



**IAEA R2D2P TM - Transition Phase
Sydney, Australia, 12-16 November 2007**

RA RR in Vinča Institute: Transition from Extended Shutdown to Decommissioning

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Content

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 - **Institute, facilities**
- **Existing safety issues – SNF, RAW**
- **VIND Program (second R2D2P meeting)**
- **Transition activities**
 - **Organizational and administrative**
 - **Regulatory – addressed at first R2D2P meeting**
 - **Technical**
 - ◇ **SNF**
 - ◇ **Care and maintenance**
 - ◇ **Modifications**
 - ◇ **Operational and transition waste**
- **Summary and lessons learned**

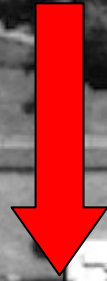


Vinča Institute in 2007

- **Multidisciplinary research**
- **750 employees**
- **400 researches**
- **15 Labs and 4 Centres**
- **Import-Export Department**
- **Supporting Services Unit**
- **15% in nuclear field**
 - **reactors, WM, HP, monitoring**
 - **small research groups**

VINCA NUCLEAR RESEARCH INSTALLATION, SERBIA

Radioisotope Lab.



RB Reactor



RA Reactor



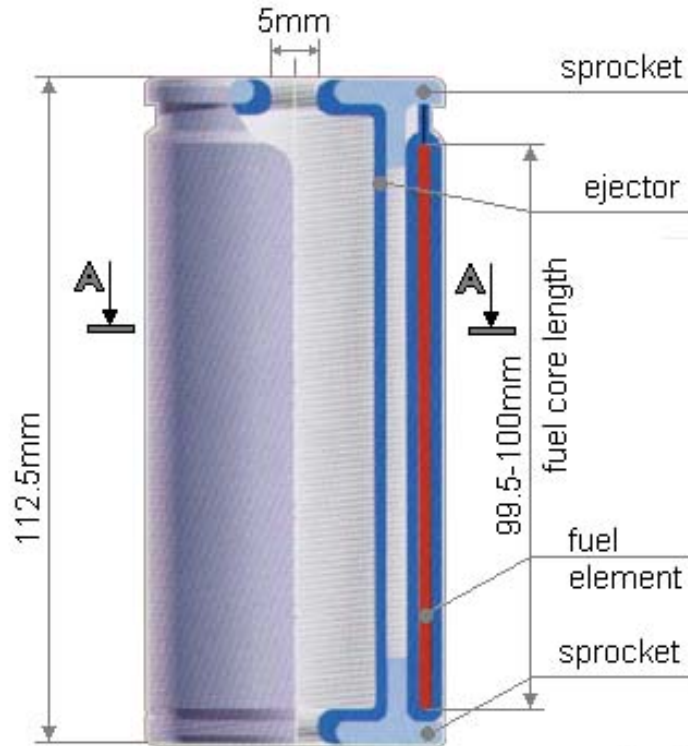
TESLA Cyclotron



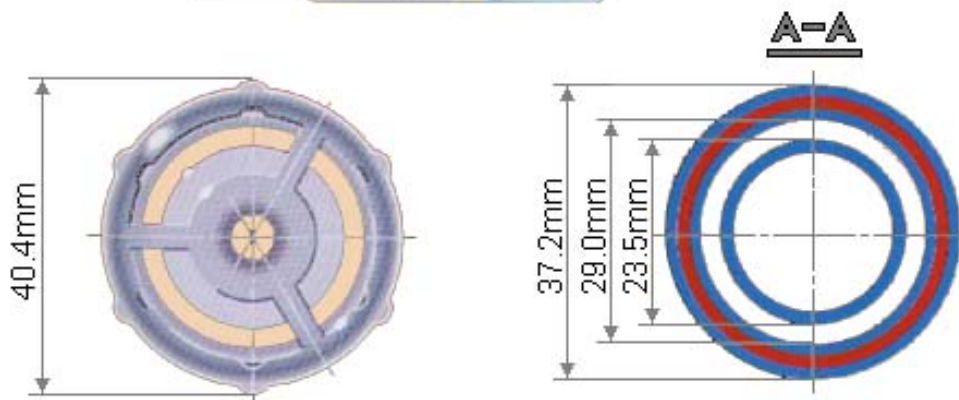
RA reactor:

- owner – state
- operator – Institute
- regulator - RCNS
- heavy water - moderator and coolant
- tank type, graphite reflector
- 6.5 MW thermal power
- 1959 start of operation
- 1984 temporary shut down
- license terminated, never restarted
- 2002 final shut down

