Dating a nuclear event based on isotopic ratios

K. YAMBA, O. SANOGO, M. B. KALINOWSKI, M. MIKKINEN J. KOULIDIATI
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- Dating of nuclear event by using isotopic activity ratio requires the use of nuclear constants such as ENDF, TENDL, JENDL JEFF or LARA(LNHB-CEA). In order to improve the accuracy of zero time, it is important to take into account these databases which do not give always the same values.
- Activity ratios Y92/Sr92 (usable for a few days), La140/Ba140 (usable for about one week) and Nb95/Zr95 (usable for up to one year) have been studied, and some constants have been proposed for a fast and accurate assessment of zero time.

**Figure 1:** Change over time of the activity ratio La140/Ba140 according to nuclear explosion and continuous nuclear reactor release scenarios.

**Figure 2:** Overview of fission product Cumulative Yield according to the various databases. Data are converging with the high yields.

**Figure 3:** Change over time of the activity ratio Nb95/Zr95 according to the nuclear test and continuous nuclear reactor release scenarios.

**Solid line in blue:** Nuclear explosion scenario. **Dotted line in green:** Continuous nuclear reactor release scenario.

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**Table:** Some costs for a fast and accurate dating of nuclear explosion by using Nb95/Zr95 activity ratio

<table>
<thead>
<tr>
<th>T2.2-P06</th>
<th>U</th>
<th>L</th>
<th>P</th>
<th>A</th>
<th>C</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENDF B.VII.</td>
<td>16.6751</td>
<td>±0.3042</td>
<td>0.7655</td>
<td>±0.0036</td>
<td>6.4748</td>
<td>±0.8277</td>
</tr>
<tr>
<td>LARA–LNHB/CEA</td>
<td>±1.393</td>
<td>±0.0175</td>
<td>0.7486</td>
<td>±0.6059</td>
<td>6.4748</td>
<td>±2.9775</td>
</tr>
</tbody>
</table>

**Table:** Some constants for a fast and accurate dating of nuclear explosion by using La95/Ba140 activity ratio

<table>
<thead>
<tr>
<th>T2.2-P06</th>
<th>U</th>
<th>L</th>
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<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENDF B.VII.</td>
<td>±2.7888</td>
<td>±2.419e-4</td>
<td>±1.472e-3</td>
<td>±1.8307e-3</td>
<td>±1.516</td>
<td>±1.294e-3</td>
</tr>
</tbody>
</table>

**Comparison with others studies based on May 15th 2010 detection**
- DE GEER (Science & Global Security, 20:1–29, 2017: May 11, 06:00 +3h/3h (UTC)
- HANTOLA (J. Radioanal Nucl Chem (2013) 298:1283–1291): May 12, 16:00 (UTC)
- ZHANG and WEN (Scientific Research Letters Volume 86, Number 1: January/February 2015): May 12, 00:00 (UTC)
- Our estimation by using the measurement data given by (DE GEER: 2015): May 11, 10:00 (UTC)

Some costs for a fast and accurate dating of nuclear explosion by using La140/Ba140 activity ratio

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