NUCLEAR RESEARCH INSTITUTE

Introduction of ÚJV Řež, a. s.

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UJV Group
PEOPLE | INNOVATION | TECHNOLOGY

EMUG 2025, April 7-11, Brno, Czechia

CONTENT

- **Overview of UJV Rez and UJV Group**
- **Activities of Division of Nuclear Safety and Reliability**
- **Highlights from R&D in Severe Accidents**
  - **IVMR**
  - **EVMR**
  - **Material research**

ÚJV Řež – people, experience, infrastructure

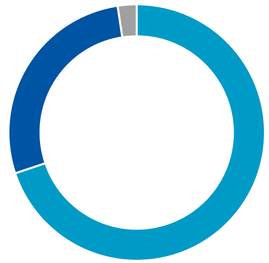
- **State-of-the-art workplace in nuclear engineering and R&D in the Czech Republic and in Europe**
  - **Formerly state nuclear research institute, since 1992 a Joint-stock company**
- **Applied research, design and engineering activities in:**
  - **Energy**
  - **Power industry**
  - **Nuclear medicine**
- **Unique infrastructure and high-level specialists**

OUR WORKFORCE:

700+

EMPLOYEES

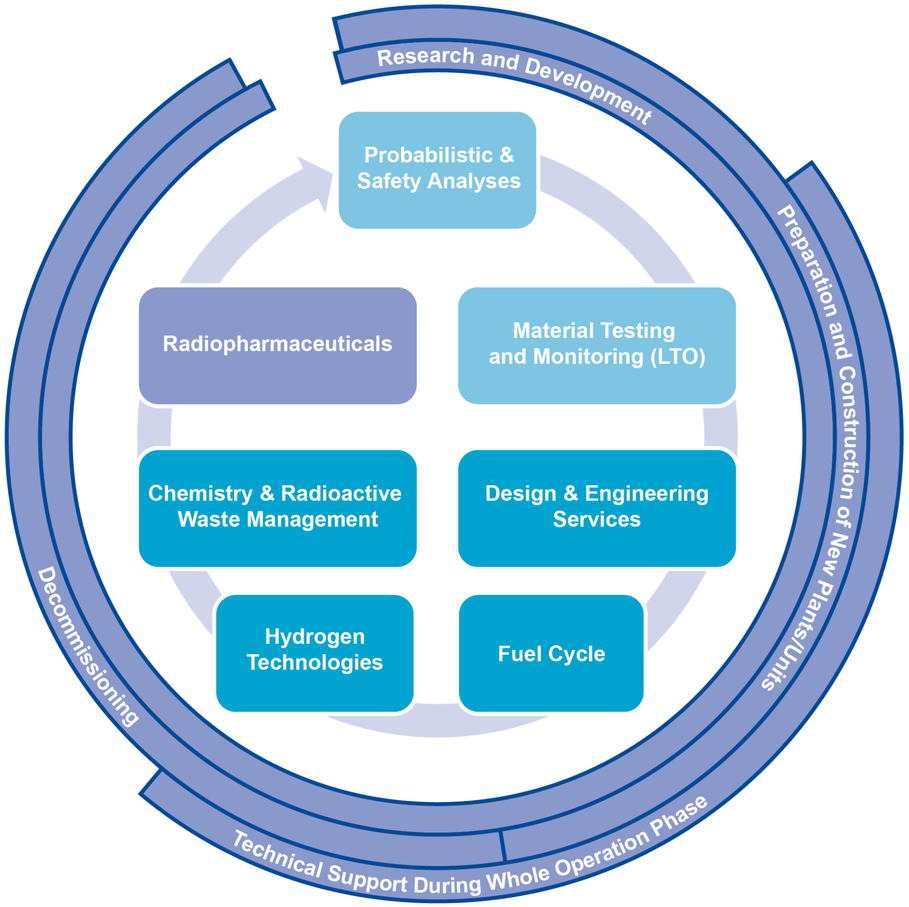
ÚJV Řež
1955–2025



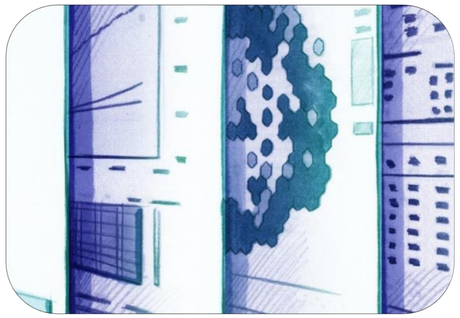
ČEZ, a. s.	69,85 %
Slovenské elektrárne, a. s.	27,77 %
Municipality of Husinec	2,38 %