SPENT FUEL



LEU 2%
metal U
HEU 80%
UO₂ in Al
8030 spent FE



Storage period 20 - 40 years

250 stainless-steel containers

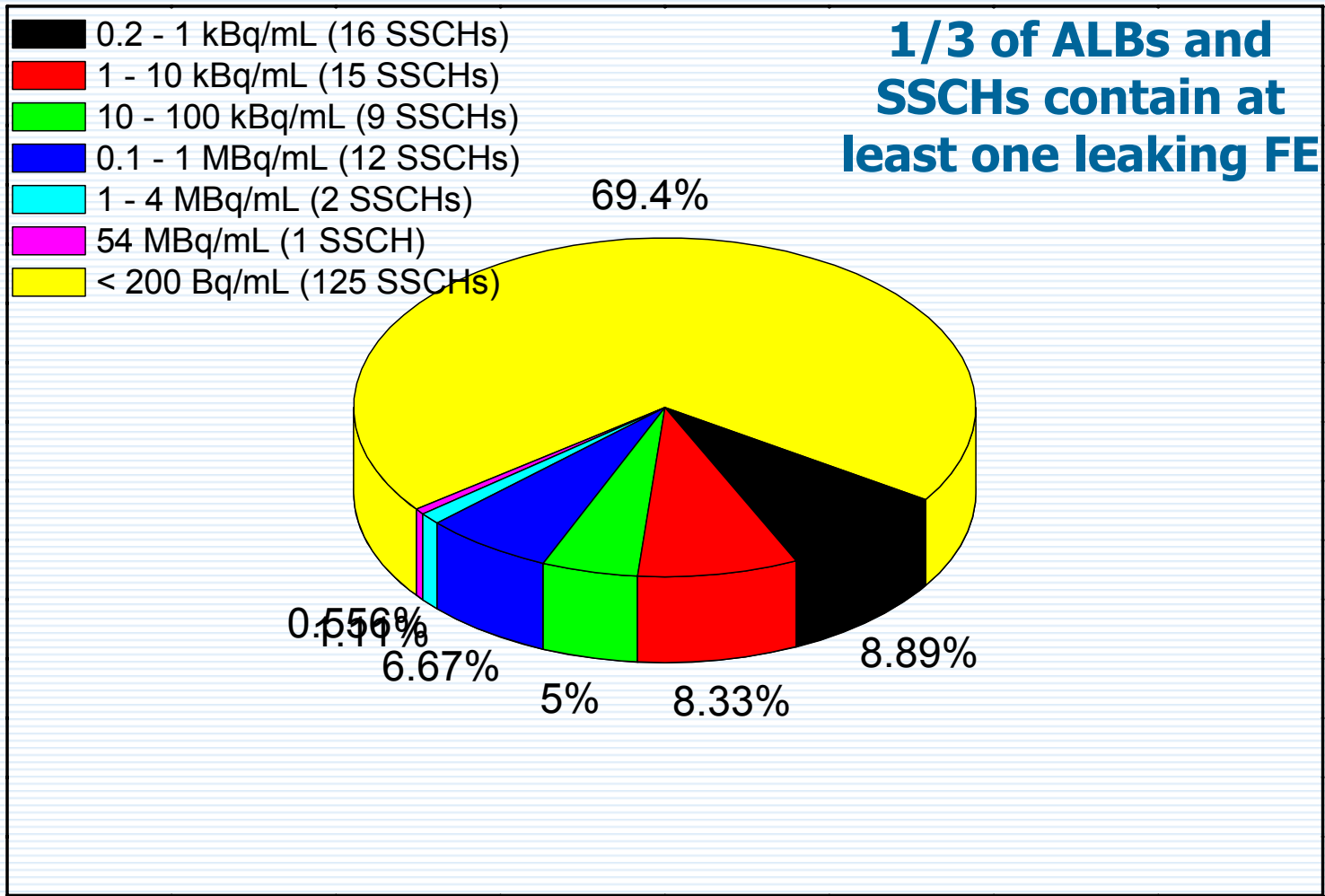
30 aluminium barrels

6656 LEU FE

894 HEU FE

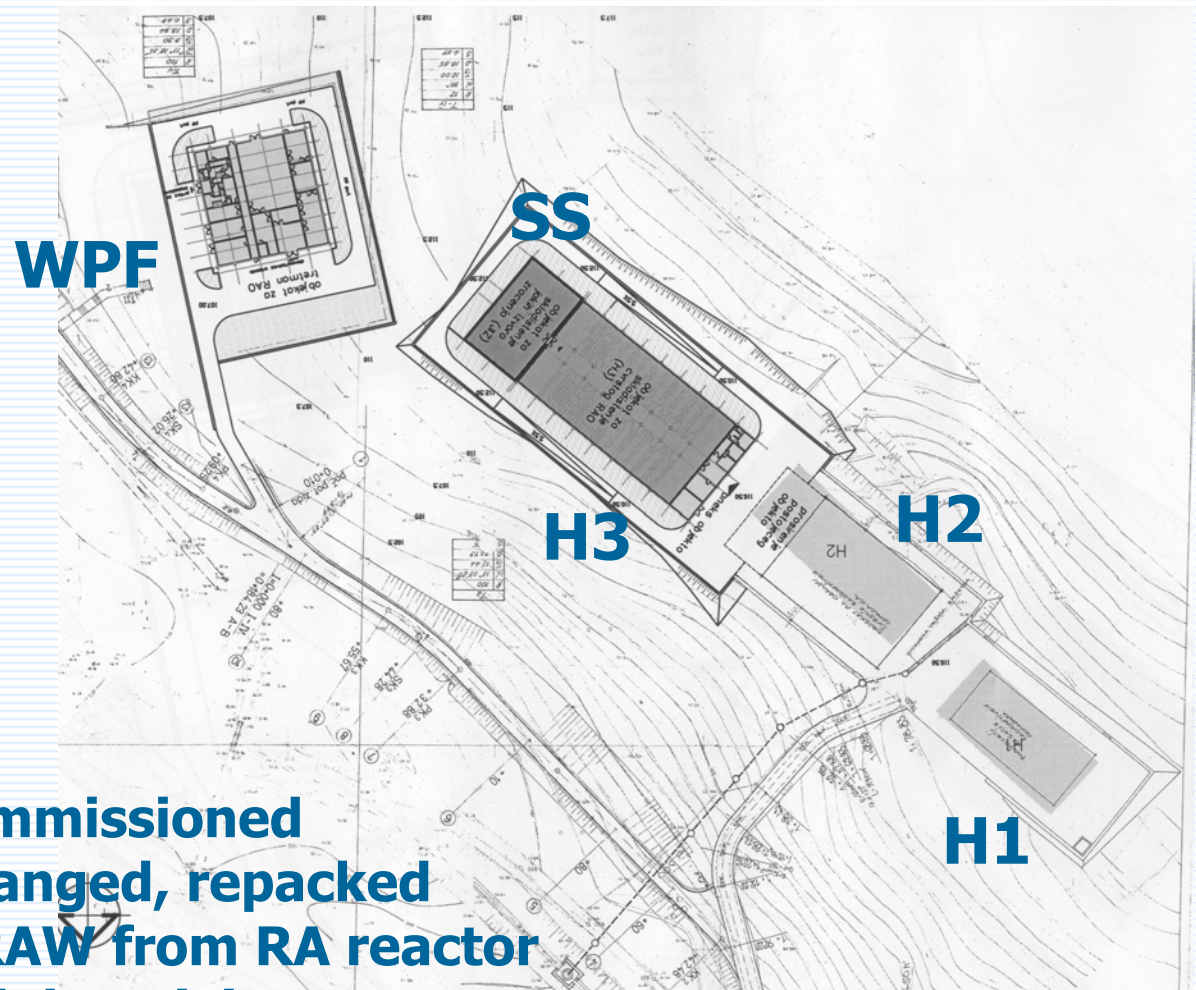
480 HEU FE still in dry RA core

1/3 of ALBs and SSCHs contain at least one leaking FE



Water A(¹³⁷Cs) in SSCHs

Historical solid waste in two hangars, liquids in four underground tanks



- H1 to be decommissioned**
- H2 to be rearranged, repacked**
- H3 to accept RAW from RA reactor**
- SS to accept high activity sources**
- WPF to treat new and historical RAW**

VINČA INSTITUTE NUCLEAR DECOMMISSIONING PROGRAM

- **Objective: to improve nuclear and radiation safety**
 - Removal of highly irradiated, partially leaking - spent nuclear fuel from the RA reactor facility
 - Removal of all radioactive and contaminated materials and structures from the RA reactor facility
 - Construction of new facilities for treatment and storage of LILRAW on the Vinča site

VINČA INSTITUTE NUCLEAR DECOMMISSIONING PROGRAM

Governmental decisions

(July 2002 & February 2004)

