CONSTRUCTION OF HOT CELL FACILITY IN CVR

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HOTLABS 2013
Since 2002, R&D organization developing ideas, technologies and solutions in power generation industry particularly focused at nuclear technologies

Member of the UJV Group

Our Vision:
To become a strong, economically independent research and development organization in power generation
R&D Activities

CVR

- Research Reactors
- Technological Loops
- Project Sustainable Energy
- Nuclear Waste Storage
- Jules Horowitz Reactor
- Technical Safety Organization
New Hot Cells

- 8 gamma hot cells, 2 alpha hot cells and 1 semi-hot cell will be constructed.
- Thickness of steel shielding:
  - **perimeter** shielding 500 mm
  - **ceiling** shielding 400 mm
  - **floor** shielding 300 mm
- Max. source activity up to 300 TBq $^{60}$Co
- In each hot cell will be hermetic, easily removable box from stainless steel
Equipment inside hot cells

- Experimental devices for diagnostics and testing for admittance of radioactive samples entering the gamma hot cells
- Technologies for a complex samples processing (cutting, welding machining)
- Experimental devices for a mechanical properties testing
- Technologies and experimental devices for metallography and microscopy (SEM, LOM)
- Experimental device FERDA 2 (Fractional separation of fluorides from fission products and transurans with origin in irradiated nuclear fuel)
Equipment inside hot cells

- Autoclave and water loop
- Creep machines
- Universal tensile testing machine
- Microscopy preparation
- Microscopy
- Experimental device FERDA II
- CNC + storage
- EDM machine
- EBW + vacuum furnace
- Fatigue machine
Building & Shielding

Cross Section of 3D Model

- Operator hall ceiling
- Operator hall
- Cell Basement
- Box
- Hot cell
- The hall above hot cells
- Operator hall ceiling
- Operator hall
- Basement
Building & Shielding

Operations in Hot Cell Facility

- Transport of Samples
- Entering Hot Cells
- Removing the Box
- Decontamination of the Box
- Preparation of an Experiment

Cell Basement

Operator Hall Ceiling

Operator Hall

Operator Hall Ceiling

Operator Hall Ceiling
Building & Shielding

- **Dose Equivalent Rates**

<table>
<thead>
<tr>
<th>Location</th>
<th>Dose Equivalent Rate (µSv/h)</th>
<th>Shielding Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hall of Hot Cells</td>
<td>γ = 54 µSv/h</td>
<td>Steel, 400 mm</td>
</tr>
<tr>
<td>Operator Halls</td>
<td>γ = 1.38 µSv/h</td>
<td>Steel, 500 mm, Steel, 300 mm</td>
</tr>
<tr>
<td>Basement</td>
<td>γ = 2950 µSv/h</td>
<td>Steel, 300 mm</td>
</tr>
</tbody>
</table>

**RA Source 300TBq**
1.173MeV, 1.332MeV

**Steel Shielding Thicknesses**
- Perimeter wall: Steel, 500 mm
- Partition wall: Steel, 300 mm
- Floor: Steel, 300 mm
- Ceiling: Steel, 400 mm
Box & instrumentation

Box inside hot cell

Box inside hot cell, connection to support technologies (must be removable)
Box & instrumentation

Box inside hot cell, connection to support technologies (must be disconnectable)

Box inside hot cell, general view
Mock up Stand of Hermetic Box

- Wood & steel construction
- Tests on Mockup Stand of Hermetic Box
Limited space in the building did not allow to create a pre-chambers, therefore was a mobile pre-chamber developed.

It is used for entry to a hot cell for workers and is designed like a transport container. It has its own electrical circuit, ventilation, connector for the fresh air (for the protective suits) and entrance doors.
Mobile Prechamber

- Entry ladder
- Overhead crane
- Material throwing hole
- Protective Clothing
- Clean air compressor
- Entry door in the floor
- Toolbox
Sample transportation device

- Irradiated samples will be transported to the hot cell via a transportation device. At this time a draft of a transportation device is known but it is not perfect.

- **Known operation:**
  - Opening of shielding part of hot cell
  - Airtight connection to box
  - Opening of transportation device and box
  - Delivering of irradiated sample to box
  - Closing of transportation device and box
  - Disconnection of transportation device
  - Closing of shielding part of hot cell

- **Difficulties:**
  - Access from above
  - Airtight connection
  - Heavy shielding
  - Precise position of device
  - Time-consuming
  - Too complex for one device
Design Layout of Biological Shielding

- Combination: Casting + Continuous Casting (machined)
Design Layout of Biological Shielding

- Casting, Layout like a Lead Brick
At the beginning of construction
Construction site – Current status - ground floor

Place for tanks for liquid radioactive waste

Storage for waste material

Under hot cell
Place for shielding

Operator Hall

Place for shielding
Construction site – Current status – 2nd. floor

View from above
Summary

- Construction of new hot cells is carrying out within the project SUSEN

Facts

- 10 hot cells and 1 semi-hot cell
  - Technologies for a complex samples processing
  - Experimental devices for testing of mechanical and corrosion properties
  - Experimental devices for metallography and microscopy
  - Experimental device FERDA 2
- 2000 tons of steel for the construction of the shielding will be use
- Unique design and properties

Operational in 2016

If you are interested see our poster about instrumentation
Thank you for your attention

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