Operational Experience and Use of IAEA Transport Safety Standards in Japan

Nuclear competent authorities
## Contents

1. Current status about transport of radioactive material  
   a. Transport of nuclear fuel material (Nuclear fuel cycle / Operational status of nuclear power plant / Transportation amount)  
   b. Transport of radioisotopes and radiopharmaceuticals (Distribution channel / Related facility / Transportation amount)  

2. Whole picture of regulations  
   a. How to adopt SSR-6 to domestic regulations  
   b. Overview of regulations under competent authorities  
   c. Interagency Coordinating Meeting for the safe transport of radioactive material  
   d. Preparation for IAEA/TRANSSC  
   e. Schedule of preparing for TRANSSC  

3. Main characteristics of domestic regulations  
   a. Packaging Registration(Approval)  
   b. Package(packaging and radioactive material) Confirmation  
   c. Confirmation of Transport Method, date and routes  
   d. On-site Inspection  

4. Transport in preparation  
   a. Return of radioactive waste and MOX fuel from Europe  
   b. Transport of spent fuel after storage  
   c. Transport of fuel debris generated in Fukushima Dai-ichi Nuclear Power Plant
1 - a. Transport of nuclear fuel material - Nuclear Fuel Cycle

uranium mine

natural uranium ore → refinery → yellow cake

uranium hexafluoride (UF6)

conversion plant

re-processing plant

recycled uranium
recovered uranium and plutonium

MOX fuel processing plant

uranium-enrichment plant

uranium dioxide (UO2)

re-conversion plant

spent fuel

spent fuel

nuclear power plant

uranium fuel

vitrified waste storage center

vitrified waste disposal center

spent fuel interim storage facility

LLW disposal center

Source: Japan Atomic Energy Relations Organization
1 - a. Transport of nuclear fuel material - Operational status of nuclear power plant

- in operation
  - 8 units

- reactor establishment change already permitted
  - 6 units

- under review for new regulatory requirements
  - 12 units

- not submit application for review for new regulatory requirements
  - 16 units

- decided to be decommissioned
  - 18 units

Kashiwazaki
Kariwa
Shiga
Tsuruga
Mihama
Ohi
Takahama
Shimane
Genkai
Sendai

(As of May 10, 2018)

Source: Homepage of Agency for Natural Resources and Energy
1. a. Transport of nuclear fuel material - Power generation of each energy source

(100 million kWh / year)

Source: Japan Atomic Energy Relations Organization
1 - a. Transport of nuclear fuel material - Nuclear fuel facilities

(As of August, 2017)

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>In Operation</th>
<th>Under Construction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing Plant</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Interim Storage Facility</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Re-processing Plant</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Waste Storage Center</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Waste Disposal Center</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Japan Atomic Energy Relations Organization
1 - a. Transport of nuclear fuel material - Transportation amount

The Number of Nuclear Fuel Material Consignment Confirmation by NRA

The Number of Confirmation

Fiscal Year

UF6
UO2, Uranium
New fuel assembly
Spent fuel assembly
HLW
Irradiated specimen
Total
1 - b. Transport of radioisotopes and radiopharmaceuticals
- Distribution channel

Supply

Foreign Manufacturers in US, UK, France, Canada, the Netherlands etc

Radiopharmaceutical Manufacturer

Narita・Haneda Airport、Oi pier etc

Japanese Radioisotopes Association

Unsealed RI: Dispose
Sealed Sources: Collect

Domestic Manufacturers

Supply

Equipment Manufacturers

Supply

Medical Facilities

Universities・Research Laboratories

Factories using equipment

Collect

Supply

Return

Supply

Return

Collect
1 - b. Transport of radioisotopes and radiopharmaceuticals
- Related facility / Transportation amount

The number of operators handling Radioisotopes (FY 2016)

<table>
<thead>
<tr>
<th>Users</th>
<th>Sellers</th>
<th>Rental Service</th>
<th>Disposers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Facilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universities / Laboratories</td>
<td>1096</td>
<td>958</td>
<td>4407</td>
</tr>
<tr>
<td>Private agencies</td>
<td></td>
<td></td>
<td>1060</td>
</tr>
<tr>
<td>Other institutions</td>
<td></td>
<td></td>
<td>309</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

