
USNRC Emergency Operations Center Status Update

March 12, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode.

On March 12, 2011, the NRC continues to operate in monitoring mode to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

NRC staff are coordinating with several federal partners, including the White House, Congress, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of State, Department of Transportation, Environmental Protection Agency, Federal Emergency Management Agency, and Secret Service.

NRC is supporting USAID response efforts. Two senior experts from NRC are designated to be a part of an USAID delegation to Japan to assist in the response and recovery efforts as necessary.

NRC liaison to the NRCC has ended.

NRC will request assistance from FEMA REPP should the need arise.

NRC is also coordinating with the International Atomic Energy Agency.

NRC has issued 4 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

Diablo Canyon

Diablo Canyon Power Plant declared a Notice of Unusual Event at 0423 EST on March 11, 2011 based on receipt of a tsunami warning for the local coastal area.

Earthquake/Tsunami Status Update March 12, 2011

1830 EST

At 1130 EST, the licensee observed potential tsunami effects of 1 foot based on buoy information. The surge expanded to approximately three feet at its peak. This change was within the normal tidal range and did not impact plant operation. On March 12, 2011, both units continue to operate at full power.

San Onofre Nuclear Generating Station (SONGS)

The effects of the tsunami at SONGS were negligible. SONGS was within the area of the tsunami advisory but did not reach any Emergency Action Level thresholds. On March 12, 2011, both units continue to operate at essentially full power.

Non-Power Reactors

Category 1 and 2 sources in the states of California, Oregon, Washington, and Alaska were not impacted by the earthquake or tsunami.

The decommissioned Humboldt Bay nuclear plant prepared for any tsunami effects but was not impacted by the earthquake or tsunami.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Situation:

A magnitude 8.9 earthquake struck 80 miles east of Onagawa, 110 miles east-northeast of Fukushima at 1246 EST on March 11, 2011.

At the time of the earthquake:

- all 3 units at Onagawa were operating; all 3 automatically shutdown
- 3 units at Fukushima Daiichi were operating (Units 1, 2, and 3, with Units 4, 5, and 6 in a maintenance outage); all 3 were automatically shutdown
- all 4 units at Fukushima Daini were operating; all 4 were automatically shutdown
- 1 unit operating at Tokai; 1 unit was automatically shutdown

At Onagawa, a fire was confirmed to have occurred in the turbine building (turbine building common to all 3 units). This fire was extinguished.

At 0136 EST on March 12, 2011, a "vertical earthquake" resulted in an explosion at the Fukushima Daiichi Unit 1. Other units at Fukushima Daiichi and units at other sites were not impacted by this earthquake.

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases – March 12th, 9pm and 11pm, and March 13th, 2am)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary. Radiation levels at the site boundary exceeded limits.

Winds are directed out to sea.

Unit 1

- The reactor is shut down.
- Explosion occurred at Unit 1 following 0136 EST (March 12, 2011) earthquake. This explosion was due to hydrogen.
- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons in the reactor core, helping to stabilize the core.
- Sea water is also being used to provide external cooling to the torus.
- Indications of degrading core conditions are not occurring.

Unit 2

- The reactor and the Reactor Core Isolation Cooling System are shut down.
- Reactor water level is lower than normal, but the water level is steady.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment.

Unit 3

- The reactor is shut down.
- Water continues to be injected by the High Pressure Core Injection System.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.

- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was cold shut down at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
 - A sufficient level of reactor coolant to ensure safety is maintained.
 - TEPCO prepared to reduce pressure in the reactor containment vessel.
 - TEPCO prepared to reduce pressure in the reactor containment vessel.
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USNRC Status

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NRC staff are coordinating with several federal partners, including the White House, Congress, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of State, Department of Transportation, Environmental Protection Agency, Federal Emergency Management Agency, and Secret Service.

The two senior experts supporting USAID response efforts from the NRC are expected to arrive late tonight and early tomorrow morning.

NRC is also coordinating with the International Atomic Energy Agency.

NRC has issued 4 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

Diablo Canyon

Diablo Canyon Power Plant declared a Notice of Unusual Event at 0423 EST on March 11, 2011 based on receipt of a tsunami warning for the local coastal area.

At 1130 EST, the licensee observed potential tsunami effects of 1 foot based on buoy information. The surge expanded to approximately three feet at its peak. This change was within the normal tidal range and did not impact plant operation.

On March 12, 2011, both units continue to operate at full power.

San Onofre Nuclear Generating Station (SONGS)

The effects of the tsunami at SONGS were negligible. SONGS was within the area of the tsunami advisory but did not reach any Emergency Action Level thresholds. On March 12, 2011, both units continue to operate at essentially full power.

Non-Power Reactors

Category 1 and 2 sources in the states of California, Oregon, Washington, and Alaska were not impacted by the earthquake or tsunami.

The decommissioned Humboldt Bay nuclear plant prepared for any tsunami effects but was not impacted by the earthquake or tsunami.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Situation:

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At the time of the earthquake:

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- 3 units at Fukushima Daiichi were operating (Units 1, 2, and 3, with Units 4, 5, and 6 in a maintenance outage); all 3 were automatically shutdown
- all 4 units at Fukushima Daini were operating; all 4 were automatically shutdown
- 1 unit operating at Tokai; 1 unit was automatically shutdown

At Onagawa, a fire was confirmed to have occurred in the turbine building (turbine building common to all 3 units). This fire was extinguished.

At 0136 EST on March 12, 2011, a "vertical earthquake" resulted in an explosion at the Fukushima Daiichi Unit 1. Other units at Fukushima Daiichi and units at other sites were not impacted by this earthquake.

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases – March 12th, 9pm and 11pm, and March 13th, 2am)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary. Radiation levels at the site boundary exceeded limits.

Winds are directed out to sea.

Unit 1

- The reactor is shut down.
- Explosion occurred at Unit 1 following 0136 EST (March 12, 2011) earthquake. This explosion was due to hydrogen.
- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons in the reactor core, helping to stabilize the core.
- Sea water is also being used to provide external cooling to the torus.
- The value of radioactive material (iodine, etc) is increasing according to the monitoring car at the site (outside of the site). One of the monitoring posts is also indicating higher than normal level.
- Radiation levels at the boundary of the site exceeds limits, clause 1 of the Article 15 of the Radiation Disaster Measure declared.

Unit 2

- The reactor and the Reactor Core Isolation Cooling System are shut down.
- Reactor water level is lower than normal, but the water level is steady.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment.

Unit 3

- The reactor is shut down.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel.
- Efforts to restart the Reactor Core Isolation Cooling System failed. Emergency Core Cooling System flow could not be confirmed. As such, at 5.10 AM, Mar 12, clause 1 of the Article 15 of the Radiation Disaster Measure
- Reactor containment is being vented to reduce pressure.

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.

- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. Preparations to reduce Units 1, 2 and 3 reactor containment pressures (partial discharge of air containing radioactive materials) are in progress. Unit 3 has been stopped and being "nuclear reactor cooling hot stop" at 12:15PM.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was cold shut down at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
 - A sufficient level of reactor coolant to ensure safety is maintained.
 - TEPCO prepared to reduce pressure in the reactor containment vessel.
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On March 12, 2011, the NRC continues to operate in monitoring mode to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

NRC staff are coordinating with several federal partners, including the White House, Congress, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of State, Department of Transportation, Environmental Protection Agency, Federal Emergency Management Agency, and Secret Service.

The one of two senior experts supporting USAID response efforts from the NRC have arrived, the second is expected early this morning.

NRC is also coordinating with the International Atomic Energy Agency.

NRC has issued 4 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

Diablo Canyon

As of 1528 3/11/11 Diablo Canyon Power Plant has exited its declared Notice of Unusual Event due to the tsunami warning; both units are operating at full power.

San Onofre Nuclear Generating Station (SONGS)

Both units are operating at full power.

Non-Power Reactors

Category 1 and 2 sources in the states of California, Oregon, Washington, and Alaska were not impacted by the earthquake or tsunami.

The decommissioned Humboldt Bay nuclear plant prepared for any tsunami effects but was not impacted by the earthquake or tsunami.

*At 5:26 PM Pacific Standard Time on March 12, an earthquake with preliminary magnitude 6.6 occurred off the east coast of Honshu, Japan. Based on the earthquake magnitude, location and historic tsunami records, a damaging tsunami **IS NOT** expected along the California, Oregon, Washington, British Columbia, and Alaska coasts. **NO** tsunami warning, watch or advisory is in effect for these areas.*

Q & A's have been developed to share with regional State Liaison Officers to dialogue with state counterparts

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Situation:

A magnitude 8.9 earthquake struck 80 miles east of Onagawa, 110 miles east-northeast of Fukushima at 1246 EST on March 11, 2011.

At the time of the earthquake:

- all 3 units at Onagawa were operating; all 3 automatically shutdown
- 3 units at Fukushima Daiichi were operating (Units 1, 2, and 3, with Units 4, 5, and 6 in a maintenance outage); all 3 were automatically shutdown
- all 4 units at Fukushima Daini were operating; all 4 were automatically shutdown
- 1 unit operating at Tokai; 1 unit was automatically shutdown

At Onagawa, a fire was confirmed to have occurred in the turbine building (turbine building common to all 3 units). This fire was extinguished.

At 0136 EST on March 12, 2011, an explosion occurred at the Fukushima Daiichi Unit 1.

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases – March 12th, 9pm and 11pm, March 13th, 2am, 8am, 9am and IAEA press releases)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary.

NISA press release (March 13, 2011 0830) stated four evacuees from Fatuaba – Machi have been found contaminated between 18000 and 40000 cpm.

Winds continue to blow out to sea.

Units 1 to 3: shutdown due to earthquake

Units 4 to 6: shutdown due to outage

Unit 1

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- Explosion occurred at Unit 1 following 0136 EST (March 11, 2011) earthquake. The containment remains intact.
- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons and cool the reactor core, helping to stabilize the core.
- Sea water is also being used to provide external cooling to the torus.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- Radiation levels at the boundary of the site have been reported to be above background.

Unit 2

- The reactor is shut down and the Reactor Core Isolation Cooling System is injecting water.
- Reactor water level is lower than normal, but above the top of active fuel and the water level is steady.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment.

Unit 3

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment. Containment remains intact.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel.
- Efforts to restart the Reactor Core Isolation Cooling System failed. Emergency Core Cooling System flow could not be confirmed.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- *Alternative methods to inject water into the core are being investigated.*
- *Containment sprays used to lower pressure within the reactor containment have been cancelled.*
- *A reactor pressure vessel manual safety valve was opened to lower the reactor pressure and immediately followed by injection of sea water and boric acid into the reactor core.*
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
 - A sufficient level of reactor coolant to ensure safety is maintained.
 - TEPCO prepared to reduce pressure in the reactor containment vessel.
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At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

NRC staff are coordinating with federal partners, including the White House, Congress, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of State, Department of Transportation, Environmental Protection Agency, Federal Emergency Management Agency, Naval Reactors, and Secret Service.

The two senior experts supporting USAID response efforts from the NRC have arrived in Japan. The experts have engaged with the US Ambassador's staff and have started coordinating transfer of information from Japanese authorities to the US government.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with regional State Liaison Officers to dialogue with state counterparts.

NRC has issued 5 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

Earthquake/Tsunami Status Update March 13, 2011

1400 EDT

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases – March 12th, 9pm and 11pm, March 13th, 2am, 8am, 9am, 0pm, 1pm, 2pm, 3pm, and IAEA information releases)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary.

The site is at a level 4 “Accident with Local Consequences” on the International Nuclear and Radiological Event Scale (INES).

A level 4 INES event can include or be characterized by:

- *Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.*
- *At least one death from radiation.*
- *Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.*
- *Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.*

Japan Nuclear and Industrial Safety Agency (NISA) press release (March 13, 2011 0830 JST) stated four evacuees from Fatuaba – Machi have been found contaminated between 18000 and 40000 cpm.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1 to 3: shutdown due to earthquake

Units 4 to 6: shutdown due to outage

Unit 1

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- Explosion occurred at Unit 1 following 0136 EST (March 12, 2011) earthquake. The secondary containment was damaged.
- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons and cool the reactor core, helping to stabilize the core.
- Sea water is also being used to provide external cooling to the torus.
- *Water level in the reactor is out of measuring range, but at least 170 cm below the top of the core.*
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared. *As of 1510 EST (March 12, 2011), an estimated 170,000 people have been evacuated. Full evacuation is not complete.*

Earthquake/Tsunami Status Update March 13, 2011

1400 EDT

- Radiation levels at the boundary of the site have been reported to be above background. *Radiation monitoring at 0020 EDT (March 13, 2011) indicates highest level is at measuring point MP4 of 47.1 uSv/hour (4.7 mrem/hour). NISA confirmed presence of cesium-137 and iodine-131 in the vicinity of the site.*
- *TEPCO is coordinating with Japanese authorities on how to cool down water in the spent fuel pool.*

Unit 2

- The reactor is shut down and the Reactor Core Isolation Cooling System is injecting water.
- Reactor water level is lower than normal, but above the top of active fuel and the water level is steady. *Water level is approximately >375 cm above the top of the core.*
- Working with the Japanese national government, TEPCO is taking measures to lower the pressure in the reactor containment.

Unit 3

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment. Containment remains intact.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel. *Reactor water level decreased to -150 to -200 cm below the top of the core.*
- Efforts to restart the Reactor Core Isolation Cooling System (*high pressure injection*) failed at 1510 EST (March 12, 2011). Emergency Core Cooling System flow could not be confirmed.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- Alternative methods to inject water into the core are being investigated.
- Containment sprays used to lower pressure within the reactor containment have been cancelled.
- A reactor pressure vessel manual safety valve was opened to lower the reactor pressure. *The valve opening procedure ended at 1920 EST on March 12, 2011. This procedure was immediately followed at 1925 EST (March 12, 2011) by injection of sea water and boric acid into the reactor core.*
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. *As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete.*

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Onagawa

At 0530 EDT (March 13, 2011), Tohoku Electric Power Company notified the Japanese national government of an increased level of radiation of 21 uSv/hour (2.1 mrem/hour) at the site boundary.

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The two senior experts supporting USAID response efforts from the NRC have arrived in Japan. The experts have engaged with the US Ambassador's staff and have started coordinating transfer of information from Japanese authorities to the US government.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with regional State Liaison Officers to dialogue with state counterparts.

