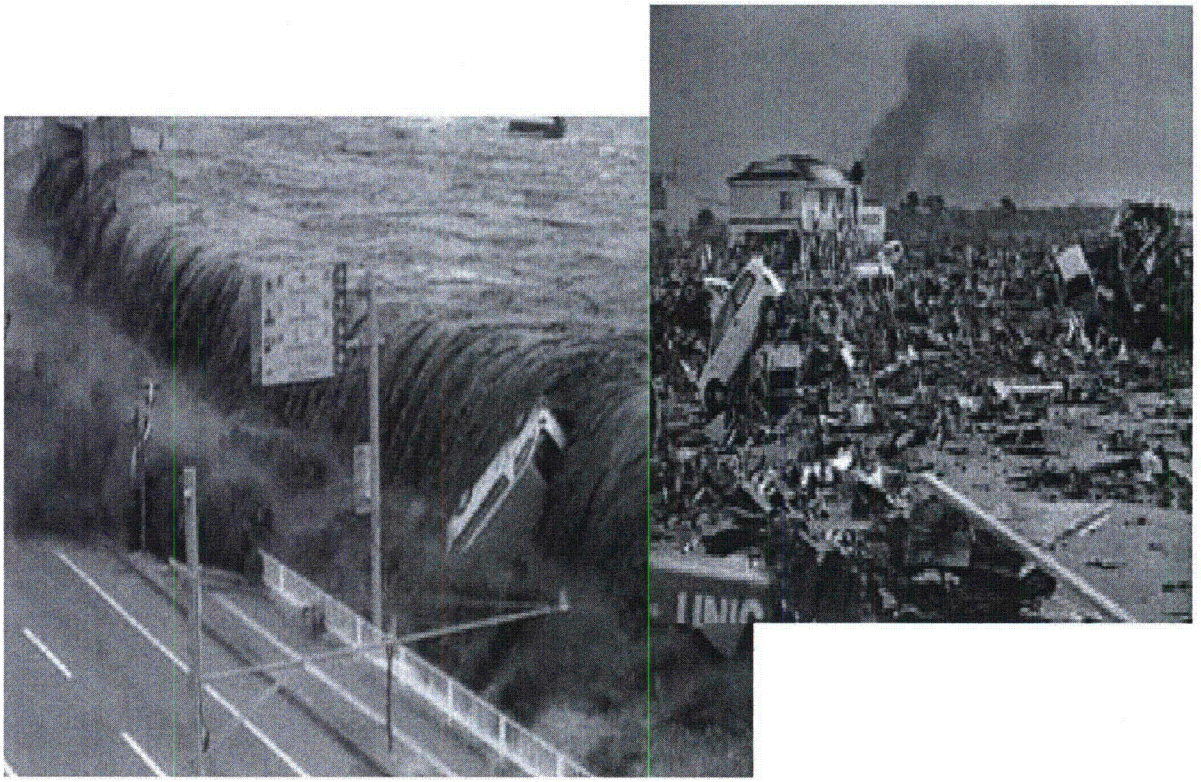
Japan

# Contents

1. Outline of earthquake and nuclear reactors ····· 2
2. Outline of Fukushima Dai-ichi NPS ····· 7
3. Report concerning incidents at Unit1 through 6 in the Fukushima Dai-ichi NPS ····· 10
4. Report concerning incidents at spent fuel pools in the Fukushima Dai-ichi NPS ····· 33
5. Action taken by the government ····· 41
6. Current situation on resident evacuation and radiation exposure ····· 47
7. Implementation status of radiation monitoring ····· 54
8. Transmission of information to overseas ····· 71
9. Remarks ····· 74

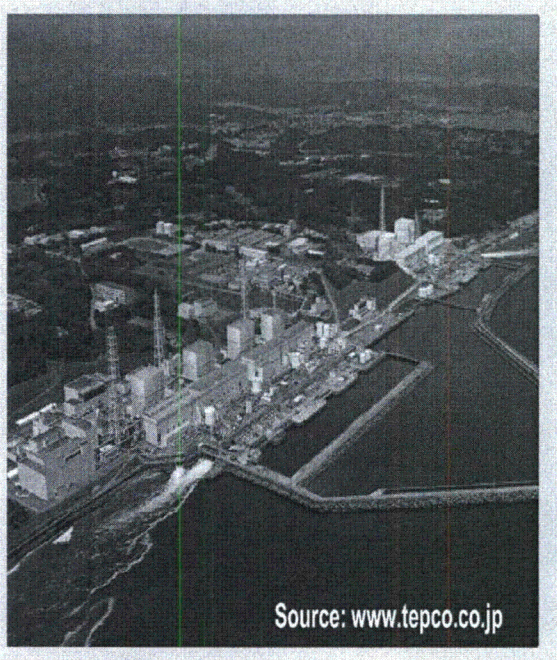
Note: Some date in this material may be incorrect. Especially, all the plant parameters were lost during some period in the accident and some parameters are apparently inconsistent among them.

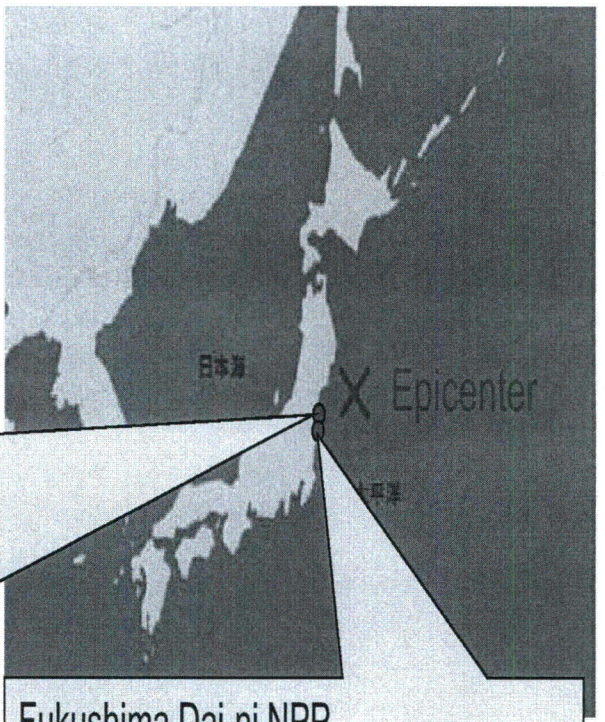
# 1. Outline of earthquake and nuclear reactors



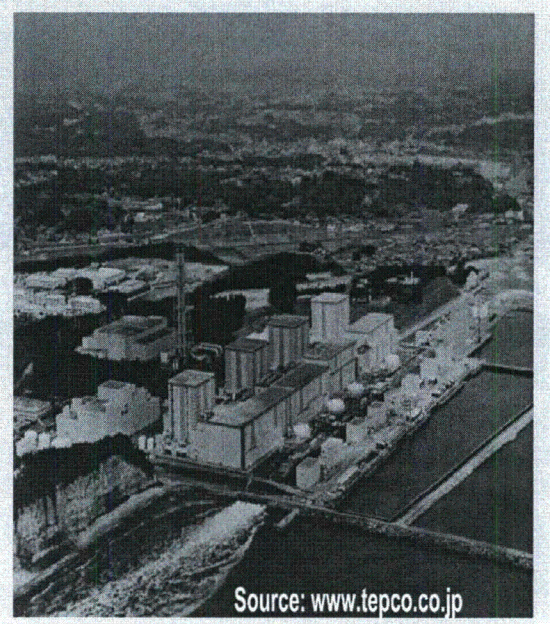
# 1-1. 2011 off Tohoku Pacific Earthquake

Fukushima Dai-ichi NPP




Fukushima Dai-ni NPP



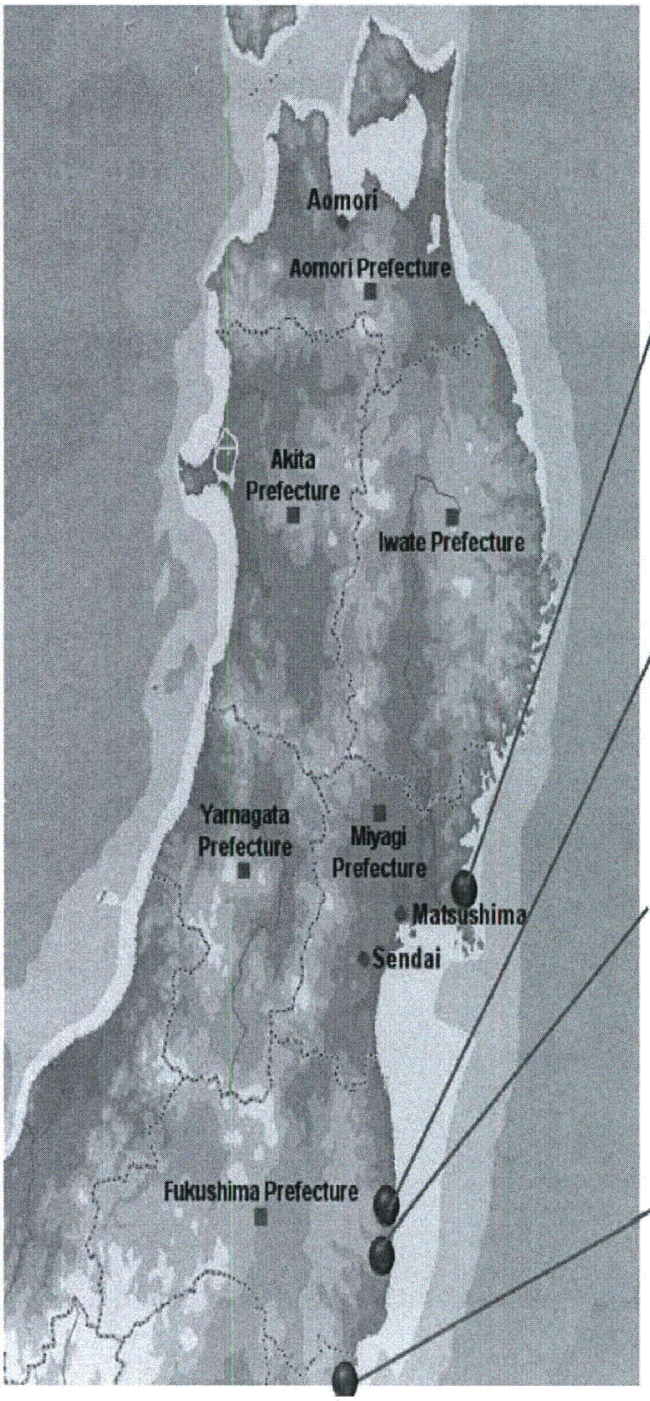

- Occurred 14:46 March 11, 2011
- Magnitude:9.0 Mw
- Epicenter location: 38° 6"N and 142° 51"E, and 24km in depth
- It is said that the height of tsunami attacked Fukushima NPP was more than 14m

# 1-2. Tsunami after the earthquake

- East coast of northern area in the main island of Japan is seriously damaged
- As of April 4, 12,175 people are dead and 15,489 people are missing

# 1-3. Nuclear reactors near epicenter of the earthquake

## Location of the Nuclear Installations




Onagawa
- Unit1: 524 MW, 1984-
- Unit2: 825 MW, 1995-
- Unit3: 825 MW, 2002-

Fukushima Ⅰ
- Unit1: 460 MW, 1971-
- Unit2: 784 MW, 1974-
- Unit3: 784 MW, 1976-
- Unit4: 784 MW, 1978-
- Unit5: 784 MW, 1978-
- Unit6: 1,100 MW, 1979-

Fukushima Ⅱ
- Unit1: 1,100 MW, 1982-
- Unit2: 1,100 MW, 1984-
- Unit3: 1,100 MW, 1985-
- Unit4: 1,100 MW, 1987-

Tokai Ⅱ (1,100 MW, 1978-)

