Metal Casks Storage Schedule of Recyclable Fuel Storage Center in Mutsu

November 2010

Tatsuki Takamatsu
Recyclable-Fuel Storage Company (RFS)
1. Corporate Overview
2. Necessity of Commercial Operations
3. History of Major Developments
4. Outline of Facility
5. Concept of Safety Design
6. Construction Plan
7. Conclusion
Recyclable-Fuel Storage Company was established with the joint capital investment of Tokyo Electric Power Company and the Japan Atomic Power Company for the purpose of storing and managing recyclable fuel generated from the two companies’ nuclear power stations.

1. Corporate Overview

<table>
<thead>
<tr>
<th>Name of company:</th>
<th>Recyclable-Fuel Storage Company (abbreviated as RFS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
<td>596-1, Aza Mizukawame, O-Aza Sekine, Mutsu-shi, Aomori</td>
</tr>
<tr>
<td>Date of establishment:</td>
<td>November 21, 2005</td>
</tr>
<tr>
<td>Capital:</td>
<td>3 billion yen</td>
</tr>
<tr>
<td>Shareholders:</td>
<td>Tokyo Electric Power Company (80%)</td>
</tr>
<tr>
<td></td>
<td>The Japan Atomic Power Company (20%)</td>
</tr>
<tr>
<td>Number of employees:</td>
<td>47 (as of November 2010)</td>
</tr>
</tbody>
</table>
2. Necessity of Commercial Operations (1)
— Nuclear Fuel Cycle —

Summarized flow of nuclear fuel cycle

Uranium mine

Smelting plant

Conversion plant

Recyclable Fuel Storage Center (intermediate storage facility)

Uranium enrichment plant

Reconversion plant

High-level radioactive waste final repository

Storage and management center for high-level radioactive waste

Reprocessing plant

MOX fuel plant

Nuclear power station

From reconversion plant

To MOX fuel plant

Low-level radioactive waste underground disposal center

From MOX fuel plant

Fabrication plant

Recyclable fuel (spent fuel)
2. Necessity of Commercial Operations (2)
— Framework for Nuclear Energy Policy —

The Framework for Nuclear Energy Policy, formulated by Japan Atomic Energy Commission, was approved by the Cabinet on October 14, 2005.

• Building nuclear fuel cycles
  (Excerpt) Japan’s basic policy has been to build nuclear fuel cycles for reprocessing of spent fuel and effective utilization of collected plutonium and uranium, etc.
  (Excerpt) .....intermediate storage of spent fuel makes temporal coordination possible until it is reprocessed, and it is therefore important as a means for contributing to the flexible operation of the overall nuclear fuel cycle.
  (Excerpt) Spent fuel will be reprocessed within the available reprocessing capacity for the time being, and the surplus volume exceeding the capacity will be stored intermediately.
2. Necessity of Commercial Operations (3)

— Necessity of Building “Recyclable Fuel Storage Center” (in Japan) —

● 54 nuclear power reactors are currently operating in Japan

![Current volume of spent fuel generation: approx. 900-1,000tU/year](image)

● Processing capacity of reprocessing plant under construction in Rokkasho Village

![Reprocessing volume: 800tU/year](image)

In addition to current storage at power stations, there is a need to build intermediate storage facilities outside power stations around the country in future.

* The “Recyclable Fuel Storage Center” will store recyclable fuel generated from two companies, Tokyo Electric Power Company and the Japan Atomic Power Company.
3. History of Major Developments

June, 2000  Partial revision of the “Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors” enforced (enabling the storage of spent fuel outside nuclear power station sites)

November 2000  Technical survey concerning the siting of “Recyclable Fuel Storage Center” requested by Mutsu municipal government

April 2003  Report on feasibility study of siting submitted to Mutsu municipal government

July 2003  Siting request by the mayor of Mutsu-shi accepted by Tokyo Electric Power Company

October 19, 2005  Siting of “Recyclable Fuel Storage Center” approved by Aomori Prefectural government and Mutsu municipal government