Three Projects:

- Spent Fuel Transport
- Decommissioning of RA Reactor
- Radioactive Waste Management at the Vinča site

Supporting activities (Project no. 4):

- Nuclear and Radiation Safety
- Radiation Protection & Environmental Monitoring
- Administration Support

Project environment

- **Non-nuclear country**
- **Within the multidisciplinary research Institute**
- **Other facilities on site**
- **Long extended shutdown period**
- **Supporting services available on site - HP, medical protection, fire protection, physical protection, export-import**
- **No previous decommissioning experience**
- **SNF still on site – leaking fuel, complex repackaging operations**
- **WM facilities to be upgraded**

Project environment

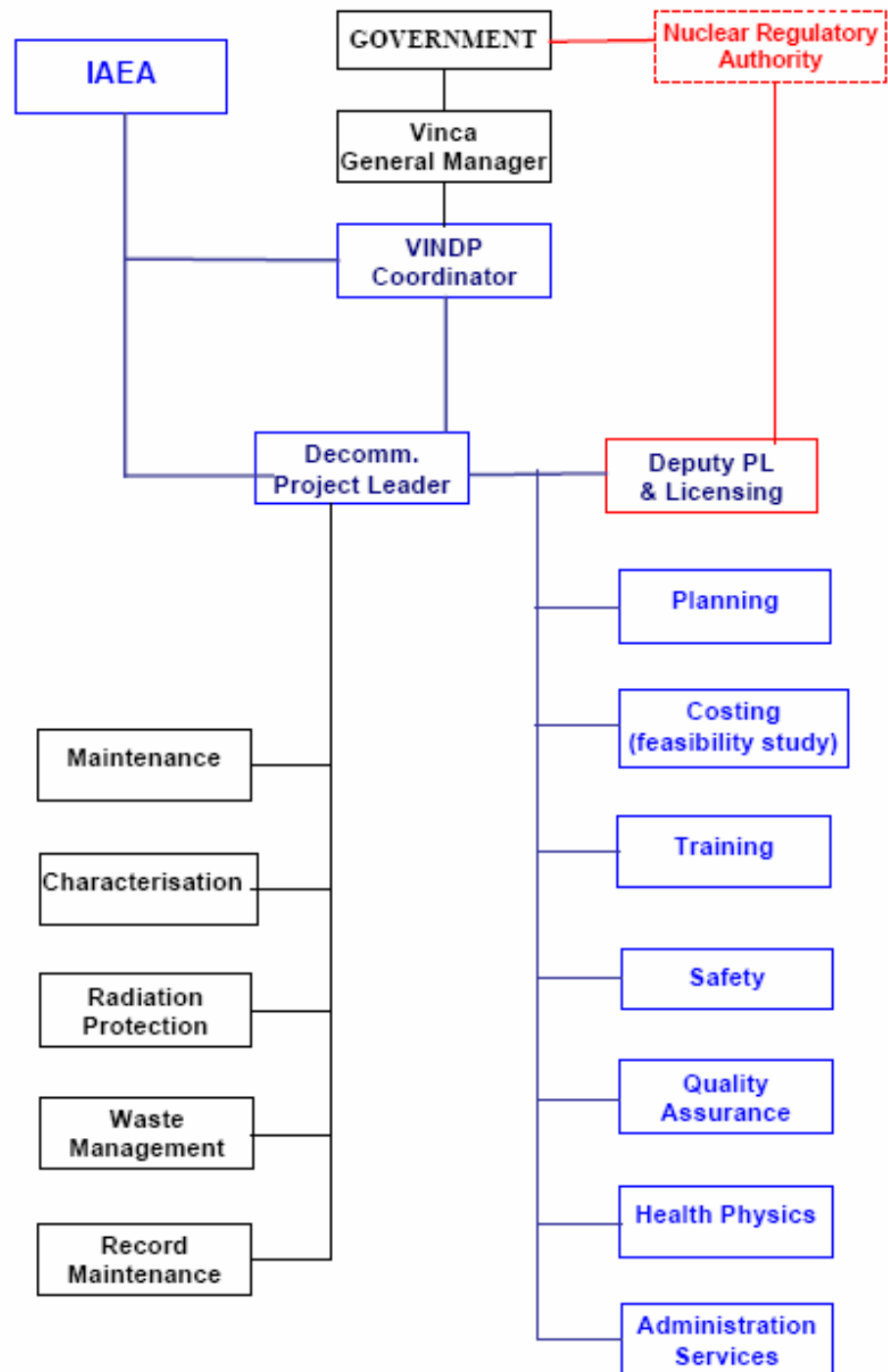
- **Team – engineers with scientific background, technicians with limited operational experience**
- **Regulatory framework to be upgraded – NS&RP Agency, new law**
- **Operation license terminated in 1984, “zero license” for transition activities**
- **Funding – from the state budget through Ministry of Science, on annual basis (based on 4 years plan), foreign donations**
- **IAEA and international expert’s and technical support**

