Regulatory Reform in Japan and Present Status of Fukushima Daiichi

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Director for International Nuclear Safety Cooperation
Nuclear Regulation Authority (NRA)
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3. Present Status of Fukushima Daiichi
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1.1 Evolution of NRA

NRA (Nuclear Regulation Authority)

Secretariat / NRA

Sep, 2012

- Safety (Nuclear)
- Security (Nuclear)
- Emergency Preparedness and Response

April, 2013

- Safety (Nuclear)
- Security (Nuclear)
- Emergency Preparedness and Response
- Safety and Security (Radioactive Isotope)
- Safe-guard

March, 2014

- Safety (Nuclear)
- Security (Nuclear)
- Emergency Preparedness and Response
- Safety and Security (Radioactive Isotope)
- Safe-guard
- Research

~ Integration of JNES ~
1.2 Integration of JNES into NRA

JNES (Japan Nuclear Energy Safety Organization) Mission as a TSO for the NRA Inspection Analysis and Evaluation etc.

was integrated into the NRA on 1st March, 2014

A non-civil service style Incorporated Administrative Agency

NRA (Nuclear Regulation Authority) Chairman and four Commissioners

The number of regular staff 399 (as of end of December, 2013)

The number of regular staff: 1,025* (the quota, as of 1st March, 2014)

*: including additional recruit of 81

Secretariat / NRA

The number of regular staff 545 (as of end of December, 2013)
1.2 Integration of JNES into NRA

As of 1 March, 2014

[Diagram showing the integration of JNES into NRA, with various departments and their responsibilities.]

【Secretariat / Nuclear Regulation Authority】

Secretary-General
Deputy SG

HRD Center

DG

Executive Insp./DG (Emergency Response)
DG (Nuclear Regulation) (2)
DG (Nucl. Reg. Tech. Affairs)

Secretarial Office

DG (Policy Plan. & Coord.)
DG (Reg. Std. & Research)

Nuclear Regulation Dept.

DG


Director (Nucl. Reg.) (7)

Director (Research) (4)

Director (Accountant/Personnel) (2)

Director (Res. & Research) (4)

Director (Emergency Prep. & Resp.)

DG (Reg. Std. & Research)

Reg. Std. & Research Div.

International Affairs Div.
Gen. Affairs Div.

Director (Nuclear Policy Plan. & Coord.)

International Affairs Div.
Gen. Affairs Div.

Director (Accountant/Personnel)

[Diagram showing various departments and their responsibilities, including a JNES box in the middle and an integration arrow pointing towards it.]

【Secretariat / Nuclear Regulation Authority】

President
Vice President (3)
Auditor (2)

【JNES】

Gen. Affairs Dept.
HRD Dept.
Planning Dept.
Office of Int'l Programs
Office of Int'l Affairs
Inspection Dept.
EPR Policy Div.
EPR Dept.
Office of PP
Nuclear Sys. Safety Dept.
Waste Safety Dept.
Seismic Safety Dept.

Secretariat
Licensing
Rad. Protection
Regulatory Research

Gen. Affairs Div.
HRD Div.
Licensing & Inspect. Div.
Reg. Std. & Research Div.
Safeguard Div.

Director (Nuclear Reg.) (7)
Director (Research) (4)
Director (Nucl. Reg.) (3)
Director (Emergency Prep. & Resp.) (2)

[Diagram showing various departments and their responsibilities, including a JNES box in the middle and an integration arrow pointing towards it.]
2.1 New Regulatory Requirement for Power Reactors

<New requirement>
- Emphasis on D in D
- Prevention against CCF for both internal and external events
- New requirements against severe accident & terrorism

<Previous requirement>
- Fire protection
- Reliability of power supply
- Function of other SSCs
- Natural phenomena
- Seismic / Tsunami resistance

Response to intentional aircraft crash
Suppression of radioactive materials dispersal
Prevention of CV failure & large release
Prevention of core damage (Postulate multiple failures)
Internal flooding
Fire protection
Reliability of power supply
Function of other SSCs
Volcano, Tornadoes, Forest fire
Seismic / Tsunami resistance