NRC has issued 5 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

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Earthquake/Tsunami Status Update March 13, 2011

1600 EDT

Background:

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Fukushima Daiichi

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A level 4 INES event can include or be characterized by:

- Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
- At least one death from radiation.
- Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

Japan Nuclear and Industrial Safety Agency (NISA) press release (March 13, 2011 0830 JST) stated four evacuees from Fatuaba – Machi have been found contaminated between 18000 and 40000 cpm.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1 to 3: shutdown due to earthquake

Units 4 to 6: shutdown due to outage

Unit 1

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- Explosion occurred at Unit 1 following 0136 EST (March 12, 2011) earthquake. The secondary containment was damaged.
- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons and cool the reactor core, helping to stabilize the core.
- Sea water is also being used to provide external cooling to the torus.
- Water level in the reactor is out of measuring range, but at least 170 cm below the top of the core.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared. As of 1510 EST (March 12, 2011), an estimated 170,000 people have been evacuated. Full evacuation is not complete.
- Radiation levels at the boundary of the site have been reported to be above background. Radiation monitoring at 0020 EDT (March 13, 2011) indicates highest level is at measuring

point MP4 of 47.1 uSv/hour (4.7 mrem/hour). NISA confirmed presence of cesium-137 and iodine-131 in the vicinity of the site.

- TEPCO is coordinating with Japanese authorities on how to cool down water in the spent fuel pool.

Unit 2

- The reactor is shut down and the Reactor Core Isolation Cooling System is injecting water.
- Reactor water level is lower than normal, but above the top of active fuel and the water level is steady. Water level is approximately >375 cm above the top of the core.
- Working with the Japanese national government, TEPCO is taking measures to lower the pressure in the reactor containment.

Unit 3

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment. Containment remains intact.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel. Reactor water level decreased to -150 to -200 cm below the top of the core.
- Efforts to restart the Reactor Core Isolation Cooling System (high pressure injection) failed at 1510 EST (March 12, 2011). Emergency Core Cooling System flow could not be confirmed.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- Alternative methods to inject water into the core are being investigated.
- Containment sprays used to lower pressure within the reactor containment have been cancelled.
- A reactor pressure vessel manual safety valve was opened to lower the reactor pressure. The valve opening procedure ended at 1920 EST on March 12, 2011. This procedure was immediately followed at 1925 EST (March 12, 2011) by injection of sea water and boric acid into the reactor core.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.

Earthquake/Tsunami Status Update March 13, 2011

1600 EDT

- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Onagawa

At 0530 EDT (March 13, 2011), Tohoku Electric Power Company notified the Japanese national government of an increased level of radiation of 21 uSv/hour (2.1 mrem/hour) at the site boundary.

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the metrological conditions; wind

Earthquake/Tsunami Status Update March 13, 2011

1600 EDT

speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

The NRC staff determined that the measurable radioactivity was consistent with the venting of the Fukushima Daiishi Unit 1 reactor. The Navy also collected air samples having activity above background from the "plume." The NRC staff determined that the "plume" was most likely a puff from the venting that contained long lived noble gases, Xe-133, Xe-135 and Kr-85.

The Navy is expediting the air samples to a base in Japan which can perform an isotopic analysis to determine the actual radio-nuclides. The NRC will be able to better determine the status of the reactor based on the nuclides found in the sample.

USNRC Emergency Operations Center Status Update

March 13, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

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USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

NRC staff are coordinating with federal partners, including the White House, Congress, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of State, Department of Transportation, Environmental Protection Agency, Federal Emergency Management Agency, Naval Reactors, and Secret Service.

The two senior experts supporting USAID response efforts from the NRC have arrived in Japan. The experts have engaged with the US Ambassador's staff and have started coordinating transfer of information from Japanese authorities to the US government.

NRC is also coordinating with the International Atomic Energy Agency.

NRC has issued 5 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

Earthquake/Tsunami Status Update March 13, 2011

2000 EDT

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases – March 12th, 9pm and 11pm, March 13th, 2am, 8am, 9am, 0pm, 1pm, 2pm, 3pm, and IAEA information releases)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary.

The site is at a level 4 “Accident with Local Consequences” on the International Nuclear and Radiological Event Scale (INES).

A level 4 INES event can include or be characterized by:

- Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
- At least one death from radiation.
- Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

Japan Nuclear and Industrial Safety Agency (NISA) press release (March 13, 2011 0830 JST) stated four evacuees from Fatuaba – Machi have been found contaminated.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1 to 3: shutdown due to earthquake

Units 4 to 6: shutdown due to outage

All Units: lost all diesel generator fuel tanks and all AC power on-site.

Unit 1

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- Explosion occurred at Unit 1 following 0136 EST (March 12, 2011) earthquake. The secondary containment was damaged.
- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons and cool the reactor core, helping to stabilize the core.
- Sea water is also being used to provide external cooling to the torus.
- Water level in the reactor is out of measuring range, but at least 170 cm below the top of the core.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared. As of 1510 EST (March 12, 2011), an estimated 170,000 people have been evacuated. Full evacuation is not complete.
- Radiation levels at the boundary of the site have been reported to be above background. NISA confirmed presence of cesium-137 and iodine-131 in the vicinity of the site.

Earthquake/Tsunami Status Update March 13, 2011

2000 EDT

- TEPCO is coordinating with Japanese authorities on how to cool down water in the spent fuel pool.

Unit 2

- The reactor is shut down and the Reactor Core Isolation Cooling System is injecting water.
- Reactor water level is lower than normal, but above the top of active fuel and the water level is steady. Water level is approximately >375 cm above the top of the core.
- Working with the Japanese national government, TEPCO is taking measures to lower the pressure in the reactor containment.
- *DC Power is stable.*

Unit 3

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment. Containment remains intact.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel. Reactor water level decreased to -150 to -200 cm below the top of the core.
- Efforts to restart the Reactor Core Isolation Cooling System (high pressure injection) failed at 1510 EST (March 12, 2011). Emergency Core Cooling System flow could not be confirmed. *Core damage likely.*
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- Alternative methods to inject water into the core are being investigated.
- Containment sprays used to lower pressure within the reactor containment have been cancelled.
- A reactor pressure vessel manual safety valve was opened to lower the reactor pressure. The valve opening procedure ended at 1920 EST on March 12, 2011. This procedure was immediately followed at 1925 EST (March 12, 2011) by injection of sea water and boric acid into the reactor core (*uncertain of success*).
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.

- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Onagawa

At 0530 EDT (March 13, 2011), Tohoku Electric Power Company notified the Japanese national government of an increased level of radiation of 21 uSv/hour (2.1 mrem/hour) at the site boundary.



NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION

Office of Public Affairs Telephone: 301/415-8200

Washington, D.C. 20555-0001

E-mail: opa.resource@nrc.gov Site: www.nrc.gov

Blog: <http://public-blog.nrc-gateway.gov>

No. 11-046

March 13, 2011

(Revised)

NRC SEES NO RADIATION AT HARMFUL LEVELS REACHING U.S. FROM DAMAGED JAPANESE NUCLEAR POWER PLANTS

The Nuclear Regulatory Commission is coordinating with the Department of Energy and other federal agencies in providing whatever assistance the Japanese government requests as they respond to conditions at several nuclear power plant sites following the March 11 earthquake and tsunami. The NRC has sent two boiling-water reactor experts to Japan as part of a U.S. Agency for International Development team.

In response to nuclear emergencies, the NRC works with other U.S. agencies to monitor radioactive releases and predict their path. All the available information indicates weather conditions have taken the small releases from the Fukushima reactors out to sea away from the population. Given the thousands of miles between the two countries, Hawaii, Alaska, the U.S. Territories and the U.S. West Coast are not expected to experience any harmful levels of radioactivity.

During a nuclear event the NRC has requirements to protect populations around reactors. For instance, the U.S. evacuation standard at 10 miles is roughly equivalent to the 20-kilometer distance recommended in Japan. The United States also uses sheltering in place and potassium iodide, protective measures also available in Japan. United States citizens in Japan are encouraged to follow the protective measures recommended by the Japanese government. These measures appear to be consistent with steps the United States would take.

The NRC will not comment on hour-to-hour developments at the Japanese reactors. This is an ongoing crisis for the Japanese who have primary responsibility.

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News releases are available through a free *listserv* subscription at the following Web address: <http://www.nrc.gov/public-involve/listserver.html>. The NRC homepage at www.nrc.gov also offers a SUBSCRIBE link. E-mail notifications are sent to subscribers when news releases are posted to NRC's website.

USNRC Emergency Operations Center Status Update

March 13, 2011
Earthquake / Tsunami Status Update
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USNRC Status

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NRC staff are coordinating with federal partners, including the White House, Congress, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of State, Department of Transportation, Environmental Protection Agency, Federal Emergency Management Agency, Naval Reactors, and Secret Service.

The two senior experts supporting USAID response efforts from the NRC have arrived in Japan. The experts have engaged with the US Ambassador's staff and have started coordinating transfer of information from Japanese authorities to the US government.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with state counterparts.

NRC has issued 5 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

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Earthquake/Tsunami Status Update March 13, 2011

2200 EDT

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases – March 12th, 9pm and 11pm, March 13th, 2am, 8am, 9am, 0pm, 1pm, 2pm, 3pm, 8pm, and 9pm, and IAEA information releases)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary.

The site is at a level 4 “Accident with Local Consequences” on the International Nuclear and Radiological Event Scale (INES).

A level 4 INES event can include or be characterized by:

- Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
- At least one death from radiation.
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- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

Japan Nuclear and Industrial Safety Agency (NISA) press release (March 13, 2011 0830 JST) stated four evacuees from Fatuaba – Machi have been found contaminated between 18000 and 40000 cpm.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1 to 3: shutdown due to earthquake

Units 4 to 6: shutdown due to outage

All Units: lost all diesel generator fuel tanks and all AC power on-site.

Unit 1

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- Explosion occurred at Unit 1 following 0136 EST (March 12, 2011) earthquake. The secondary containment was damaged.
- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons and cool the reactor core, helping to stabilize the core.
- Sea water is also being used to provide external cooling to the torus.
- Water level in the reactor is out of measuring range, but at least 170 cm below the top of the core.

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Earthquake/Tsunami Status Update March 13, 2011

2200 EDT

- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared. As of 1510 EST (March 12, 2011), an estimated 170,000 people have been evacuated. Full evacuation is not complete.
- Radiation levels at the boundary of the site have been reported to be above background. Radiation monitoring at 0020 EDT (March 13, 2011) indicates highest level is at measuring point MP4 of 47.1 uSv/hour (4.7 mrem/hour). NISA confirmed presence of cesium-137 and iodine-131 in the vicinity of the site.
- TEPCO is coordinating with Japanese authorities on how to cool down water in the spent fuel pool.

Unit 2

- The reactor is shut down and the Reactor Core Isolation Cooling System is injecting water.
- Reactor water level is lower than normal, but above the top of active fuel and the water level is steady. Water level is approximately >375 cm above the top of the core.
- Working with the Japanese national government, TEPCO is taking measures to lower the pressure in the reactor containment.
- DC Power is stable.

Unit 3

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment. Containment remains intact.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel. Reactor water level decreased to -150 to -200 cm below the top of the core.
- Efforts to restart the Reactor Core Isolation Cooling System (high pressure injection) failed at 1510 EST (March 12, 2011). Emergency Core Cooling System flow could not be confirmed. Core damage likely.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- Alternative methods to inject water into the core are being investigated.
- Containment sprays used to lower pressure within the reactor containment have been cancelled.
- A reactor pressure vessel manual safety valve was opened to lower the reactor pressure. The valve opening procedure ended at 1920 EST on March 12, 2011. This procedure was immediately followed at 1925 EST (March 12, 2011) by injection of sea water and boric acid into the reactor core (uncertain of success).
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

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Earthquake/Tsunami Status Update March 13, 2011

2200 EDT

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
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Onagawa

At 0530 EDT (March 13, 2011), Tohoku Electric Power Company notified the Japanese national government of an increased level of radiation of 21 uSv/hour (2.1 mrem/hour) at the site boundary.

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Earthquake/Tsunami Status Update March 13, 2011

2200 EDT

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the metrological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

The NRC staff determined that the measurable radioactivity was consistent with the venting of the Fukushima Daiishi Unit 1 reactor. The Navy also collected air samples having activity above background from the "plume."

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. *The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.*

USNRC Emergency Operations Center Status Update

March 13, 2011
Earthquake / Tsunami Status Update
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Changes/Additions from previous updates are underlined

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All Units: lost all diesel generator fuel tanks and all AC power on-site.

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- Sea water is also being used to provide external cooling to the torus.
- Water level in the reactor is out of measuring range, but at least 170 cm below the top of the core.

- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared. As of 1510 EST (March 12, 2011), an estimated 170,000 people have been evacuated. Full evacuation is not complete.
- Radiation levels at the boundary of the site have been reported to be above background. Radiation monitoring at 0020 EDT (March 13, 2011) indicates highest level is at measuring point MP4 of 47.1 uSv/hour (4.7 mrem/hour). NISA confirmed presence of cesium-137 and iodine-131 in the vicinity of the site.
- TEPCO is coordinating with Japanese authorities on how to cool down water in the spent fuel pool.

Unit 2

- The reactor is shut down and the Reactor Core Isolation Cooling System is injecting water.
- Reactor water level is lower than normal, but above the top of active fuel and the water level is steady. Water level is approximately >375 cm above the top of the core.
- Working with the Japanese national government, TEPCO is taking measures to lower the pressure in the reactor containment.
- DC Power is stable.

Unit 3

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment. Containment remains intact.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel. Reactor water level decreased to -150 to -200 cm below the top of the core.
- Efforts to restart the Reactor Core Isolation Cooling System (high pressure injection) failed at 1510 EST (March 12, 2011). Emergency Core Cooling System flow could not be confirmed. Core damage likely.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- Alternative methods to inject water into the core are being investigated.
- Containment sprays used to lower pressure within the reactor containment have been cancelled.
- A reactor pressure vessel manual safety valve was opened to lower the reactor pressure. The valve opening procedure ended at 1920 EST on March 12, 2011. This procedure was immediately followed at 1925 EST (March 12, 2011) by injection of sea water and boric acid into the reactor core (uncertain of success).
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.
- At approximately 2200 EDT (March 13, 2011) there was a hydrogen explosion at Unit 3.

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Earthquake/Tsunami Status Update March 13, 2011

2230 EDT

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Onagawa

At 0530 EDT (March 13, 2011), Tohoku Electric Power Company notified the Japanese national government of an increased level of radiation of 21 uSv/hour (2.1 mrem/hour) at the site boundary.

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the metrological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

The NRC staff determined that the measurable radioactivity was consistent with the venting of the Fukushima Daiishi Unit 1 reactor. The Navy also collected air samples having activity above background from the "plume."

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

USNRC Emergency Operations Center Status Update

March 14, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

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USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

NRC is coordinating with federal partners, including the White House, Congress, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of State, Department of Transportation, Environmental Protection Agency, Federal Emergency Management Agency, Naval Reactors, and Secret Service.

The two senior experts supporting USAID response efforts from the NRC have arrived in Japan. The experts have engaged with the US Ambassador's staff and have started coordinating transfer of information from Japanese authorities to the US government.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with state counterparts.

NRC has issued 5 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases – March 12th, 9pm and 11pm, March 13th, 2am, 8am, 9am, 0pm, 1pm, 2pm, 3pm, 8pm, and 9pm, and IAEA information releases)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place for residents who stayed behind.