The number of radioisotopes and radiopharmaceuticals packages transported in a year

<table>
<thead>
<tr>
<th></th>
<th>excepted</th>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radioisotopes *1</td>
<td>17499</td>
<td>23935</td>
<td>488</td>
</tr>
<tr>
<td>Radiopharmaceuticals *2</td>
<td>31684</td>
<td>521564</td>
<td>—</td>
</tr>
</tbody>
</table>

Reference*1 : Survey results of transportation of radioisotopes in 2017
Reference*2 : Commissioned project by Nuclear Safety Committee in FY 2007
Survey results of transportation of radioactive material and accidents related to radiation source
2 - a. How to adopt SSR-6 to domestic regulations

IAEA
SSR-6

UN-ECOSOC
United Nations Recommendations on the Transport of Dangerous Goods (Orange Book)

Domestic legislation
- Act for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors
- Act for Prevention of Radiation Hazards due to Radioisotopes, etc.
- Act for Securing Quality, Efficacy and Safety of Products Including Pharmaceuticals and Medical devices

Civil Aviation Act
Ship Safety Act

ICAO
Convention on International Civil Aviation
ICAO-TI

IMO
SOLAS
IMDG Code
<table>
<thead>
<tr>
<th>Transportation Mode</th>
<th>Land Transport</th>
<th>Sea Transport</th>
<th>Air Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Material</strong></td>
<td><strong>Package</strong></td>
<td><strong>Transport Method</strong></td>
<td><strong>Ship Safety Act</strong></td>
</tr>
</tbody>
</table>
| **Nuclear Fuel Material** | Act for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors  
● The Rules for Transport of Nuclear Fuel Material, etc. Outside Plants (Nuclear competent authorities) | Act for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors  
● The Rules for Vehicle Transport of Nuclear Fuel Material, etc. (Ministry of Land, Infrastructure, Transport and Tourism) | | |
| **Radioisotope** | Act for Prevention of Radiation Hazards due to Radioisotopes, etc.  
● The Rules implementing the Act on Prevention of Radiation Hazards due to Radioisotopes, etc. (Nuclear competent authorities) | Act for Prevention of Radiation Hazards due to Radioisotopes, etc.  
● The Rules for Vehicle Transport of Radioisotopes, etc. (Ministry of Land, Infrastructure, Transport and Tourism) | | |
| **Radiopharmaceutical** | Act for Securing Quality, Efficacy and Safety of Products Including Pharmaceuticals and Medical devices (Ministry of Health, Labour and Welfare) | | | |

※Postal Transport : Postal Act (Ministry of Internal Affairs and Communications) in addition to Act above

- Ensure safety about date and routes of transport (National Police Agency / Japan Coast Guard)
- Preparedness for fire accident (Fire and Disaster Management Agency)
Interagency Coordinating Meeting for the safe transport of radioactive material

- Established in 1983 considering regulations under plural competent authorities
- Share information and exchange views about safety regulations and measures (e.g. SSR-6, SSG-26, IRRS)
- Establish liaison system and divisions of roles in case of accidents
- Draft guidelines of making manuals for safe transport and instruct operators to make them

Conference on Countermeasures for Transport Accident of Radioactive Materials

- Hold conference if necessary
- Collect and analyze information
- Arrange the measures taken by each ministry

Interagency Conference on Countermeasures for Nuclear Accident

- Collect and analyze accident information
- Arrange first response of related competent authorities

Nuclear Emergency Response headquarters Conference

- Take measures against emergency response
- All competent authorities (Headquarter: Prime Minister)
Japan decides national responding policy for important IAEA meetings (e.g., TRANSSC) and important comments (e.g., 120-day comment by member states) under the following preparation system.

