Nuclear Accident at the Fukushima Dai-ichi Nuclear Power Station

April 9, 2011
Ministry of Foreign Affairs of Japan
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A. Japan Faces Unprecedented Challenge
(Enormous Earthquakes, Tsunamis and Nuclear Accident)

1. Rescuing Efforts and Foreign Assistance

2. Fukushima Dai-ichi Nuclear Power Station
Earthquakes:
M - 9.0 quake (March 11)

14 meters or higher

A. Japan Faces an Unprecedented Challenge
(Enormous Earthquake, Tsunamis and Nuclear Accident)

Tsunamis
14 meters or higher

Earthquakes:
M - 9.0 quake (March 11)
M - 7 class 4 times
M - 6 class 67 times
M - 5 class 396 times

1. Casualties: over 27,000
   - Dead: over 12,000
   - Missing: over 15,000

2. Evacuees: over 150,000
   (As of April 8th)
Nuclear Reactors Near Epicenter of the Earthquake

4 Nuclear Power Stations with 14 Units

<table>
<thead>
<tr>
<th>Plant</th>
<th>Unit</th>
<th>Capacity</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onagawa</td>
<td>Unit 1</td>
<td>524 MW</td>
<td>1984-</td>
</tr>
<tr>
<td></td>
<td>Unit 2</td>
<td>825 MW</td>
<td>1995-</td>
</tr>
<tr>
<td></td>
<td>Unit 3</td>
<td>825 MW</td>
<td>2002-</td>
</tr>
<tr>
<td>Fukushima Dai-ichi</td>
<td>Unit 1</td>
<td>460 MW</td>
<td>1971-</td>
</tr>
<tr>
<td></td>
<td>Unit 2</td>
<td>784 MW</td>
<td>1974-</td>
</tr>
<tr>
<td></td>
<td>Unit 3</td>
<td>784 MW</td>
<td>1976-</td>
</tr>
<tr>
<td></td>
<td>Unit 4</td>
<td>784 MW</td>
<td>1978-</td>
</tr>
<tr>
<td></td>
<td>Unit 5</td>
<td>784 MW</td>
<td>1978-</td>
</tr>
<tr>
<td></td>
<td>Unit 6</td>
<td>1,100 MW</td>
<td>1979-</td>
</tr>
<tr>
<td>Fukushima Dai-ni</td>
<td>Unit 1</td>
<td>1,100 MW</td>
<td>1982-</td>
</tr>
<tr>
<td></td>
<td>Unit 2</td>
<td>1,100 MW</td>
<td>1984-</td>
</tr>
<tr>
<td></td>
<td>Unit 3</td>
<td>1,100 MW</td>
<td>1985-</td>
</tr>
<tr>
<td></td>
<td>Unit 4</td>
<td>1,100 MW</td>
<td>1987-</td>
</tr>
<tr>
<td>Tokai Dai-ni</td>
<td>Unit 1</td>
<td>1,100 MW</td>
<td>1978-</td>
</tr>
</tbody>
</table>

- **Automatic shut down**
- **Cold shut down**
1. Rescuing Efforts and Foreign Assistance

Japan deeply appreciates the assistance offered from

134 countries and regions and
39 international organizations

(Rescue teams were sent from 24 countries and region)
2. Fukushima Dai-ichi Nuclear Power Station

Before the Earthquakes and Tsunamis

After the Earthquakes and Tsunamis

TEPCO

Air Photo Service Inc (Myoko, Niigata Japan)
2. Fukushima Dai-ichi Nuclear Power Station

Evacuation

Cause of the Damage

① Loss of External Power Supply due to the Earthquake

② Diesel Generator Inoperable due to the Tsunami

All Motor Operated Pumps including Emergency Core Cooling Pumps became Inoperable
B. Key Challenges

1. Cool Down the Reactors
2. Contain Spread of Radioactive Substances
   (sea, soil and atmosphere)
3. Rigorous and Intensive Monitoring
4. Ensure the Safety of Food, Drinking Water and On-site Workers
# 1. Cool Down the Reactors

(As of April 8)