# 1-4. Automatic shut-down of nuclear reactors

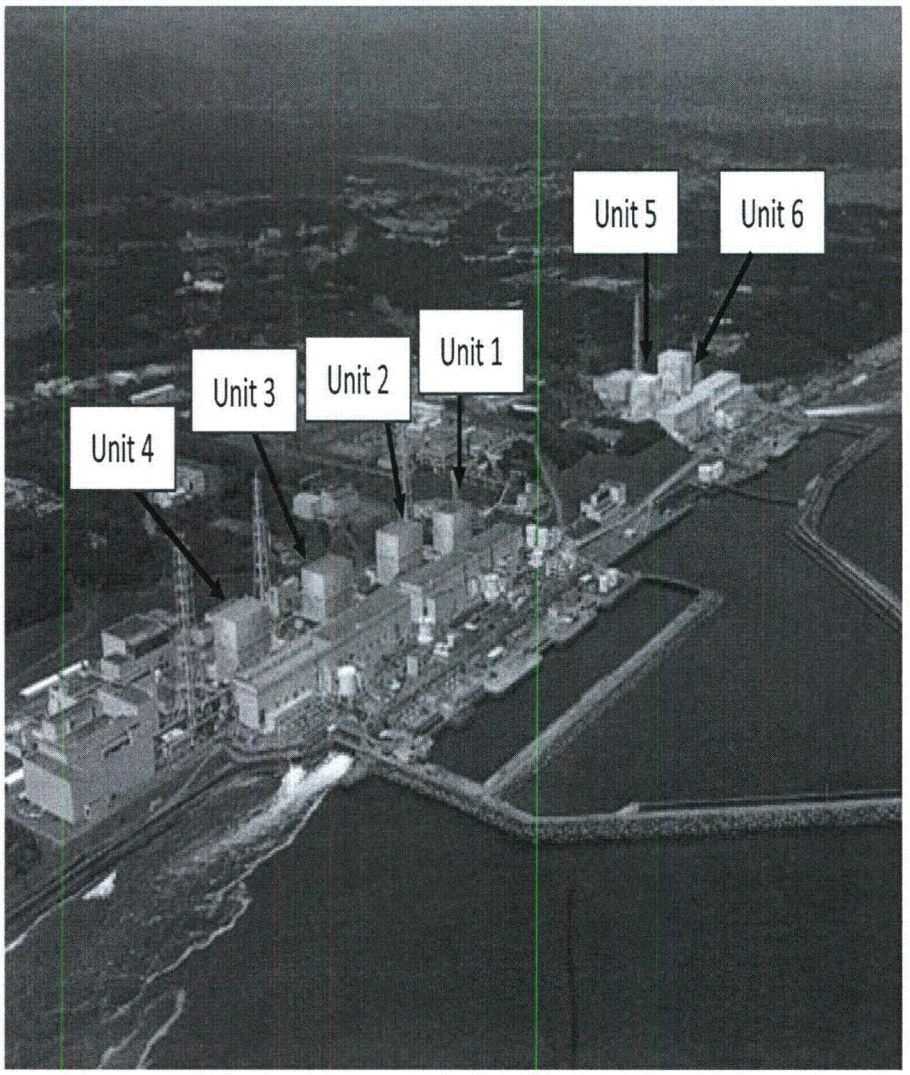
- **11 reactors were automatically shut-down**
  - Onagawa Unit 1,2,3
  - Fukushima Dai-ichi (I) Unit 1,2,3
  - Fukushima-Dai-ni (II) Unit 1,2,3,4
  - Tokai Dai-ni (II)

- **3 reactors were under periodic inspection**
  - Fukushima Dai-ichi (I) Unit 4,5,6

-After the automatic shut-down, the Unit 1-3 at Onagawa Nuclear Power Station, the Unit 3 at Fukushima II Nuclear Power Station, and the Unit at Tokai II Nuclear Power Station have been cold shut down safely.

-As for the unit 1,2,4 at Fukushima II Nuclear Power Station, the operator of the station reported NISA nuclear emergency situation because the temperature of the suppression pools became more than 100 °C, but afterward the three units have been cold shut down.

# 2. Outline of Fukushima Dai-ichi NPS

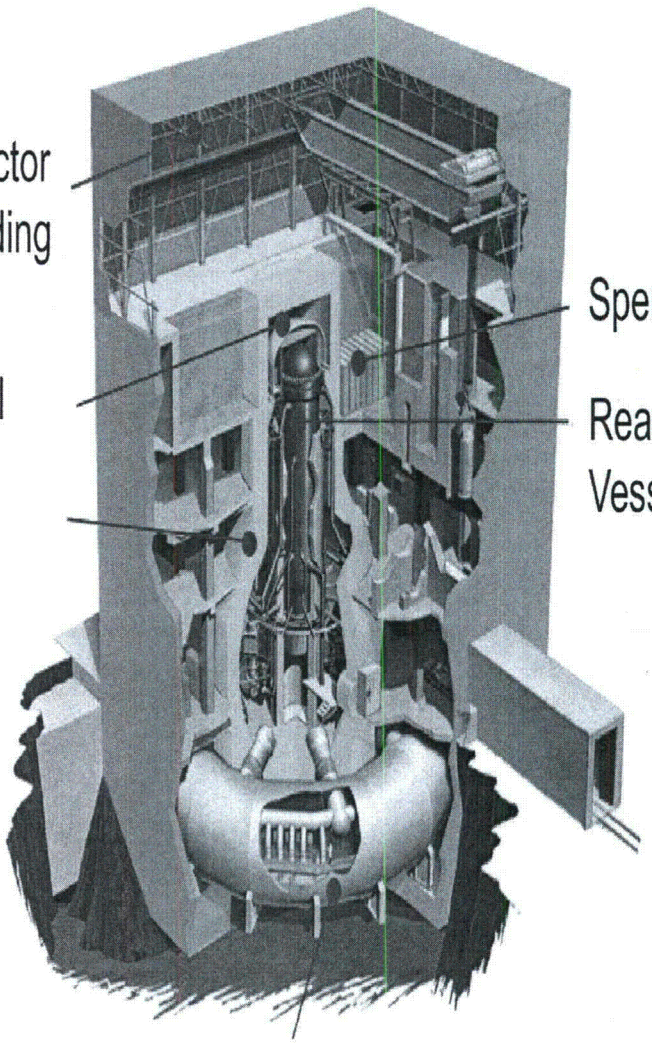


# 2-1. Summary of Fukushima Dai-ichi NPS

| | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Unit 5 | Unit 6 |
|---|---|---|---|---|---|---|
| | BWR-3 | BWR-4 | BWR-4 | BWR-4 | BWR-4 | BWR-5 |
| PCV Model | Mark-1 | Mark-1 | Mark-1 | Mark-1 | Mark-1 | Mark-2 |
| Electric Output (MWe) | 460 | 784 | 784 | 784 | 784 | 1100 |
| Max. pressure of RPV | 8.24MPa | 8.24MPa | 8.24MPa | 8.24MPa | 8.62MPa | 8.62MPa |
| Max. Temp of the RPV | 300℃ | 300℃ | 300℃ | 300℃ | 302℃ | 302℃ |
| Max. Pressure of the CV | 0.43MPa | 0.38MPa | 0.38MPa | 0.38MPa | 0.38MPa | 0.28MPa |
| Max. Temp of the CV | 140℃ | 140℃ | 140℃ | 140℃ | 138℃ | 171℃(D/W)<br>105℃(S/C) |
| Commercial Operation | 1971,3 | 1974,7 | 1976,3 | 1978,10 | 1978,4 | 1979,10 |
| Emergency DG | 2 | 2 | 2 | 2 | 2 | 3* |
| Electric Grid | 275kV × 4 | | | | 500kV × 2 | |
| Plant Status on Mar. 11 | In Operation | In Operation | In Operation | Refueling Outage | Refueling Outage | Refueling Outage |

