DGR design optimization

Radioactive Waste Repository Authority

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Optimization

Disposal casks, engineered barriers system

Hot-cell location in DGR area

Disposal casks transport to the underground area

Disposal system and layout
Disposal casks, engineered barriers system

Optimization

- **Material tests** (verification of material properties in DGR expected conditions, irradiation and temperature degradation)

- **Verification thermo-technical calculations** (to specify and prove the amount of SNF placed into the cask, the thickness of backfill)

- **Strength calculations** (verification of swelling pressure of bentonite to cask´s surface, shear stress due to movement of rock blocks at possible tectonic events)

- **Long-term safety verification** (in the case of modification)
## Disposal casks transport to the underground

<table>
<thead>
<tr>
<th>Shaft</th>
<th>Incline drift</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Smaller amount of excavated rock</td>
<td>• Higher operational safety</td>
</tr>
<tr>
<td>• Smaller expensiveness of transport</td>
<td>• Less complicated clearing away of accident impacts</td>
</tr>
</tbody>
</table>

### Optimization

In dependence on cask´s construction to check:

- **Operational safety protection** (especially in the case of shaft transport to the underground area)
- **Possibilities of safe accident impacts removing, evaluation of impacts**
### Hot-cell location in DGR area
(Czech background)

<table>
<thead>
<tr>
<th>pros</th>
<th>cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nowadays used storage containers (CASTOR) are declared both for storage and transport. <em>(Not necessity to design new transport casing for DGR disposal casks)</em></td>
<td>Necessity of construction of technological background <em>(Hot-cells, located in NPP areas could use NPP’s background)</em></td>
</tr>
<tr>
<td>Noticeable decrease of transports between NPP and DGR areas <em>(EDU 12x, ETE 6-7x)</em></td>
<td>Necessity of more extensive areal</td>
</tr>
<tr>
<td>• Public acceptance <em>(Threatness of workplace with non-sealed sources)</em></td>
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</tbody>
</table>

### Optimization

- **Common decision with CEZ, a.s. about construction and operation of hot-cell**
  *(location of hot-cell could be influenced by locality selection and distance of DGR from NPPs)*
  *(location of hot-cell could be influenced/have influence to NPP’s decommissioning scenario selection)*
## Disposal system and layout

<table>
<thead>
<tr>
<th>Horizontal</th>
<th>Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pros</strong></td>
<td><strong>cons</strong></td>
</tr>
<tr>
<td>Need of smaller area</td>
<td>More demanding manipulation with casks and bentonite blocks (<em>long disposal drifts</em>)</td>
</tr>
<tr>
<td>Smaller amount of excavated rock</td>
<td>Geological survey can give more restriction (<em>craks x long disposal drifts</em>)</td>
</tr>
</tbody>
</table>

**Combination?**
Disposal system and layout (cont.)

INCLINE SYSTEM

WHY?

- **Economic aspects**
  - Possibility to remove disposal casks with SNF

- **Technical aspects**
  - Better utilization of the host rock *(limited size of host rock complying with requirements - CZ conditions)*
  - Simplified handling both the disposal cask and the bentonite buffer segments
Disposal system and layout (cont.)

BUT…

There are many questions to be clarified…

- Long-term mechanical resistance *(in dependence to disposal drift inclination)*
- Analyse of threatnes in the case of cask deformation *(upper casks can increase the risk of SNF destruction in lower damaged cask due to its mass – nuclear safety)*
- The time of economic favourableness *(quality/mechanical damages of SNF assemblies)*
- … ?
Disposal system and layout (cont.)

... SOLUTION?

1) SWOT analyse

2) Definition of the topics to be worked up

3) Elaboration of relevant supporting studies

4) Optimal technological solution, based on long term safety analyses assessment requirements

5) Case study
Disposal system and layout (cont.)

International cooperation

<table>
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<tr>
<th>pros</th>
<th>cons</th>
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<tr>
<td>Sophisticated solution</td>
<td>-</td>
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</table>
Thank you for your attention

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