<table>
<thead>
<tr>
<th>Type / MW / Commercial Operation</th>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Unit 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status at time of Earthquake</td>
<td>In Service</td>
<td>In Service</td>
<td>In Service</td>
<td>Periodical Inspection Outage</td>
</tr>
<tr>
<td>Automatic Shutdown</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Fresh Water Injection</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Water Level [mm] (distance from the top of fuel)</td>
<td>-1,650 (A)</td>
<td>-1,500 (A)</td>
<td>-1,850 (A)</td>
<td>—</td>
</tr>
<tr>
<td>GP V</td>
<td>-1,650 (B)</td>
<td>N/A (B)</td>
<td>N/A (B)</td>
<td>N/A (B)</td>
</tr>
<tr>
<td>Reactor Pressure [Mpa g]</td>
<td>0.395 (A)</td>
<td>-0.020 (A)</td>
<td>-0.004 (A)</td>
<td>—</td>
</tr>
<tr>
<td>GP V</td>
<td>0.793 (B)</td>
<td>-0.020 (D)</td>
<td>-0.079 (C)</td>
<td>—</td>
</tr>
<tr>
<td>Temperature</td>
<td>246.6°C</td>
<td>141.2°C</td>
<td>N/A</td>
<td>—</td>
</tr>
<tr>
<td>Feedwater Nozzle</td>
<td>119.4°C</td>
<td>N/A</td>
<td>110.7°C</td>
<td>—</td>
</tr>
<tr>
<td>Bottom Head of RPV</td>
<td>N/A</td>
<td>110.7°C</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>S F P</td>
<td>Fresh Water Injection</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Temperature</td>
<td>24°C*</td>
<td>53°C</td>
<td>60°C*</td>
<td>57°C*</td>
</tr>
<tr>
<td>Building</td>
<td>Damage</td>
<td>Slight Damage</td>
<td>Damage</td>
<td>Damage</td>
</tr>
<tr>
<td>AC Power (Lighting of Central Operation Room **)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Temperature based on reading of the thermograph from air by Ministry of Defense. (the indicators attached to the SFPs are broken)

**Facilities are under-checking.
1. Cool Down the Reactors (Unit 1)

As of April 8, 2011

Spent Fuel Pool Cooling System

Fuel Bundle
- 400

Spent Fuel in the Pool
- 292 + 100 (new)

Major Events
- Mar. 12 - Venting started
- Mar. 12 - Hydrogen explosion
- Mar. 12 - Seawater injection to reactor core
- Mar. 25 - Fresh water injection to reactor core
- Mar. 31 - Fresh water spray by concrete pump trucks
- Apr. 7 - Injection of nitrogen to the reactor

Injecting Fresh water or Seawater

Injection

Damaged
Spent Fuel Pool Cooling System

Recovered

Emergency Diesel Generator

Residual Heat Removal System

External Power
(Mar. 24 - connected to the central control room)
1. Cool Down the Reactors  
(Unit 2)  
(As of April 8, 2011)

- **Spent Fuel in the Pool**
  - New: 587 + 28

- **Fuel Bundle**
  - 548

- **Spent Fuel Pool Cooling System**

- **Major Events**
  - Mar.13- Venting started
  - Mar.14- Seawater injection to reactor core
  - Mar.15- Sound of explosion
  - Mar.20- Seawater injection to spent fuel pool (SFP)
  - Mar.26- Fresh water injection to reactor core
  - Apr. 1- Fresh water injection to SFP

- **Possible damage of the suppression chamber**

- **External Power**
  - (Mar.26- connected to the central control room)

- **Emergency Diesel Generator**

- **Residual Heat Removal System**

- **Injection**
  - Injecting Fresh water or Seawater

- **Damaged**

- **Recovered**
1. Cool Down the Reactors (Unit 3) (As of April 8, 2011)

- **Fuel Bundle**
  - 548
- **Spent Fuel in the Pool**
  - 514 + 52 (new)

**Major Events**
- Mar.13 - Venting started
- Mar.13 - Seawater injection to reactor core
- Mar.14 - Hydrogen explosion
- Mar.17 - Seawater discharge by helicopters and sprayed to spent fuel pool (SFP)
- Mar.25 - Fresh water injection to reactor core
- Mar.29 - Fresh water spray by concrete pump trucks to SFP