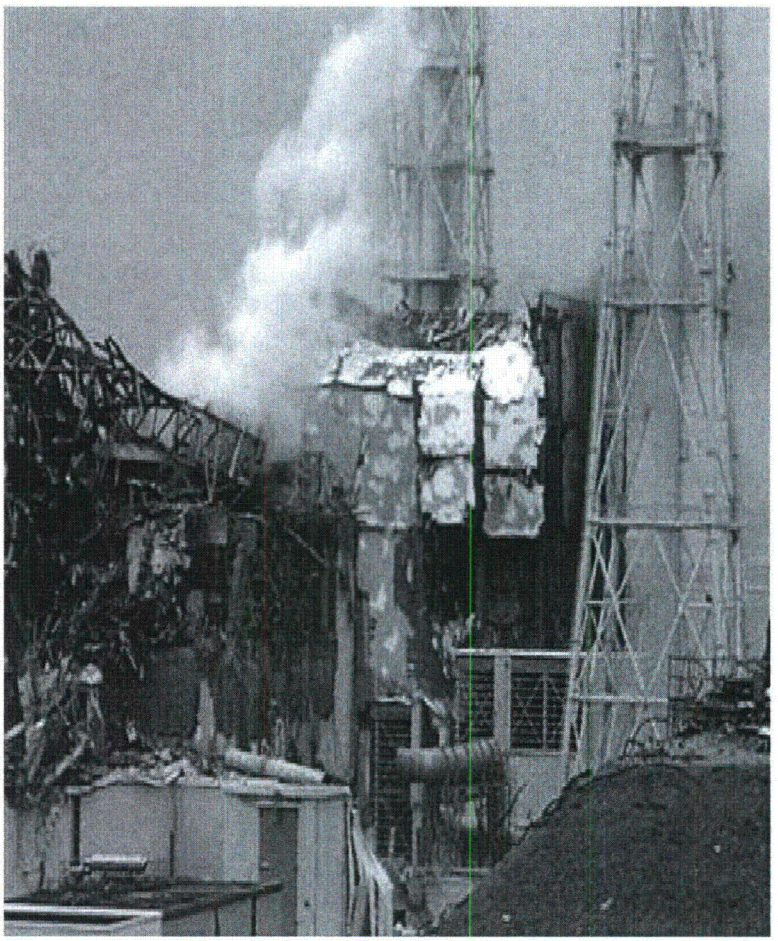
* One Emergency DG is Air-Cooled

# 2-2. Overview of Mark-1 Type BWR (Unit 1,2,3 and 4)

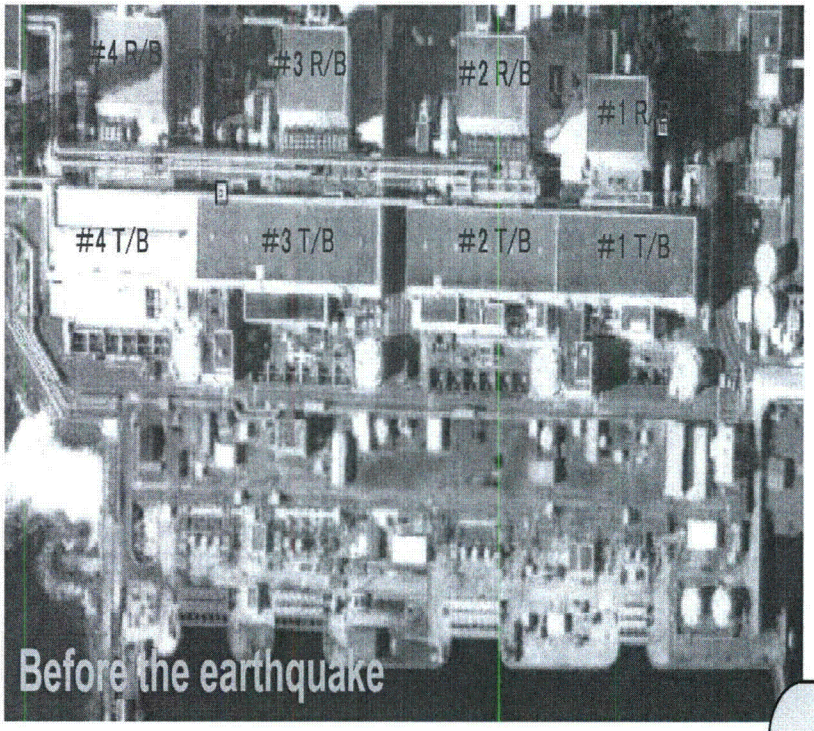


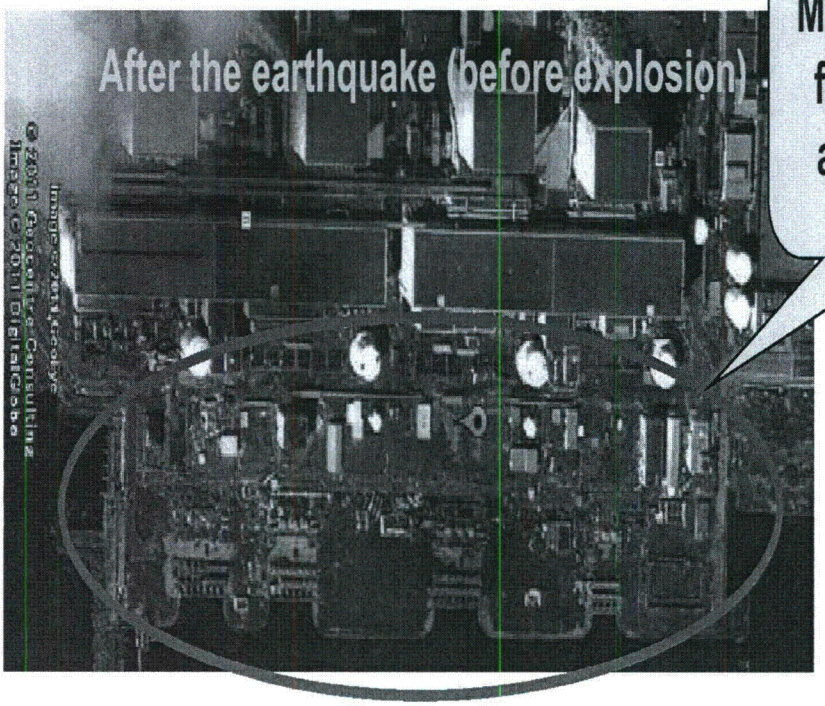

出典：http://nei.cachefly.net/static/images/BWR_illustration.jpg

# 3. Report concerning incidents at Unit 1 through 6 in the Fukushima Dai-ichi NPS



# 3-1. Satellite view of Fukushima Dai-ichi NPP

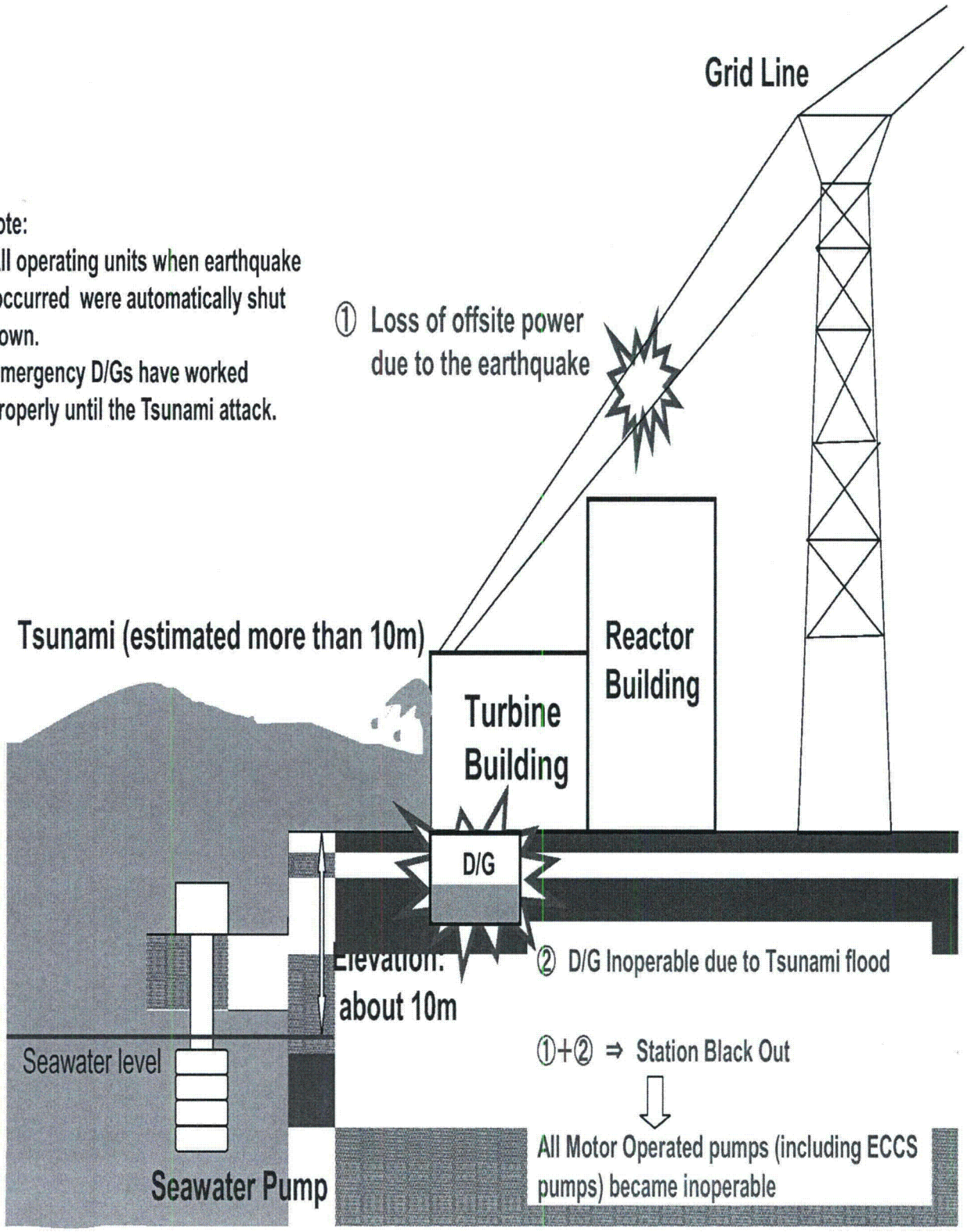


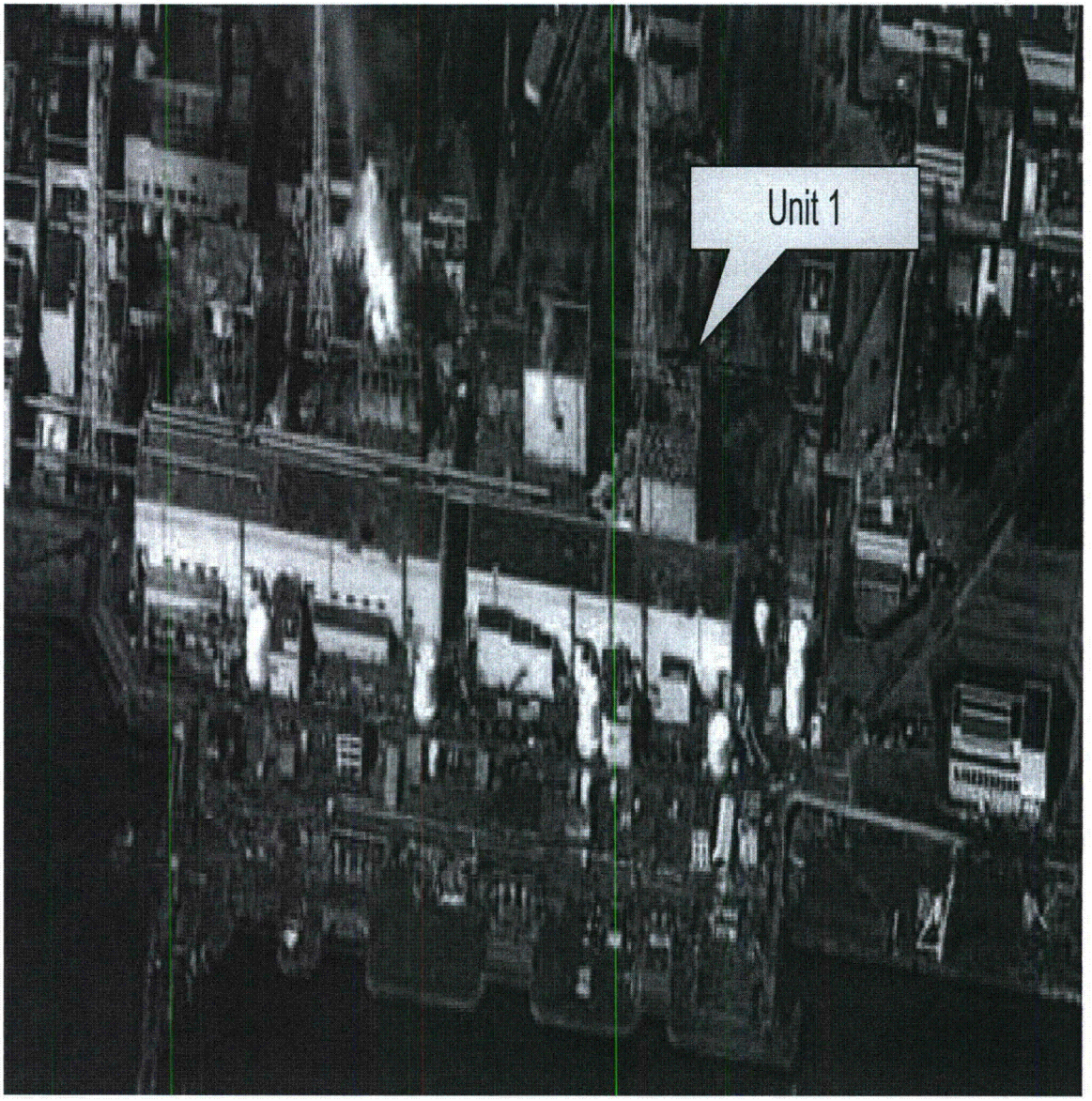

Source: Google Earth

# 3-2. Major root cause of the damage

Note:
-All operating units when earthquake occurred were automatically shut down.
-Emergency D/Gs have worked properly until the Tsunami attack.



# 3-3. Accident Progression at Unit 1 Reactor



# 3-4. Chronology of Unit 1 after the earthquake

## ●*Unit 1*

11th
- ●Under operation, Automatic shutdown by the earthquake
- ●Loss of A/C power
- ●Loss of water injection function

12th
- ●Unusual increase of PCV pressure
- ●Started to vent
- ●Sound of explosion
- ●Started of injection of seawater and borated water to the core

22nd
- ●Rise of reactor temperature (383°C) → Drop (26th 05:00 144.3°C)

23rd
- ●Water supply line in addition to the Fire Extinguish line. Switched to water supply line only.(Flow rate: 7m$^3$/h)

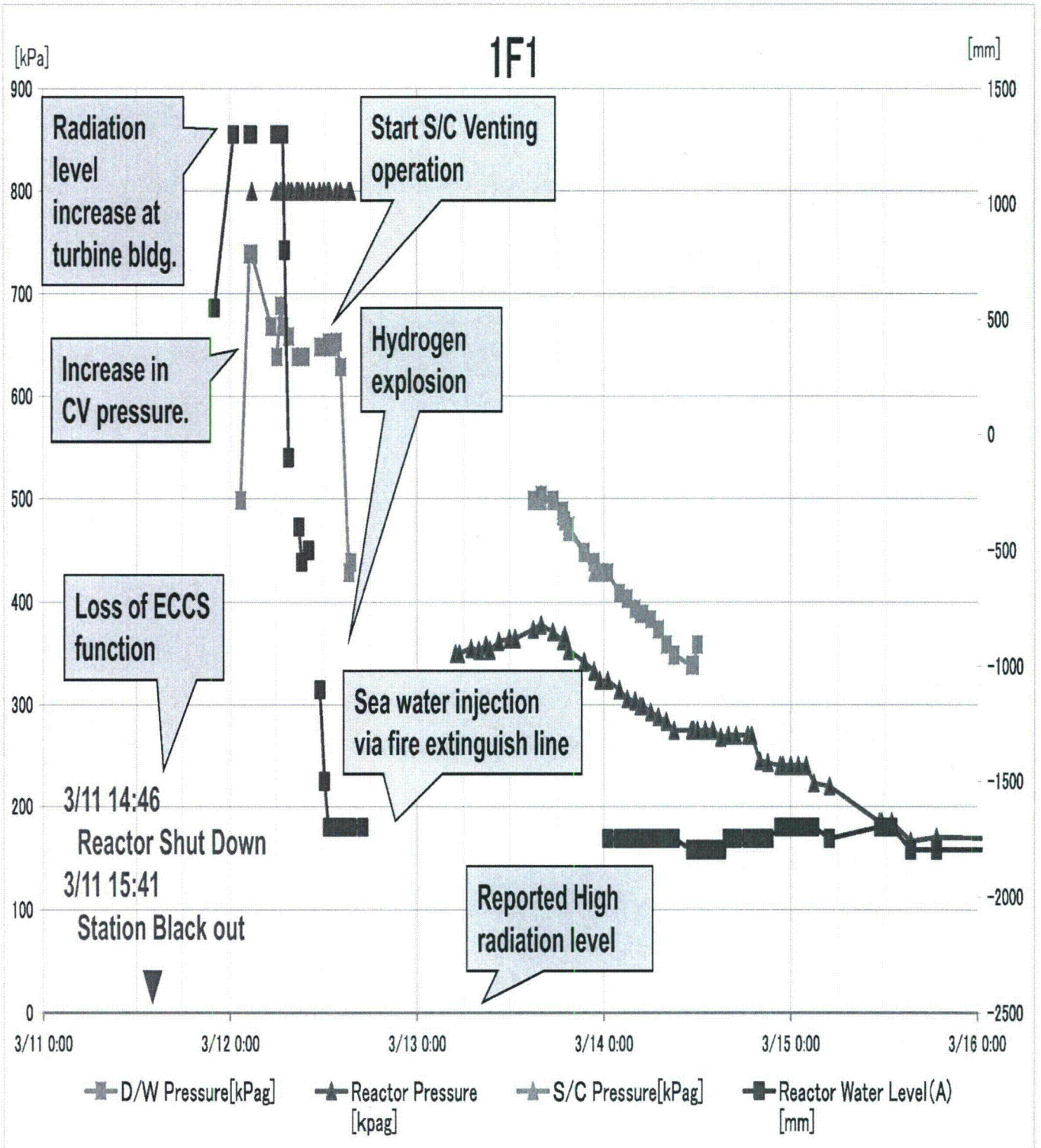
24th
- ●Lighting in the Central Control Room was recovered.

25th
- ●Started fresh water injection

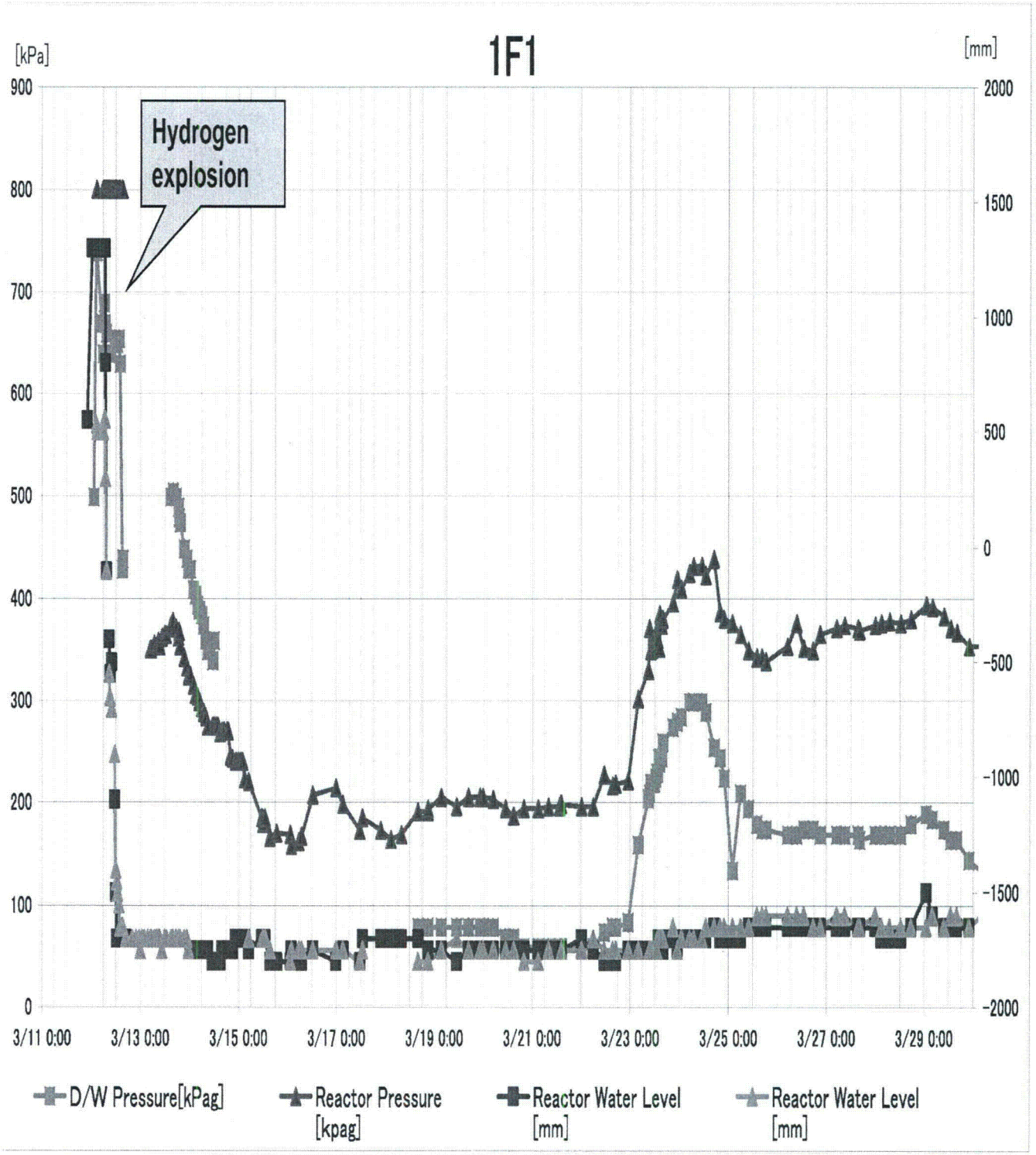
29th
- ●Switched to the water injection to the core using a temporary motor operated pump.

