Safety-Security Interface in Madagascar: Experience, Challenges, and Opportunities with Transport of NORM

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- Location: East Africa, Indian Ocean
- Area: 592 000 km²
- Population: 23 millions
Industry sectors identified

(01) Extraction of rare earth elements;
(01) Mining of ores other than uranium ore;
(02) Oil drilling;
(01) Production of cobalt and nickel;
(01) Manufacture of titanium dioxide pigments;
(01) Extraction of zircon;
(01) Extraction of chromium;
(01) Production of iron.
Transport of radioactive minerals
Transport of radioactive minerals

Relevant exposure scenarios:

– Exposure to gamma radiation

– Dust (only when mineral transported in bulk)

– Radon (sometimes in storage areas, cargo holds of ships and containers)
Transport of radioactive minerals

Separation of monazite from other minerals and transport
Transport of radioactive minerals

Separation of monazite from other minerals and transport
Transport of radioactive minerals

Detection of radioactivity and dose rate measurements from NORM before transport and shipment are required:

Even if a material is exempt from the Regulations and the associated signposting, the concentrations of radionuclides may cause gamma radiation levels outside the packages (e.g. sea containers) that are easily detectable by the equipment that is commonly used in ports.

Transport documentation needs to contain detailed information about the concentrations of naturally occurring radionuclides, irrespective of its classification. All necessary information may be provided in the document that is accompanying every material shipment.

The inclusion of the gamma-spectrum for a particular material is highly advisable. Whilst not absolutely necessary, this information would assist in the process of clearing a particular NORM through the radiation detection equipment at seaport.
Transport of radioactive minerals

Monazite transported by truck from mining separation to seaport for shipment

<table>
<thead>
<tr>
<th>August 2018</th>
<th>No of containers: 144</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Dose rate in contact with the container (mSv.h⁻¹)</th>
<th>Dose rate at 1m from the container (mSv.h⁻¹)</th>
<th>IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>80</td>
<td>38</td>
<td>11.4</td>
</tr>
<tr>
<td>Min</td>
<td>23</td>
<td>9</td>
<td>2.7</td>
</tr>
<tr>
<td>Average</td>
<td>40.6</td>
<td>19.5</td>
<td>5.8</td>
</tr>
</tbody>
</table>

| March 2019     | No of containers: 98                             |

<table>
<thead>
<tr>
<th></th>
<th>Dose rate in contact with the container (mSv.h⁻¹)</th>
<th>Dose rate at 1m from the container (mSv.h⁻¹)</th>
<th>IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>33</td>
<td>17.5</td>
<td>5.3</td>
</tr>
<tr>
<td>Min</td>
<td>12</td>
<td>6</td>
<td>1.8</td>
</tr>
<tr>
<td>Average</td>
<td>19.5</td>
<td>12.2</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Reference: IAEA Safety Standards N° SSR 6 [§ 523, (a), (b) and Table 7.]
NSS 14 specifies in para. 4.36 that:

when establishing security measures to protect against a malicious act particularly sabotage, the safety features of the design of the transport package, container and conveyance should be taken into account
In cooperation with Customs Department and Border Polices, at the international airports and seaports.
Detection
Detection

NSDA

Strategy development

Implementation

Assessment

Site Information and Design Document (SIDD)
Detection

Implementation

In the implementation of the NSDA in Madagascar, radiation detection instruments have been deployed to support the detection and identification of possible illicit trafficking in nuclear and other radioactive materials.

**IAEA to donate the following:**

- 16 PRDs (Rad Eye PRD-ER)
- 2 RIDs (FLIR identiFINDER 2 ULK NG gamma only)
- 4 PRD software packages (one per organization - Police, Customs, Gendarmerie, and INSTN)
- USB cable for data communications.

Pager (PRD)  
Identifinder (RID)
Challenges

Legislation and Regulation
- Adoption of Nuclear National Policy and Strategies.
- Promulgation of a comprehensive Nuclear Law (*Safety* - *Security* - *Safeguards*).
- Revision of Regulations for transport of radioactive materials.

Regulatory body
- Establishment of an independent and sustainable Regulatory Body.

Detection and Identification
- Deployment of equipment to identify isotopes such as uranium-235, uranium-238 and thorium-232 at the border.
- Establishment of Site Information and Design Document (SIDD) for the main seaports of Madagascar concerned with NORM shipments.
- Compilation of data to support the development of guidelines and tools to determine with high confidence if an alarming container has only NORM content and if the proper labeling/packaging had been used.
- Help Customs Officers in Madagascar to make more efficient and high confidence decisions regarding alarm assessments to ensure safety and security.