The site is at a level 4 “Accident with Local Consequences” on the International Nuclear and Radiological Event Scale (INES).

A level 4 INES event can include or be characterized by:

- Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
- At least one death from radiation.
- Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 0230 EDT (March 14, 2011) received report from the NRC expert at the US Embassy in Tokyo that cooling capability has been lost to all three units for several hours. Units 1 and 3 have lost the ability to inject seawater into the reactor and containment. Unit 2 has lost the ability to maintain core cooling using the Reactor Core Isolation Cooling System (RCIC).
- The reactor cores of all three units remain covered, but core cooling is currently unavailable.

Units 4, 5, and 6: shutdown due to outage

All Units: lost all diesel generator fuel tanks and all AC power on-site.

Unit 1

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- Explosion occurred at Unit 1 following 0136 EST (March 12, 2011) earthquake. The secondary containment was damaged.

- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons and cool the reactor core, helping to stabilize the core.
- Sea water was also being used to provide external cooling to the torus.
- At approximately 0230 EDT on March 14, 2011, NRC received information that Unit 1 has lost the ability to inject seawater into the reactor and containment.
- The reactor core remains covered, but seawater injection has been unavailable for several hours.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared. As of 1510 EST (March 12, 2011), an estimated 170,000 people have been evacuated. Full evacuation is not complete.
- Radiation levels at the boundary of the site have been reported to be above background. Radiation monitoring from 0825 local time (March 13, 2011) to 0338 local time (March 14, 2011) indicates highest level is at measuring point MP4 (Plant site, upwind of venting release points) of 1200 uSv/hour (120 mrem/hour) and a background of approximately 40 mr/hour with 120 mr/hour during venting. NISA confirmed presence of cesium-137 and iodine-131 in the vicinity of the site.
- TEPCO is coordinating with Japanese authorities on how to cool down water in the spent fuel pool.

Unit 2.

- The reactor is shut down and the Reactor Core Isolation Cooling System is injecting water.
- Reactor water level is lower than normal, but above the top of active fuel and decreasing. Working with the Japanese national government, TEPCO is taking measures to lower the pressure in the reactor containment by venting.
- DC Power is stable.
- At approximately 0230 EDT on March 14, 2011, the NRC senior expert reported that the core remains covered, but RCIC is unable to maintain level due to unreliable operation. RCIC has been unavailable for several hours.
- Japanese officials have informed the public of the possibility of a hydrogen explosion as a result of the loss of cooling.

Unit 3

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment. Containment remains intact.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel. Reactor water level decreased to -150 to -200 cm below the top of the core, but have since been raised above the top of active fuel.
- Efforts to restart the Reactor Core Isolation Cooling System (high pressure injection) failed at 1510 EST (March 12, 2011). Emergency Core Cooling System flow could not be confirmed. Core damage likely.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- Alternative methods to inject water into the core are being investigated.

- Containment sprays used to lower pressure within the reactor containment have been cancelled.
- A reactor pressure vessel manual safety valve was opened to lower the reactor pressure. The valve opening procedure ended at 1920 EST on March 12, 2011. This procedure was immediately followed at 1925 EST (March 12, 2011) by injection of sea water and boric acid into the reactor core (uncertain of success).
- At approximately 0230 EDT on March 14, 2011, NRC received information that Unit 3 has lost the ability to inject seawater into the reactor and containment.
- The reactor core remains covered, but levels are decreasing.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.
- At approximately 2200 EDT (March 13, 2011) there was a hydrogen explosion at Unit 3 that damaged the secondary containment.

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete. The Daini units have AC power, but have lost their ultimate heat sink.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Onagawa

At 2145 CET (March 13, 2011), IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the metrological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

The US 7th Fleet has repositioned its ships out of the downwind plume direction from the Fukushima Daiichi Nuclear Power Plant after detecting low level contamination in the air and on its aircraft operating in the area.

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The two senior experts supporting USAID response efforts from the NRC have arrived in Japan. The experts have engaged with the US Ambassador's staff and have started coordinating transfer of information from Japanese authorities to the US government.

At 0550 EDT, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units 1, 2, and 3, which have been without cooling for approximately 18 hours. The effort is being coordinated by the US Ambassador.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with state counterparts.

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Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases – March 12th, 9pm and 11pm, March 13th, 2am, 8am, 9am, 0pm, 1pm, 2pm, 3pm, 8pm, and 9pm, and IAEA information releases)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place for residents who stayed behind.

The site is at a level 4 “Accident with Local Consequences” on the International Nuclear and Radiological Event Scale (INES).

A level 4 INES event can include or be characterized by:

- Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
- At least one death from radiation.
- Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1, 2, and 3: shutdown due to earthquake

- approximately 0230 EDT (March 14, 2011) received report from the NRC expert at the US Embassy in Tokyo that cooling capability has been lost to all three units for several hours. Units 1 and 3 have lost the ability to inject seawater into the reactor and containment. Unit 2 has lost the ability to maintain core cooling using the Reactor Core Isolation Cooling System (RCIC).
- The status of core coverage for all three units is highly uncertain.

Units 4, 5, and 6: shutdown due to outage

All Units: lost all diesel generator fuel tanks and all AC power on-site.

Unit 1

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- Explosion occurred at Unit 1 following 0136 EST (March 12, 2011) earthquake. The secondary containment was damaged.

Earthquake/Tsunami Status Update March 14, 2011

0600 EDT

- At 0620 EST on March 12, 2011, operators began injection of sea water and boric acid into the reactor core. This combination acts to absorb neutrons and cool the reactor core, helping to stabilize the core.
- Sea water was also being used to provide external cooling to the torus.
- At approximately 0230 EDT on March 14, 2011, NRC received information that Unit 1 has lost the ability to inject seawater into the reactor and containment.
- The status of core coverage highly uncertain.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared. As of 1510 EST (March 12, 2011), an estimated 170,000 people have been evacuated. Full evacuation is not complete.
- Radiation levels at the boundary of the site have been reported to be above background. Radiation monitoring from 0825 local time (March 13, 2011) to 0338 local time (March 14, 2011) indicates highest level is at measuring point MP4 (Plant site, upwind of venting release points) of 1200 uSv/hour (120 mrem/hour) and a background of approximately 40 mr/hour with 120 mr/hour during venting. NISA confirmed presence of cesium-137 and iodine-131 in the vicinity of the site.
- TEPCO is coordinating with Japanese authorities on how to cool down water in the spent fuel pool.

Unit 2

- The reactor is shut down and the Reactor Core Isolation Cooling System is injecting water.
- Reactor water level is lower than normal, but above the top of active fuel and decreasing. Working with the Japanese national government, TEPCO is taking measures to lower the pressure in the reactor containment by venting.
- DC Power is stable.
- The status of core coverage is highly uncertain.
- Japanese officials have informed the public of the possibility of a hydrogen explosion as a result of the loss of cooling.

Unit 3

- The reactor is shut down. No offsite power, no emergency diesel generators working.
- TEPCO is working with the Japanese national government to reduce the pressure in the reactor containment. Containment remains intact.
- TEPCO informed Japanese Cabinet that Unit 3 water injection stopped and water level decreased exposing fuel. Reactor water level decreased to -150 to -200 cm below the top of the core, but have since been raised above the top of active fuel.
- Efforts to restart the Reactor Core Isolation Cooling System (high pressure injection) failed at 1510 EST (March 12, 2011). Emergency Core Cooling System flow could not be confirmed. Core damage likely.
- The national government has instructed evacuation for those local residents within 20km radius of the site periphery in accordance with clause 1 of the Article 15 of the Radiation Disaster Measure declared.
- Alternative methods to inject water into the core are being investigated.
- Containment sprays used to lower pressure within the reactor containment have been cancelled.
- A reactor pressure vessel manual safety valve was opened to lower the reactor pressure. The valve opening procedure ended at 1920 EST on March 12, 2011. This procedure was

immediately followed at 1925 EST (March 12, 2011) by injection of sea water and boric acid into the reactor core (uncertain of success).

- At approximately 0230 EDT on March 14, 2011, NRC received information that Unit 3 has lost the ability to inject seawater into the reactor and containment.
- The status of core coverage is highly uncertain.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.
- At approximately 2200 EDT (March 13, 2011) there was a hydrogen explosion at Unit 3 that damaged the secondary containment.

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete. The Daini units have AC power, but have lost their ultimate heat sink.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Onagawa

At 2145 CET (March 13, 2011), IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the metrological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

The US 7th Fleet has repositioned its ships out of the downwind plume direction from the Fukushima Daiichi Nuclear Power Plant after detecting low level contamination in the air and on its aircraft operating in the area.

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The two senior experts supporting USAID response efforts from the NRC have arrived in Japan. The experts have engaged with the US Ambassador's staff and have started coordinating transfer of information from Japanese authorities to the US government. At least six additional experts are ready to be deployed.

At 0550 EDT, March 14, 2011, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units 1, 2, and 3, which have been without cooling for approximately 21 hours. The effort is being coordinated by the US Ambassador.

The President considers it the highest priority to respond quickly and comprehensively to any request from Japan. USFJ is providing equipment to pump water at a high pressure to assist TEPCO at its Fukushima nuclear plant.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with State counterparts.

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- At least one death from radiation.
- Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 2300, March 14, Japan, Unit 2 core was again uncovered.

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

All Units: all AC power on-site lost.

Unit 1

- Partial core damage from exposed fuel.
- As of 2200 on March 14, Japan time, sea water is being injected.
- The reactor was described as "more stable."

Earthquake/Tsunami Status Update March 14, 2011

1330 EDT

- Containment described as "functional."
- Hydrogen explosion has damaged reactor building roof.

Unit 2

- Hydrogen explosion possibility has been mitigated because a part of the reactor building roof has been removed.
- RCIC has failed.
- Coolant was stopped for quite some time so core damage is assumed. Core was most likely totally uncovered for some time.
- As of 2200 on March 14, Japan time, sea water is being injected.
- Unit 2 containment is described as "functioning."

Unit 3

- Condition described as essentially the same as Unit 1.
- As of 2200 on March 14, Japan time, sea water is being injected.
- Hydrogen explosion has damaged reactor building roof.
- Containment described as "functional."

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
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Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete. The Daini units have AC power, but have lost their ultimate heat sink.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Onagawa

At 2145 CET (March 13, 2011), IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

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NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

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The two senior experts supporting USAID response efforts from the NRC have arrived in Japan. The experts have engaged with the US Ambassador's staff and have started coordinating transfer of information from Japanese authorities to the US government. Nine additional experts are ready to be deployed.

At 0550 EDT, March 14, 2011, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units 1, 2, and 3, which have been without cooling for approximately 24 hours. The effort is being coordinated by the US Ambassador.

The President considers it the highest priority to respond quickly and comprehensively to any request from Japan. USFJ is providing equipment to pump water at a high pressure to assist TEPCO at its Fukushima nuclear plant.

The NRC is evaluating the current plant status information, and based on the information provided to date some fuel damage has occurred. The NRC is monitoring the restoration of cooling water to prevent additional fuel damage. Current information indicates that the structure that contains the reactor vessel remains intact.

On March 14, 2011, NRC performed preliminary analysis based on the information available from the Japanese authorities. The result indicated the protective measures implemented by the Japanese government, including evacuation, sheltering, and potassium iodide, are

Earthquake/Tsunami Status Update March 14, 2011

2200 EDT

consistent with the U.S. Protective Action Guidelines. The NRC does not expect the U.S. to experience any harmful levels of radioactivity.

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Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with State counterparts.

NRC has issued 5 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (3 at Onagawa, 6 at Fukushima Daiichi, 4 at Fukushima Daini, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases and IAEA information releases.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place for residents who stayed behind.

The site is at a level 4 "Accident with Local Consequences" on the International Nuclear and Radiological Event Scale (INES).

A level 4 INES event can include or be characterized by:

- Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
- At least one death from radiation.
- Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Earthquake/Tsunami Status Update March 14, 2011

2200 EDT

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 2300, March 14, Japan, Unit 2 core was again uncovered.

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

All Units: all AC power on-site lost.

Unit 1

- Partial core damage from exposed fuel.
- As of 2200 EDT on March 14, it is reported that sea water is being injected.
- The reactor was described as "more stable."
- Containment described as "functional."
- Hydrogen explosion has damaged reactor building roof.

Unit 2

- Hydrogen explosion possibility has been mitigated because a part of the reactor building roof has been removed.
- RCIC has failed.
- Coolant was stopped for quite some time so core damage is assumed. Core was most likely totally uncovered for some time.
- As of 2200 EDT on March 14, it is reported that sea water is being injected.
- Unit 2 containment is described as "functioning."

Unit 3

- Condition described as essentially the same as Unit 1.
- As of 2200 EDT on March 14, it is reported that sea water is being injected.
- Hydrogen explosion has damaged reactor building roof.
- Containment described as "functional."

Unit 4

- The reactor is shut down.
- Sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 5

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

Unit 6

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO does not believe that there is any reactor coolant leakage inside the reactor containment vessel.

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Earthquake/Tsunami Status Update March 14, 2011

2200 EDT

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete. The Daini units have AC power, but have lost their ultimate heat sink.

Unit 1

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 2

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Unit 3

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.
- The reactor was in cold shutdown at 2215 EST on March 11, 2011

Unit 4

- The reactor is shut down.
- A sufficient level of reactor coolant to ensure safety is maintained.
- TEPCO prepared to reduce pressure in the reactor containment vessel.

Onagawa

At 2145 CET (March 13, 2011), IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the metrological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

Earthquake/Tsunami Status Update March 14, 2011

2200 EDT

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

The US 7th Fleet has repositioned its ships out of the downwind plume direction from the Fukushima Daiichi Nuclear Power Plant after detecting low level contamination in the air and on its aircraft operating in the area.

Reactor Safety Team Worst Case Analysis

Hypothetical Worst Case Daiichi Units 1, 2 and 3 Accident Sequence Based on our Knowledge of Current Plant Conditions

In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell could also result in a containment failure. With cooling water added to the drywell, however, a containment venting capability is also needed to preclude failure from over-pressurization. A containment failure will result in a large radioactive release to the environment.

Please note that failure to add water to the core and drywell is a hypothetical worst case event that will result in containment failure and radioactive release to the environment.

Protective Measures Team Worst Case Analysis

Meteorological conditions are changing, at 2300 the wind is from the NNE. Radioactive material (Cs-137 & I-131) has been detected at the Yokosuka Naval Base.

USNRC Emergency Operations Center Status Update

March 15, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

Caution - This information may be dated and is subject to constant change.

Changes/Additions from previous updates are underlined

USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

The two senior experts supporting USAID response efforts from the NRC are in Japan and have engaged with the US Ambassador's staff. Nine additional experts are in transit to Japan.

At 0550 EDT, March 14, 2011, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units 1, 2, and 3. The effort is being coordinated by the US Ambassador.