31st
- ●White smoke was confirmed to generate continuously
- ●Freshwater is being injected into the RPV

# 3-5. Trend data of Unit 1 until March 15

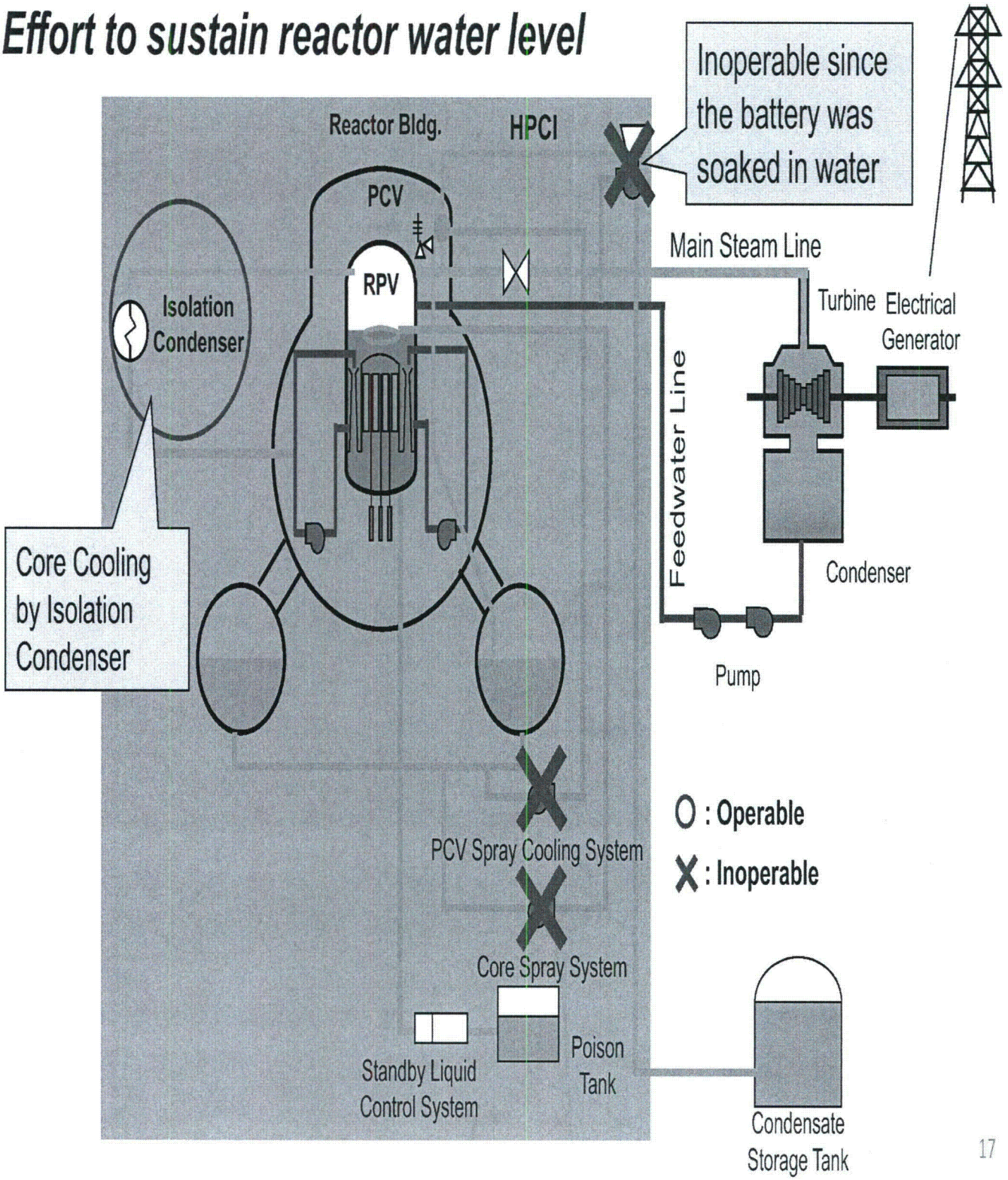


# 3-6. Trend data of Unit 1 until March 30



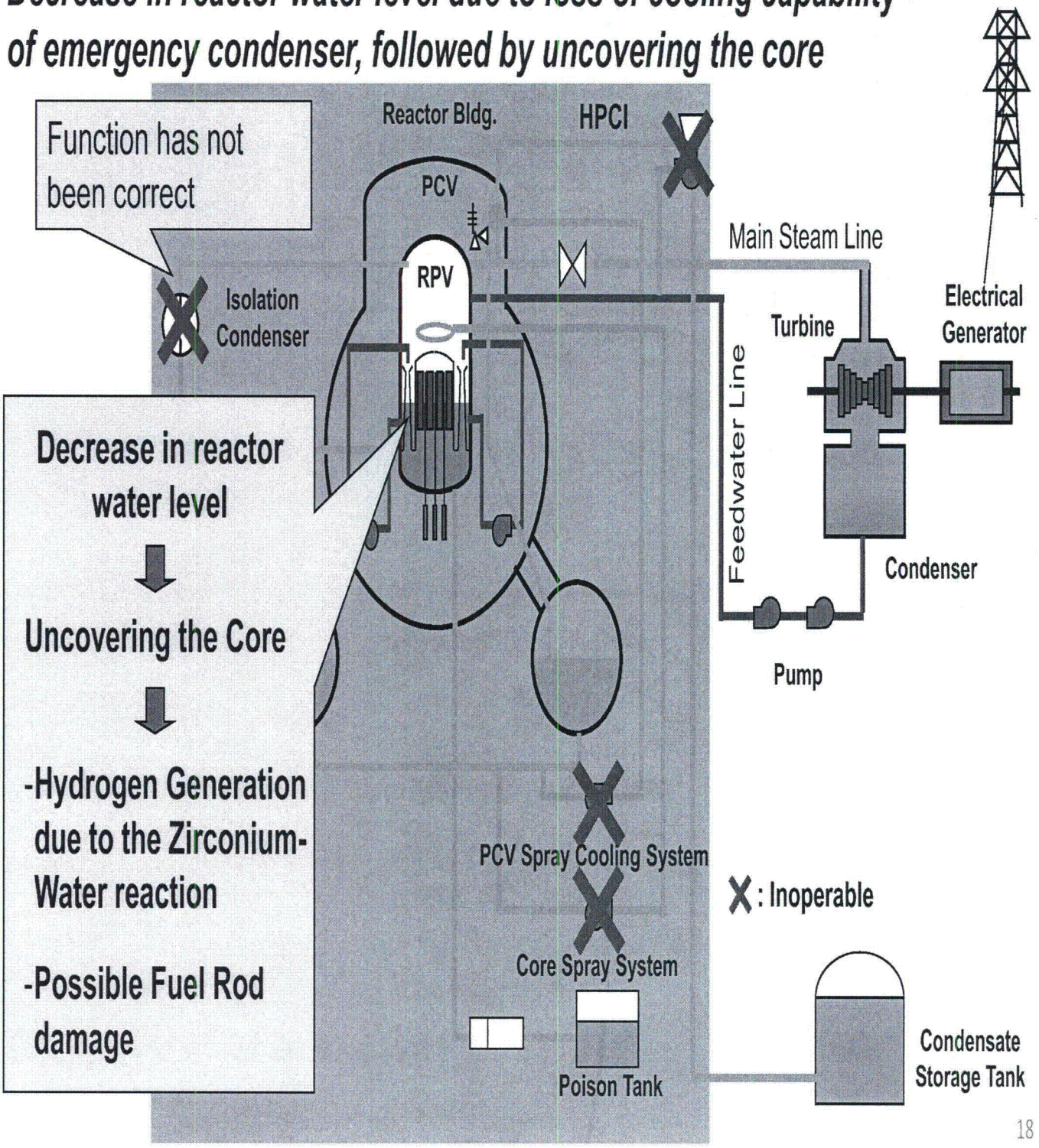
# 3-7. Major event progression at Unit 1 (1/4)

## *Effort to sustain reactor water level*



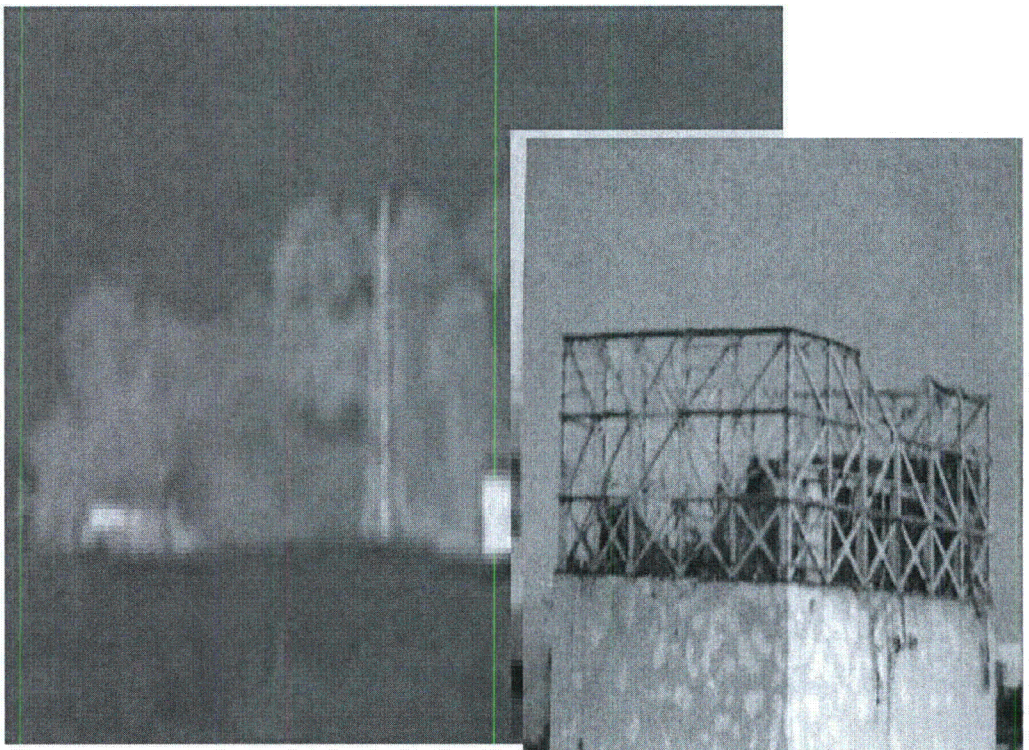
# 3-7. Major event progression at Unit 1 (2/4)

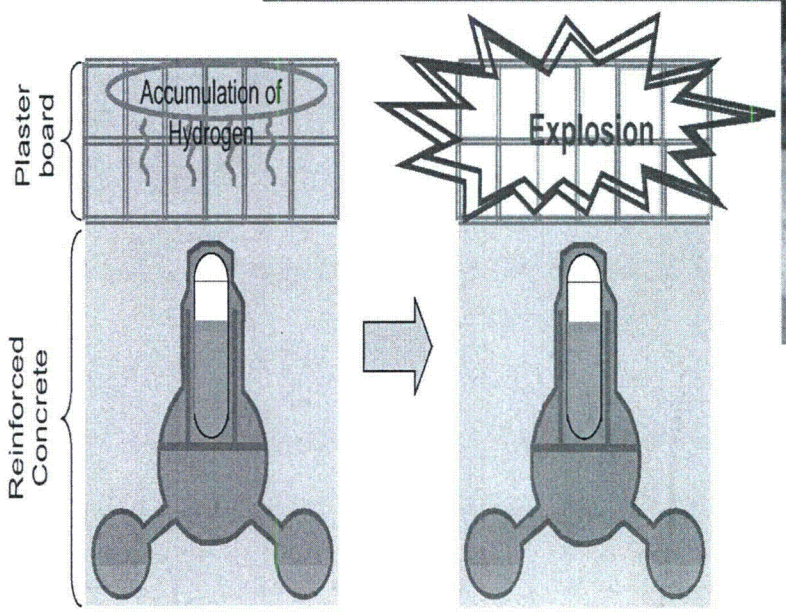
***Decrease in reactor water level due to loss of cooling capability of emergency condenser, followed by uncovering the core***