PRODUCTS & SERVICES

- **Nuclear safety and reliability analysis**
- **Fuel cycle support services**
- **Design and engineering**
- **Radioactive waste and decommissioning**
- **Technical support for operation of nuclear and conventional power plants**
- **Applied R&D**
- **Hydrogen Technologies**
- **Radiopharmaceuticals**

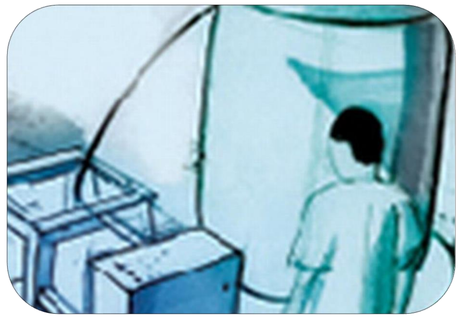


UJV DIVISIONS

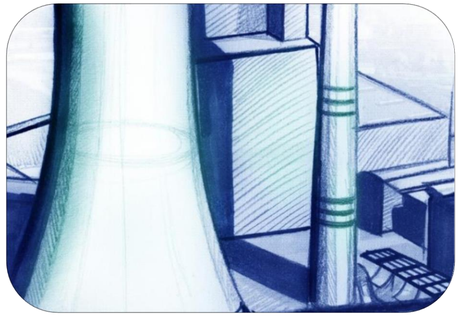


Nuclear Safety & Reliability

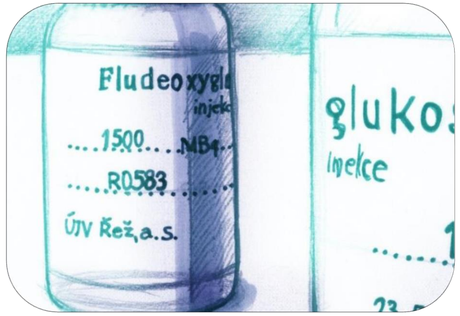
Integrity & Engineering



Authorised Body

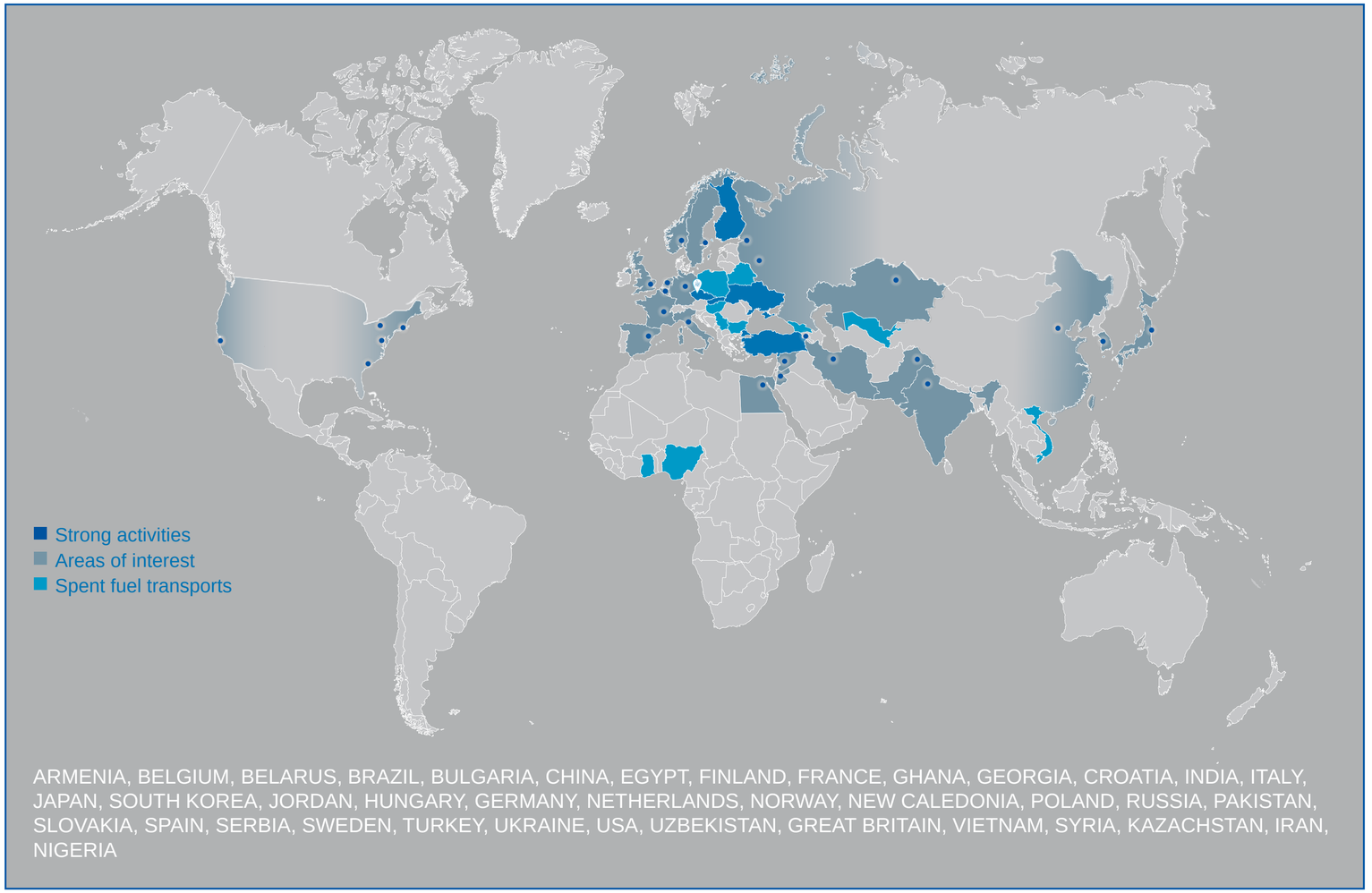


ENERGOPROJEKT (Design)



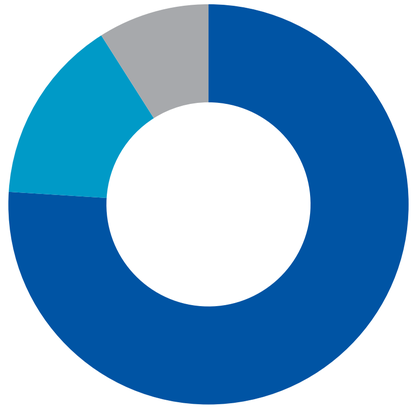
Radiopharmaceuticals

ÚJV Řež WORLDWIDE