**Spent Fuel Pool Cooling System**
- Damaged

**Injecting Fresh water or Seawater**

**External Power**
- (Mar.22 - connected to the central control room)

**Emergency Diesel Generator**
- Damaged

**Residual Heat Removal System**
- Recovered

Air Photo Service Inc (Myoko, Niigata Japan)
1. Cool Down the Reactors (Unit 4)  
(As of April 8, 2011)

- **Spent Fuel in the Pool**
  - 1331 + 204 (new)

- **Major Events**
  - Mar.15- Fire occurred
  - Mar.16- Fire occurred.
  - Mar.20- Seawater spray by Self-Defense Forces to spent fuel pool (SFP)
  - Mar.25- Seawater injection to SFP
  - Apr. 1- Fresh water spray by concrete pump trucks to SFP

- **External Power**
  (Mar.29- connected to the central control room)

- **Recovered**

- **Fuel Bundle**
  - 0

- **Spent Fuel Pool Cooling System**
  Damaged

- **Injection**

Air Photo Service Inc (Myoko, Niigata Japan)
1. Cool Down the Reactors (Unit 5&6)

(As of April 8, 2011)

- **Fuel Bundle**
  - Unit 5: 548
  - Unit 6: 764

- **Spent Fuel in the Pool**
  - Unit 5: 946 + 48 (new)
  - Unit 6: 876 + 64 (new)

**Spent Fuel Pool Cooling System**

**Functioning**

- External Power
- Residual Heat Removal System
- Emergency Diesel Generator
- Spent Fuel Pool Cooling System

*TEPCO*
Onagawa (3 Units)

All units (Units 1-3) were immediately shut down automatically, then safely cold shut down.

Fukushima Dai-ni (4 Units)

All units (Units 1-4) were immediately shut down automatically, then safely cold shut down.
The Japanese Government and TEPCO are making the utmost effort to prevent the dispersion of flow-out radioactive contaminated water.

### Major Events

- **Mar. 27**
  Stagnant water on the basement floor of the turbine of Unit 2 and in the trenches found to be highly contaminated.

- **Mar. 29**
  Stagnant water in the trenches and the turbine building transferred to the storage tank, then to the surge tank.

- **Apr. 1**
  Highly contaminated water discovered leaking into the sea.

- **Apr. 6**
  Leak of contaminated water into the sea was stopped.
Experts are making the utmost effort to prevent radioactive substances contained in dust, debris and vapor from spreading.

Spraying synthetic materials on the surface of the ground to prevent the spread of radioactive substances

[Image of workers spraying material]
3. Rigorous and Intensive Monitoring

TEPCO monitors radioactivity levels every ten minutes and releases the results immediately. Radioactivity levels rose on March 15th, but have since fallen and remain low.

Monitoring posts and the readings at the Fukushima Dai-ichi NPS

Environmental Radioactivity Level at the Fukushima Dai-ichi NPS

- **Unit 1~6**
  - Near West Gate: 59.8 μSv/h
  - Main Gate: 82.0 μSv/h

(as of 21:30 April 6th, 2011)

Measurement point:
- Main Gate (1.0km from Unit2)
- West Gate (1.1km from Unit2)

Max. 0
Min. 1

- White smoke from Unit 3
- Grayish smoke from Unit 3
- Explosion in Unit 2
Readings at Monitoring Posts out of Fukushima Dai-ichi NPS

Unit: μSv per hour

Monitoring Time
April 7, 6:00~18:00

Circles indicate approximate range.
Atmospheric Readings within 100km

Fukushima
61km

Miyagi
90km

Iwaki
43km

MEXT, Fukushima Prefectural Government
Atmospheric Readings in Tokyo, Osaka and Sapporo

Hokkaido
630km

Osaka
400km

Tokyo
230km

Fukushima Dai-ichi
200km
100km
4. Ensure the Safety of Food and Water

The Japanese government inspects radiation dosages every day, and prohibits distribution and consumption of food that fails to meet stringent criteria.