# 3-7. Major event progression at Unit 1 (3/4)

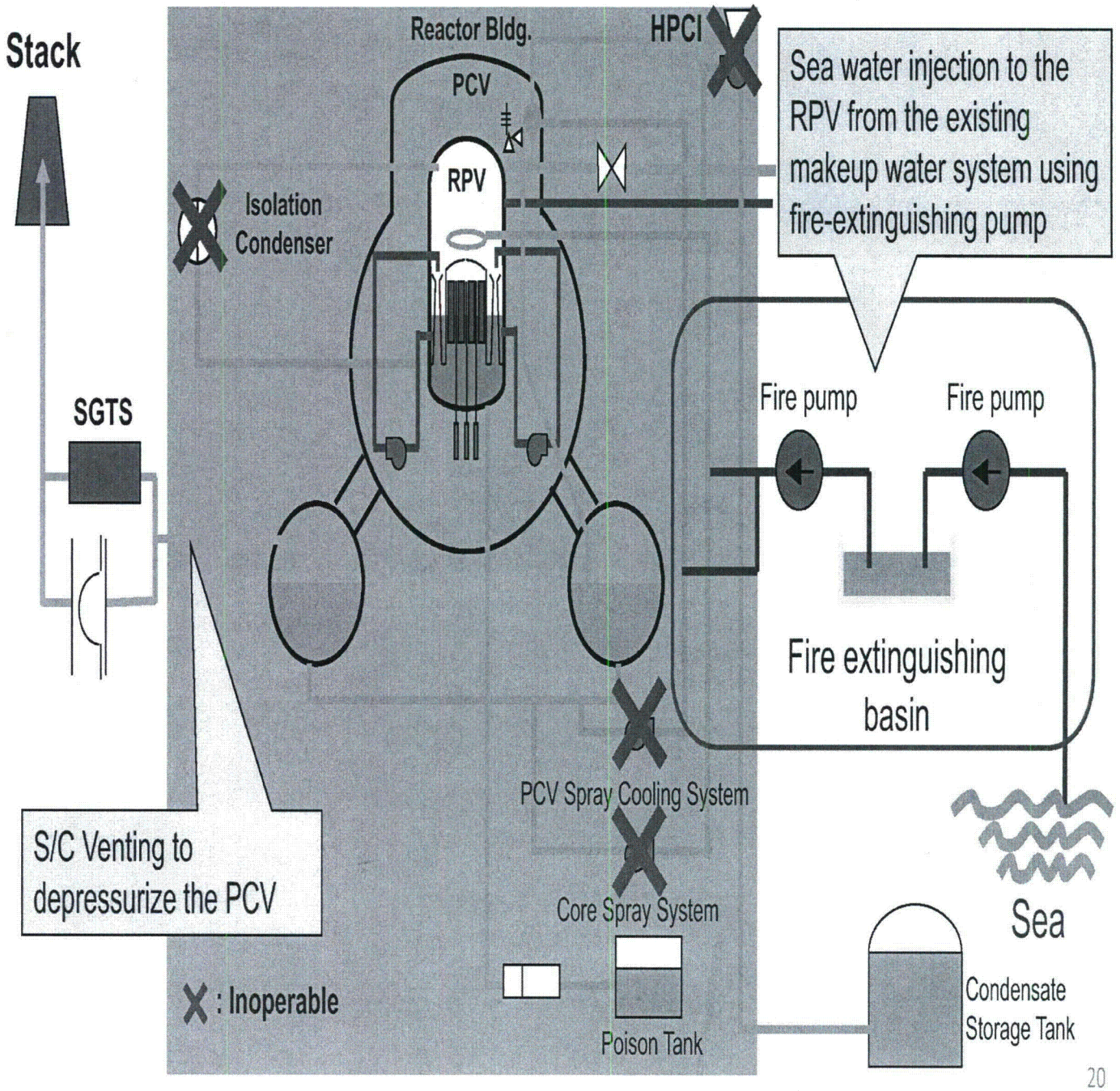
## *Hydrogen explosion in the operation floor*



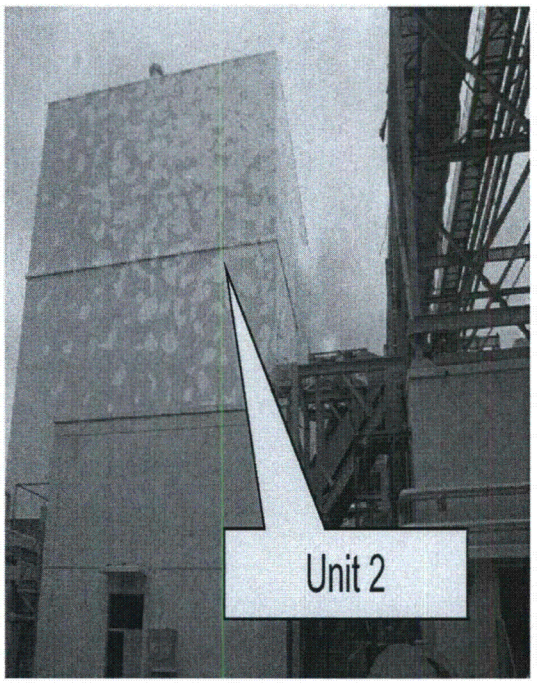


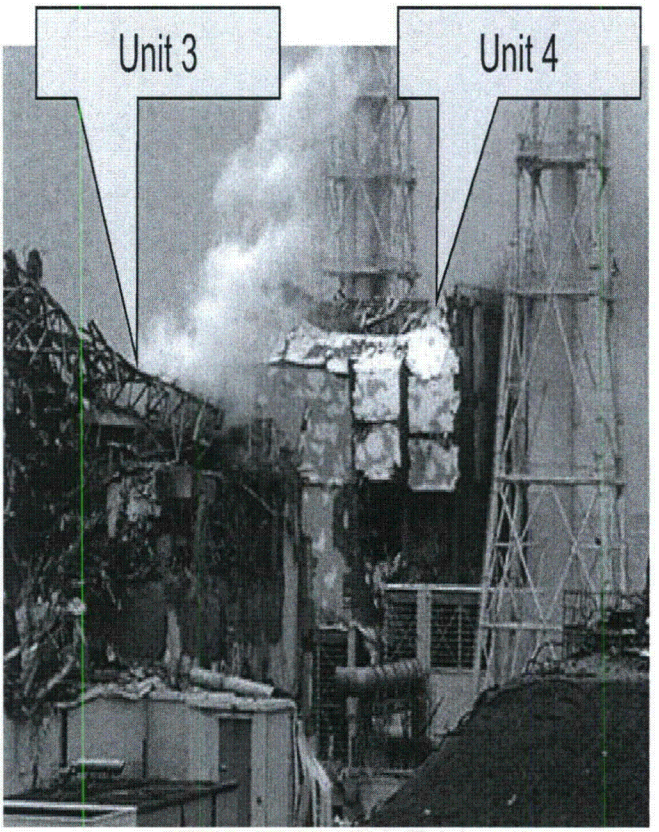
# 3-7. Major event progression at Unit 1 (4/4)

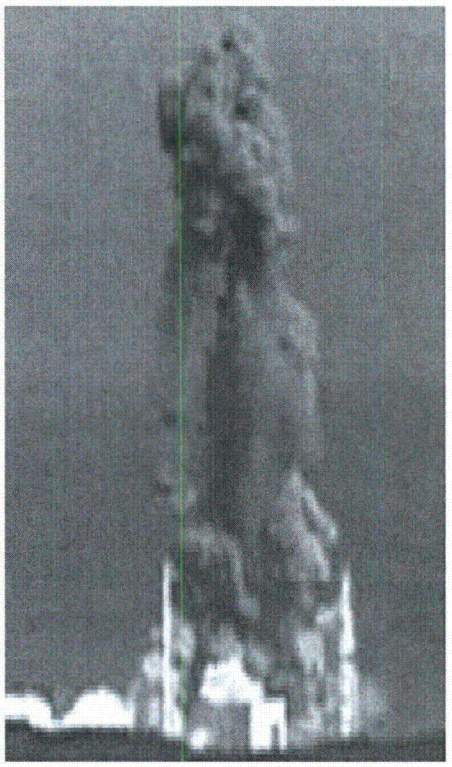
- ***Sea water injection using fire water pump***
- ***S/C Venting to depressurize the PCV***

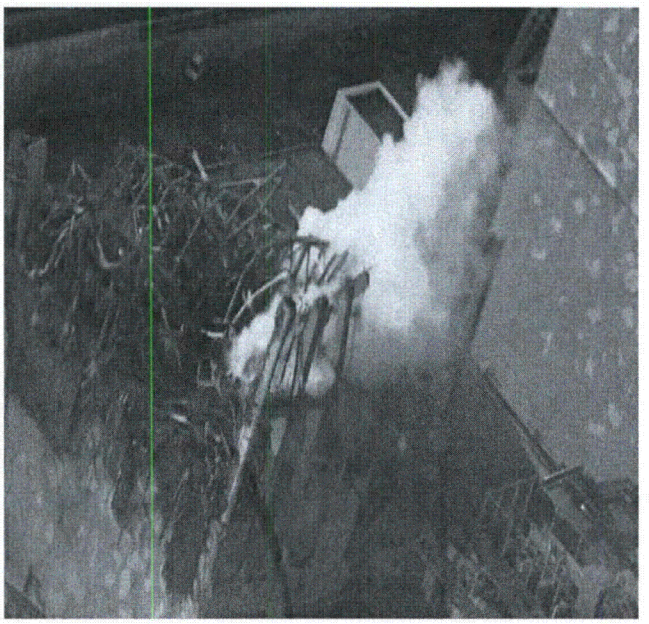


# 3-8. Accident Progression at Unit 2 through 4 reactors





# 3-9. Chronology of Unit 2 after the earthquake (1/2)

## ● *Unit 2*

11th
- ●Under operation, Automatic shutdown by the earthquake
- ● Loss of A/C power
- ● Loss of water injection function

14th
- ● Loss of water cooling function
- ● Unusual increase in PCV pressure

15th
- ● Sound of explosion
- ● Possible damage of the suppression chamber

20th
- ● Injection of about 40 tons of seawater into SFP through fire extinguishing system.
- ● Injection of seawater to the Spent Fuel Pool (SFP)

21st
- ● White smoke generated

22nd
- ● Injection of seawater to the Spent Fuel Pool (SFP)

25th
- ● Injection of seawater to SFP

# 3-9. Chronology of Unit 2 after the earthquake (2/2)

## ● *Unit 2(Continued)*

26th ●Lighting in the Central Control Room was recovered

27th ●Switched to the water injection to the core using a temporary motor-driven pump.

29th ●The Seawater injection to the Spent Fuel Pool using the Fire Pump Truck was switched to the fresh water injection using the temporary motor-driven pump

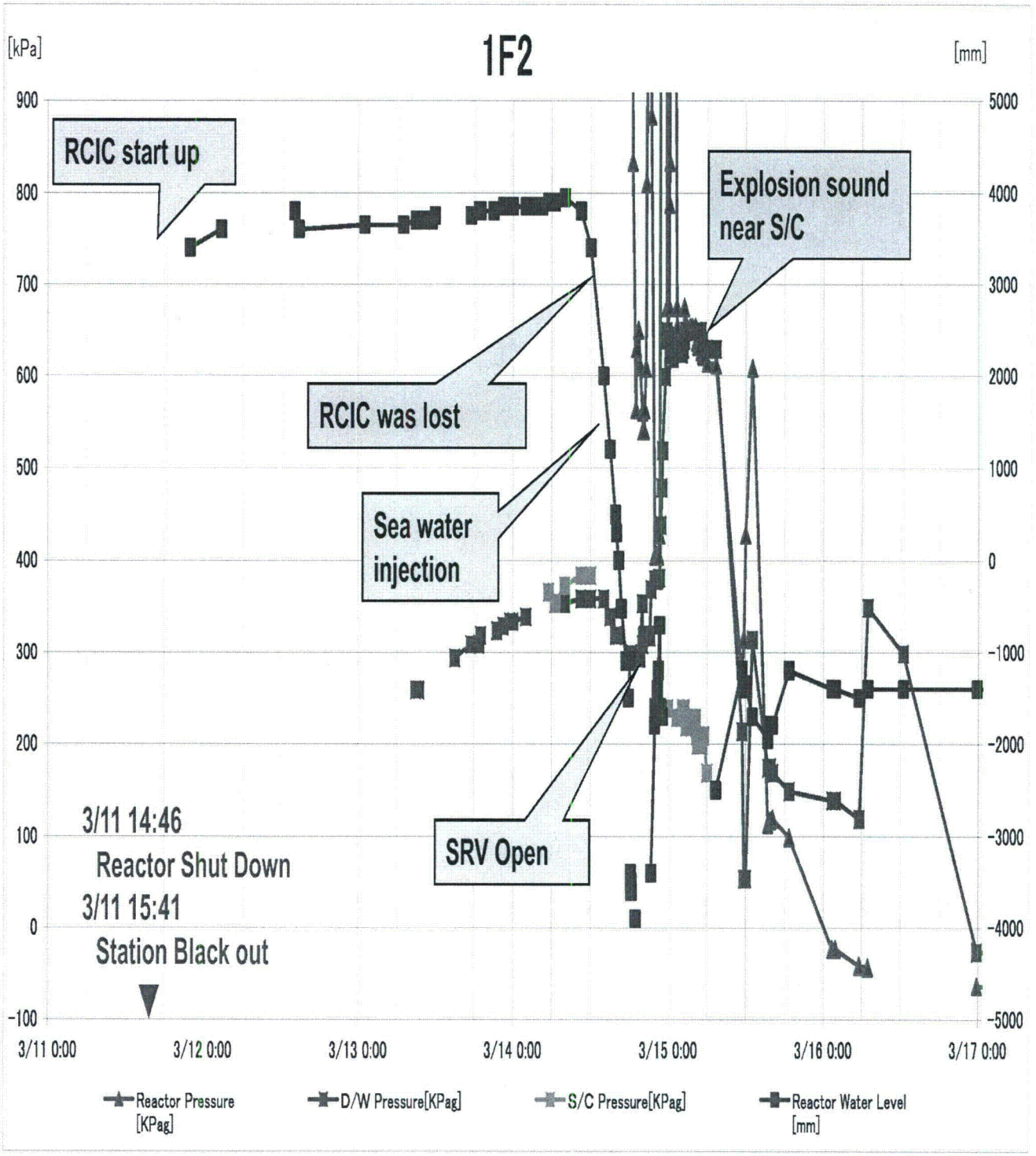
●In order to prepare for transferring the stagnant water on the basement floor of turbine building to the Condenser, the water in the Condensate Storage Tank is being transferred to the Surge Tank of Suppression Pool Water.