“Memorandum of Agreement on Intermediate Storage of Spent Fuel” signed by Aomori Prefectural government, Mutsu municipal government, Tokyo Electric Power Company and the Japan Atomic Power Company

November 21, 2005  Recyclable-Fuel Storage Company established in Mutsu-shi with the joint capital investment of Tokyo Electric Power Company and the Japan Atomic Power Company

March 22, 2007  Application for permission of spent fuel storage operation for the “Recyclable Fuel Storage Center” submitted to Minister of Economy, Trade and Industry

May 13, 2010  Granting of permission for spent fuel storage operation for the “Recyclable Fuel Storage Center”

August 27, 2010  Approval of design and construction method

August 31, 2010  Commencement of construction work for spent fuel storage facility
4. Outline of Facility
– Site (1) –

Map showing sites in Japan including:
- TEPCO Kashiwazaki Kariwa Unit 1-7 (BWR)
- JAPC Tsuruga Unit 2 (PWR)
- TEPCO Fukushima1 Unit 1-6 (BWR)
- TEPCO Fukushima2 Unit 1-4 (BWR)
- JAPC Tokai2 (BWR)

Legend:
- TEPCO
- JAPC
- Fukushima
- Tokai
4. Outline of Facility
— Site (2) —

Electric Power Development Co., Ltd.: Ohma Nuclear Power Plant (under construction)

Recyclable-Fuel Storage Center (under construction)

Recyclable Fuel Storage Company

Aomori Prefecture

Tokyo Electric Power Company: Higashidori Nuclear Power Station (in preparation for construction)

Tohoku Electric Power Company: Higashidori Nuclear Power Station

Japan Nuclear Fuel Limited: Nuclear fuel cycle facility
4. Outline of Facility

- Site (3) -

- Port of Sekinehama
- A point of meteorological observations
- Japan Agency for Marine-Earth Science and Technology
- Mutsu Science Museum
- Japan Atomic Energy Agency
- A point of seismic observations
- Planned Construction site
- Port of Sekinehama
Storage volume

**Amount covered by current permission:** 3,000 tons

Final storage amount: 5,000 tons

Amount generated from Tokyo Electric Power Company: approx. 4,000 tons
Amount generated from the Japan Atomic Power Company: approx. 1,000 tons

(Note) The first storage building with a reprocessing capacity of approx. 3,000 tons will be constructed for the time being, with the second building scheduled to be built later.

Storage period

The service period is 50 years for each facility, and up to 50 years for each cask.
4. Outline of Facility
- Storage Amount/Storage Period — (2)

- **Carrying-in of recyclable fuel**
  Recyclable fuel of approx. 200-300 tons will be carried in each year in about four shipments
  (Max. 8 Casks / 1 Shipment)
4. Outline of Facility

- Transport -

Receiving of casks
- Pre-storage inspection

During storage
- Monitoring
  - Periodic inspections

Shipment of casks
- Pre-shipment inspection
4. Outline of Facility

- Storage Building — (1)

(Width) approx. 62m x (Depth) approx. 131m x (Height) approx. 28m (capacity: approx. 3,000 tons)
4. Outline of Facility
— Storage Building — (2)

[Outline of storage building]
- One floor above ground
- Floor plan: 131m x 62m
- Height: 28m
- Utilizing convection of air.
- Metal casks: 288
  - Weight of uranium metal: 3,000t
  - BWR fuel: 2,600t
  - PWR fuel: 400t

[Areas]
① Acceptance area
  - temporary mounts, traveling crane
② Storage area
  - * carried by cask transport vehicles.
③ Auxiliary area
  - panel display devices, other equipment.
4. Outline of Facility
— Metal Cask —

