AGENDA ITEM – 2.5.2

TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA

B.S.MANJUNATH
Bhabha Atomic Research Center
Mumbai – 400085, India
TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA

भारत की स्थिति Position of India
TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA

INTRODUCTION TO INDIAN NUCLEAR PROGRAM

Ushering India to a brighter future...

NUCLEAR POWER

RADIATION TECHNOLOGIES

- Medicine
- Agriculture
- Basic Research
- Industry
- Water Resources
Nuclear Power Plants:
Operating: 22
Under Construction: 8
TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA

ORGANIZATIONAL STRUCTURE OF ATOMIC ENERGY ESTABLISHMENTS

- ATOMIC ENERGY COMMISSION
  - DAE Science Research Council
  - ATOMIC ENERGY REGULATORY BOARD

- DEPARTMENT OF ATOMIC ENERGY

- R&D CENTRES
  - Bhabha Atomic Research Centre, Mumbai
  - Indira Gandhi Centre for Atomic Research, Kalpakkam
  - Centre for Advanced Technology, Indore
  - Variable Energy Cyclotron Centre, Kolkata
  - Atomic Minerals Directorate for Exploration & Research, Hyderabad

- PUBLIC SECTOR UNDERTAKINGS
  - Nuclear Power Corp. of India Ltd., Mumbai
  - Indian Rare Earths Ltd., Mumbai
  - Uranium Corp. of India Ltd., Jaduguda
  - Electronics Corp. of India Ltd., Hyderabad
  - Bharatiya Nabhikya Vidyut Nigam Ltd., Kalpakkam

- INDUSTRIAL ORGANISATIONS
  - Heavy Water Board, Mumbai
  - Nuclear Fuel Complex, Hyderabad
  - Board of Radiation & Isotope Technology, Mumbai

- SERVICE ORGANISATIONS
  - Directorate of Purchase & Stores, Mumbai
  - Directorate of Construction, Services & Estate Management, Mumbai
  - General Services Organisation, Kalpakkam

- AIDED INSTITUTIONS
  - Tata Institute of Fundamental Research, Mumbai
  - Tata Memorial Centre, Mumbai
  - Saha Institute of Nuclear Physics, Kolkata

- INSTITUTIONS
  - Institute of Physics, Bhubaneswar
  - Institute for Plasma Research, Ahmedabad
  - Harish-Chandra Research Institute, Allahabad
  - Institute of Mathematical Sciences, Chennai
  - Atomic Energy Education Society, Mumbai
TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA

ATOMIC ENERGY REGULATORY BOARD (AERB)

- Package Transported in India/Year: More than 0.1 Million
- Range of Activities Transported: kilo Bq to Peta Bq
- Modes of Transportation: Road, Sea & Air

Atomic Energy Regulatory Board (AERB)

- Constituted as Indian Regulatory Authority on November 15, 1983, by President of India by exercising the powers conferred by the Atomic Energy Act 1962

Mission of AERB:

- To ensure that the use of ionizing radiation and nuclear energy in India does not cause undue risk to health and environment."
Two Apex Safety Review Committees:

- Safety Review Committee for Operating Plants (SARCOP)

and

- Safety Review Committee for Applications of Radiation (SARCAR), includes Transportation sub-Committee (COSTRAM)
TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA
SOME OF THE TRANSPORTATION PACKAGES IN INDIA

Radioactive Sources

Radiography Camera

Cask for Teletherapy Sources
The Codes & Guides adopt ‘Graded-Approach’ to enforce Safety & Security, during transportation of different categories of packages.


   - Current Type-A Registrations: 30 Nos
   - Current Type-B Approvals: 39 Nos
RADIOACTIVE CONSIGNMENTS IN INDIA


- Minerals and Ores \((U, Th)\)
- Radiopharmaceuticals
- Iridium- 192 Sources:
  Radiography Cameras for Industrial Application
- Co-60 Sources:
  Gamma Chambers / Irradiators / Teletherapy Machines
- Nuclear Fuel Cycle Materials:
  \((\text{Fresh Fuel – } UO_2, \text{ Irradiated fuel})\)
- Radioactive Waste:
  \((\text{Irradiated Coolant Channel Tubes from PHWRs})\)
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Package Type</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Excepted Package</td>
<td>Radioimmunoassay kit Small sealed sources, Activated samples</td>
</tr>
<tr>
<td>2.</td>
<td>Industrial Package – I</td>
<td>U, Th. Ores and concentrates of such ore, Iridium-192 Radiography Cameras</td>
</tr>
<tr>
<td></td>
<td>Industrial Package – II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial Package – III</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Type-A</td>
<td>Cameras &amp; Radiopharmaceutical Flask</td>
</tr>
<tr>
<td>4.</td>
<td>Type B(U) and</td>
<td>Gamma Chambers / Casks for Irradiator Sources / Teletherapy Sources</td>
</tr>
<tr>
<td>5.</td>
<td>Type B(M)</td>
<td>Spent Fuel cask, Irradiated Coolant Channel Flask</td>
</tr>
</tbody>
</table>
NORMAL CONDITION TESTING FACILITIES IN INDIA

WATER SPRAY

STACKING TEST / COMPRESSION TEST

FREE DROP

PENETRATION
TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA

ACCIDENT CONDITION TESTING FACILITIES IN INDIA

9M IMPACT TEST
(On Unyielding Target)

PUNCH TEST

9M CRUSH TEST,
(On Unyielding Target)

WATER IMMERSION
(0.9m/15m/200m)
TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA

ACCIDENT CONDITION TESTING FACILITIES IN INDIA

FURNACE TEST

OPEN POOL FIRE TESTING (As per ASTM-E-2230)
TRANSPORT OF RADIOACTIVE MATERIALS IN INDIA

ELECTRONIC-GOVERNANCE OF RADIATION FACILITIES

E-LICENSING OF RADIATION APPLICATIONS (e-LORA)

Government of India
Atomic Energy Regulatory Board
e-Licensing of Radiation Applications (eLORA) System

It is mandatory for all users/owners of Medical Diagnostic X-ray equipment to obtain Licence/Registration from AERB for Operation of the equipment as per Atomic Energy (Radiation Protection) Rules 2004.