**Instructions**
(issued by Prime Minister on 21, 23 March and 4 April 2011)

- Fukushima Prefecture
  - Fresh raw milk*1
  - Non-head type leafy vegetables and head type leafy vegetables (e.g. spinach)
  - Flowerhead brassicas including turnip (e.g. broccoli, cauliflower)

- Ibaraki Prefecture
  - Fresh raw milk
  - Spinach
  - Parsley

- Tochigi and Gunma*2 Prefectures
  - Spinach

- Chiba Prefecture
  - Spinach (Asahi-shi, Katori-shi, Tako-machi)
  - Shungiku, Qing-geng-cai, Sanchu, Parsley, Celery (Asahi-shi)

... Not to Distribute

* Fukushima Prefecture
  - Fresh raw milk*1
  - Non-head type leafy vegetables and head type leafy vegetables (e.g. spinach)
  - Flowerhead brassicas including turnip (e.g. broccoli, cauliflower)

* Ibaraki Prefecture
  - Fresh raw milk
  - Spinach
  - Parsley

* Tochigi and Gunma*2 Prefectures
  - Spinach

* Chiba Prefecture
  - Spinach (Asahi-shi, Katori-shi, Tako-machi)
  - Shungiku, Qing-geng-cai, Sanchu, Parsley, Celery (Asahi-shi)

... Not to Consume

* Fukushima Prefecture
  - Non-head type leafy vegetables and head type leafy vegetables
  - Flowerhead brassicas
Radioactive Contamination in Leafy Vegetables in Samekawa-village (Fukushima Prefecture)

<table>
<thead>
<tr>
<th>(bq/kg)</th>
<th>Samekawa-village</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21-Mar</td>
<td>24-Mar</td>
<td>21-Mar</td>
</tr>
<tr>
<td>radioactive iodine</td>
<td>5,900</td>
<td>1,200</td>
<td>5,900</td>
</tr>
<tr>
<td>radioactive cesium</td>
<td>1,700</td>
<td>68</td>
<td>1,700</td>
</tr>
</tbody>
</table>

Guidance Levels for Radionuclides in Vegetables

<table>
<thead>
<tr>
<th></th>
<th>Japan</th>
<th>EU</th>
<th>IAEA *</th>
</tr>
</thead>
<tbody>
<tr>
<td>radioactivity iodine</td>
<td>2,000</td>
<td>2,000</td>
<td>3,000</td>
</tr>
<tr>
<td>radioactivity cesium</td>
<td>500</td>
<td>1,250</td>
<td>1,000 (Cs134)</td>
</tr>
</tbody>
</table>

Source: Ministry of Health, Labour and Welfare, EURATOM, IAEA

*OIL (Operational Intervention Levels): Locally produced food, milk and water have been screened, and all members of the public, including infants, children, and pregnant women can safely drink the milk and water and eat the food during the emergency phase.
The Japanese Government has been implementing necessary measures based on its stringent criteria for radionuclides in drinking water, and monitoring radionuclide levels every day.

**Guidance Levels for Radionuclides in Drinking Water**

<table>
<thead>
<tr>
<th>(Bq/kg)</th>
<th>Japan</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>radioactive iodine (I(^{131})) for babies</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>radioactive cesium</td>
<td>200</td>
<td>1,000</td>
</tr>
</tbody>
</table>

**Radioactive Iodine (I\(^{131}\)) in Drinking-Water in Tokyo (Kanamachi filter plant)**

- Japan: 300
- Japan (for babies): 100
- Under detectable level

*On March 23, the Japanese Government recommended that the residents in Tokyo area refrain from having their babies intake tap water, but it withdraw the recommendation in two days.*
Emergency Dose Limit

<table>
<thead>
<tr>
<th>mSv</th>
<th>JAPAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>emergency dose limit</td>
<td>100 ↓ 250</td>
</tr>
</tbody>
</table>

(limit raised for Fukushima emergency workers)

The Japanese Government closely supervises on-site workers’ health conditions, limiting the level of their maximum exposure to radiation to 250mSv. No workers in Fukushima NPS have been exposed to 250mSv or more. On March 24, three workers exposed to more than 170mSv were hospitalized, but were released four days later as no health problems were found.

