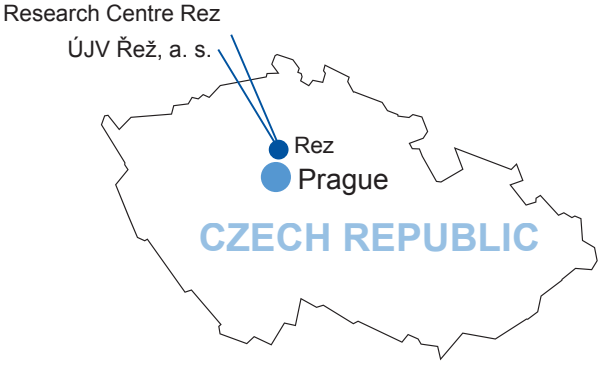
HOT CELL DESIGN AND CONSTRUCTION

At the Research Centre Rez Czech Republic



ÚJV Group

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Activities, Strong Points and Tools

Activities

Completed activities

- Feasibility study of spent nuclear fuel storage at Czech NPP Temelin;
- Design, construction, and operation of a hot cell HK EK-10 in Rez within the frame of Russian Research Reactor Fuel Return Program (RRRFR).

Current activities

- Supply of hot cells for Jules Horowitz Reactor (JHR);
- Preliminary design of active cells and high bay flasks for European Spallation Source (ESS);
- Design of hot cells to be built in Rez in the frame of Sustainable Energy (SUSEN) project.

Foreseen future activities

- Detailed design and construction of ESS active cells;
- Construction of hot cells in Rez in the frame of SUSEN project.

Strong points

Gains from projects work

- Experience in designing modern hot cells;
- Network of suppliers for the design and the construction of hot cells;
- Well-established practice in documentation support for nuclear supplies;
- Quality assurance for both design and construction phase (codes RCC-G, RCC-MX).

Other benefits

- Long experience in component qualification in radiation environments;
- Own workshop for manufacturing of smaller parts;
- Long experience in operation of hot and semi-hot cells, including hot cells for research reactors;
- Experience from design, construction, and operation of a hot cell for research reactor spent fuel repackaging.

Main design tools

- 3D mock-up, drawings – CATIA V5 + SmarTeam, Solid Edge, Inventor;
- Biological protection calculations - MCNPX 2.5.0;
- Static calculations – SCIA ESA PT 7.1.170 (provided in cooperation with NRI Rez);
- Analyses – FMEA, ILS, safety – provided in cooperation with specialists from companies in NRI Group.

Current hot cells for material testing in NRI Rez (mother company of RCR)

Jules Horowitz Reactor (JHR) – Cadarache, France

JHR is an international project of development and building a new high-power nuclear reactor for material and nuclear fuel research. The reactor construction site is located within the nuclear research centre CEA Cadarache in southern France.
JHR thermal power will be 100 MW with a planned lifetime of 50 years.
The RCR supplies a whole hot cells complex.

Scope of RCR supply

- Detailed design including the necessary calculations – biological shielding), seismic, static, and engineering – and other studies;
- Manufacturing of embedded steel structure, shielded doors, docking port, stainless steel liner, internal lifting devices, crossings;
- Installation on site, testing.

JHR vertical docking port for transport casks, part installed on site

Main characteristics of the cells

- 7 hot cells (4 big + 3 small), 2 hatches
- Cells inner dimensions (H x D x W):
  Big: 10 m x 2.5 m x 3–4 m
  Small: 4 m x 2.7 m x 2.3–4 m
- Shielding walls: 120 cm of heavy concrete;
- Containment barrier: Stainless steel liner;
- All big cells connected to pools;
- Load capacity of cranes: 2.5 T

Sustainable Energy (SUSEN) – Rez, Czech Republic *(since 2012)*

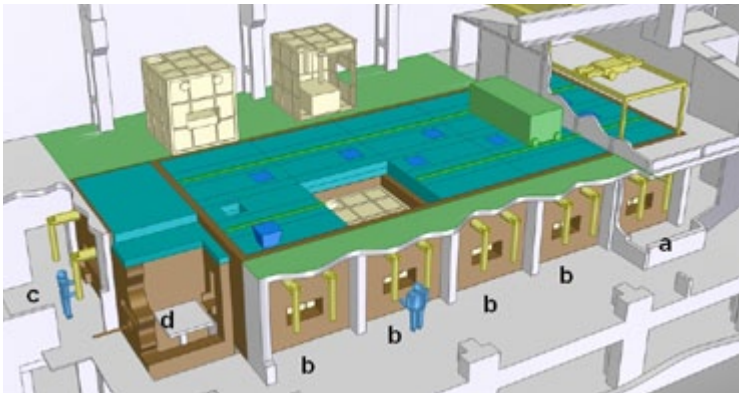
SUSEN is a large-scale project with a budget of EUR 95 million. Main goal is implementation of a regional R&D centre in two locations within the Czech Republic – in Rez near Prague and in Pilsen.
The project includes 4 R&D programmes:

- Technological Experimental Loops;
- Structural and System Diagnostics;
- Nuclear Fuel Cycle;
- Material Research.