Obtain AERB Licence/Registration for Medical Diagnostic X-ray equipment through eLORA

eLORA System

eLORA (e-Licensing of Radiation Applications), an e-Governance Initiative by AERB, is a web-based application for automation of regulatory processes for various Radiation Facilities in India. The objective of the project is to enhance efficiency and transparency in the regulatory processes of AERB. The system is aimed at achieving paperless licensing of Radiation Facilities.
e-LORA is launched for achieving more Efficiency, Reliability and Transparency in Regulation.

Features of e-LORA:

- Regulatory Approvals are issued (License, Authorisation, Registration) which includes Permission for Transport
- Inspection and Enforcement
- Tracking of Radiation Sources starting from the stage of procurement to its safe disposal i.e. “Cradle to Grave”
India follows the provisions of IAEA Code:

“Conduct on Safety and Security of Radioactive Sources (2004)” and

“Guidance on the import and export of radioactive sources “

Example: Export of Category -1 source:

Utility submits:

- Application form for export
- a copy of import permission issued to the importing facility by the relevant Competent Authority of the Importing State

AERB seeks:

- confirmation from its counterpart prior to export of category -1 radioactive source in a specified format

AERB accords consent for export with a condition that the exporting facility shall notify the competent authority of the Importing State at least 7 calendar days prior to shipment of radioactive consignment.
TRANSPORT DOCUMENTS DURING TRANSPORTATION

- Consignor’s Declaration
- TREM Card (Transport Emergency Card)
- Instructions to the Carrier
- Emergency Measures, Instructions in case of Transport Incidents
<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo</td>
<td>Radioactive Material</td>
</tr>
<tr>
<td>Nature of Hazard</td>
<td>Radioactive Material</td>
</tr>
<tr>
<td>Hazard</td>
<td>Potential External and Internal Exposure</td>
</tr>
<tr>
<td>Protective device to be</td>
<td>One set each for Driver and his Assistant,</td>
</tr>
<tr>
<td>carried in the Vehicle</td>
<td>- Protective Clothing (Boots, Gloves, Caps)</td>
</tr>
<tr>
<td></td>
<td>- Big Polythene Bags for collecting</td>
</tr>
<tr>
<td></td>
<td>Contaminated Materials</td>
</tr>
<tr>
<td>Emergency Action</td>
<td>Inspect the Package Visually. Proceed, if intact</td>
</tr>
<tr>
<td></td>
<td>In case of Fire, fight from a distance</td>
</tr>
<tr>
<td></td>
<td>If package appears damaged, Cordon off for 3m</td>
</tr>
</tbody>
</table>
Contact Telephone Numbers for Advice and Assistance:

a) Contact the Consignor at the Address given on the Package

b) Emergency Control Room, Crisis Management Group, DAE, Mumbai - 400 001, TF: 022-2202 3978, Telefax: 022-22021714
   Fax : 022-22830441; Mob:+919969201364;
   Email: daeecr@dae.gov.in

Alternate CMG : DAE Emergency Control Room (ECR) located in Anushaktinagar (VSB), Mumbai-400094, Ph: 022-2599 1070
   Telefax : 022-25515283*
   Fax : 022-25991080/022-25993080
   Mob : +919969201365
   Email : vsbcecr@npcil.co.in
NUCLEAR EMERGENCY RESPONSE

DEPARTMENT OF ATOMIC ENERGY

CRISIS MANAGEMENT GROUP (CMG)

- Maintains 24x7 Emergency Control Room (ECR)
- Coordinates with the Emergency Response Centre's (23 Nos. Spread across the country)
- Coordinates with the concerned DDMA, SDMA
- Takes part in emergency exercises

National Crisis Management Committee (NCMC)

The Local District Administration

Atomic Energy Regulatory Board (AERB)

Nuclear Power Corporation of India Ltd (NPCIL)

Bhabha Atomic Research Centre (BARC)

Heavy Water Board (HWB)

Directorate of Purchase and Stores (DP&S)
### HIGHLIGHTS OF SECURITY GUIDE: AERB/NRF-TS/SG-10

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Security Level</th>
<th>Salient Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Level-1</strong> (Prudent Management Practices)</td>
<td>Account for Quantity of RAM Produced, Dispatched and In-Stock. Selection of Carrier, Notification to Consignee, Keeping Track during Transport and Confirmation of Receipt by Consignee</td>
</tr>
<tr>
<td>4.</td>
<td>Level - Special Security Measures</td>
<td>Level-3 + Details of the Route, Details of Conveyance, Security Personnel, Details of Security Escort</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Package Type</td>
<td>Applicable Transport Security Level</td>
</tr>
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<td>Type-A</td>
<td>Level-2</td>
</tr>
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<td>3.</td>
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<td>Level-3</td>
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<td></td>
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</table>
SUMMARY

Record of Safe and Secure Transportation in India
Six decades

This exemplary safety record is attributed to:

- Strict Implementation of Regulations

- Strong Engineering basis for Testing and Analysis of Packaging, to ensure that they meet Regulatory Requirements

- Training of Personnel in Radiological Safety and Security, to update with improved Procedures

- Assessing and Mitigating Risks during Transport
Thanks for Your Attention