ARMENIA, BELGIUM, BELARUS, BRAZIL, BULGARIA, CHINA, EGYPT, FINLAND, FRANCE, GHANA, GEORGIA, CROATIA, INDIA, ITALY, JAPAN, SOUTH KOREA, JORDAN, HUNGARY, GERMANY, NETHERLANDS, NORWAY, NEW CALEDONIA, POLAND, RUSSIA, PAKISTAN, SLOVAKIA, SPAIN, SERBIA, SWEDEN, TURKEY, UKRAINE, USA, UZBEKISTAN, GREAT BRITAIN, VIETNAM, SYRIA, KAZACHSTAN, IRAN, NIGERIA

REVENUE GEOGRAPHICAL SPLIT



76% CZECH REPUBLIC

15% EU

9% Others

UJV Group

- **The portfolio of services of ÚJV Řež is complemented by its 100% owned subsidiaries, which together with ÚJV Řež form the UJV Group.**

- **UJV Group consists of:**

  ÚJV Řež (www.ujv.cz)

  Research Centre Řež (www.cvrez.cz)

  RadioMedic (www.radiomedic.cz)

  Research and Testing Institute Plzeň (www.vzuplzen.cz)

  ŠKODA PRAHA (www.skodapraha.cz)

TOTAL WORKFORCE:

