Transport of Radioactive Materials in China

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1. Transport system profile

Highway: 4.8 million km
Expressway: 140,000 km
Rail: 127,000 km
High speed rail: 25,000 km
Inland waterway: 127,000 km
Airport: 229
1. Transport system profile

Volumes of freight transport

- Rail
- Road
- Water
- Air

100 million tons

100 million tons.km
2. Nuclear Facilities

Nuclear Power Plant (NPP):

- 38 NPP in operation
- 18 NPP under construction

Up to April 15, 2018
From NNSA, in Chinese mainland
Main Nuclear Fuel Recycle Facilities:

- Mining and milling
- Conversion
- Enrichment
- Fuel fabrication
- Spent fuel storage and reprocessing
Radioactive sources in use:

- Entities producing, selling, and using radioisotopes:
  - ~12,700
- Radioactive sources in use:
  - ~135,500
- Waste radioactive sources recovered and stored in temporary storage:
  - ~200,000

Up to Dec. 31, 2017 from NNSA 2017 Annual report
Radiopharmaceutical:

- **Main species:**
  - Tc-99 (technetium)
  - I-125, I-131 (iodine)
  - F-18 (fluorine)
  - C-14 (carbon), etc.

- **Annual transport volume:**
  - About 500,000 packages per year
4. Regulatory Authorities

- MEP (NNSA) — Ministry of Environmental Protection (National Nuclear Safety Administration)
- MPS — Ministry of Public Security
- MOT — Ministry of Transport
- NRA — National Railway Administration
- CAAC — Civil Aviation Administration
- MSA — Maritime Safety Administration
- CAEA — China Atomic Energy Authority
- NHFPC — National Health and Family Planning Commission
- GAC — General Administration of Customs
- SPB — State Post Bureau
4. Regulatory Authorities

Main responsibilities of the various regulatory authorities

- MEP (NNSA)
  - Radiation safety permits
  - Approve nuclear material license
  - Package design license
  - Package manufacture permits
  - Approval of nuclear and radiation SAR about shipment
  - Supervision on nuclear and Radiation Safety
  - Nuclear and Radiation Accident Emergency

- Transport (MOT, NRA, CAAC, MSA)
  - Carrier transport qualification permit
  - Specific management for different modes of transport
  - Participate in emergency response

- MPS
  - Road transport permit:
    - Spent fuel transport: approved by MPS
    - Others: approved by the public security organs above the county level
  - Participate in emergency response

- CAEA
  - Nuclear material license
  - Spent fuel transfer approval
  - Spent fuel shipment approval
  - Approval for spent fuel transport emergency plans
  - Participate in emergency response

- Others (NHFPC, GAC, SPB)
  - NHFPC: Participate in emergency response
  - GAC: Import and export of RM

- Others
  - Approved by the public security organs above the county level
  - Participate in emergency response
5. Legal system

Nuclear Safety Regulatory Hierarchy (4 tiers)

- **Law/Act**: Issued by the National People’s Congress (NPC)
- **Decree/Regulation**: Issued by the State Council
- **Department Rules (HAF)**: General: Issued by Ministries of the State Council
  - Nuclear and Radiation Safety: mostly issued by MEP (NNSA)
- **Safety Guides (HAD)**
- **Technical Documents (HAJ)**: Nuclear and Radiation Safety: Issued by NNSA
## 5. Legal System

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
</table>
| **Laws**                       | - Law on Prevention and Control of Radioactive Pollution, 2003 (President Order No. 6)  
                                  - Law on Nuclear safety, Issued by the National People’s Congress, 2017 (President Order No. 73) |
| **Regulations**                | Regulations on the Administration of Transport Safety of Radioactive Materials, 2009 (The State Council Order No. 562) |
| **Department Rules/National Standards** | - Code on Licensing of Transport Safety of Radioactive Materials (HAF 701), 2010  
                                  - Code on Supervision of Transport Safety of Radioactive Materials (HAF 702), 2016  
                                  - Classification and Lists of Radioactive Materials, issued jointly by 8 ministries, 2010  
                                  - Regulations for the Safe Transport of Radioactive Materials (GB 11806-2004) |
## 5. Legal system