<table>
<thead>
<tr>
<th>level of exposure</th>
<th>number of workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>more than 100mSv</td>
<td>21</td>
</tr>
<tr>
<td>more than 250mSv</td>
<td>0</td>
</tr>
</tbody>
</table>

Workers Exposed to Radiation in Fukushima Dai-ichi NPS, as of April 5

Nuclear and Industrial Safety Agency

Ministry of Health, Labour and Welfare, Nuclear and Industrial Safety Agency, ICRP,
Radiation in Daily-life

Radiation dose (microsievert; μ Sv)

- 250,000
- 50,000
- 10,000
- 1,000
- 100
- 10

- 250,000 μ Sv/year
  - Upper limit of radiation dose permitted for people who engage in emergency work.
- 50,000 μ Sv/year
  - Upper limit of radiation dose permitted for radiation workers, police, and firefighters who engage in disaster prevention.
- 6,900 μ Sv/each time
  - Chest CT scan
- 1,000 μ Sv/year
  - Dose limit for public per year (except for medical care).
- 600 μ Sv/each time
  - Gastrointestinal X-ray examination.
- 50 μ Sv/each time
  - Chest X-ray examination.
- 50 μ Sv/year
  - Standard dose of radiation around a nuclear plant (light water reactor).
  - (Actual result is far below the value.)

- ~10,000 μ Sv/year
  - Radiation dose in Guarapari(Girola) per year.
- ~2,400 μ Sv/year
  - Maximum difference of the average of natural radiation dose in each prefecture.
  - ~400 μ Sv/year
  - An air travel between Tokyo and New York (RT).
  - (Increased cosmic radiation at high altitude.)
- ~200 μ Sv/round trip
- 22 μ Sv/year
  - Evaluated dose of radiation from radioactive substances emitted from the nuclear fuel reprocessing plant per year.
- 10 μ Sv/year
  - Standard radiation dose from Clearance level.
C. Information Sharing and Cooperation with the International Community

1. Cooperation with the IAEA
2. Press Releases by International Organizations
3. Speedy Dissemination of Accurate Information
1. Cooperation with the IAEA

1. Information Sharing
   (1) Japan has been providing facility-related and other relevant information to the IAEA.
   (2) Nuclear Industry Safety Agency (NISA) provided updates on situations of the
       Fukushima Dai-ichi Nuclear Power Station at the IAEA Technical Briefing (21st March)
       and at the side event of the Fifth Review Meeting of the Contract Parties to the

2. IAEA Expert Missions
   (1) The IAEA has extended to Japan upon the request of the Government of Japan, in
       connection with the incidents involving the nuclear power plants in Japan by dispatching
       a series of the IAEA experts to Japan mainly in the field of radiation monitoring. Such
       dispatch of experts includes:
       (i) Radiation Monitoring Teams, totaling up to 16 members who have been taking
           measurements mainly in Fukushima since 19 March;
       (ii) one marine expert from the IAEA’s laboratory in Monaco, who boarded Research
           Vessel “MIRAI” during 2-4 April to observe and provide advice for Japanese experts
           on their method of collection and analysis of seawater samples; and
       (iii) A Joint FAO/IAEA Food Safety Assessment Team, who met with local government
           officials, farmers etc. in Fukushima, Ibaraki, Tochigi and Gunma prefecture.
   (2) In addition, IAEA experts in BWR technology met with Japanese officials and operators
       including NISA and the Tokyo Electric Power Company (TEPCO) and visited the
       Fukushima Dai-ichi Nuclear Power Plant on 6 April.
2. Press Releases by International Organizations

- ‘No Restrictions on Travel to Japan’ on 18\textsuperscript{th} March (ICAO) and 21\textsuperscript{th} March (IMO)
  - International flight and maritime operations can continue normally into and out of Japan’s major airports and sea ports, excluding those damaged by the tsunami; according to the latest information available from WHO, IAEA, WMO, IMO and ICAO

- ‘Current Radiation Levels In Japan And Travel Advice’ on 1\textsuperscript{st} April
  - Radioactive material from the damaged Fukushima Daiichi Plant is gradually spreading outside of Japan into global atmosphere but at extremely low concentrations that do not present health or transportation safety hazards, according to the United Nations organizations closely monitoring the situation.
  - Screening for radiation of passengers arriving from Japan is currently considered unnecessary at airports or seaports around the world.

-FAQs ‘Japan Nuclear Concerns’ on 5\textsuperscript{th} April
  - At this time, WHO is not advising general restrictions on travel to Japan.
### 3. Speedy Dissemination of Accurate Information

- Japan is committed to the speedy dissemination of accurate information.
- All necessary information can be found at the following websites.

#### Japan’s Countermeasures


#### Measurement of Radioactivity Level


#### Drinking Water Safety


#### Food Safety


#### Ports and Airports Safety