1700+

EMPLOYEES

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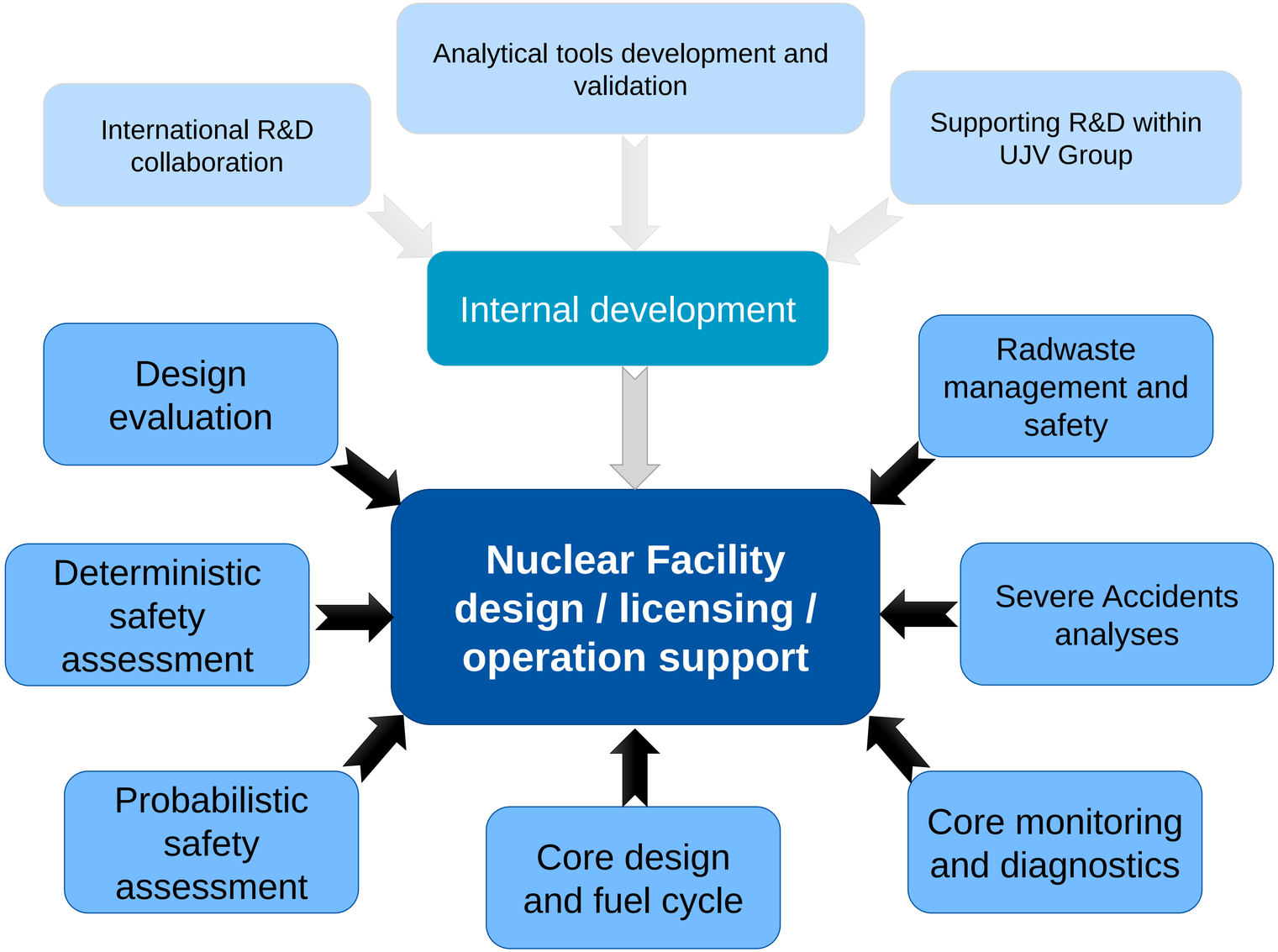
ACTIVITIES OF DIVISION OF NUCLEAR SAFETY AND RELIABILITY

DIVISION OF NUCLEAR SAFETY AND RELIABILITY

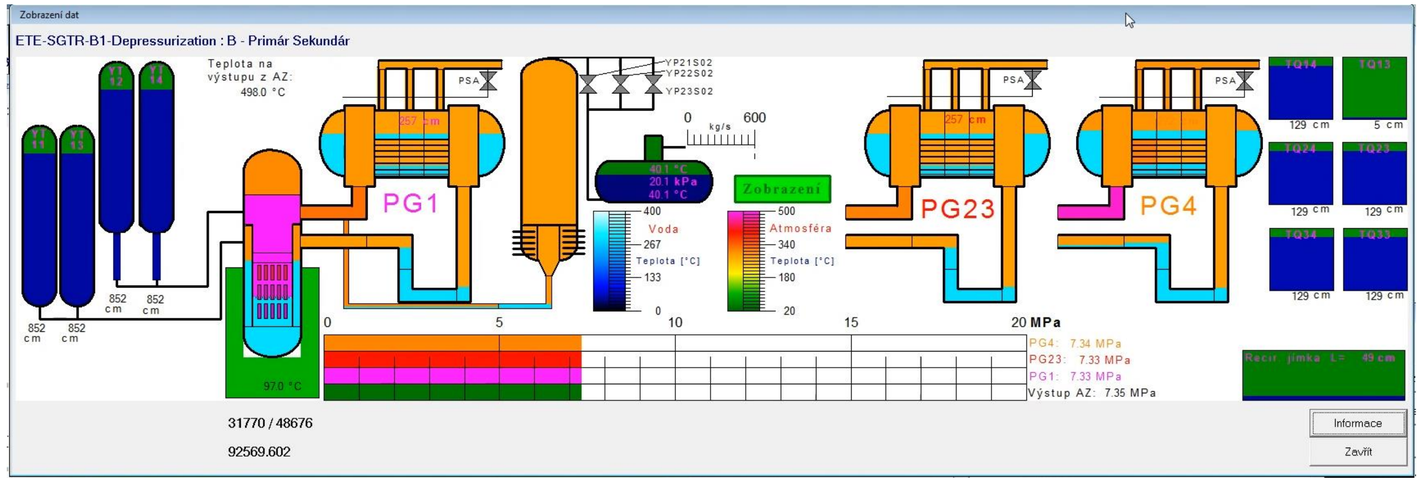
- Mission: To be the leading Czech expert provider of:
  - Core design, nuclear fuel cycle optimization and nuclear fuel performance assessment
  - Deterministic and probabilistic safety assessment of nuclear installations
  - Design and safety assessment of new reactor concepts
- All activities of the division are supported by:
  - Application of cutting-edge computer codes and state of the art methodologies
  - Active participation in the top-level international expert bodies (IAEA, OECD NEA, EPRI…)
  - International and national experimental programs providing state-of-the art data