The NRC is evaluating the current plant status information, and based on the information provided to date some fuel damage has occurred. The NRC is monitoring the restoration of cooling water to prevent additional fuel damage. Current information indicates that the structure that contains the reactor vessel remains intact.

On March 14, 2011, NRC performed preliminary analysis based on the information available from the Japanese authorities. The result indicated the protective measures implemented by the Japanese government, including evacuation, sheltering, and potassium iodide, are consistent with the U.S. Protective Action Guidelines. The NRC does not expect the U.S. to experience any harmful levels of radioactivity.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with State counterparts.

NRC has issued 5 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

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Earthquake/Tsunami Status Update March 15, 2011

0600 EDT

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (6 at Fukushima Daiichi, 4 at Fukushima Daini, 3 at Onagawa, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases and IAEA information releases.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. Kyodo news reports a no fly zone out to 30 km.

The site is at a level 4 "Accident with Local Consequences" on the International Nuclear and Radiological Event Scale (INES).

A level 4 INES event can include or be characterized by:

- Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
- At least one death from radiation.
- Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 2300, March 14, Japan, Unit 2 core was again uncovered.

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

All Units: all AC power on-site lost.

Operators and other personnel not directly involved in water injection have been evacuated. 40-50 persons have been left onsite to mitigate accident.

Unit 1

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Containment described as "functional."
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof.
- There is stable core cooling
- The spent fuel pool level is unknown

- Radiation levels uncertain at this time

Unit 2

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- RCIC has failed.
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Core Cooling is NOT stable
- There are reports of a loud sound at Unit 2 in the vicinity of the suppression chamber – containment integrity is not assured.
- The following pressures have been reported – RPV is at 0.612 MPa (88 psi), Drywell is at 10 psi, and the Suppression Pool instrumentation is unreadable.
- SRV control problem is making pressure control difficult for reactor vessel
- Radiation levels uncertain at this time
- The spent fuel pool level is unknown

Unit 3

- Possible core damage due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof.
- Containment described as "functional."
- Core cooling believed to be stable
- There is no spent fuel pool information
- Radiation levels uncertain at this time

Unit 4

- Fire in the spent fuel building (Zirconium?) with IAEA reports that fire was put out at 2200 EDT, March 14
- There is a possible water loss from pool
- Radiation levels uncertain at this time

Unit 5

- The reactor is stable.
- There is no spent fuel pool information

Unit 6

- The reactor is stable.
- There is no spent fuel pool information

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete. The Daini units have AC power, and were previously reported to have lost their ultimate heat sink.

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Earthquake/Tsunami Status Update March 15, 2011

0600 EDT

Unit 1-4

- All units have stable offsite power
- All units are reported to be in cold shutdown with stable water level
- Latest TEPCO reports do not mention any problem with the ultimate heat sink

Onagawa

At 2145 CET (March 13, 2011), IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

Unit 1-3

- All units are shutdown and stable
- The fire in the turbine building has been extinguished

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the metrological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

The US 7th Fleet has repositioned its ships out of the downwind plume direction from the Fukushima Daiichi Nuclear Power Plant after detecting low level contamination in the air and on its aircraft operating in the area.

Reactor Safety Team Worst Case Analysis

Hypothetical Worst Case Daiichi Units 1, 2 and 3 Accident Sequence Based on our Knowledge of Current Plant Conditions

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Earthquake/Tsunami Status Update March 15, 2011

0600 EDT

In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell could also result in a containment failure. With cooling water added to the drywell, however, a containment venting capability is also needed to preclude failure from over-pressurization. A containment failure will result in a large radioactive release to the environment.

Please note that failure to add water to the core and drywell is a hypothetical worst case event that will result in containment failure and radioactive release to the environment.

Protective Measures Team Worst Case Analysis

Metrological forecasts show a steady wind shift continuing counter clockwise over the next 6 to 12 hours, with wind direction blowing a plume offshore again early Wednesday morning, local Japan time.

Based on unconfirmed reports that Fukushima Daiichi Unit 2 had lost vessel and drywell pressure subsequent to what was believed to be an explosion in the reactor building, the PMT ran RASCAL offsite dose estimations for an x-vessel core failure with loss of containment. Estimates were run with no change in wind direction (wind toward Tokyo) and with the predicted wind shift counterclockwise over the island and back out to sea. For the steady wind direction scenario, PAGs (>1 Rem TEDE and >5 Rem CDE) were exceeded at 50 miles. For the wind shift scenario, PAGs were exceeded between 30 to 40 miles. A RASCAL run of a Unit 4 SFP zirconium fire (with wind shift) showed PAGs exceeded at 15 miles.

Information continued to be conflicting regarding plant conditions for Unit 2 and all units SFPs. A report from the Japan Ministry of Foreign Affairs, over phone, stated that there were pressure readings in both the vessel and drywell, and that the suppression pool instrumentation was "below scale". In the same report, no confirmation for the status of any SFP could be provided.

USNRC Emergency Operations Center Status Update

March 15, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

Caution - This information may be dated and is subject to constant change.

Changes/Additions from previous updates are underlined

USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

The two senior experts supporting USAID response efforts from the NRC are in Japan and have engaged with the US Ambassador's staff. Nine additional experts are in transit to Japan.

At 0550 EDT, March 14, 2011, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units 1, 2, and 3. The effort is being coordinated by the US Ambassador.

The NRC is evaluating the current plant status information, and based on the information provided to date some fuel damage has occurred. The NRC is monitoring the restoration of cooling water to prevent additional fuel damage. Current information indicates that the structure that contains the reactor vessel remains intact.

On March 14, 2011, NRC performed preliminary analysis based on the information available from the Japanese authorities. The result indicated the protective measures implemented by the Japanese government, including evacuation, sheltering, and potassium iodide, are consistent with the U.S. Protective Action Guidelines. The NRC does not expect the U.S. to experience any harmful levels of radioactivity.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with State counterparts.

NRC has issued 5 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Earthquake/Tsunami Status Update March 15, 2011

0730 EDT

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (6 at Fukushima Daiichi, 4 at Fukushima Daini, 3 at Onagawa, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases and IAEA information releases.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. Kyodo news reports a no fly zone out to 30 km.

The site is at a level 4 "Accident with Local Consequences" on the International Nuclear and Radiological Event Scale (INES).

A level 4 INES event can include or be characterized by:

- Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
- At least one death from radiation.
- Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
- Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.

All available information indicates that releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 2300, March 14, Japan, Unit 2 core was again uncovered.

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

All Units: all AC power on-site lost.

Operators and other personnel not directly involved in water injection have been evacuated. 40-50 persons have been left onsite to mitigate accident.

Unit 1

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Containment described as "functional."
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof.
- There is stable core cooling
- The spent fuel pool level is unknown

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Earthquake/Tsunami Status Update March 15, 2011

0730 EDT

- Radiation levels uncertain at this time

Unit 2

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- RCIC has failed.
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Core Cooling is NOT stable
- There are reports of a loud sound at Unit 2 in the vicinity of the suppression chamber – while containment integrity is not assured, all indication is that containment is intact.
- The following pressures have been reported – RPV is at 1.0 MPa (145 psi).
- SRV control problem is making pressure control difficult for reactor vessel
- Radiation levels uncertain at this time
- The spent fuel pool level is unknown

Unit 3

- Core damage due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof.
- Containment described as "functional."
- Core cooling believed to be stable
- There is no spent fuel pool information
- Radiation levels uncertain at this time

Unit 4

- Fire in the spent fuel building was a small generator lube oil fire. IAEA reports that fire was put out at 2200 EDT, March 14.
- There is a possible water loss from the spent fuel pool and operators are having difficulty providing adequate cooling and water level to the pool;
- There are reports of possible hydrogen burn from the spent fuel.
- High radiation dose rates measured between Units 3 and 4, source is suspected to be Unit 4 spent fuel pool.
- Radiation levels uncertain at this time

Unit 5

- The reactor is stable.
- There is no spent fuel pool information

Unit 6

- The reactor is stable.
- There is no spent fuel pool information

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is

not complete. The Daini units have AC power, and were previously reported to have lost their ultimate heat sink.

Unit 1-4

- All units have stable offsite power
- All units are reported to be in cold shutdown with stable water level
- Latest TEPCO reports do not mention any problem with the ultimate heat sink

Onagawa

At 2145 CET (March 13, 2011), IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

Unit 1-3

- All units are shutdown and stable
- The fire in the turbine building has been extinguished

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the metrological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

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Reactor Safety Team Worst Case Analysis

Hypothetical Worst Case Daiichi Units 1, 2 and 3 Accident Sequence Based on our Knowledge of Current Plant Conditions

In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell could also result in a containment failure. With cooling water added to the drywell, however, a containment venting capability is also needed to preclude failure from over-pressurization. A containment failure will result in a large radioactive release to the environment.

Please note that failure to add water to the core and drywell is a hypothetical worst case event that will result in containment failure and radioactive release to the environment.

Protective Measures Team Worst Case Analysis

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Based on unconfirmed reports that Fukushima Daiichi Unit 2 had lost vessel and drywell pressure subsequent to what was believed to be an explosion in the reactor building, the PMT ran RASCAL offsite dose estimations for an x-vessel core failure with loss of containment. Estimates were run with no change in wind direction (wind toward Tokyo) and with the predicted wind shift counterclockwise over the island and back out to sea. For the steady wind direction scenario, PAGs (>1 Rem TEDE and >5 Rem CDE) were exceeded at 50 miles. For the wind shift scenario, PAGs were exceeded between 30 to 40 miles. A RASCAL run of a Unit 4 SFP zirconium fire (with wind shift) showed PAGs exceeded at 15 miles.

Information continued to be conflicting regarding plant conditions for Unit 2 and all units SFPs. A report from the Japan Ministry of Foreign Affairs, over phone, stated that there were pressure readings in both the vessel and drywell, and that the suppression pool instrumentation was "below scale". In the same report, no confirmation for the status of any SFP could be provided.

USNRC Emergency Operations Center Status Update

March 15, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

Caution - This information may be dated and is subject to constant change.

Changes/Additions from previous updates are underlined

USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

The two senior experts supporting USAID response efforts from the NRC are in Japan and have engaged with the US Ambassador's staff. Nine additional experts are in transit to Japan.

At 0550 EDT, March 14, 2011, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units 1, 2, and 3. The effort is being coordinated by the US Ambassador. At 0900 EDT (March 15, 2011), the Japanese government accepted DOE's RAP team assistance, which includes AMS fly-overs.

The NRC is evaluating the current plant status information, and based on the information provided to date some fuel damage has occurred. The NRC is monitoring the restoration of cooling water to prevent additional fuel damage. Current information indicates that the structures that contain the reactor vessels remain intact.

On March 14, 2011, NRC performed preliminary analysis based on the information available from the Japanese authorities. The result indicated the protective measures implemented by the Japanese government, including evacuation, sheltering, and potassium iodide, are consistent with the U.S. Protective Action Guidelines. The NRC does not expect the U.S. to experience any harmful levels of radioactivity.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with State counterparts.

NRC has issued 6 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

IAEA reports that at 1331 UTC on March 15, 2011 a 6.1 magnitude earthquake occurred in eastern Honshu, approximately 100 km from the Hamaoka nuclear power plant. Operational units at the plant remain in safe status after the earthquake.

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (6 at Fukushima Daiichi, 4 at Fukushima Daini, 3 at Onagawa, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases and IAEA information releases.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. IAEA confirms a no fly zone out to 30 km around the Fukushima Daiichi plant.

Japanese authorities classified the event at a Level 4 "Accident with Local Consequences" on the International Nuclear and Radiological Event Scale (INES) based on radioactive dose measurements at the site boundary exceeding limit values.

All available information indicates that the majority of releases from the Fukushima site have been carried out to sea by the prevailing winds.

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 2300, March 14, Japan, Unit 2 core was again uncovered.

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

All Units: all AC power on-site lost.

Operators and other personnel not directly involved in water injection have been evacuated. 40-50 persons have been left onsite to mitigate accident.

The following data was provided by the IAEA at 0912 EDT on March 15, 2011:

Data for Daiichi Units 1, 2 and 3 (as of 02:42 UTC)

Parameter	Unit	Fukushima Daiichi		
		Unit 1	Unit 2	Unit 3
Reactor Pressure	MPa	0.072 (A)	0.315	0.244(A)
Vessel Pressure		0.185 (B)		0.244 (B)
Drywell Pressure	KPa	315	155	415
Reactor Level	mm (above the top of active fuel)	-1700(A)	+400(A)	-1800(A)
		-1700(B)		-2300(B)
Suppression Pool Temperature	°C	No Data	No Data	No Data
Suppression Pool Pressure	KPa	No Data	D/S	D/S

Unit 1

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Containment described as "functional."
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof.
- There is stable core cooling
- The spent fuel pool level is unknown
- At 2000 ECT (March 14, 2011) IAEA reported dose rates at the Daiichi main gate of 11.9 mSv/hr (1190 mrem/hour), subsequent monitoring at 0200 EDT (March 15, 2011) showed dose rates at the Daiichi main gate of 0.6 mSv/hr (60 mrem/hr).

Unit 2

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- RCIC has failed.
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Core Cooling is NOT stable
- There are reports of a loud sound at Unit 2 in the vicinity of the suppression chamber – while containment integrity is not assured, all indication is that containment is intact.
- Radiation levels uncertain at this time
- The spent fuel pool level is unknown

Unit 3

- Core damage due to insufficient cooling water caused by loss of offsite power and onsite

- diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof.
- Containment described as "functional."
- Core cooling believed to be stable
- There is no spent fuel pool information
- Radiation levels uncertain at this time

Unit 4

- Fire in the spent fuel building was a small generator lube oil fire. IAEA reports that fire was put out at 2200 EDT, March 14.
- There is a possible water loss from the spent fuel pool and operators are having difficulty providing adequate cooling and water level to the pool;
- There are reports of possible hydrogen burn from the spent fuel.
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool.

Unit 5

- The reactor is stable.
- There is no spent fuel pool information

Unit 6

- The reactor is stable.
- There is no spent fuel pool information

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 10km radius of the site boundary. Radiation levels at the site boundary have not exceeded limits. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete. The Daini units have AC power, and were previously reported to have lost their ultimate heat sink.

Unit 1-4

- All units have stable offsite power
- All units are reported to be in cold shutdown with stable water level
- Latest TEPCO reports do not mention any problem with the ultimate heat sink

Onagawa

At 2145 CET (March 13, 2011), IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

Unit 1-3

- All units are shutdown and stable
- The fire in the turbine building has been extinguished

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the meteorological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

The US 7th Fleet has repositioned its ships out of the downwind plume direction from the Fukushima Daiichi Nuclear Power Plant after detecting low level contamination in the air and on its aircraft operating in the area.

Reactor Safety Team Worst Case Analysis

Hypothetical Worst Case Daiichi Units 1, 2 and 3 Accident Sequence Based on our Knowledge of Current Plant Conditions

In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell could also result in a containment failure. With cooling water added to the drywell, however, a containment venting capability is also needed to preclude failure from over-pressurization. A containment failure will result in a large radioactive release to the environment.