<table>
<thead>
<tr>
<th>Item</th>
<th>BWR (Large)</th>
<th>BWR (Medium)</th>
<th>PWR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1</td>
<td>Type 2</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>5.4m</td>
<td>5.4m</td>
<td>5.5m</td>
</tr>
<tr>
<td>Outer dia.</td>
<td>2.5m</td>
<td>2.5m</td>
<td>2.4m</td>
</tr>
<tr>
<td>Total mass*</td>
<td>119t</td>
<td>119t</td>
<td>116t</td>
</tr>
<tr>
<td>Number of fuel</td>
<td>69</td>
<td>69</td>
<td>52</td>
</tr>
<tr>
<td>Main material</td>
<td>Low alloy steel, carbon steel (body, lids)</td>
<td>Boron-added stainless steel (basket)</td>
<td>Boron-added aluminium alloy (basket)</td>
</tr>
<tr>
<td>Internal fill gas</td>
<td>Helium gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confine structure</td>
<td>Double lid system (primary and secondary lids)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Including spent fuel assemblies
5. Concept of Safety Design
   — Basic Safety Functions — (1)

(1) Containment
(2) Shielding
(3) Sub-criticality
(4) Heat removal
5. Concept of Safety Design
   -- Basic Safety Functions -- (2)

(1) If a leak in the primary lid occurs
   Space between lids → Helium gas → Inside the cask

(2) If a leak in the secondary lid occurs
   Space between lids → Helium gas → Outside air

Even if a leak at a metal gasket occurs, no radioactive material inside the cask is released outside the cask.

Sensor gives alarm if pressure drops.
Monitoring is scheduled for the items shown below among the four basic safety functions for confinement, shielding, criticality prevention and heat removal.

(1) Monitoring items for confinement functions
   - Pressure between the two lids

(2) Monitoring items for shielding functions
   - Spatial radiation dose rate, etc. inside the storage building
   - Spatial radiation dose rate, etc. near the boundary of supervised area

(3) Monitoring items for heat removal functions
   - Temperature and temperature difference at the building’s air inlet/outlet
   - Cask surface temperature

(2) Measurement of spatial radiation dose rate inside the supervised area or other locations (monitoring post)
(2) Measurement of integrating dose rate at appropriate positions near the fence for supervised area or other locations (integrating dosimeter)
(3) Temperature measurement at air inlet/outlet
(3) Measurement of cask surface temperature
(1) Measurement of pressure between the two lids
# 6. Construction Plan

<table>
<thead>
<tr>
<th>FY</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
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<tbody>
<tr>
<td>Principal process</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Commencement of construction work</td>
<td></td>
<td>Commencement of operation</td>
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<tr>
<td></td>
<td>Safety review</td>
<td></td>
<td></td>
<td></td>
<td>Construction of building</td>
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<td></td>
<td>Approval of design and construction method</td>
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<td></td>
<td>Manufacturing of casks</td>
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<tr>
<td></td>
<td>Preparatory work for construction</td>
<td></td>
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</tbody>
</table>
6. Construction Plan
– Status of Construction Work –
### 6. Construction Plan

#### Schematic Drawing and Processes (Scheduled)

<table>
<thead>
<tr>
<th>Principal process</th>
<th>FY2010</th>
<th>FY2011</th>
<th>FY2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commencement of construction work in August 2010</td>
<td></td>
<td></td>
<td>Commencement of operation in July 2012</td>
</tr>
<tr>
<td>Piling work</td>
<td>Approx. 4 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Based mat construction</td>
<td></td>
<td>Approx. 6 months</td>
<td></td>
</tr>
<tr>
<td>Shed construction</td>
<td></td>
<td></td>
<td>Approx. 16 months</td>
</tr>
</tbody>
</table>

- Around the winter of 2010
- Around the spring of 2011
- Around the summer of 2011
- Rendering
6. Construction Plan

— Conceptual Rendering of Completed Building —
7. Conclusion

- The construction of “Recyclable Fuel Storage Center” started in August 2010.
- The construction is scheduled to complete in July 2012.

Preparatory work for construction:

- Approval of local communities
- Establishment of RFS (November 21, 2005)
- Detail survey/facility design
- Application for permit (March 22, 2007)
- Safety review
- Granting of permission (May 13, 2010)
- Approval of design and construction method (June 16, 2010)
- Commencement of construction work (August 31, 2010)
- Commencement of commercial operation (Scheduled July 2012)