GENERAL OVERVIEW OF DIVISION ACTIVITIES



HIGHLIGHTS - SEVERE ACCIDENTS MANAGEMENT

- Severe accident simulations with state-of-the-art codes (MELCOR, ASTEC, MAAP…) with in-house modular visualization and operator training software (VINSAP)
- Design and assessment of measures and strategies enhancing plant safety in response to Fukushima-Daiichi event:
  - Hydrogen risk management
  - Filtered containment venting
  - In / ex vessel cooling of the corium
- Development of severe accident management guidelines



VINSAP visualisation / training SW overview screen

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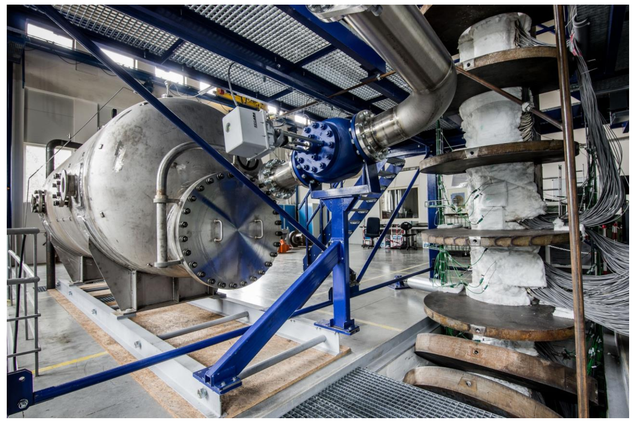
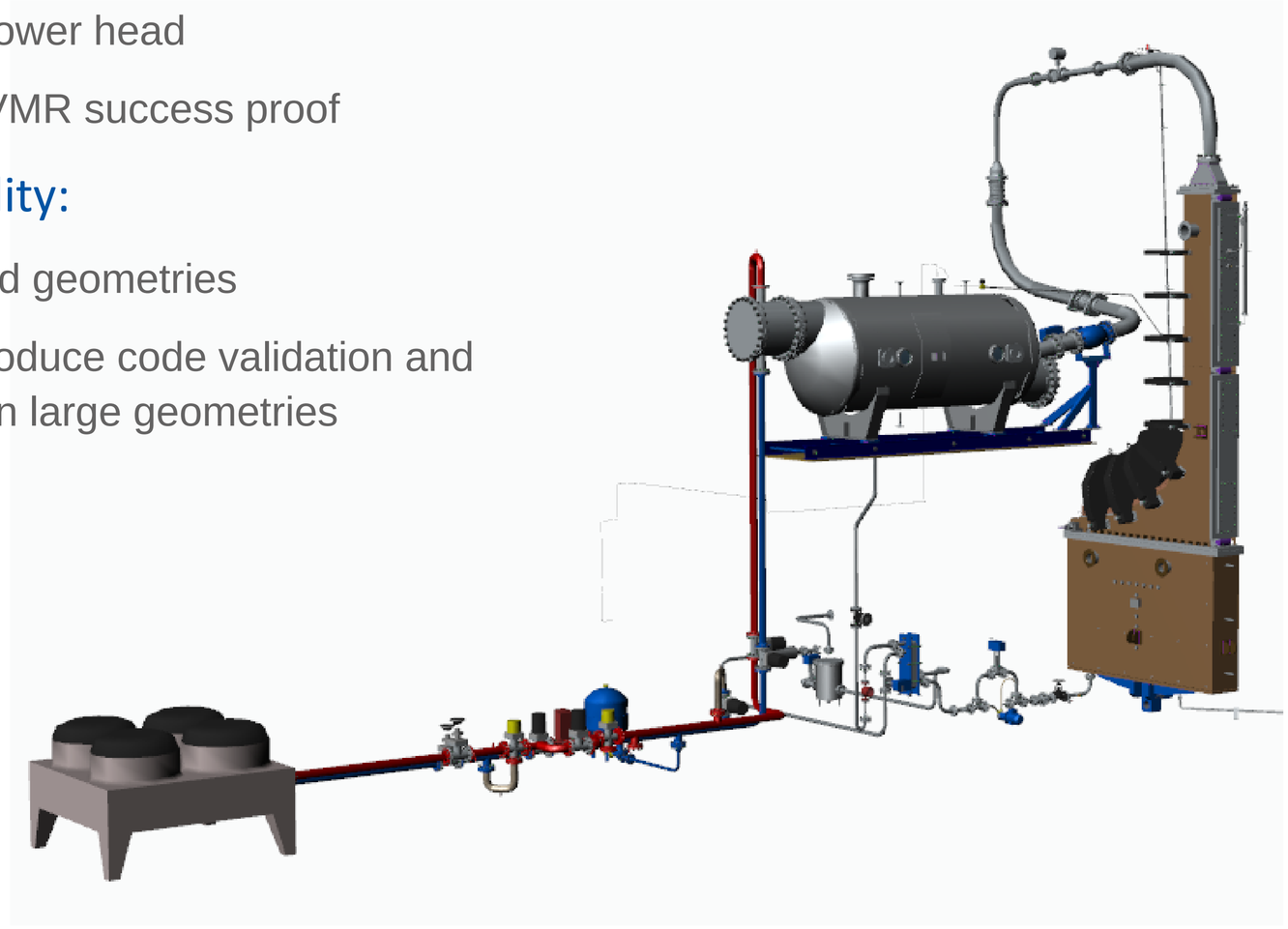
HIGHLIGHTS FROM SEVERE ACCIDENTS R&D