30th ●The injection pump was switched to the Fire Pump Truck. However, because cracks were confirmed in the hose (12:47 and 13:10 March 30th), the injection was suspended. The injection of fresh water resumed at 19:05 March 30th.

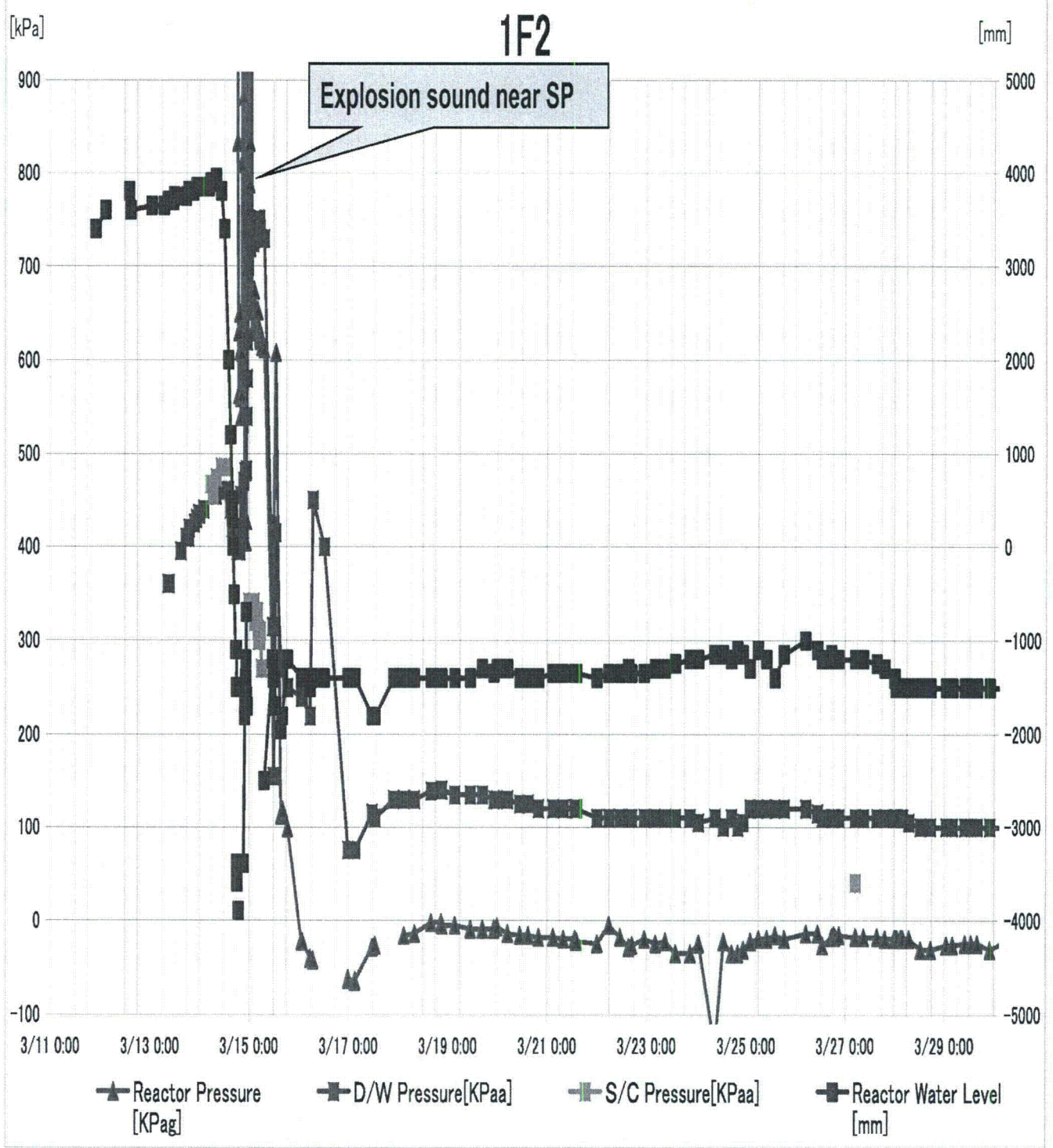
31st ●White smoke was confirmed to generate continuously.

●Fresh water is being injected to the spent fuel pool and the RPV

# 3-10. Trend data of Unit 2 until March 17



# 3-11. Trend data of Unit 2 until March 30



# 3-12. Chronology of Unit 3 after the earthquake (1/2)

## ●*Unit 3*

11th
- ●Under operation, Automatic shutdown by the earthquake
- ● Loss of A/C power

13th
- ● Loss of water injection function
- ● Started to vent

14th
- ●Unusual increase in PCV pressure
- ●Sound of explosion

16th
- ●White smoke generated

17th
- ●Water discharge by the helicopters of Self-Defense Force(4 times)
- ●Water spray from the ground by High pressure water-cannon trucks (Police: once, Self-Defense Force: 5 times)

18th
- ●Water spray from the ground by same trucks (Self-Defense Force: 6 times)

Water spray from the ground by US water-cannon trucks (US armed force:1 time)

19th
- ●Water spray from the ground by High pressure water-cannon trucks by Hyper Rescue Unit of Tokyo Fire Department.

# 3-12. Chronology of Unit 3 after the earthquake (2/2)

## ●*Unit 3(Continued)*

20th ●Sprayed by Hyper Rescue Unit of Tokyo Fire Department

22nd ●Lighting in the Central Control Room was recovered.

23rd ●Injection of seawater to the SFP

24th ●Injection of seawater to the SFP

25th ●Water spray (Emergency fire support team
●Started fresh water injection

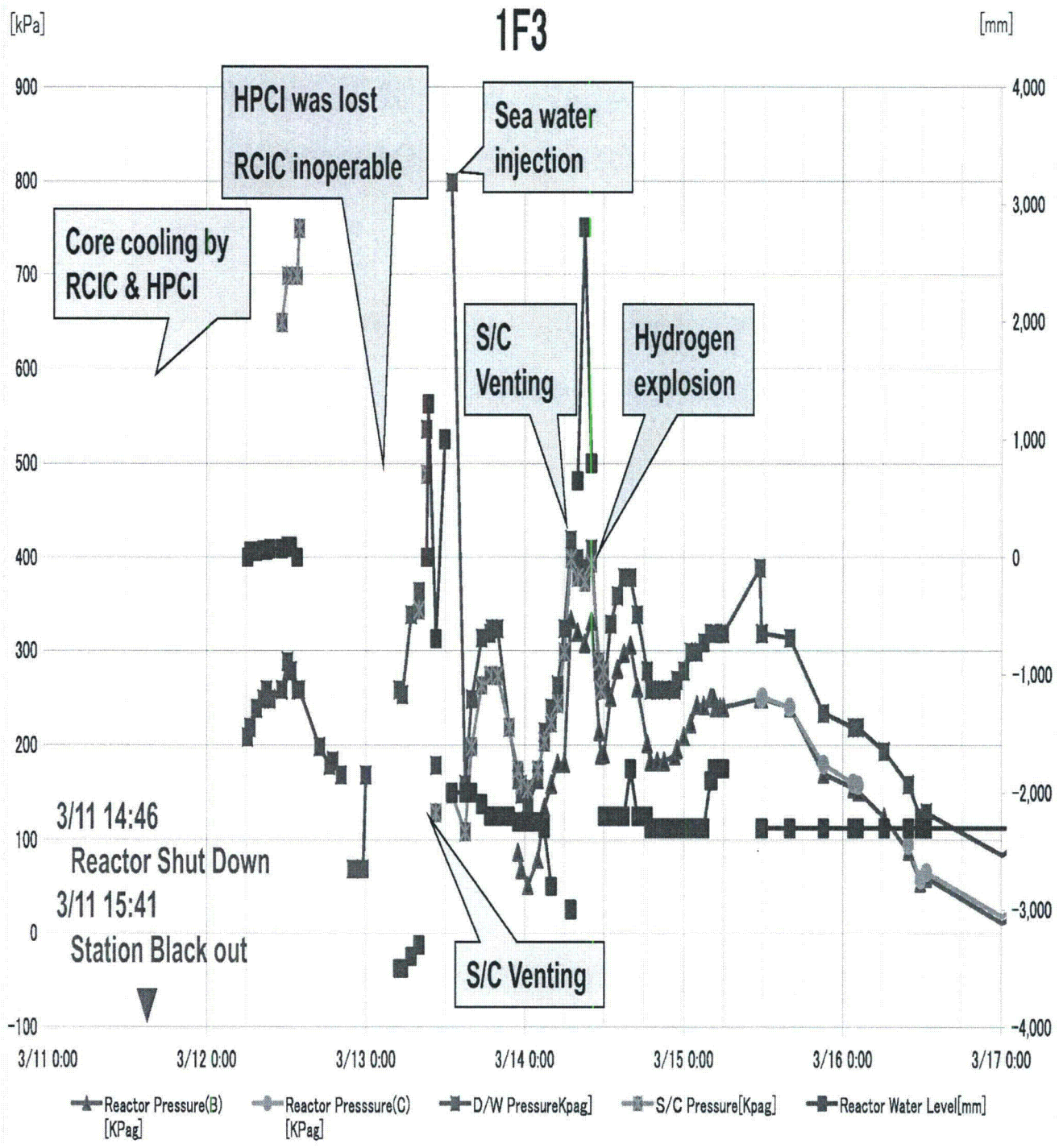
27th ●Water spray by Concrete Pump Truck

28th ●Switched to the water injection to the core using a temporary motor-driven pump
●In order to prepare for transfer the stagnant water on the basement floor of turbine building to the Condenser, the water in the Condensate Storage Tank is being transferred to the Surge Tank of Suppression Pool Water

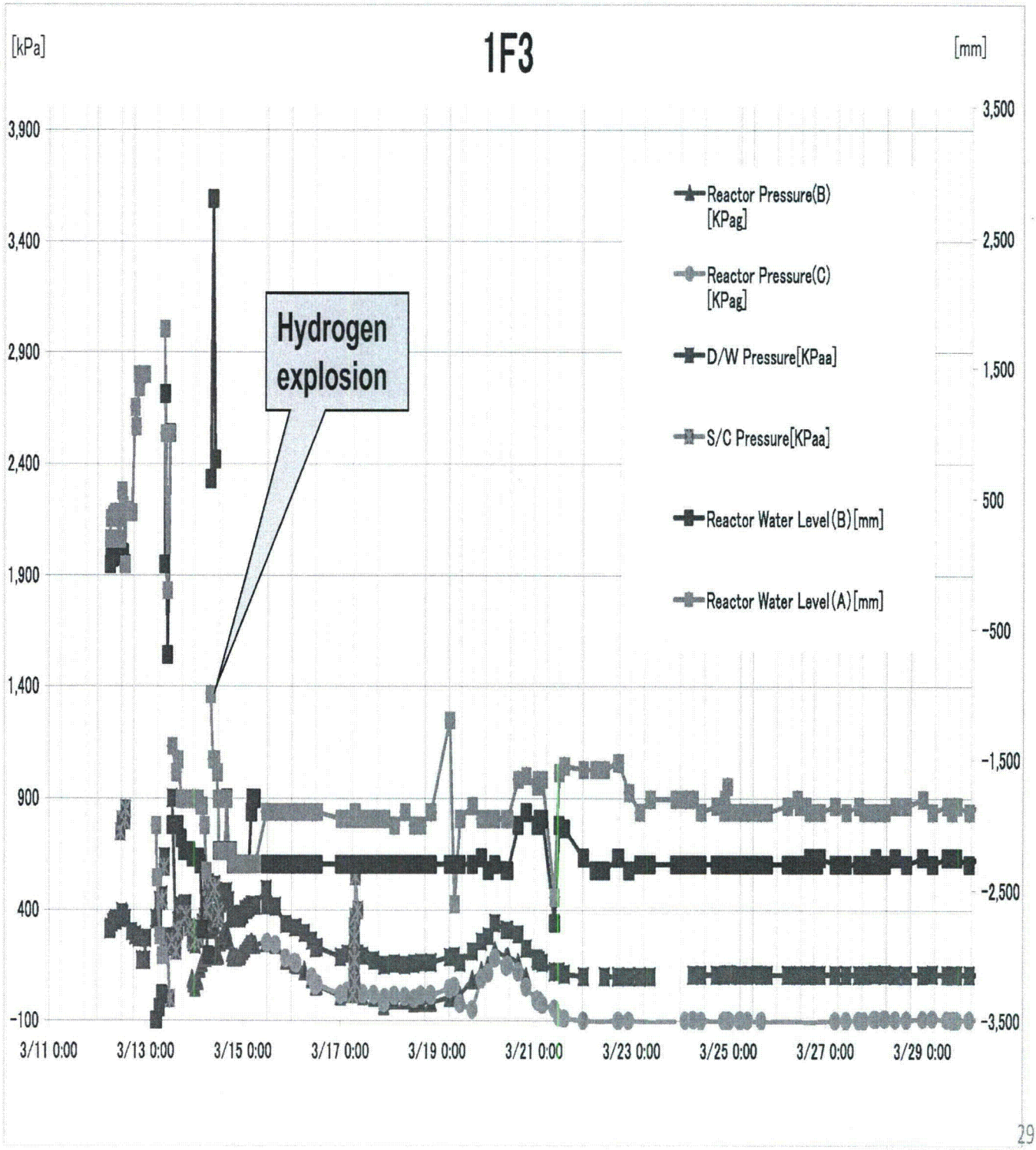
29th ●Started to spray freshwater by Concrete Pump Truck