Please note that failure to add water to the core and drywell is a hypothetical worst case event that will result in containment failure and radioactive release to the environment.

Protective Measures Team (PMT) Worst Case Analysis

The PMT ran RASCAL offsite dose estimations for a hypothetical x-vessel core failure at Fukushima Daiichi Unit 2 with loss of containment. Two estimates were run: 1) no change in wind direction (wind toward Tokyo) and 2) with the predicted wind shift counterclockwise over the island and back out to sea. For the steady wind direction scenario, PAGs (>1 Rem TEDE and >5 Rem CDE) were exceeded at 50 miles beyond Unit 2. For the wind shift scenario, PAGs were exceeded between 30 to 40 miles.

Another RASCAL run for the Fukushima Unit 4 spent fuel pool (SFP) was updated to reflect an actual spent fuel inventory of 1331 bundles in the Unit 4 SFP. Since observed meteorological data is unavailable, forecast meteorological data for the 24 hour release period, which indicate wind shifting offshore, were used. For the meteorological conditions utilized, at 20 miles, the Protective Action Guide (PAG) for Total Effective Dose Equivalent (TEDE) is 1.4 rem, slightly above the 1 rem PAG. At 30 miles, the TEDE is 0.9 rem.

USNRC Emergency Operations Center Status Update

March 15, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

**Caution – This information may be dated and is subject to constant change.
Changes/Additions from previous updates are underlined**

USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

The two senior experts supporting USAID response efforts from the NRC are in Japan and have engaged with the US Ambassador's staff. Nine additional experts are in transit to Japan.

At 0550 EDT, March 14, 2011, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units 1, 2, and 3. The effort is being coordinated by the US Ambassador. At 0900 EDT (March 15, 2011), the Japanese government accepted DOE's Radiological Assistance Program (RAP) team assistance, which includes Aerial Measuring System (AMS) fly-overs.

The NRC is evaluating the current plant status information, and based on the information provided to date some fuel damage has occurred. The NRC is monitoring the restoration of cooling water to prevent additional fuel damage. Current information indicates that the structures that contain the reactor vessels remain intact.

On March 14, 2011, NRC performed preliminary analysis based on the information available from the Japanese authorities. The result indicated the protective measures implemented by the Japanese government, including evacuation, sheltering, and potassium iodide, are not inconsistent with the U.S. Protective Action Guidelines. The NRC does not expect the U.S. and its territories to experience any harmful levels of radioactivity.

NRC provided the White House with information on protective measures for NRC staff in Japan, being able to provide advice for other federal workers in Japan, and that US citizens in Japan should follow advice of the government of Japan.

NRC is also coordinating with the International Atomic Energy Agency.

Q & A's have been developed and shared with Regional State Liaison Officers to dialogue with State counterparts.

NRC has issued 6 press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Earthquake/Tsunami Status Update March 15, 2011

1930 EDT

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

The Institute of Nuclear Power Operations (INPO) issued a Level 1 Event Report (highest level) to its members this afternoon. It identifies 4 actions, with due dates, and requires a written response. In general, the actions include walkdowns and verifications of aspects of facility capabilities to address B.5.b equipment and procedures, Severe Accident Management Guidelines (SAMGs), mitigation of station blackout (SBO) conditions, mitigation of internal and external flooding, and fire and flooding events that could be impacted by a concurrent seismic event.

Status of Japanese Facilities (This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

IAEA reports that at 1331 UTC on March 15, 2011 a 6.1 magnitude earthquake occurred in eastern Honshu, approximately 100 km from the Hamaoka nuclear power plant. Operational units at the plant remain in safe status after the earthquake.

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (6 at Fukushima Daiichi, 4 at Fukushima Daini, 3 at Onagawa, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases and IAEA information releases.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. IAEA confirms a no fly zone out to 30 km around the Fukushima Daiichi plant. As of 1830 EDT on March 15, 2011, there have been no updates to protective actions.

Japanese authorities classified the event at a Level 4 "Accident with Local Consequences" on the International Nuclear and Radiological Event Scale (INES) based on radioactive dose measurements at the site boundary exceeding limit values.

All available information indicates that the majority of releases from the Fukushima site have been carried out to sea by the prevailing winds. Forecast meteorological data for the 24 hour period (until 1700 EDT on March 16, 2011) indicates wind remaining toward offshore (N, NW).

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 1000 EDT (March 14, 2011), Unit 2 core was again uncovered.

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

All Units: all AC power on-site lost.

Operators and other personnel not directly involved in water injection have been evacuated. 40-50 persons have been left onsite to mitigate accident.

The following data was provided by the IAEA at 0912 EDT on March 15, 2011:

Data for Daiichi Units 1, 2 and 3 (as of 02:42 UTC)

Parameter	Unit	Fukushima Daiichi		
		Unit 1	Unit 2	Unit 3
Reactor Pressure	MPa	0.072 (A)	0.315	0.244(A)
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Reactor Level	mm (above the top of active fuel)	-1700(A)	+400(A)	-1800(A)
		-1700(B)		-2300(B)
Suppression Pool Temperature	°C	No Data	No Data	No Data
Suppression Pool Pressure	KPa	No Data	D/S	D/S

Unit 1

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected.
- Containment described as "functional."
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof.
- Sea water is being injected with reported stable cooling
- The spent fuel pool level is unknown
- High radiation levels reduced to 600 mSv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011 at site gate. (Site gate is same for each unit).

Unit 2

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Reactor Core Isolation Cooling (RCIC) has failed.
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- Sea water injection restarted with reports of non-stable conditions.
- There are reports of a loud sound at Unit 2 in the vicinity of the suppression chamber. It was reported at 0730 EDT on March 15, 2011 that containment is intact (better than previously thought).

Earthquake/Tsunami Status Update March 15, 2011

1930 EDT

- High radiation levels reduced to 600 mSv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011 at site gate. (Site gate is same for each unit).
- The spent fuel pool level is unknown

Unit 3

- Core damage due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Sea water is being injected with reported stable cooling
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof.
- Primary containment described as "functional."
- There is no spent fuel pool information
- High radiation levels reduced to 600 mSv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011 at site gate. (Site gate is same for each unit).

Unit 4

- First fire in the reactor building was a small generator lube oil fire. IAEA reports that fire was put out at 2200 EDT, March 14.
- High radiation levels reduced to 600 mSv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011 at site gate. (Site gate is same for each unit).
- Second fire began 1645 EDT, March 14, 2011 in reactor building. Reports indicate that this fire is not yet contained. TEPCO is determining whether to use helicopter or fire truck to fight fire. Fuel reported to be uncovered.
- Radiation level in the area of unit 4 reported to be 30R/hour following second fire.
- There is a possible water loss from the spent fuel pool and operators are having difficulty providing adequate cooling and water level to the pool.
- There are reports of possible hydrogen explosion due to uncovered fuel in the spent fuel pool (awaiting visual confirmation).
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool.

Unit 5

- The reactor is stable.
- Spent fuel pool is reported to be heating up.

Unit 6

- The reactor is stable.
- Spent fuel pool is reported to be heating up.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary. As of 1510 EST (March 12, 2011), an estimated 30,000 people have been evacuated. Full evacuation is not complete. As of 1830 EDT on March 15, 2011, there have not been updates to this information. The Daini units have AC power, and were previously reported to have lost their ultimate heat sink.

Unit 1-4

- All units have stable offsite power
- All units are reported to be in cold shutdown with stable water level

Earthquake/Tsunami Status Update March 15, 2011

1930 EDT

- Latest TEPCO reports do not mention any problem with the ultimate heat sink

Onagawa

At 2145 CET (March 13, 2011), IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

Unit 1-3

- All units are shutdown and stable
- The fire in the turbine building has been extinguished

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan and USS George Washington

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem per hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hr up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the meteorological conditions; wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radio-nuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

The US 7th Fleet has repositioned its ships out of the downwind plume direction from the Fukushima Daiichi Nuclear Power Plant after detecting low level contamination in the air and on its aircraft operating in the area.

The US Navy identified radiological data from the USS George Washington located at Yokosuka Base at 0300 EDT on March 15, 2011 that showed an air sample of 7E-9 uCi/mL, from which the Navy estimated a dose rate of 1.5 mrem/hour.

Reactor Safety Team Worst Case Analysis

Hypothetical Worst Case Daiichi Units 1, 2 and 3 Accident Sequence Based on our Knowledge of Current Plant Conditions

In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell could also result in a containment failure. With cooling water added to the drywell, however, a containment venting capability is also needed to preclude failure from over-pressurization. A containment failure will result in a large radioactive release to the environment.

Please note that failure to add water to the core and drywell is a hypothetical worst case event that will result in containment failure and radioactive release to the environment.

Protective Measures Team (PMT) Worst Case Analysis

On March 15, 2011, the PMT ran RASCAL offsite dose estimations for a hypothetical x-vessel core failure with loss of containment at a boiling water reactor (BWR) similar to Fukushima Daiichi Unit 2 with loss of containment. Two estimates were run: 1) no change in wind direction (wind toward Tokyo) and 2) with the predicted wind shift counterclockwise over the island and back out to sea. For the steady wind direction scenario, Protective Action Guides (PAGs) (>1 rem Total Effective Dose Equivalent (TEDE) and >5 rem Committed Dose Equivalent (CDE)) were exceeded at 50 miles beyond Unit 2. For the wind shift scenario, PAGs were exceeded between 30 to 40 miles.

Another RASCAL run with assumptions to model the Fukushima Unit 4 spent fuel pool (SFP) was updated to reflect a spent fuel inventory of 1331 bundles. Since observed meteorological data is unavailable, forecast meteorological data for the 24 hour release period, which indicate wind shifting offshore, were used. For the meteorological conditions utilized, at 20 miles, the PAG for TEDE is 1.4 rem, slightly above the 1 rem PAG. At 30 miles, the TEDE is 0.9 rem.

As of 1900 EDT on March 15, 2011, we believe the runs are bounding for all four units. The PMT is working to update the RASCAL run for the Unit 4 spent fuel pool, using actual meteorological parameters.

Reference

Units

1 rem (rem) = 1000 millirem (mrem)

1 Sievert (Sv) = 1000 milliSieverts (mSv)

1 rem = 0.01 Sv = 10 mSv

USNRC Emergency Operations Center Status Update

March 15, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

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USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

A total of 11 NRC experts supporting USAID response efforts from the NRC are in Japan and have engaged with the US Ambassador's staff.

At 0550 EDT, March 14, 2011, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units 1, 2, and 3. The effort is being coordinated by the US Ambassador. At 0900 EDT, March 15, 2011, the Japanese government accepted DOE's Radiological Assistance Program (RAP) team assistance, which includes Aerial Measuring System (AMS) fly-overs.

NRC provided the White House with information on protective measures for NRC staff in Japan, being able to provide advice for other federal workers in Japan, and that U.S. citizens in Japan should follow advice of the government of Japan.

NRC has issued numerous press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

The Institute of Nuclear Power Operations (INPO) issued a Level 1 Event Report (highest level) to its members this afternoon. It identifies 4 actions, with due dates, and requires a written response. In general, the actions include walkdowns and verifications of aspects of facility capabilities to address B.5.b equipment and procedures, Severe Accident Management Guidelines (SAMGs), mitigation of station blackout (SBO) conditions, mitigation of internal and external flooding, and fire and flooding events that could be impacted by a concurrent seismic event.

Status of Japanese Facilities

(This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

IAEA reports that at 1331 UTC on March 15, 2011 a 6.1 magnitude earthquake occurred in eastern Honshu, approximately 100 km from the Hamaoka nuclear power plant. Operational units at the plant remain in safe status after the earthquake.

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (6 at Fukushima Daiichi, 4 at Fukushima Daini, 3 at Onagawa, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases and IAEA information releases.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. As of March 12, a 10 km complete radius evacuation has been ordered for the public. IAEA confirms a no-fly zone out to 30 km around the Fukushima Daiichi plant. As of 1830 EDT on March 15, 2011, there have been no updates to protective actions.

Japanese authorities classified the event at a Level 4 "Accident with Local Consequences" on the International Nuclear and Radiological Event Scale (INES) based on radioactive dose measurements at the site boundary exceeding limit values.

IAEA reported at 1340 EDT, March 15, 2011:

- Highest reading at fence was 60 mrem/hour at 0200 EDT
- Reduction of dose rates after the peak at 2122 EDT, March 14 (400 mSv/hr in area surrounding Unit 3)
- 30 mSv/hr between Units 2 & 3, and 100 mSv/hr surrounding Unit 4
- 2227 EDT, March 15: dose info came in from DTRA. GIS will figure out locations.
- Offsite dose measured in Tokai on the coast 100 km NE of Tokyo on March 14 at 1845 EDT was 5 uSv/hr.
- On March 14, NISA reported 160 people were exposed to radiation around the Fukushima nuclear power plant. 170,000 people have been evacuated.
- A no-fly zone was implemented 30 km from the site from zero to unlimited altitude. Source from DOE NIT who talked with FAA.
- On March 16, DITRA data is from 165 miles SSW from the site.

All available information indicates that the majority of releases from the Fukushima site have been carried out to sea by the prevailing winds. Forecast meteorological data for the 24 hour period (until 1700 EDT on March 16, 2011) indicates wind remaining toward offshore (N, NW).

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 1000 EDT, March 14, 2011, Unit 2 core was again uncovered.

Earthquake/Tsunami Status Update March 16, 2011

0630 EDT

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

- All Units: all AC power on-site lost.
- Operators and other personnel not directly involved in water injection have been evacuated. 40-50 persons have been left onsite to mitigate accident.

Unit 1

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected with reported stable cooling
- Containment described as "functional"
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building (secondary containment)
- The spent fuel pool level is decreasing
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)

Unit 2

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Reactor Core Isolation Cooling (RCIC) has failed
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- Secondary containment: Cut hole to reduce likelihood of hydrogen gas buildup
- Sea water injection restarted with core cooling reported as not stable
- There are reports of a loud sound at Unit 2 in the vicinity of the suppression chamber. It was reported at 0730 EDT on March 15, 2011 that containment is intact (better than previously thought).
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)
- The spent fuel pool level is decreasing

Unit 3

- Core damage due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Sea water is being injected with reported stable cooling
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building (secondary containment)
- Primary containment described as "functional"
- The spent fuel level is decreasing, with zirc interaction
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)

Unit 4

- First fire in the reactor building was a small generator lube oil fire. IAEA reports that fire was put out at 2200 EDT, March 14.
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)

Earthquake/Tsunami Status Update March 16, 2011

0630 EDT

- Second fire began at 1645 EDT, March 15, 2011 in reactor building. Reports indicate that this fire is not yet contained. TEPCO is determining whether to use helicopter or fire truck to fight fire. Fuel reported to be uncovered.
- Radiation level inside Unit 4 reported to be 30R/hour following second fire.
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool.
- There is a total water loss from the spent fuel pool with no ability to retain water in the pool; and zirc interaction taking place
- There are reports of possible hydrogen explosion due to uncovered fuel in the spent fuel pool (awaiting visual confirmation).
- Unconfirmed reports of 30 R/hr at the Unit 4 SFP which is making fire fighting difficult (March 15). Another fire at Unit 4 SFP.