- **Interagency Coordinating Meeting for the safe transport of radioactive material**
  - Share and arrange the national policy among competent authorities
  - Get approval of executive officials
  - Decide national policy

- **Nuclear competent authorities**

- **Committees for international transport regulation**
  - Suggest national policy

- **Subcommittee for radiation protection**
  - 8 Experts

- **Subcommittee for package design and test conditions**
  - 11 Experts

- **Subcommittee for tasks of operation of transport regulation**
  - 10 Experts

Secretariat: National Maritime Research Institute (Commissioned by Nuclear competent authorities)
It takes 2 months from uploading drafted agendas until IAEA committee
<table>
<thead>
<tr>
<th>Operators work</th>
<th>Approval or confirmation procedures by competent authorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design of package</td>
<td>1. Approval of design of package (packaging &amp; radioactive content)【related competent authorities】</td>
</tr>
</tbody>
</table>
| 2. Manufacturing of packaging | 2. Approval (register) of packaging 【related competent authorities】
- Review whether packaging is manufactured according to approved design
- Review method of manufacturing packaging |
| 3. Production of package | 3. Confirmation of package (packaging & radioactive content)【related competent authorities】
- Confirm by inspection record whether physical properties such as dose rates, surface contaminated density and temperature of package which will be actually transported are satisfied with standards |
| 4. Decision of transport method and reporting to transport date and route | 4. Confirmation of transport method and ensuring safety about transport date and route
- Confirm by documents whether loading method, dose rate of vehicles and ships, labelling, radiation protection program, etc. are satisfied with standards 【MLIT】
- Ensure safety about transport date, route, organization of cars, the kind of ships, etc. 【JPA・JCG】 |
| 5. Loading of package prior to transport | 5. Inspection of loading method of package
- Conduct on-site inspection about whether the method of loading to vehicles and ships is satisfied with standards 【MLIT】 |

- Step 1 is according to SSR-6. Steps 2, 3, 4 and 5 are unique to Japan.
- Steps 1 to 5 are applied mainly to Type BM package and Type BU package.
4. Transport in preparation
- a. Return of radioactive waste and MOX fuel from Europe

- **Return of radioactive waste and MOX fuel from Europe**
  - **MOX fuel** returning to **nuclear power plant**
  - **Vitrified waste storage center** (in Rokkasho, in operation)
  - **Vitrified waste disposal center** (site not decided)
  - **LLW disposal center** (site not decided)

- **Vitrified waste**
  - Start in 1995
  - All 1300 finished
  - Start in 2010
  - 520 finished
  - About 310 not finished

- **LLW(TRU)**
  - Return in the future

- **Nuclear Fuel Transport Co. Ltd.** submitted an application of packaging approval.
  - NRA is reviewing now.

*1 *2 Source: Homepage of Japan Nuclear Fuel Limited

Transport after off-site storage

- Nuclear power plant (e.g. Kashiwazaki)
- Spent fuel interim storage facility (in Mutsu / plan to start operating in late 2018 FY)
- Re-processing plant (site not decided)

- Tokyo Electric Power Co., Inc. submitted application of approval of packaging.
- NRA is reviewing now.

**Dual Purpose Cask**

*1 Source: Homepage of Tokyo Electric Power Co., Inc.
*2 Source: Homepage of Recyclable-Fuel Storage Company

Transport after on-site storage

- Nuclear power plant (e.g. Hamaoka)
- Dry storage facility
- Re-processing plant (site not decided)

- Chubu Electric Power Co., Inc. submitted application of approval of design and permit of reactor establishment change.
- NRA is reviewing now.

**Dual Purpose Cask**

*3,*4 Source: Homepage of Chubu Electric Power Co., Inc.
4. Transport in preparation

c. Transport of fuel debris generated in Fukushima Dai-ichi Nuclear Power Plant

<table>
<thead>
<tr>
<th>Unit</th>
<th>No1., 2.</th>
<th>No.3</th>
<th>No.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of rubble &amp; decontamination</td>
<td>now</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of equipment for removal of spent fuel from reactor building</td>
<td></td>
<td>around mid-FY 2018</td>
<td></td>
</tr>
<tr>
<td>Removal of spent fuel from reactor building</td>
<td>around FY 2023</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage and handling of spent fuel</td>
<td></td>
<td></td>
<td>now</td>
</tr>
</tbody>
</table>

Capturing the status inside the PCV / Examining the fuel debris retrieval method, etc. | now | around FY 2019 | |
| Fuel debris retrieval from reactor building | | |
| Storage and handling of fuel debris | | |

Scenario development and technology consideration for dismantling nuclear facilities | Design and manufacturing of equipment | Dismantling of nuclear facilities

Reference: The Meeting for Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment

Fuel debris is left in reactor containment vessel.
Thank you for your attention!