IVMR R&D

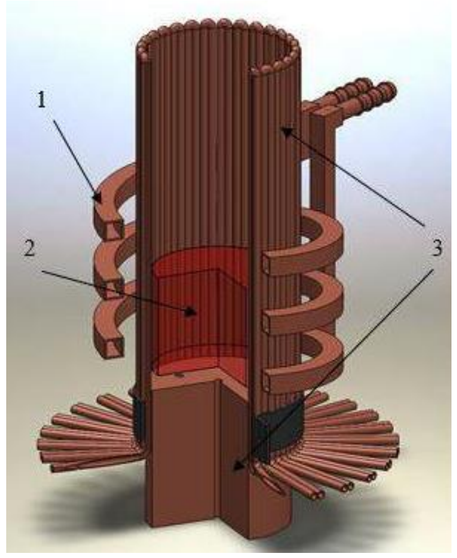
- THS-15 large-scale facility
  - 1:1 scale cut of VVER-1000 RPV lower head
  - Critical heat flux experiments for IVMR success proof
- Further development of the facility:
  - Continuous IVMR R&D with modified geometries
  - Refurbishments and upgrades to produce code validation and benchmarking data on pool boiling in large geometries

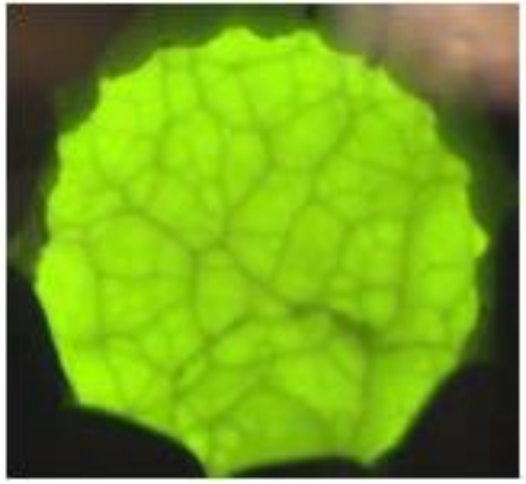




SEVERE ACCIDENT LABORATORY

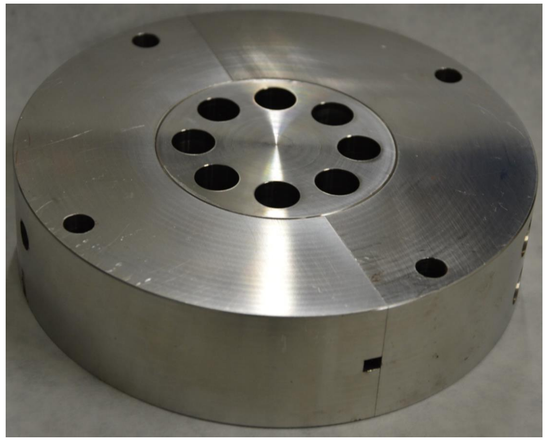
- Operated by CVR in Rez
- Cold crucible with induction furnace heating:
  - Achieving high temperatures, pure melts
- Fully certified to work with radiation
  - Experiments with prototypical corium compositions
  - Material properties, phase diagrams
  - Corium spreading, MCCI experiments