31st ●White smoke was confirmed to generate continuously
●Fresh water is being injected to the spent fuel pool and the RPV

# 3-13. Trend data of Unit 3 until March 17



# 3-14. Trend data of Unit 3 until March 30



# 3-15. Hydrogen explosion at Unit 1 & 3


Unit 1

Unit 3

# 3-16. Chronology of Unit 4 after the earthquake

## ●*Unit 4*

| | |
|---|---|
| 14th | ●Water temperature in the Spent Fuel Pool, 84℃ |
| 15th | ●Damage of wall in the 4th floor confirmed<br>●Fire occurred in the 3rd floor (12:25 extinguished) |
| 16th | ●Fire occurred. TEPCO couldn't confirm any fire on the ground. |
| 20th | ●Water spray over the spent fuel pool by Self Defense Force |
| 21st | ●Water spray over the spent fuel pool by Self Defense Force |
| 22nd-24th | ●Water spray (Concrete Pump Track (3 times) |
| 25th | ●Injection of seawater to SFP via the Fuel Pool Cooling Line (FPC)<br>●Water spray (Concrete Pump Truck) |
| 27th | ●Water spray (Concrete Pump Truck) |
| 29th | ●Lighting in the Central Control Room was recovered. |
| 3oth | ●White smoke was confirmed to generate continuously.<br>●Spray of fresh water (Around 140t) over the Spent Fuel Pool using Concrete Pump Truck (50t/h) was carried out.<br>●Fresh water is being injected to the spent fuel pool |

# 3-17. Chronology of Unit 5 & 6 after the earthquake

## ● *Unit 5&6*

20th
- Unit 5 under cold shutdown (Water temperature of reactor water is less than 100°C)
- Unit 6 under cold shutdown (Water temperature of reactor water is less than 100°C)

21st
- Water spray over the Common Spent Fuel Pool started

22nd
- Recovering power supply of unit 5 and 6 is completed.

24th
- The power was started to be supplied. Cooling also started

30th
- Bach up power of Unit 6 is in working condition and external power was supplied to Unit 5 as of March 30th

# 4. Report concerning incidents at spent fuel pools in the Fukushima Dai-ichi NPS

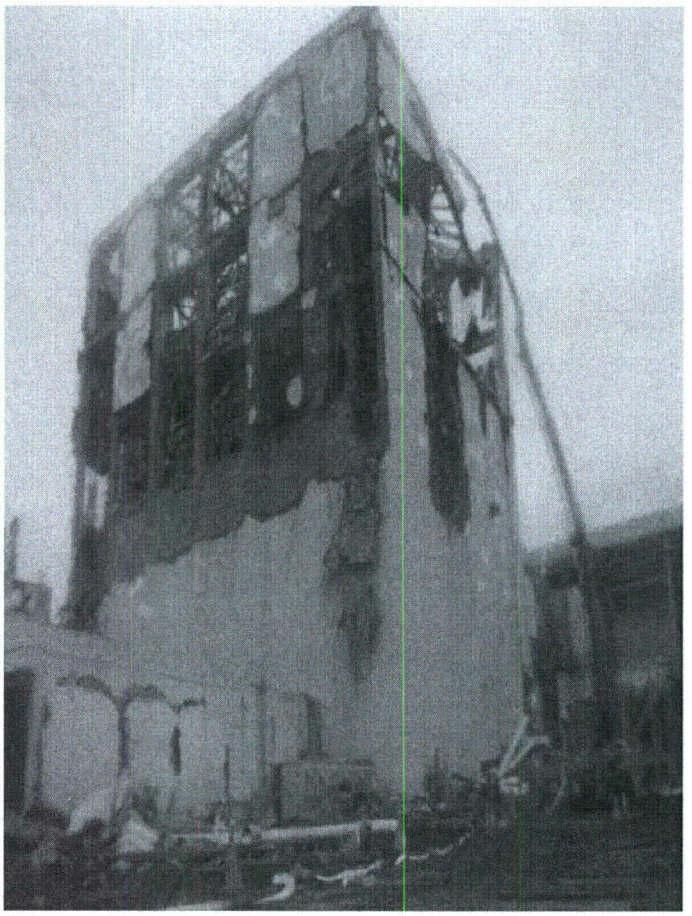
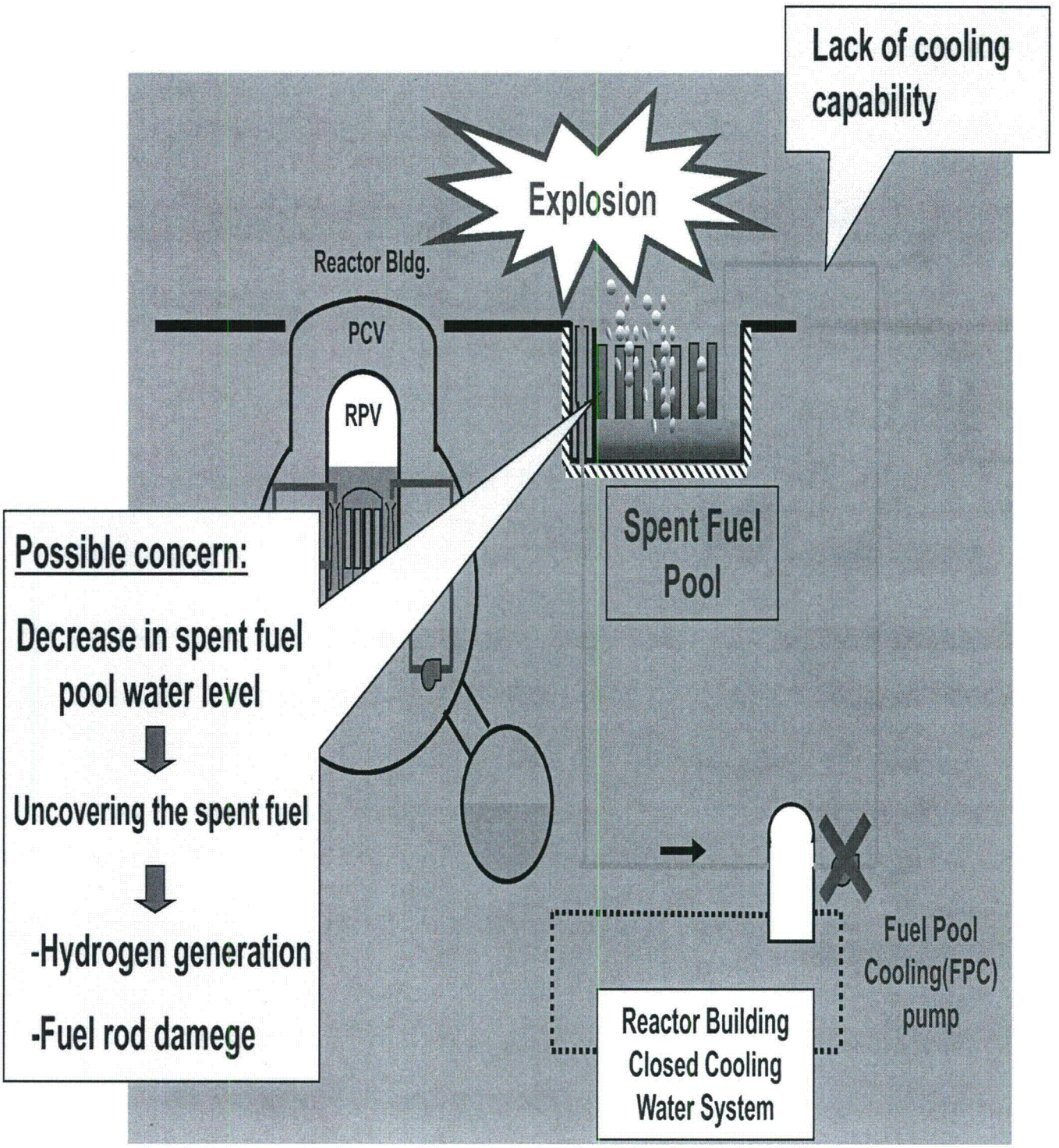


**Photo: Water spray into the SFP in Unit 4 using concrete pump truck**

# 4-1. Possible concerns about Spent Fuel Pool



# 4-2. Status of the Fuel as of March 11, 2011

| Unit | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Number of Fuel Assembly in the Core | 400 | 548 | 548 | - | 548 | 764 |
| Number of Spent Fuel Assembly in the Spent Fuel Pool | 292 | 587 | 514 | 1,331 | 946 | 876 |
| Number of New Fuel Assembly in the Spent Fuel Pool | 100 | 28 | 52 | 204 | 48 | 64 |
| Water Volume ($m^3$) | 1,020 | 1,425 | 1,425 | 1,425 | 1,425 | 1,497 |

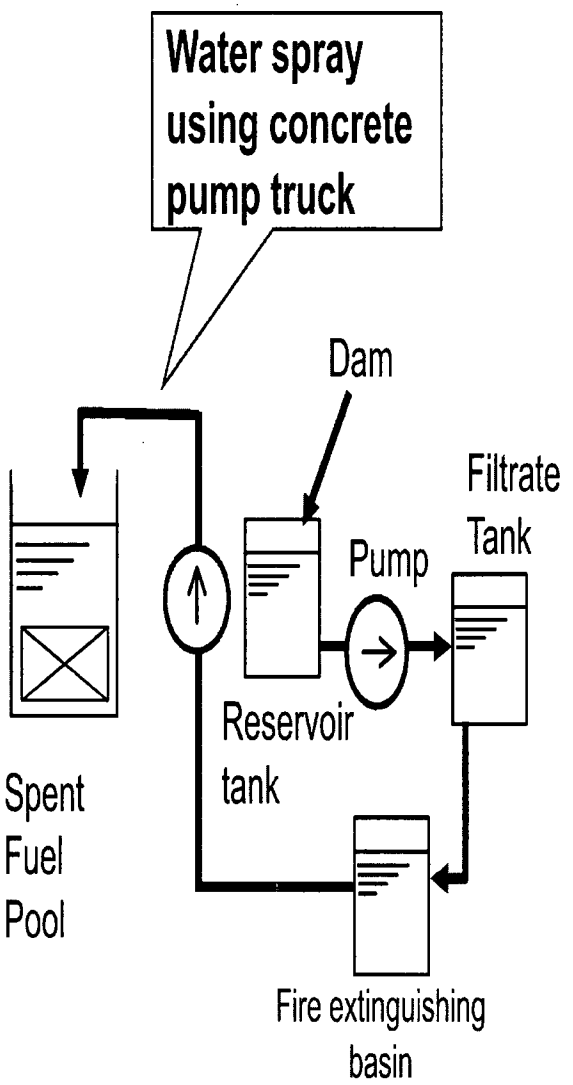
## Condition of the fuel in the Spent Fuel Pool

| Unit 1 | Unit 2 | Unit 3 | Unit 4 |
|---|---|---|---|
| -Most recent shut down was on Sep.27,2010 | - Most recent shut down was on Nov.18,2010 | - Most recent shut down was on Sep.23,2010 | -Most recent shut down was on Nov.29,2010<br>-All fuel assembly was removed from the core and located in the pool due to the core shroud replacement |

