Taking Stock: Plutonium in Northeast Asia

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Viewpoints expressed here are those of the author, and not necessary those of his affiliations
Plutonium Management Guidelines

- Nine countries formed Plutonium Management Guidelines (INFCIRC/549) to declare their separated civil Pu stocks.

<table>
<thead>
<tr>
<th>Country</th>
<th>1996</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>20.1</td>
<td>47.0</td>
</tr>
<tr>
<td>Germany</td>
<td>22.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Belgium, France</td>
<td>2.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.05</td>
<td>0.0</td>
</tr>
<tr>
<td>US</td>
<td>35.6</td>
<td>65.3</td>
</tr>
<tr>
<td>Japan</td>
<td>4.65</td>
<td>49.45</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.0</td>
<td>0.04</td>
</tr>
<tr>
<td>China, Russia, UK, US</td>
<td>51.9</td>
<td>110.3</td>
</tr>
<tr>
<td>Total</td>
<td>165.6</td>
<td>332.5</td>
</tr>
</tbody>
</table>

Plutonium Stocks in INFCIRC/549 Countries
Reducing Plutonium Risks in the West

• **Soft Landing** – Belgium, Switzerland, Germany
  - No more separated civil Pu in Belgium and Switzerland.
  - Germany too, when it phases-out nuclear power in 2022.

• In **Cruise Control** – France
  - Balance its Pu stock with La Hague, Melox, and PWRs.

• From **No Landing** to **Cooperative Landing** – UK (w/ France)
  - UK has no reactor to use its 110 t Pu.
  - If UK Pu moxified at Melox and used in 13 French PWRs, gone* in ~20 y.
  - Electricity supplied to UK through underwater cables.
  - UK pays for MOX and use-in-reactor service, and takes back spent MOX.
  - Is it **Politically possible?**

• **Rush Landing** – US
  - US cancelled plan to moxify 34 t WPu which could have been used in 5 reactors for 17 y.
  - It opted for a “dilute-and-dispose” option, e.g., dilute in 170,000 55-gal drums and dispose of at WIPP in ~4 y.

* Pu turned into spent MOX fuel
Reducing Plutonium Risks in NE Asia

• **Guided Landing** – Japan, w/o RRP, JMOX, or Oma
  - Using MOX in 8 restarted reactors, its 15 t Pu in France, gone in 5 y.
  - Its 23 t Pu in UK\(^1\), gone in another 7 y, within reactor operating lives.
  - Japan could explore in turning over its domestic Pu\(^2\) to the US.

**Prolonged Landing** – Japan, w/RRP, JMOX and Oma
  - Without new NPP construction, operating RRP and JMOX to produce Oma’s ~5 t core Pu and ~1.7 t/y reload Pu\(^3\) would be expensive.
  - Japan would stock Pu again if RRP and JMOX operated at capacity.

• **Awaiting Take-Off** – Russia, China (and perhaps, ROK)
  - Russia aims to moxify Mayak Pu for FR BN800/1200.
  - China’s 50-t pilot Rep plant, 1/2-t MOX line and CEFR are in early stage.
  - KAERI’s Pyro-processing (w/USDOE) aims to make metal fuel for FR.

• What to do with DPRK’s **denuclearized Pu** (if happens)?
  - Verifiably sent out to China, Russia or other P5?
  - Implications to Japan, ROK, and NE Asia?

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\(^1\) after enriched with Magnox Pu and moxified at Melox.
\(^2\) legacy materials from FR Monju & Joyo, and ATR Fugen.
\(^3\) 20% RRP & JMOX capacities.