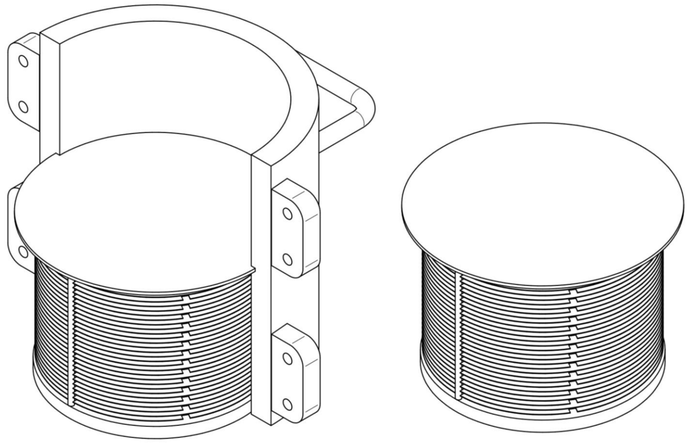


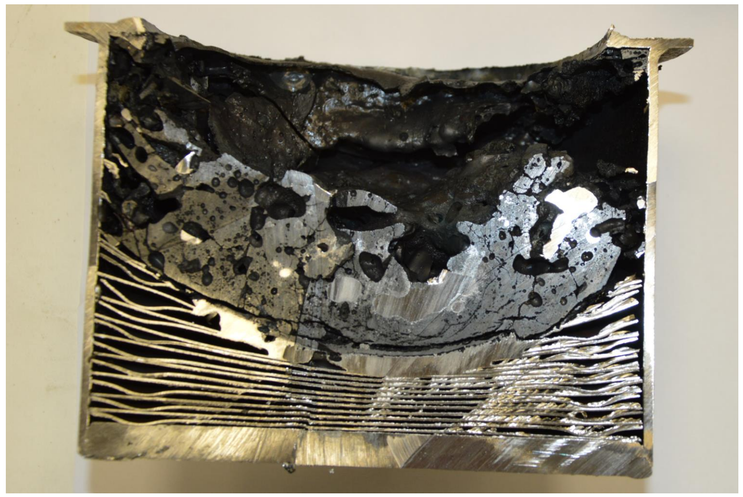
CORIUM INTERACTIONS WITH STRUCTURES

Interaction with core barrel penetrations



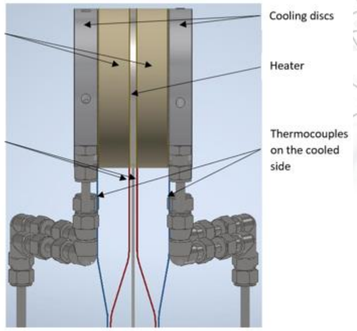
Interaction of thermal shielding at reactor pit bottom

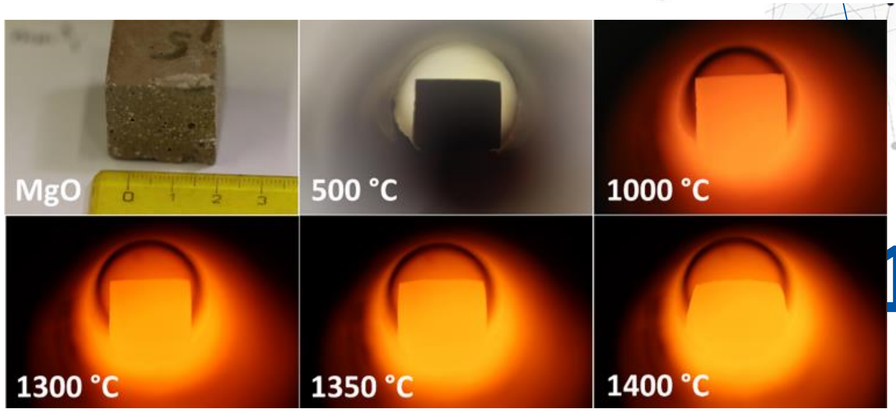


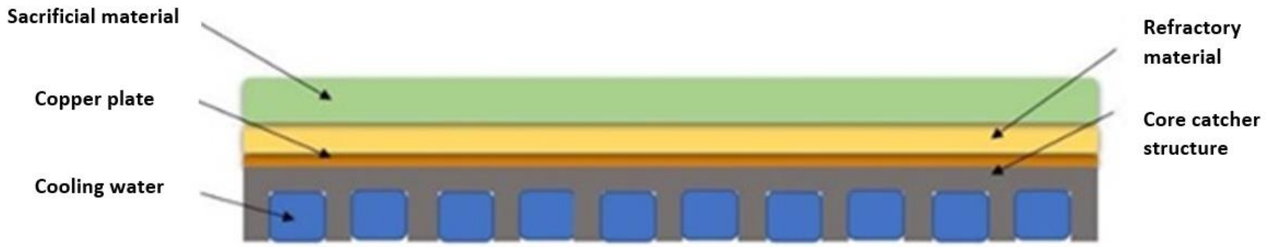


INNOVATIVE MATERIALS FOR EX-VESSEL SEVERE ACCIDENTS

- Development of sacrificial materials
  - Based on geopolymer matrices
- Experiments for determination of thermophysical properties
  - Using BUCKET experimental device (UJV) and high-temperature furnace (Charles University)
- Thermogravimetry and mass spectroscopy
  - Up to 1000°C + dedicated high-temperature experiments using geopolymers and metals (Fe, Zr)
  - To investigate composition and amount of released gases
  - Followed by MCCI Simulations calculated using CORQUENCH and MELCOR