(Against SA & Terrorism)
New
Reinforced
Reinforced

Emphasis on D in D
Prevention against CCF for both internal and external events
New requirements against severe accident & terrorism
Response to intentional aircraft crash
Suppression of radioactive materials dispersal
Prevention of CV failure & large release
Prevention of core damage (Postulate multiple failures)
Internal flooding
Fire protection
Reliability of power supply
Function of other SSCs
Volcano, Tornadoes, Forest fire
Seismic / Tsunami resistance

<New requirement>
## 2.2 Applications for Safety Review of NPPs

<table>
<thead>
<tr>
<th>Application</th>
<th>Licensee</th>
<th>NPP Type</th>
<th>Application Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomari 1, 2</td>
<td>Hokkaido</td>
<td>2 loop PWR</td>
<td>8 July, 2013</td>
</tr>
<tr>
<td>Tomari 3</td>
<td>Hokkaido</td>
<td>3 loop PWR</td>
<td>8 July, 2013</td>
</tr>
<tr>
<td>Takahama 3, 4</td>
<td>Kansai</td>
<td>3 loop PWR</td>
<td>8 July, 2013</td>
</tr>
<tr>
<td>Ohi 3, 4</td>
<td>Kansai</td>
<td>4 loop PWR</td>
<td>8 July, 2013</td>
</tr>
<tr>
<td>Ikata 3</td>
<td>Shikoku</td>
<td>3 loop PWR</td>
<td>8 July, 2013</td>
</tr>
<tr>
<td><strong>Sendai 1, 2</strong></td>
<td><strong>Kyushu</strong></td>
<td><strong>3 loop PWR</strong></td>
<td><strong>8 July, 2013</strong></td>
</tr>
<tr>
<td>Genkai 3, 4</td>
<td>Kyushu</td>
<td>4 loop PWR</td>
<td>12 July, 2013</td>
</tr>
<tr>
<td>Kashiwazaki-Kariwa 6,7</td>
<td>Tokyo</td>
<td>ABWR</td>
<td>27 Sep, 2013</td>
</tr>
<tr>
<td>Shimane 2</td>
<td>Chugoku</td>
<td>BWR</td>
<td>25 Dec, 2013</td>
</tr>
<tr>
<td>Onagawa 2</td>
<td>Tohoku</td>
<td>BWR</td>
<td>27 Dec, 2013</td>
</tr>
<tr>
<td>Hamaoka 4</td>
<td>Chubu</td>
<td>BWR</td>
<td>14 Feb, 2014</td>
</tr>
<tr>
<td>Tokai Daini</td>
<td>JAPC</td>
<td>BWR</td>
<td>20 May, 2014</td>
</tr>
</tbody>
</table>

### In Service vs. Under Review

<table>
<thead>
<tr>
<th>NPP Type</th>
<th>In Service</th>
<th>Under Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>BWR</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

As of 9 June, 2014
3. Present Status of Fukushima Daiichi

Treatment of Contaminated Water

- Reactor cooling water: Approx. 400 m³/day injected
- Ground water: Approx. 400 m³/day inflow
- Desalted water storage tank
- Surplus water: Approx. 400 m³/day generated

A. Reactor building
   - Contaminated Water
   - Turbine building
   - Sea Water Pipe Trench
   - Highly Contaminated Water
   - Desalination equipment
     - (1) RO
     - (2) Evaporation
   - Equipment for removing Cs
     - (1) Areva (France) 〈Standby〉
     - (2) Kurion (USA) 〈Used as backup〉
     - (3) SARRY (Toshiba) 〈Used for normal operation〉

B. Desalination equipment
   - Equipment for removing radioactive materials except ³H
     - (1) ALPS (Toshiba)

- Contaminated Water in Turbine Buildings is treated, and the treated water is injected to RPVs.
- 400 m³/d of groundwater inflowing the buildings increases capacity of tank storage.

