Geopolymer matrix waste disposal experience in the Czech Republic

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Radioactive Waste Disposal in CR

- Main waste streams:
  - INSTITUTIONAL – subsurface disposal, Drum in drum, Repositories Richard(1965) and Bratrství(1975)
Main types of NPP waste disposed in DUKOVANY

• Liquid waste – evaporate and bituminized
• Solid waste – different treatment (mid pressure compaction, incineration, cutting and partitioning + cementation)

• Some waste was without suitable conditioning for disposal:
  • Ion Exchange resins
  • Sludges

2006 started conditioning these types of waste into geopolymer matrix SIAL®
Licensing considerations

2006 – new material – existing Slovak experience

• use approach applied to cemented waste
• no increase in activity limits above that for cemented waste
• Add clear indicator which prove quality of the conditioning process
Known approach in different countries

- Czech Republic, Slovakia derived WAC from cemented RW.
- In the UK, existing standards may be applied where useful, although each individual waste is treated separately when gaining approvals.
- In other countries, the first step in gaining approval to use a geopolymer matrix for the solidification of radioactive waste is to develop new standards for determining the properties of geopolymers. These standards are general and not only for geopolymers used for radioactive waste treatment (e.g. Australia, Japan).
Example of a campaign at Dukovany NPP

Result: 191 m³ of spent ion exchange resins treated into the SIAL® matrix in 2,006 200 litre drums
Project Duration: May 2010 – Dec. 2012 (31 months - 3 years before original client target date)
Workplace decontaminated and equipment transported out of NPP area in Dec. 2012 on completion

The international missions WANO and OSART evaluated it as an example of best practice
### Number of disposed drums with geopolymer matrix 2011-2020

<table>
<thead>
<tr>
<th>Year</th>
<th>Total drums</th>
<th>Geopolymer drums</th>
<th>Geopolymer ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2439</td>
<td>236</td>
<td>10%</td>
</tr>
<tr>
<td>2011</td>
<td>2499</td>
<td>923</td>
<td>37%</td>
</tr>
<tr>
<td>2012</td>
<td>2246</td>
<td>747</td>
<td>33%</td>
</tr>
<tr>
<td>2013</td>
<td>1774</td>
<td>241</td>
<td>14%</td>
</tr>
<tr>
<td>2014</td>
<td>2497</td>
<td>1053</td>
<td>42%</td>
</tr>
<tr>
<td>2015</td>
<td>933</td>
<td>536</td>
<td>57%</td>
</tr>
<tr>
<td>2016</td>
<td>1510</td>
<td>442</td>
<td>29%</td>
</tr>
<tr>
<td>2017</td>
<td>645</td>
<td>195</td>
<td>30%</td>
</tr>
<tr>
<td>2018</td>
<td>1439</td>
<td>345</td>
<td>24%</td>
</tr>
<tr>
<td>2019</td>
<td>1413</td>
<td>423</td>
<td>30%</td>
</tr>
<tr>
<td>2020</td>
<td>1056</td>
<td>796</td>
<td>75%</td>
</tr>
</tbody>
</table>

The chart shows the number of total drums and geopolymer drums disposed from 2010 to 2020, with a ratio of geopolymer drums to total drums.
Thank you for your attention