One part of infrastructure to be built for the Material Research program is a new complex of hot cells. Cells will be used for the preparation and testing of material samples and experiments with flame fluorination of pulverized fuel.

Main characteristics of the cells

- 10 hot cells, 1 semi-hot cell, dry loading pool;
- Cells inner dimensions (H x D x W): 3 m x 2.4 m x 2.4 m;
- Shielding walls: 50 cm of steel;
- Containment barrier: Sealed removable stainless steel box, boxes are mutually interchangeable;
- Entrance of operators and all material through the ceiling;
- Connection of all media and cables from the bottom.



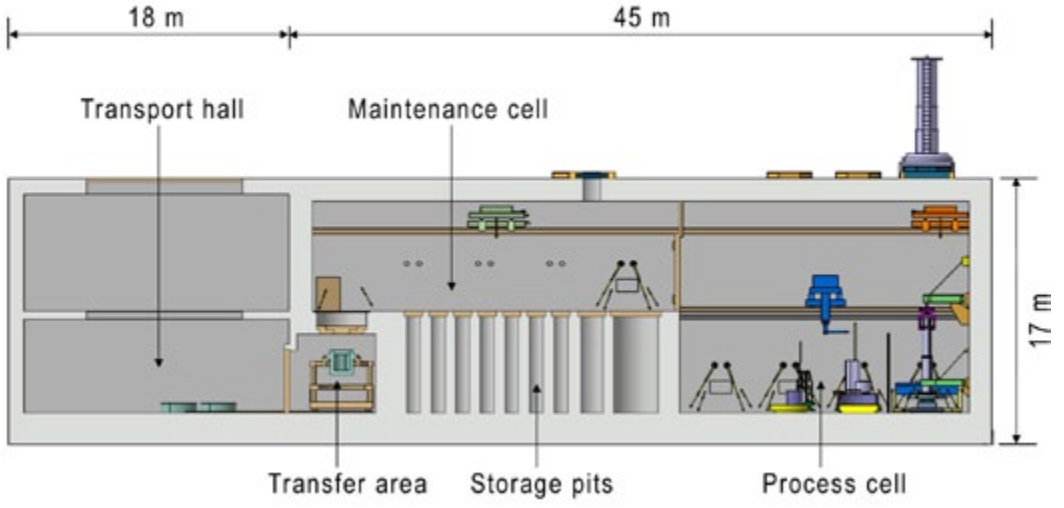
Preliminary outline of the SUSEN hot cells complex – 2 alpha cells for operation with fuel (a), 8 gamma cells for mechanical tests and sample preparation (b), 1 semi-hot cell for microstructure studies (c), dry loading pool (d) .

European Spallation Source (ESS) – Lund, Sweden *(since 2012)*

ESS is a material research facility focused on the neutron scattering technique which will be built in Lund in Sweden. The neutrons are produced by the spallation reaction when accelerated protons impact a rotating tungsten target.
Hot cells are foreseen to maintain, process, package and store used radioactive components of the facility. Handling casks should ensure the transport of the main radioactive components within the facility.
In the frame of the ESS pre-construction phase, RCR was responsible of the hot cells and handling casks preliminary design. A future collaboration with ESS for the detailed design of the hot cells is highly expected.

Main characteristics of the cells

- 2 hot cells: One process cell and one maintenance cell. The maintenance cell has shielded pits on its floor to store the radioactive waste.
- Cells inner dimensions (H x D x W):
  - Process cell: 13.5 m x 8 m x 20 m
  - Maintenance cell: 7 m x 8 m x 25 m
  - Storage pits height: 7 m;
- Shielding walls: 145 cm of heavy concrete;
- Containment barrier: Stainless steel liner.



Preliminary 3D design of the ESS hot cells complex

Centrum výzkumu Řež s.r.o.
Research Centre Rez

Centrum vyzkumu Rez
Husinec-Rez 130
250 68 Rez
Czech Republic

Contact Person:
Jiří Záborský
Tel.: +420 266 173 177
E-mail: jiri.zaborsky@cvrez.cz