Total Beta and low-level Cs water storage tank
Water with ³H storage tanks
3. Present Status of Fukushima Daiichi

A-1: Bypassing groundwater (Reduction of Groundwater Inflow)

【Operational Rule for Bypassed Water】
Cs-134: less than 1 Bq/L
Cs-137: less than 1 Bq/L
Total Beta: less than 5 Bq/L
H-3: less than 1,500 Bq/L

100 – 150 ton/day
Reduction is expected

1. Pumping out
2. Transport to storage tanks
3. Checking radioactivity of stored water
4. Release

Source: TEPCO
Edited by NRA
3. Present Status of Fukushima Daiichi

A-2: Concept of Frozen Wall

- Frozen wall is one of profound measures for “preventing groundwater from accessing to the contaminated water in the reactor and turbine buildings”.
- Frozen wall will reduce volume of contaminated water to be treated.
- Construction work of frozen wall started in June 2014, and is expect to complete by March in 2015.

Source: TEPCO
Edited by NRA
3. Present Status of Fukushima Daiichi

A-3: Control of Water Level

- Prevention of contaminated water in the buildings from flowing out to the environment

(1) Retained water level in buildings
(2) Groundwater level inside the frozen wall
(3) Groundwater level outside the frozen wall

(1) < (2) < (3)

Source: TEPCO
B-1: Storage Tanks

✓ 495,000 m³ of various levels of radioactive water is stored in the storage tanks.
✓ 399,000 m³ out of 495,000 m³ is total Beta and low-level Cs water after treating with reverse osmosis (RO) membrane.

Cylindrical storage tanks  Square-shaped storage tanks  Horizontal-installation-type storage tanks

Source: TEPCO
Edited by NRA
<table>
<thead>
<tr>
<th></th>
<th>Current ALPS</th>
<th>Additional ALPS</th>
<th>Advanced ALPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity</strong></td>
<td>750m³/day</td>
<td>&gt;750m³/day</td>
<td>&gt;500m³/day</td>
</tr>
<tr>
<td><strong>Number of systems</strong></td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Improvement of corrosion resistance</strong></td>
<td>SUS316L</td>
<td>Lining Carbon Steel</td>
<td>Duplex Stainless Steel Lining Carbon Steel</td>
</tr>
<tr>
<td><strong>Pretreatment</strong></td>
<td>Flocculation and precipitation</td>
<td>Flocculation and precipitation</td>
<td>Filtration</td>
</tr>
<tr>
<td><strong>Facility size (App.)</strong></td>
<td>60m × 60m</td>
<td>80m × 60m</td>
<td>76m × 36m</td>
</tr>
<tr>
<td><strong>Engineering Considerations</strong></td>
<td>Dose contributed from ALPS : 0.42 mSv/y at Site Boundary</td>
<td>Enhancement of shielding of ALPS &amp; Dose contributed from ALPS : considerably as low as possible at Site Boundary</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** TEPCO
3. Present Status of Fukushima Daiichi

Fuel removal from Spent Fuel Pool of Unit 4

- The removal of fuels stored in the SFP started on 18 November, 2013 and is planned to finish by the end of 2014.
- The removed fuel assemblies are 1122/1533. (Spent: 1100, New: 22) as of 23 June, 2014.
The Installation of the cover for fuel removal work and fuel handling machine is planned.

The installation is scheduled to start in the near future.
3. Present Status of Fukushima Daiichi

Debris removal from Unit 3 Reactor Building

24 March, 2011

31 January, 2014

21 February, 2012

25 February, 2014

Photos taken by TEPCO
3 Present Status of Fukushima Daiichi

Debris removal from Unit 3 Reactor Building

December, 2013

Removal of FHM mast (27 March, 2014)

Removal of roof truss (28 March, 2014)

19 April, 2014

Curing material

FHM

Source: TEPCO
Regulatory reform has been completed as integration of JNES into NRA.

Safety review on conformity to new regulatory requirements for NPPs has been intensively conducted by NRA.

Fukushima Daiichi status is moving forward day by day.
Thank you for your attention