Quantifying Cl. 7 shipments

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Background – Global shipments

• Figure of 20m Cl. 7 shipments a year globally widely used in transport circles
• Raises questions:
  • What is its origin?
  • Is it up to date?
• Breakdown:
  • Nuclear v non-nuclear
  • Mode
• Having more up-to-date estimates could:
  • Help us design the right solutions for issues we face
  • Help with outreach
Research project

- Visiting Research Officer at World Nuclear Association asked to research the annual package / shipment figures, including a method for calculating:
  - Cl. 7 total
  - Maritime component
  - Fuel cycle component
- WNTI has offered support
Title: ESTIMATED ANNUAL WORLDWIDE SHIPMENTS OF RADIOACTIVE MATERIAL

Year: 1986 PATRAM conference

- **Data collection procedure**: Questionnaire, asking international (only export shipment data) and domestic number of “Package Shipment”, centred on 1981.

- **Collected data**: 49 countries responded, 35 counties’ data were used.

- **Conclusion**: from 18 to 38 million Package Shipments were made annually

- **Notes**:
  - The definition of “Package Shipment” means a single package transported by single mode of transport from an origin to a destination.
  
    e.g. 3 Package Shipments

  - The worldwide volume was estimated from the point of view of GDP and population.
Previous research 1 (IAEA)

Approx. 10,000,000 package shipments were reported by 35 countries.

55% of world’s GDP are covered.

26% of world’s population are covered.

Estimated 18,000,000 package shipments worldwide

Estimated 38,000,000 package shipments worldwide
Title: STATISTICS ON THE TRANSPORT OF RADIOACTIVE MATERIALS AND STATISTICAL ANALYSIS
Year: 2003

- **Data collection Procedure:** Questionnaire, asking numbers of shipments/packages, centred on 2001.
- **Collected data:** 25 counties’ data were used.
- **Conclusion:** Over a million packages of radioactive materials are transported.
- **Note:**
  - Estimates seem quite conservative, probably due to concern over double (or more) counting.
Figure 2. Radioactive material transport in EU Member States and Applicant Countries (1990s/early 2000)

- All Material Categories
- Nuclear Fuel Cycle
- Radioisotopes
- Radiation Sources
- Non-nuclear Waste

Estimated Number of Packages per Year

Countries:
- Austria
- Belgium
- Denmark
- Finland
- France
- Germany
- Greece
- Hungary
- Ireland
- Italy
- Luxembourg
- Netherlands
- Poland
- Portugal
- Romania
- Slovakia
- Spain
- Sweden
- Switzerland
- Turkey
- UK
- Other
Other sources

- Several presentations given at IAEA TRANSSC
- Some countries’ data were found on the internet.

<table>
<thead>
<tr>
<th>Country</th>
<th>Organization</th>
<th>Reported year</th>
<th>Shipments</th>
<th>Packages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>STUK</td>
<td>2015</td>
<td>-</td>
<td>~ 23,000</td>
</tr>
<tr>
<td>France</td>
<td>ASN</td>
<td>2016</td>
<td>770,000</td>
<td>980,000</td>
</tr>
<tr>
<td>Germany</td>
<td>BMU</td>
<td>2016</td>
<td>~ 500,000</td>
<td>-</td>
</tr>
<tr>
<td>Japan</td>
<td>IAEA</td>
<td>2006</td>
<td>-</td>
<td>707,000</td>
</tr>
<tr>
<td>Philippine</td>
<td>DOTC</td>
<td>2013</td>
<td>-</td>
<td>5,431</td>
</tr>
<tr>
<td>Spain</td>
<td>CNS</td>
<td>2014</td>
<td>~ 40,500</td>
<td>-</td>
</tr>
<tr>
<td>US</td>
<td>ANS</td>
<td>2012</td>
<td>2 – 5 m</td>
<td>-</td>
</tr>
</tbody>
</table>
Maritime shipments

- Estimates provided for global maritime nuclear shipments at World Nuclear Fuel Cycle 2017:
  - Uranium Ore Concentrate: ~1500 TEU
  - Fissile: ~300 TEU
- Tantalum ores: < 200 TEU
- Natural UF6:
- Isotopes:
- Waste:
- TEU transported globally annually: ~150 m
  - Cl. 7 component a tiny proportion of maritime market
  - Maritime component a tiny proportion of global Cl. 7 market
Future activities

- Need to decide which data should be collected, shipments and/or packages, with clear definitions.
- Need to discuss how to collect and compile the data.
  - Through governments / through industry
- Need to discuss how to estimate worldwide statistics.
  - estimate from the point of view of GDP and population based on some prime countries’ data?
    (Obviously it is impossible to collect the data from all counties.)

IAEA conclusions:
If similar data collection activities are attempted in the future, it is recommended that;
(a) the data collection sheets should be much simpler
(b) the data collection activity should be less ambitious
(c) data need only be collected from approx. 20 countries (the largest shippers) to obtain a good estimate.
(d) clear detailed instructions, with examples, should be provided.

We would like your ideas to achieve the goal!
## Organisations contacted

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Response</th>
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</thead>
<tbody>
<tr>
<td>Association of Imaging Producers and Equipment Suppliers (AIPES)</td>
<td>Pending</td>
</tr>
<tr>
<td>International Source Suppliers and Producers Association (ISSPA)</td>
<td>No data</td>
</tr>
<tr>
<td>IRSN</td>
<td>Yes</td>
</tr>
<tr>
<td>TIC</td>
<td>Yes</td>
</tr>
<tr>
<td>International Irradiation Association (IIA)</td>
<td>No data</td>
</tr>
<tr>
<td>Nuclear Energy Institute (US)</td>
<td>Pending</td>
</tr>
</tbody>
</table>