<table>
<thead>
<tr>
<th>Safety Guides</th>
<th>Technical Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Standard Format and Content of Safety Analysis</td>
<td>• Periodic Evaluation on the Safety Performance of Package for Transport of Radioactive Materials</td>
</tr>
<tr>
<td>• Standard Format and Content of Nuclear and Radiation Safety Analysis Report for Shipment of Radioactive Materials (HAD 701/02), 2014</td>
<td>• Handbook on radiation monitoring of radioactive materials transport packages and transport vehicles</td>
</tr>
<tr>
<td>• Physical Protection of Transport of Nuclear Materials (HAD 501/05), 2008</td>
<td></td>
</tr>
</tbody>
</table>
5. Legal system

Development of transport regulation of RM:

GB11806 issued ~ TS-R-1-1985

1989

GB11806 revised ~ TS-R-1-2003

2004

A Series of department rules issued

2009

the Regulation Issued (the State Council Order No.562)

2010


GB11806 revising ~ SSR6-2012

2013
Main rules/provisions for transport of dangerous goods:

- **ROAD**
  - Rules for road transport dangerous goods (JT617.1~JT617.7)
    - ✓ being revised
    - ✓ Reference to UN Model and ADR
  - Provisions on the Administration of Road Transport of Radioactive Materials, 2010

- **RAIL**
  - Rules for the Administration of Railway Dangerous Goods Transportation, 2008

- **SEA**
  - Regulations on the Safety Administration of Port for Dangerous Goods, 2017

- **AIR**
  - Provisions on the Administration of Dangerous Goods Transportation in China (CCAR-276-R1, 2013)
  - IMDG Code
  - ICAO
There are four basic principles for the regulation of radioactive materials transport:

**No.1 Packaging is the primary means to ensure the safety of RM transport**
- According to this principle, set up a management system for the design and manufacture of packaging

**No.2 Category Management**
- Radioactive materials shall be classified into three categories, based on their properties and their potential hazards to human health and the environment.

<table>
<thead>
<tr>
<th>Category</th>
<th>Impact to human health and the environment</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>Significant</td>
<td>high-level waste, spent fuel, new fuel, Category I radioactive source, UF$_6$ and other fissile material.</td>
</tr>
<tr>
<td>Category II</td>
<td>General</td>
<td>Middle-level waste, Category II &amp; III radioactive source.</td>
</tr>
<tr>
<td>Category III</td>
<td>Minor</td>
<td>Low-level waste, Category IV &amp; V radioactive source.</td>
</tr>
</tbody>
</table>
No.3 The consignor is responsible for the transport safety

- The consignor must have the appropriate knowledge, skills, and hold the legal documents.
- The consignor shall be responsible for: packaging, transport description, radiation monitoring and protection, accident emergency guides, for the relevant administrative examination and approval procedures.

No.4 Consistent with international practices

- The main management system is in line with the IAEA procedures
- A fraction of management requirements has been properly adjusted in accordance with the national conditions, such as the requirements for manufacture of some type packages and for some shipments
### 6. Basic Regulatory Principles

#### Major Approaches:

<table>
<thead>
<tr>
<th>Category</th>
<th>Package Design</th>
<th>Package Manufacture</th>
<th>Shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>Approval by NNSA</td>
<td></td>
<td>The nuclear and radiation SAR shall be approved by NNSA (Valid for 5 years)</td>
</tr>
<tr>
<td></td>
<td><em>(Valid for 5 years)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category II</td>
<td>Submitted to NNSA for the record</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category III</td>
<td>Archived by the designers</td>
<td>Submitted to NNSA for the record</td>
<td></td>
</tr>
</tbody>
</table>
7. Package Test facilities

Mechanical test facilities

Smaller facility

Thermal test facilities

Furnaces

larger facility

Open pool
7. Package Test facilities

Water immersion test facilities

2.5MPa
I.D:1200mm
I.H:4000mm

2.0MPa
I.D:3500mm
I.H:6000mm

Leakage test facilities
8. Safety requirements on shipment

The nuclear and radiation SAR for category I materials shall be approved by NNSA

① Vehicle
② Driver
③ Load and unload
④ Tie-down
⑤ Route investigation
⑥ Radiation inspection
⑦ Environment impact assessment
⑧ Emergency preparation and response
⑨ Quality assurance
⑩ Safety and security
8. Safety requirements on shipment

**documents**
- Plan for emergency
- Guide for emergency
- Plan for security
- Plan for radiation protection
- Guide for safety and protection
- Quality assurance plan
- Procedures
- Etc.

**training**
- Driving
- Load and unload
- Tie-down
- Emergency
- Safety and Security
- Radiation protection
- Medical
- Etc.
Thank you!
谢谢！