Unit 5

- The reactor is stable.
- Spent fuel pool is reported to be heating up.
- IAEA reports that water level in was down 40 cm in 5 hours since 0800 EDT, March 15, 2011. It is not clear if this is the RPV or SFP water level. TEPCO plans to use operational diesel generator at Unit 6 to provide water to Unit 5.

Unit 6

- The reactor is stable.
- Spent fuel pool is reported to be heating up.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary. As of 1510 EST, March 12, 2011, an estimated 30,000 people have been evacuated. Full evacuation is not complete. As of 1830 EDT on March 15, 2011, there have not been updates to this information. The Daini units have AC power, and were previously reported to have lost their ultimate heat sink.

Unit 1-4

- All units have stable offsite power
- All units are reported to be in cold shutdown with stable water level
- Latest TEPCO reports do not mention any problem with the ultimate heat sink

Onagawa

At 2145 CET, March 13, 2011, IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

Unit 1-3

- All units are shutdown and stable
- The fire in the turbine building has been extinguished

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan and USS George Washington

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem/hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hour up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the meteorological conditions, wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

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Reactor Safety Team Worst Case Analysis

Hypothetical Worst Case Daiichi Units 1, 2 and 3 Accident Sequence Based on our Knowledge of Current Plant Conditions

In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell

could also result in a containment failure. With cooling water added to the drywell, however, a containment venting capability is also needed to preclude failure from over-pressurization. A containment failure will result in a large radioactive release to the environment.

Please note that failure to add water to the core and drywell is a hypothetical worst case event that will result in containment failure and radioactive release to the environment.

Protective Measures Team (PMT) Worst Case Analysis

On March 15, 2011, the PMT ran RASCAL offsite dose estimations for a hypothetical x-vessel core failure with loss of containment at a boiling water reactor (BWR) similar to Fukushima Daiichi Unit 2 with loss of containment. Two estimates were run: 1) no change in wind direction (wind toward Tokyo) and 2) with the predicted wind shift counterclockwise over the island and back out to sea. For the steady wind direction scenario, Protective Action Guides (PAGs) (>1 rem Total Effective Dose Equivalent (TEDE) and >5 rem Committed Dose Equivalent (CDE)) were exceeded at 50 miles beyond Unit 2. For the wind shift scenario, PAGs were exceeded between 30 to 40 miles.

Another RASCAL run with assumptions to model the Fukushima Unit 4 spent fuel pool (SFP) was updated to reflect a spent fuel inventory of 1331 bundles. Since observed meteorological data is unavailable, forecast meteorological data for the 24 hour release period, which indicate wind shifting offshore, were used. For the meteorological conditions utilized, at 20 miles, the PAG for TEDE is 1.4 rem, slightly above the 1 rem PAG. At 30 miles, the TEDE is 0.9 rem.

As of 1900 EDT on March 15, 2011, we believe the runs are bounding for all four units. The PMT is working to update the RASCAL run for the Unit 4 spent fuel pool, using actual meteorological parameters.

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Earthquake/Tsunami Status Update March 16, 2011

0630 EDT

Reference

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1 rem (rem) = 1,000 millirem (mrem)

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USNRC Emergency Operations Center Status Update

March 15, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

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A total of 11 NRC experts supporting USAID response efforts from the NRC are in Japan and have engaged with the US Ambassador's staff.

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NRC provided the White House with information on protective measures for NRC staff in Japan, being able to provide advice for other federal workers in Japan, and that U.S. citizens in Japan should follow advice of the government of Japan.

NRC has issued numerous press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Status of NRC Licensee and Agreement State Facilities

At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

The Institute of Nuclear Power Operations (INPO) issued a Level 1 Event Report (highest level) to its members this afternoon. It identifies 4 actions, with due dates, and requires a written response. In general, the actions include walkdowns and verifications of aspects of facility capabilities to address B.5.b equipment and procedures, Severe Accident Management Guidelines (SAMGs), mitigation of station blackout (SBO) conditions, mitigation of internal and external flooding, and fire and flooding events that could be impacted by a concurrent seismic event.

Earthquake/Tsunami Status Update March 16, 2011

1400 EDT

Status of Japanese Facilities

(This information is compiled from available sources, including press releases by the Tokyo Electric Power Company (TEPCO) and information from the International Atomic Energy Agency (IAEA)).

IAEA reports that at 1331 UTC on March 15, 2011 a 6.1 magnitude earthquake occurred in eastern Honshu, approximately 100 km from the Hamaoka nuclear power plant. Operational units at the plant remain in safe status after the earthquake.

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (6 at Fukushima Daiichi, 4 at Fukushima Daini, 3 at Onagawa, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases and IAEA information releases.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. As of March 12, a 10 km complete radius evacuation has been ordered for the public. IAEA confirms a no-fly zone out to 30 km around the Fukushima Daiichi plant. As of 1830 EDT on March 15, 2011, there have been no updates to protective actions.

Japanese authorities classified the event at a Level 4 "Accident with Local Consequences" on the International Nuclear and Radiological Event Scale (INES) based on radioactive dose measurements at the site boundary exceeding limit values.

IAEA reported at 1340 EDT, March 15, 2011:

- Highest reading at fence was 60 mrem/hour at 0200 EDT
- Reduction of dose rates after the peak at 2122 EDT, March 14 (400 mSv/hr in area surrounding Unit 3)
- 30 mSv/hr between Units 2 & 3, and 100 mSv/hr surrounding Unit 4
- 2227 EDT, March 15: dose info came in from DTRA. GIS will figure out locations.
- Offsite dose measured in Tokai on the coast 100 km NE of Tokyo on March 14 at 1845 EDT was 5 uSv/hr.
- On March 14, NISA reported 160 people were exposed to radiation around the Fukushima nuclear power plant. 170,000 people have been evacuated.
- A no-fly zone was implemented 30 km from the site from zero to unlimited altitude. Source from DOE NIT who talked with FAA.
- On March 16, DITRA data is from 165 miles SSW from the site.

All available information indicates that the majority of releases from the Fukushima site have been carried out to sea by the prevailing winds. Forecast meteorological data for the 24 hour period (until 1700 EDT on March 16, 2011) indicates wind remaining toward offshore (N, NW).

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 1000 EDT, March 14, 2011, Unit 2 core was again uncovered.

Earthquake/Tsunami Status Update March 16, 2011

1400 EDT

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

- All Units: all AC power on-site lost.
- Operators and other personnel not directly involved in water injection have been evacuated. 40-50 persons have been left onsite to mitigate accident.

Unit 1

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected with reported stable cooling
- Containment described as "functional"
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building (secondary containment)
- The spent fuel pool level is unknown
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)

Unit 2

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Reactor Core Isolation Cooling (RCIC) has failed
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- Secondary containment: Cut hole to reduce likelihood of hydrogen gas buildup
- Sea water injection restarted with core cooling reported as not stable
- There are reports of a loud sound at Unit 2 in the vicinity of the suppression chamber. It was reported at 0730 EDT on March 15, 2011 that containment is intact (better than previously thought).
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)
- The spent fuel pool level is unknown. Possibility of steam/smoke from water boil-off or zirc-water reaction.

Unit 3

- Core damage due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Sea water is being injected with reported stable cooling
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building (secondary containment)
- Primary containment described as "functional"
- The spent fuel pool level is unknown. Possibility of steam/smoke from water boil-off or zirc-water reaction.
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)

Unit 4

- First fire in the reactor building was a small generator lube oil fire. IAEA reports that fire was put out at 2200 EDT, March 14.

Earthquake/Tsunami Status Update March 16, 2011

1400 EDT

- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)
- Second fire began at 1645 EDT, March 15, 2011 in reactor building. Reports indicate that this fire is not yet contained. Fuel reported to be uncovered.
- Radiation level outside Unit 4 reported to be 30R/hour following second fire.
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool.
- The spent fuel pool's ability to retain water is in doubt.
- Explosion (likely hydrogen) in Unit 4 due to uncovered fuel in the spent fuel pool (awaiting visual confirmation).

Unit 5

- The reactor is stable.
- Spent fuel pool is reported to be heating up.
- IAEA reports that water level in was down 40 cm in 5 hours since 0800 EDT, March 15, 2011. It is not clear if this is the RPV or SFP water level. TEPCO plans to use operational diesel generator at Unit 6 to provide water to Unit 5.

Unit 6

- The reactor is stable.
- Spent fuel pool is reported to be heating up.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary. As of 1510 EST, March 12, 2011, an estimated 30,000 people have been evacuated. Full evacuation is not complete. As of 1830 EDT on March 15, 2011, there have not been updates to this information. The Daini units have AC power, and were previously reported to have lost their ultimate heat sink.

Unit 1-4

- All units have stable offsite power
- All units are reported to be in cold shutdown with stable water level
- Latest TEPCO reports do not mention any problem with the ultimate heat sink

Onagawa

At 2145 CET, March 13, 2011, IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

Unit 1-3

- All units are shutdown and stable
- The fire in the turbine building has been extinguished

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan and USS George Washington

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead "plume" were approximately 0.6 mrem/hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hour up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the meteorological conditions, wind speed of 3-5 mph and the calm 'Class D and E' weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

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In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell

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A RASCAL run at 06:54AM (EDT) on March 16, 2011 for hypothetical combined core based on the following assumptions: Units 2 & 3 each, 33% core melt & no containment; Unit 4, full core offload 100% melt in the Spent Fuel Pool (SFP) with no roof; wind direction from West Northwest blowing out to the ocean. Results: PAG exceeded at 50 miles (80.5 km) with TEDE of 24.0 rem, and CDE thyroid of 130 rem.

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Earthquake/Tsunami Status Update March 16, 2011

1400 EDT

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USNRC Emergency Operations Center Status Update

March 16, 2011
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Earthquake/Tsunami Status Update March 16, 2011

1900 EDT

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Earthquake/Tsunami Status Update March 16, 2011

1900 EDT

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- At approximately 1000 EDT, March 14, 2011, Unit 2 core was again uncovered.

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

- All Units: all AC power on-site lost.
- Operators and other personnel not directly involved in water injection have been evacuated. 40-50 persons have been left onsite to mitigate accident.

Unit 1

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected with reported stable cooling
- Containment described as "functional"
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building (secondary containment)
- The spent fuel pool level is unknown
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)

Unit 2

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Reactor Core Isolation Cooling (RCIC) has failed
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- Secondary containment: Cut hole to reduce likelihood of hydrogen gas buildup
- Sea water injection restarted with core cooling reported as not stable
- Primary containment is intact.
- High radiation levels reduced to 600 μ Sv/hour (60 mrem/hour) at 0200 EDT on March 15, 2011, at site gate. (Site gate is same for each unit.)
- The spent fuel pool level is unknown. Some water is available as evidenced by steam emanating from hole.

Unit 3

- Core damage due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Sea water is being injected with reported stable cooling
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building (secondary containment)
- Primary containment described as "functional"
- The spent fuel pool level is possibly drained – some evidence of steam.
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Unit 4

- First fire in the reactor building was a small generator lube oil fire. IAEA reports that fire was put out at 2200 EDT, March 14.
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- Radiation level outside Unit 4 reported to be 30R/hour following second fire.
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool.
- The spent fuel pool's ability to retain water is in doubt, no steam – likely dry.

Unit 5

- The reactor is defueled.
- Spent fuel pool is reported to be heating up.
- A/C power available from Unit 6 diesel generator.

Unit 6

- The reactor is defueled.
- Spent fuel pool is reported to be heating up.
- A/C power available from diesel generator.

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Earthquake/Tsunami Status Update March 16, 2011

1900 EDT

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March 17, 2011
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The US State Department has approved voluntary authorized departure for US Government employees at the Embassy in Japan.

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Earthquake/Tsunami Status Update March 17, 2011

0600 EDT

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Status of Japanese Facilities

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IAEA reports that at 1331 UTC on March 15, 2011 a 6.1 magnitude earthquake occurred in eastern Honshu, approximately 100 km from the Hamaoka nuclear power plant. Operational units at the plant remain in safe status after the earthquake.

Background:

There are 14 operational Boiling Water Reactors (BWRs) proximal to the earthquake zone (6 at Fukushima Daiichi, 4 at Fukushima Daini, 3 at Onagawa, and 1 at Tokai)

Current Understanding of Japanese Reactor Status

(This information is compiled from TEPCO press releases and IAEA information releases.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. As of March 12, a 10 km complete radius evacuation has been ordered for the public. IAEA confirms a no-fly zone out to 30 km around the Fukushima Daiichi plant. As of 1830 EDT on March 15, 2011, there have been no updates to protective actions.

Japanese authorities classified the event at a Level 4 "Accident with Local Consequences" on the International Nuclear and Radiological Event Scale (INES) based on radioactive dose measurements at the site boundary exceeding limit values.

Federation of Electric Power Companies of Japan (FEPC) reported at 1015 EST, March 16, 2011:

- Dose rate at main gate (monitoring station 6) ranged from 150 mr/hr to 1000 mr/hr.
- 10 Rem/hr west of Unit 3 and 4 (assuming on roadway next to reactor buildings)
- 30 Rem/hr between Units 2 and 3
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Earthquake/Tsunami Status Update March 17, 2011

0600 EDT

- Offsite dose measured in Tokai on the coast 100 km NE of Tokyo on March 14 at 1845 EDT was 5 uSv/hr.
- On March 14, NISA reported 160 people were exposed to radiation around the Fukushima nuclear power plant. 170,000 people have been evacuated.
- A no-fly zone was implemented 30 km from the site from zero to unlimited altitude. Source from DOE NIT who talked with FAA.
- On March 16, DTRA data is from 165 miles SSW from the site.

All available information indicates that the majority of releases from the Fukushima site have been carried out to sea by the prevailing winds. Forecast meteorological data for the 24 hour period (until 1200 EDT on March 17, 2011) indicates wind headed offshore (from NW).

Units 1, 2, and 3: shutdown due to earthquake

- At approximately 1000 EDT, March 14, 2011, Unit 2 core was again uncovered.

Units 4, 5, and 6: shutdown due to outage, prior to earthquake

- Operators and other personnel not directly involved in water injection have been evacuated. 40-50 persons have been left onsite to mitigate accident.
- Unit 5 diesel generator is providing power to cool Unit 5 and Unit 6 spent fuel pool.

TEPCO is working to restore site power and anticipates restoration to Units 2,5, and 6 today and Units 1, 3, and 4 tomorrow.

Five portable pumps have arrived at the Daiichi site and additional equipment to connect the pumps is being coordinated.

DOE Aerial Measurement Teams have completed fly-over of the Daiichi site. Awaiting results.