# 4-3. Measures taken to cool the Spent Fuel Pool (1/4)

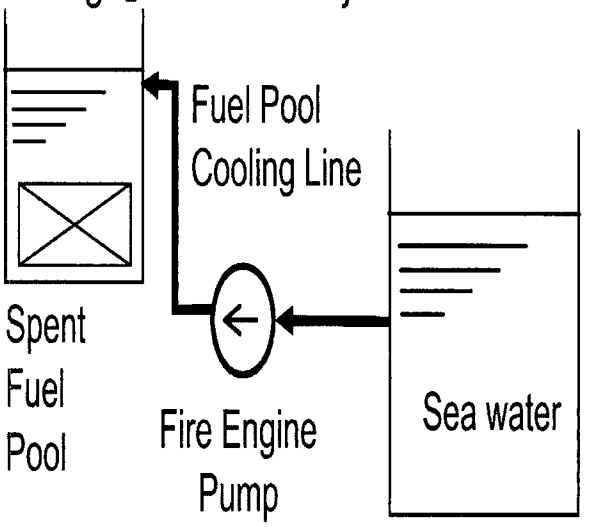
## Unit 1

Fresh water injection

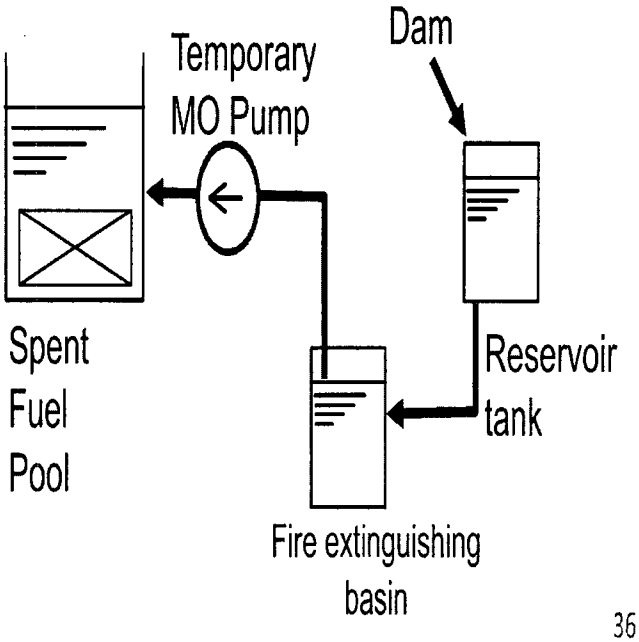



## Unit 2

【1st Stage】Sea water injection



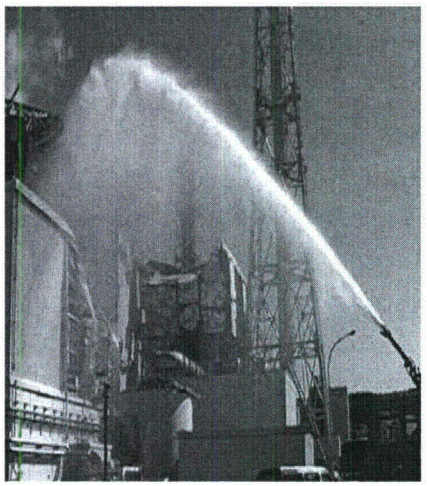

【2nd Stage】Fresh water injection



# 4-3. Measures taken to cool the Spent Fuel Pool (2/4)

## Unit 3

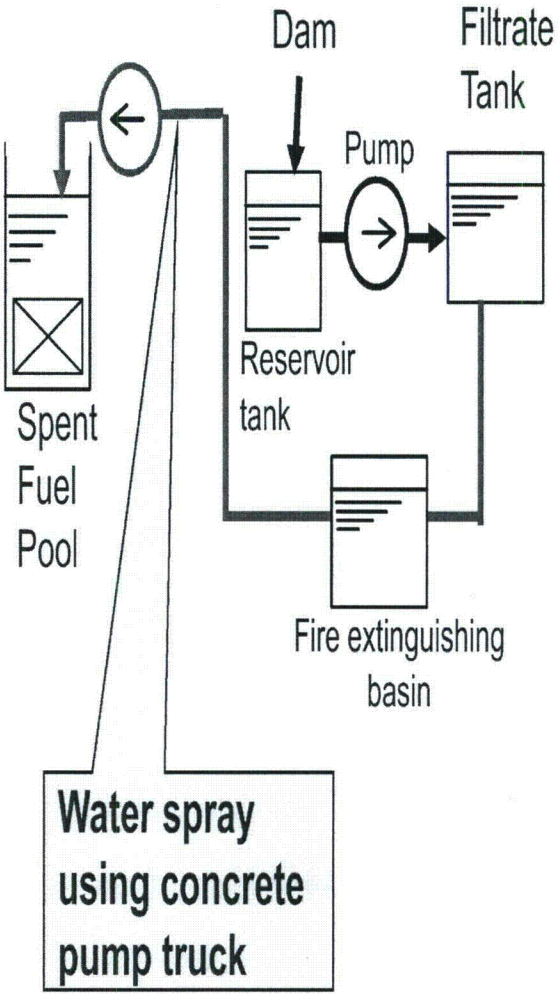
【1st Stage】 Sea water injection



Source: Asahi.com




【2nd Stage】 Fresh water injection



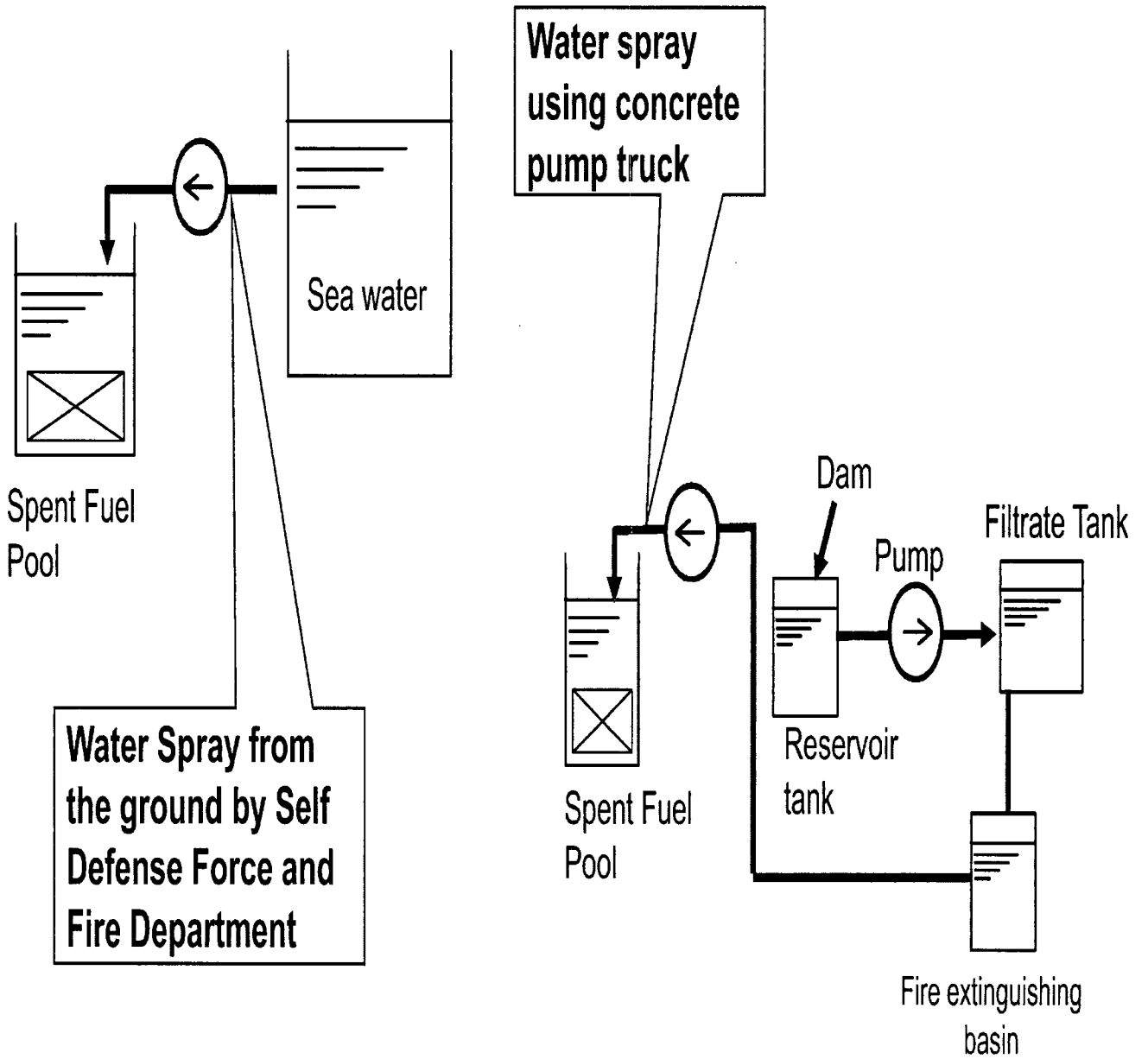

*** Sea water discharge by helicopters of the Self Defense Force**

# 4-3. Measures taken to cool the Spent Fuel Pool (3/4)

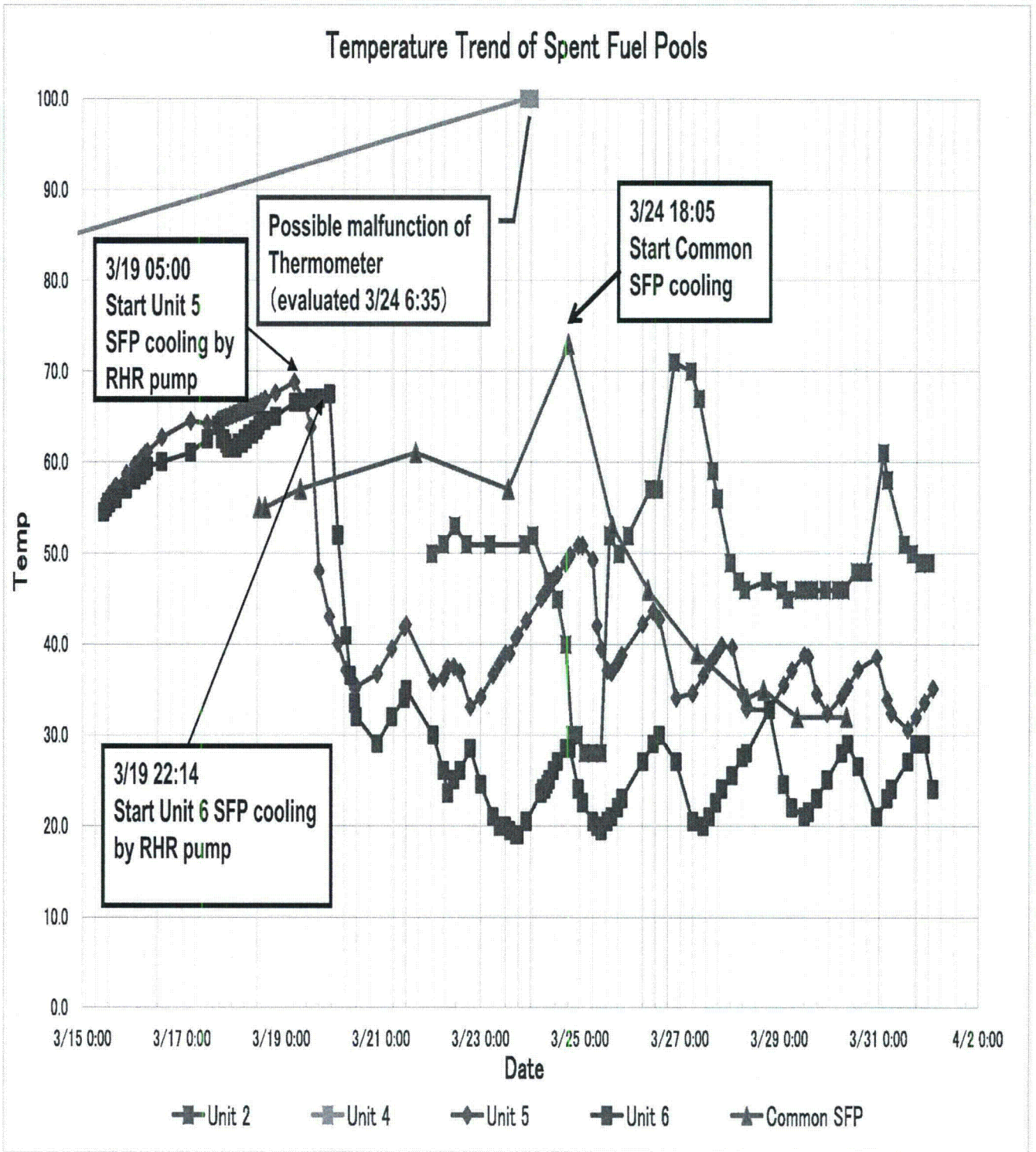
## *Unit 4*

【1st Stage】Sea water injection

【2nd Stage】Fresh water injection



# 4-3. Measures taken to cool the Spent Fuel Pool (4/4)



# 4-4. INES Rating

- NISA issued temporary INES ratings 3 times. Those provisional ratings are provided based on "What is known" at the time.

- The first temporary rating was issued at 0:30 on March 12 (About 10 hours later from the earthquake attack)
  At that moment, Following units were rated as Level 3 since all heat removal function became inoperable based on "Defense in Depth" criteria.
  - Fukushima dai-ichi unit 1, 2 and 3
  - Fukushima dai-ni Unit 1, 2 and 4

- In the evening on March 12, the rating of Fukushima dai-ichi Unit 1 was re-evaluated to Level 4 base on the "Radiological Barriers and Control" criteria, since the radiation level in the site increased.

- On March 18, re-evaluation was carried out. The rating of Fukushima dai-ichi Unit 1, 2 and 3 were re-rated to Level 5 based on "Radiological Barriers and Control" criteria because the fuel damage was highly possible. Fukushima dai-ichi Unit 4 was evaluated to Level 3 based on the "Defense in Depth" criteria.