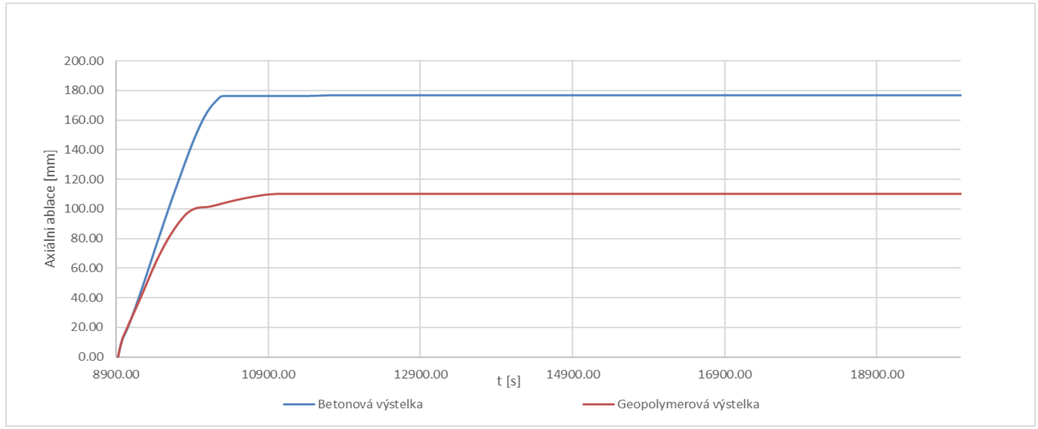




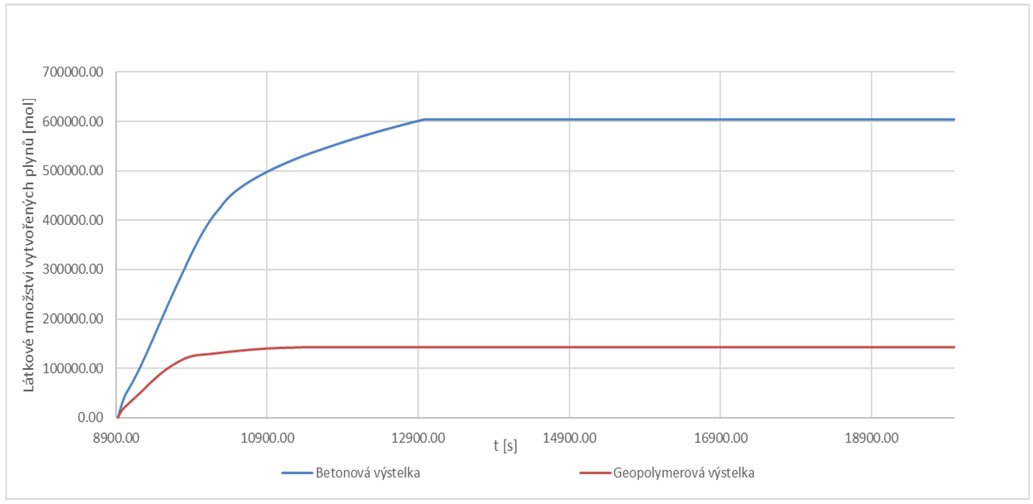
COMPARISON OF PERFORMANCE IN MCCI

- CORQUENCH simulation using experimental data
  - Data acquired from experiments on containment concrete sample and innovative geopolymer
- Results show superior performance of geopolymers:
  - Release of flammable gases reduced by 80 %
  - Production of heavier gases limits pressurization of containment
  - Strongly endothermic reaction dissipating a lot of heat

Material	Total amount of gas from MCCI [kmol]	Total mass of gas from MCCI [kg]	**Hydrogen produced [kg]**	CO produced [kgl] *	CO2 produced [kg] *
Concrete	604	1218	**1218**	-	-
Geopolymer „CVR 47“	142	3069	**72**	107	2890



Depth of axial ablation (concrete in blue)



Total amount of gas produced from MCCI (concrete in blue)

Thank you for attention!

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INSTITUTE

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