Unit 1

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- As of 2200 JST (0900 EDT) on March 14, it is reported that sea water is being injected with reported stable cooling
- Containment described as "functional"
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building (secondary containment)
- The spent fuel pool level is unknown
- Radiation levels 150-1000 mrem/hour at 1000 EDT on March 16, 2011, at site gate. (Site gate is same for each unit.)
- Core cooling is via the core spray header.

Unit 2

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Reactor Core Isolation Cooling (RCIC) has failed
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- Secondary containment: Cut hole in the side of the reactor building superstructure to reduce likelihood of hydrogen gas buildup
- Sea water injection restarted with core cooling reported as not stable

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Earthquake/Tsunami Status Update March 17, 2011

0600 EDT

- Primary containment is intact.
- Radiation levels 150-1000 mrem/hour at 1000 EDT on March 16, 2011, at site gate. (Site gate is same for each unit.)
- The spent fuel pool level is unknown. Some water is available as evidenced by steam emanating from hole.

Unit 3

- Core damage due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Sea water is being injected with reported stable cooling
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building (secondary containment)
- Primary containment described as "functional"
- The spent fuel pool level is possibly drained – some evidence of steam.
- Radiation levels 150-1000 mrem/hour at 1000 EDT on March 16, 2011, at site gate. (Site gate is same for each unit.)
- Unit 3 is currently TEPCO's priority (unclear whether reactor or spent fuel pool)
- Water cannon should be onsite soon (as of 0400 EDT)

Unit 4

- Unit was in a refueling outage at the time of the event and core was off loaded to the spent fuel pool
- First fire in the reactor building was a small generator lube oil fire. IAEA reports that fire was put out at 2200 EDT, March 14.
- Radiation levels 150-1000 mrem/hour at 1000 EDT on March 16, 2011, at site gate. (Site gate is same for each unit.)
- Second fire began at 1645 EDT, March 15, 2011 in reactor building. Reports indicate that this fire is not yet contained. Fuel reported to be uncovered.
- Radiation level outside Unit 4 reported to be 30R/hour following second fire.
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the Unit 4 spent fuel pool.
- The spent fuel pool's ability to retain water is in doubt, no steam – likely dry.

Unit 5

- The reactor is defueled.
- IAEA Reports Temperature of pool at 64.5 degrees C at 1500 EDT, March 16, 2011.
- Unit 5 diesel generator is providing power to cool Units 5 and 6 spent fuel pools.

Unit 6

- The reactor is defueled.
- IAEA Reports Temperature of pool at 61.0 degrees C at 1300 EDT, March 16, 2011.
- Power to cool the Unit 6 spent fuel pool is being provided by the Unit 5 diesel generator.

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary. As of 1510 EST, March 12, 2011, an estimated 30,000 people have been evacuated. Full evacuation is not complete. As of 1830 EDT on March 15, 2011, there have not been updates to this information. The Daini units have AC power, and were previously reported to have lost their ultimate heat sink.

Earthquake/Tsunami Status Update March 17, 2011

0600 EDT

Unit 1-4

- All units have stable offsite power
- All units are reported to be in cold shutdown with stable water level
- Latest TEPCO reports do not mention any problem with the ultimate heat sink

Onagawa

At 2145 CET, March 13, 2011, IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

Unit 1-3

- All units are shutdown and stable
- The fire in the turbine building has been extinguished

Rokkasho

Earthquake cut off power supply, but diesel generators were immediately connected. Some water spilled from spent fuel pool – liquid was drained and appropriately recovered in liquid waste treatment system. Power supplies are restored to commercial electricity. All units operating.

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan and USS George Washington

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead “plume” were approximately 0.6 mrem/hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hour up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the meteorological conditions, wind speed of 3-5 mph and the calm ‘Class D and E’ weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radionuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

The US 7th Fleet has repositioned its ships out of the downwind plume direction from the Fukushima Daiichi Nuclear Power Plant after detecting low level contamination in the air and on its aircraft operating in the area.

Earthquake/Tsunami Status Update March 17, 2011

0600 EDT

The US Navy identified radiological data from the USS George Washington located at Yokosuka Base at 0300 EDT on March 15, 2011, that showed an air sample of 7E-9 $\mu\text{Ci}/\text{mL}$, from which the Navy estimated a dose rate of 1.5 mrem/hour.

Reactor Safety Team Worst Case Analysis

Hypothetical Worst Case Daiichi Units 1, 2 and 3 Accident Sequence Based on our Knowledge of Current Plant Conditions

In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell could also result in a containment failure. With cooling water added to the drywell, however, a containment venting capability is also needed to preclude failure from over-pressurization. A containment failure will result in a large radioactive release to the environment.

Please note that failure to add water to the core and drywell is a hypothetical worst case event that will result in containment failure and radioactive release to the environment.

Protective Measures Team (PMT) Worst Case Analysis

A RASCAL run at 0654 EDT on March 16, 2011 for hypothetical combined core based on the following assumptions: Units 2 & 3 each, 33% core melt & no containment; Unit 4, full core offload 100% melt in the Spent Fuel Pool (SFP) with no roof; wind direction from West Northwest blowing out to the ocean. Results: PAG exceeded at 50 miles (80.5 km) with TEDE of 24.0 rem, and CDE thyroid of 130 rem.

NRC PMT discussion with DOE NIT and NARAC requested expedited AMS flyover data of deposition near site to provide better characterization of source term. Information is expected by approximately 5am EDT.

Wind shift over land not expected until Sunday.

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1 rem (rem) = 1,000 millirem (mrem)

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USNRC Emergency Operations Center Status Update

March 17, 2011
Earthquake / Tsunami Status Update
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At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed.

A total of 11 NRC experts supporting USAID response efforts from the NRC are in Japan and have engaged with the US Ambassador's staff.

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NRC provided the White House with information on protective measures for NRC staff in Japan and information to provide advice for other federal workers in Japan. The current protective action recommendation for U.S. citizens residing within 50 miles (80 km) of the Fukushima Daiichi site is to evacuate.

The US State Department has approved voluntary authorized departure of family members at the U.S. Embassy in Tokyo, the U.S. Consulate in Nagoya and the Foreign Service Institute in Yokohama.

NRC has issued numerous press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

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At this time, NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects.

The Institute of Nuclear Power Operations (INPO) issued a Level 1 Event Report (highest level) to its members on the afternoon of March 15, 2011. It identifies 4 actions, with due dates, and requires a written response. In general, the actions include walkdowns and verifications of aspects of facility capabilities to address B.5.b equipment and procedures, Severe Accident Management Guidelines (SAMGs), mitigation of station blackout (SBO) conditions, mitigation of

Earthquake/Tsunami Status Update March 17, 2011

0700 EDT

internal and external flooding, and fire and flooding events that could be impacted by a concurrent seismic event.

The Nuclear Energy Institute (NEI) issued two fact sheets on March 16, 2011: "Industry Taking Action to Ensure Continued Safety at U.S. Nuclear Energy Plants" and "Used Nuclear Fuel Storage at the Fukushima Daiichi Nuclear Power Plant."

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Earthquake/Tsunami Status Update March 17, 2011 0700 EDT

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Unit 2

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Earthquake/Tsunami Status Update March 17, 2011

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- Water cannon should be onsite soon (as of 0400 EDT)

Unit 4

- Unit was in a refueling outage at the time of the event and core was off loaded to the spent fuel pool
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Earthquake/Tsunami Status Update March 17, 2011

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- Unit 5 diesel generator is providing power to cool Unit 5 and Unit 6 spent fuel pool.

TEPCO is working to restore site power and anticipates restoration to Units 2,5, and 6 today and Units 1, 3, and 4 tomorrow.

Five portable pumps have arrived at the Daiichi site and additional equipment to connect the pumps is being coordinated.

DOE Aerial Measurement Teams have completed fly-over of the Daiichi site. Data was received and is being analyzed.

Priority	Unit	Fukushima Daiichi STATUS AS OF 1500 EDT, 03/17/2011 - (0400 JDT)
1	3	Core Status Damaged, fuel >1/2 covered, RCS depressurized (FEPC) Radiation released. Sea water injection sufficient to cool core. (WANO)
		Containment Primary Containment, some damage. Secondary Containment lost (visual).
		Spent Fuel Pool 514 Bundles in SFP (GEH) Low Level (JAIF), Dumping water with helicopter suspended (NRC staff in Japan 0420 EDT)
2	4	Spent Fuel Pool ?Pool is dry? 1201 Bundles in SFP (GEH) Damage to fuel rods suspected (JAIF) dumping water from helicopter suspended (Casto 0420 EDT)
3	2	Core Status damaged, fuel 2/3 covered, RCS depressurized (FEPC). Sea

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Earthquake/Tsunami Status Update March 17, 2011

1700 EDT

		water inject enough to cool core (WANO)
		Containment Primary Containment, some damage. Secondary Containment, Hole cut in side of Fuel Floor metal to reduce H2 buildup, steam coming from hole (visual).
		Spent Fuel Pool 587 Bundles in SFP (GEH) No information on SFP status (JAIF).
4	1	Core Status damaged, >1/2 fuel covered, RCS depressurized (FEPC) Sea water inject enough to cool core (WANO)
		Containment Primary Containment functional (JAIF) Secondary Containment lost (visual)
		Spent Fuel Pool 292 Bundles in SFP (GEH) SFP Level unknown (JAIF).
5	5	Shutdown since 1/3/11. Core in RPV. SFP 950 Bundles (GEH), Unit 6 EDG providing power
6	6	Shutdown since 8/14/10. Core in RPV. SFP 876 Bundles (GEH), Unit's EDG available.
7	N/A	Common Spent Fuel Pool: 6,000 spent fuel bundles (GEH) Located on land side of Unit 4 (visual)
		Electrical Power Restoration from Switchyard to Unit 2 480 v Pumps (first) in progress

(Sources: FEPC – Federation of Electric Power Companies of Japan; GEH – General Electric Hitachi; JAIF – Japan Atomic Industrial Forum; WANO – World Association of Nuclear Operators)

Fukushima Daini

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary. As of 1510 EST, March 12, 2011, an estimated 30,000 people have been evacuated. Full evacuation is not complete. As of 1830 EDT on March 15, 2011, there have not been updates to this information. The Daini units have AC power, and were previously reported to have lost their ultimate heat sink.

Unit 1-4

- All units have stable offsite power
- All units are reported to be in cold shutdown with stable water level
- Latest TEPCO reports do not mention any problem with the ultimate heat sink

Onagawa

At 2145 CET, March 13, 2011, IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary of the Onagawa Nuclear Power Plant have returned to normal background levels.

Earthquake/Tsunami Status Update March 17, 2011

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Unit 1-3

- All units are shutdown and stable
- The fire in the turbine building has been extinguished

Rokkasho

Earthquake cut off power supply, but diesel generators were immediately connected. Some water spilled from spent fuel pool – liquid was drained and appropriately recovered in liquid waste treatment system. Power supplies are restored to commercial electricity. All units operating.

NRC Evaluation of Radiation Measurements from the USS Ronald Reagan and USS George Washington

On the morning of March 13, 2011, Naval Reactors notified the NRC that dose rates were being measured from the flight deck of the USS Reagan that was ~130 nautical miles off the Japanese coast. Dose rates from the overhead “plume” were approximately 0.6 mrem/hour gamma with no measurable activity on the ship surfaces. The NRC had received an IAEA report showing dose rates of 100 mrem/hour up wind at the site boundary measured ~ 20 hours earlier and press reports for the previous day of plant venting. Given the meteorological conditions, wind speed of 3-5 mph and the calm ‘Class D and E’ weather stability for the 20-24 hour time period, a plume with low dose rates from the venting is credible at this location.

NRC staff believes that US Naval readings are not inconsistent based on reports and shine dose measurements received from Japanese officials during venting from Fukushima Daiichi Units 1, 2, and 3.

The Navy sent the contamination samples to a base in Japan to perform an isotopic analysis to determine the actual radionuclides. The principle radionuclides identified were iodine, cesium, and technetium, consistent with a release from a nuclear reactor.

The US 7th Fleet has repositioned its ships out of the downwind plume direction from the Fukushima Daiichi Nuclear Power Plant after detecting low level contamination in the air and on its aircraft operating in the area.

The US Navy identified radiological data from the USS George Washington located at Yokosuka Base at 0300 EDT on March 15, 2011, that showed an air sample of 7E-9 µCi/mL, from which the Navy estimated a dose rate of 1.5 mrem/hour.

Reactor Safety Team Worst Case Analysis

Hypothetical Worst Case Daiichi Units 1, 2 and 3 Accident Sequence Based on our Knowledge of Current Plant Conditions

In this hypothetical event in which no cooling water is added to the core, the water level in the core will decrease, exposing the top of the core to a steam environment and a subsequent heat-up of the fuel rods. As the water continues to boil and recede toward the core bottom, the heat-up rate of the rods will increase rapidly resulting in fuel cladding failure and melt. With the continued lack of cooling water, the melting rods will relocate toward the bottom of the core and eventually into the lower plenum of the reactor vessel. Molten fuel and core debris entering the lower plenum will then cause the lower plenum liquid to boil. If cooling water is added to the drywell to a level above the top elevation of the lower plenum, lower head failure can be prevented. With no cooling water added to the drywell, the lower head will fail by creep rupture allowing molten fuel to enter the drywell. Moreover, the absence of cooling water to the drywell could also result in a containment failure. With cooling water added to the drywell, however, a containment venting capability is also needed to preclude failure from over-pressurization. A containment failure will result in a large radioactive release to the environment.

Please note that failure to add water to the core and drywell is a hypothetical worst case event that will result in containment failure and radioactive release to the environment.

Protective Measures Team (PMT) Worst Case Analysis

A RASCAL run at 0654 EDT on March 16, 2011 for hypothetical combined core based on the following assumptions: Units 2 & 3 each, 33% core melt & no containment; Unit 4, full core offload 100% melt in the Spent Fuel Pool (SFP) with no roof; wind direction from West Northwest blowing out to the ocean. Results: PAG exceeded at 50 miles (80.5 km) with TEDE of 24.0 rem, and CDE thyroid of 130 rem.

PMT has transmitted agreed source term to NARAC and is awaiting updated dose projections for along Japan and trans-Pacific for doses to US west coast. First AMS run data received. PMT working to correlate AMS data with limited survey data from Japan.

Wind shift over land not expected until Sunday.

Reference

Units

1 rem (rem) = 1,000 millirem (mrem)

1 Sievert (Sv) = 1,000 milliSieverts (mSv) = 1,000,000 microsieveerts (μ Sv)

1 rem = 0.01 Sv = 10 mSv

to NRC

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Earthquake/Tsunami Status Update March 18, 2011

0600 EDT

USNRC Emergency Operations Center Status Update

March 18, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

This report was changed to include NRC's current understanding of the ongoing situation in Japan. Historical and background information can be found in past reports.

USNRC Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed 24/7.

A total of 11 NRC experts supporting USAID response efforts from the NRC are in Japan and have engaged with the US Ambassador and his staff.

At 0550 EDT, March 14, 2011, the NRC experts in Japan reported that the Japanese have requested US technical assistance with cooling the Fukushima Daiichi Units, as needed. The effort is being coordinated by the US Ambassador. At 0900 EDT, March 15, 2011, the Japanese government accepted DOE's Radiological Assistance Program (RAP) team assistance, which includes Aerial Measuring System (AMS) flyovers.

On March 16, NRC provided the White House with information on protective measures for NRC staff in Japan and information to provide advice for other federal workers in Japan. The current protective action recommendation for U.S. citizens residing within 50 miles (80 km) of the Fukushima Daiichi site is to evacuate.

The US State Department has approved voluntary authorized departure of family members at the U.S. Embassy in Tokyo, the U.S. Consulate in Nagoya and the Foreign Service Institute in Yokohama.

Japanese Ministry of Defense appears to be taking on a larger role in the response effort.

NRC has issued numerous press releases related to the earthquake and tsunami. These press releases can be found online at: <http://www.nrc.gov/reading-rm/doc-collections/news/2011/>

Current Top Priorities

Currently, NRC's top priorities are determining radiological conditions, dose projections, and protective action recommendations, as well as facilitating the design, procurement, and delivery of temporary pumping equipment for emergency cooling.

Bechtel has completed engineering design work and is working with vendors to procure the required material. USAID has not yet authorized payment for these activities. GE Hitachi may be the organization that will install and operate the equipment.

Status of NRC Licensee and Agreement State Facilities

NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects. NRC is currently working on a generic communication for distribution to the U.S. nuclear power reactor fleet.

The Institute of Nuclear Power Operations (INPO) issued a Level 1 Event Report (highest level) to its members on the afternoon of March 15, 2011. It identifies 4 actions, with due dates, and requires a written response. In general, the actions include walkdowns and verifications of aspects of facility capabilities to address B.5.b equipment and procedures, Severe Accident Management Guidelines (SAMGs), mitigation of station blackout (SBO) conditions, mitigation of internal and external flooding, and fire and flooding events that could be impacted by a concurrent seismic event.

The Nuclear Energy Institute (NEI) issued two fact sheets on March 16, 2011: "Industry Taking Action to Ensure Continued Safety at U.S. Nuclear Energy Plants" and "Used Nuclear Fuel Storage at the Fukushima Daiichi Nuclear Power Plant."

Current Understanding of Japanese Facilities

(This information is compiled from TEPCO press releases, IAEA information releases, Federation of Electric Power Companies of Japan, Japan Atomic Industrial Forum, World Association of Nuclear Operators, the NRC in-country team and others.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. As of March 12, a 10 km complete radius evacuation has been ordered for the public. IAEA confirms a no-fly zone out to 30 km around the Fukushima Daiichi plant. As of 1830 EDT on March 15, 2011, there have been no updates to protective actions.

Japanese authorities have changed the classification of the event from a Level 4 to a Level 5 "Accident with Wider Consequences" on the International Nuclear and Radiological Event Scale (INES).

NHK media report on March 17, 0100 EDT stated that helicopter crews dumping water on Unit 3 reactor building reported dose rates at 375 R/hr at 300 ft. above the building.

An array of fire trucks have been deployed at the site and appeared to be supplying // spraying water over Unit 3.

All available information indicates that the majority of releases from the Fukushima site have been carried out to sea by the prevailing winds. Forecast meteorological data for the 24 hour period until 2000 EDT on March 18, 2011 indicates wind headed offshore (from NW/westerly).

DOE Aerial Measurement Teams have completed two flyovers of the Daiichi site. Data from the second flyover was received and is being analyzed.

The NRC in-country team is embedding a staffer at the TEPCO EOC.

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Earthquake/Tsunami Status Update March 18, 2011

0600 EDT

NRC Priority	Fukushima Daiichi STATUS as of 1500 EDT, March 17, 2011 - (0400 Japan)	Unit
1	Core Status: damaged	3
	Core Cooling: RCS depressurized; radiation released; sea water injected to cool core (Source: JAIF)	
	Primary Containment: some damage	
	Secondary Containment: lost (visual)	
	Spent Fuel Pool: 514 bundles in pool; low water level; helicopters flew to drop water and water cannon truck sprayed water on March 17. (Source: METI), fire trucks are supplying sea water for cooling spray	
2	Core Status:	4
	Core Cooling	
	Primary Containment	
	Secondary Containment: lost (visual)	
	Spent Fuel Pool: 1201 bundles in pool; pool dry?; damage to fuel rods suspected; water was dumped on site with water cannons; fire trucks are supplying seawater for cooling spray	
3	Core Status: damaged	2
	Core Cooling: RCS depressurized; sea water inject to cool core (Source: JAIF)	
	Primary Containment: possible torus damage	
	Secondary Containment: hole cut in side of fuel floor metal to reduce H2 buildup	
	Spent Fuel Pool: 587 bundles in pool; fire trucks are supplying seawater for cooling spray	
4	Core Status: damaged	1
	Core Cooling: RCS depressurized; sea water inject to cool core (Source: JAIF)	
	Primary Containment: functional	
	Secondary Containment: lost (visual)	
	Spent Fuel Pool: 292 bundles in pool, water level unknown, fire trucks are supplying seawater for cooling spray	
5	Shutdown since January 3, 2011	5
	Core Status: core in RPV (Source: INPO)	
	Spent Fuel Pool: 950 bundles; unit 6 emergency diesel generator available	
6	Shutdown since August 14, 2010	6
	Core Status: core in RPV (Source: INPO)	
	Spent Fuel Pool: 876 bundles; unit's emergency diesel generator available	
7	Common Spent Fuel Pool: 6,000 bundles located on land side of Unit 4	N/A
	Electrical Power: Restoration from Switchyard to Unit 2 480v pumps (first) in progress	

Earthquake/Tsunami Status Update March 18, 2011

0600 EDT

Fukushima Daini

- No changes to report

Onagawa

- No changes to report

Rokkasho

- No changes to report

Protective Measures Team (PMT) Conducting Two Analyses

PMT is actively working with DOE, NARAC, and other Federal Agencies to refine and model offsite dose calculation models to estimate the potential for radio nuclides to reach US territories. The models assume fuel damage, containment damage, and damage to some spent fuel pools with open access to the environment.

Wind shift over land not expected until Sunday, March 20, 2011.

International Response

- IAEA sent a two person team to conduct coordination activities and to take measurements. NRC communicated with IAEA to discuss the status and concerns.
- France has shared technical data with the NRC and publicly posted their assessment of doses in Tokyo on the IRSN website.
- Spain Parliament is still reviewing and deciding on support levels.
- Italy is interested in discussing what the USG is doing, and might be interested in helping in some way.
- China has offered to help.
- Russia has sent a team to Tokyo. The U.S. team is planning to meet to understand Russian capabilities and to coordinate activities.

Reference

Units

1 rem (rem) = 1,000 millirem (mrem)

1 Sievert (Sv) = 1,000 milliSieverts (mSv) = 1,000,000 microsieverts (μ Sv)

1 rem = 0.01 Sv = 10 mSv

USNRC Emergency Operations Center Status Update

March 18, 2011
Earthquake / Tsunami Status Update
Compiled by Executive Briefing Team

This report was changed to include NRC's current understanding of the ongoing situation in Japan. Historical and background information can be found in past reports.

NRC's Top Priorities

- 1) Continued assessment of radiological conditions, dose projections, and protective action recommendations.
 - 2) Providing technical assistance to the Government of Japan.
 - 3) Coordination with other U.S. Departments and Agencies, the Institute of Nuclear Power Operations (INPO), Bechtel, General Electric Hitachi (GEH), Tokyo Electric Power Company (TEPCO), and the Japanese military.
-

Status

At 0946 EST, March 11, 2011, the NRC entered Monitoring Mode and the agency continues to monitor the unfolding events in Japan. The Headquarters Operations Center is staffed 24/7.

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On March 16, NRC provided the White House with information on protective measures for NRC staff in Japan and information to provide advice for other federal workers in Japan. The current protective action recommendation for U.S. citizens residing within 50 miles (80 km) of the Fukushima Daiichi site is to evacuate.

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Earthquake/Tsunami Status Update March 18, 2011

1800 EDT

The US State Department has approved voluntary authorized departure of family members at the U.S. Embassy in Tokyo, the U.S. Consulate in Nagoya and the Foreign Service Institute in Yokohama.

Japanese Ministry of Defense appears to be taking on a larger role in the response effort.

The U.S. Department of Energy and the U.S. Environmental Protection Agency are the Federal communicators on questions regarding possible domestic impacts from the events in Japan and on domestic monitoring.

Status of NRC Licensee and Agreement State Facilities

NRC is discontinuing reporting status of NRC licensee and Agreement State facilities. NRC will resume this reporting should any issues arise related to earthquake or tsunami effects. NRC is currently working on a generic communication for distribution to the U.S. nuclear power reactor fleet.

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The Nuclear Energy Institute (NEI) issued several fact sheets, the latest on March 17, 2011: "Perspective on Radiation Releases and Emergency Planning at U.S. Nuclear Power Plants"

Current Understanding of Japanese Facilities

(This information is compiled from TEPCO press releases, IAEA information releases, Federation of Electric Power Companies of Japan, Japan Atomic Industrial Forum, World Association of Nuclear Operators, the NRC in-country team and others.)

Fukushima Daiichi

Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30 km for residents who stayed behind. IAEA confirms a no-fly zone out to 30 km around the Fukushima Daiichi plant. As of 1830 EDT on March 15, 2011, there have been no updates to protective actions.

Japanese authorities have changed the classification of the event from a Level 4 to a Level 5 "Accident with Wider Consequences" on the International Nuclear and Radiological Event Scale (INES).

NHK media report on March 17, 0100 EDT stated that helicopter crews dumping water on Unit 3 reactor building reported dose rates at 375 R/hr at 300 ft. above the building.

An array of fire trucks have been deployed at the site and appeared to be supplying / spraying water over Unit 3.

All available information indicates that the majority of releases from the Fukushima site have been carried out to sea by the prevailing winds. Forecast meteorological data for the 24 hour period until 2000 EDT on March 18, 2011 indicates wind headed offshore (from NW/westerly).

DOE Aerial Measurement Teams have completed two flyovers of the Daiichi site. NRC has received the data and the analyses from the first fly-over. Data from the second fly-over was received by DOE and is being analyzed.

Fukushima Daiichi
STATUS as of 1500 EDT, March 17, 2011 - (0400 Japan)

Unit 1 – (NRC priority: 4)

Core Status: Damaged, extent undetermined

Core Cooling: RCS depressurized (Source: FEPC); sea water injected to cool core (Source: NISA)

Primary Containment: functional (Source: JAIF)

Secondary Containment: lost (visual)

Spent Fuel Pool: 292 bundles in pool (Source: GEH); water level unknown (Source: JAIF); fire trucks are supplying seawater for cooling spray

Unit 2 – (NRC priority: 3)

Core Status: damaged, extent undetermined

Core Cooling: RCS depressurized (Source: FEPC); sea water injected to cool core (Source: NISA)

Primary Containment: Possible Torus damage

Secondary Containment: Hole cut in side of fuel floor metal to reduce H₂ buildup.

Steam coming from hole (visual).

Spent Fuel Pool: 587 bundles in pool (Source: GEH); fire trucks are supplying seawater for cooling spray

Unit 3 – (NRC priority: 1)

Core Status: Damaged, extent undetermined

Core Cooling: RCS depressurized (Source: FEPC); radiation released; sea water injected to cool core (Source: NISA)

Primary Containment: status unknown

Secondary Containment: lost (visual)

Spent Fuel Pool: 514 bundles in pool (Source: GEH); **Pool Dry (Source: NRC Team)**; helicopters flew to drop water and water cannon truck sprayed water on March 17 (Source: METI); fire trucks are supplying seawater for cooling spray

Unit 4 – (NRC priority: 2)

Core Status: offloaded

Core Cooling: N/A

Primary Containment: N/A

Secondary Containment: lost (visual)

Spent Fuel Pool: 1201 bundles in pool (Source: GEH); pool may be dry; damage to fuel rods suspected (Source: JAIF); water was dumped on site with water cannons; fire trucks are supplying seawater for cooling spray

Unit 5 – Shutdown since January 3, 2011 (NRC priority: 5)

Core Status: Core in RPV (Source: INPO)

Spent Fuel Pool: 950 bundles (Source: GEH); Unit 6 emergency diesel generator is available

Unit 6 – Shutdown since August 14, 2010 (NRC priority: 6)

Core Status: Core in RPV (Source: INPO)

Spent Fuel Pool: 876 bundles (Source: GEH); Unit's emergency diesel generator is available.

Common Spent Fuel Pool (NRC priority: 7): 6,000 bundles (Source: GEH) located on land side of Unit 4 (visual)

Electrical Power (NRC priority: 7): Restoration from switchyard to Unit 2 480V in progress

Other Plants

Fukushima Daini

- No changes to report

Onagawa

- No changes to report

Rokkasho

- No changes to report

Protective Measures Team (PMT)

The PMT is working with DOE/NARAC to refine source term models in an effort to develop dose projections beyond 50 miles. The 50 mile distinction is made because NRC RASCAL modeling is only capable to estimate dose values out to 50 miles. Therefore, NRC has the responsibility to develop source terms and dose projections within Japan, up to 50 miles from the reactor site, while DOE has the lead for dose projections beyond 50 miles and for the United States and territories.

The source term provided to NARAC was: (1) 25% of the total fuel in unit 2 released to the atmosphere, (2) 50% of the total spent fuel from unit 3 was released to the atmosphere, and (3)

100% of the total spent fuel was released to the atmosphere from unit 4. All 96 hour dose projections (Alaska, Hawaii, West Coast) are well below the 1 rem total effective dose (TED) Protective Action Guide (PAG) based on predicted Cs-137 deposition. Except for Alaska, all thyroid dose estimates are well below the EPA 5 rem PAG. The thyroid estimate is very conservative and does not consider intervention actions like distribution of potassium iodide, removing dairy cows from contaminated pastures, or interdicting milk or leafy vegetables contaminated with I-131.

Wind shift over land not expected until Sunday, March 20, 2011.

International Response

- IAEA sent a two person team to conduct coordination activities and to take measurements. NRC communicated with IAEA to discuss the status and concerns.
- France has shared technical data with the NRC and publicly posted its assessment of projected doses in Tokyo on the IRSN website.
- Spain Parliament is still reviewing and deciding on support levels.
- Italy is interested in discussing what the USG is doing, and might be interested in helping in some way.
- China has offered to help.
- Russia has sent a team to Tokyo. The U.S. team has met with the Russians.
- **South Africa will not be assisting.**

Reference

Units

1 rem (rem) = 1,000 millirem (mrem)

1 Sievert (Sv) = 1,000 milliSieverts (mSv) = 1,000,000 microsieverts (μ Sv)

1 rem = 0.01 Sv = 10 mSv