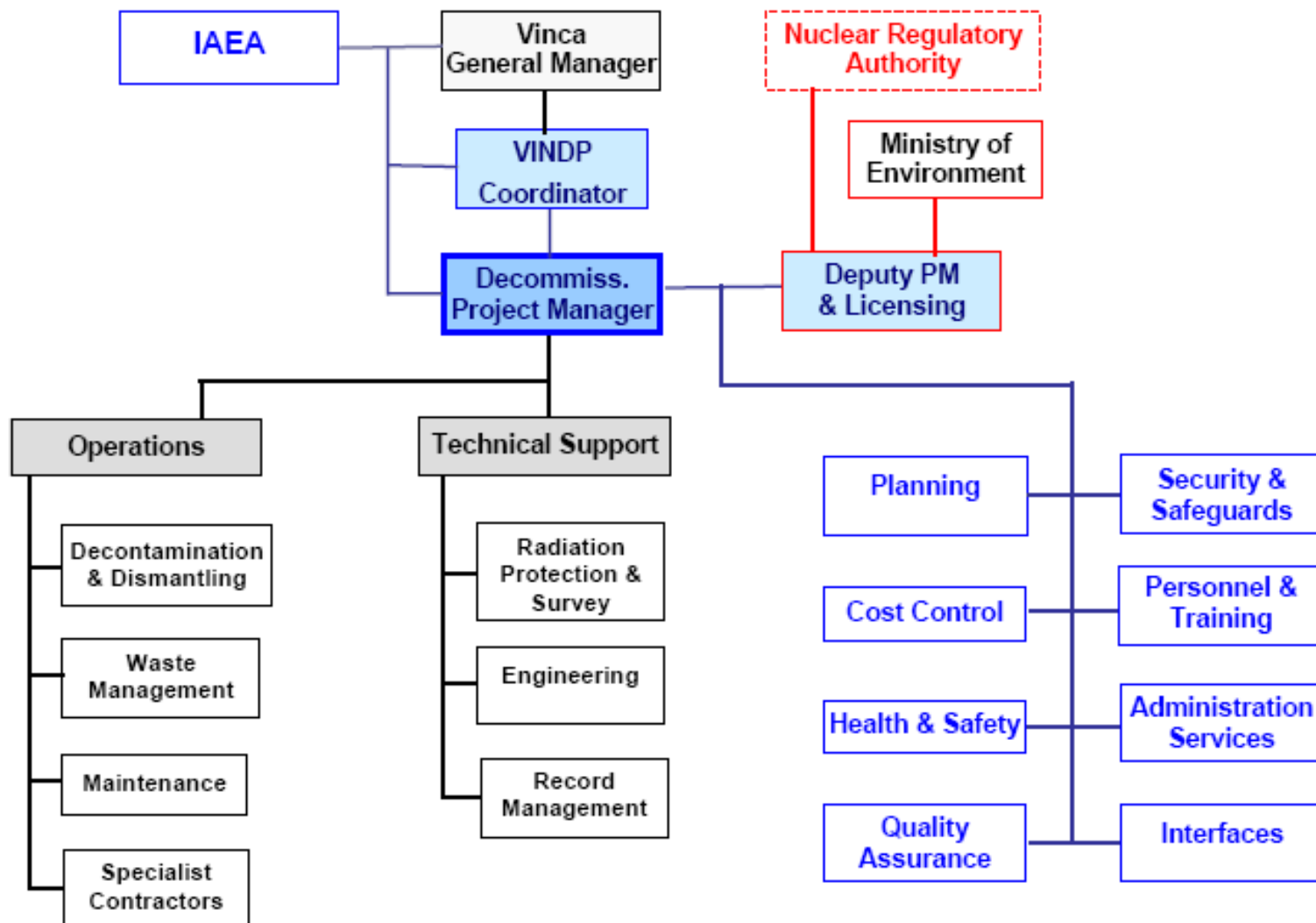
Team

- **No decommissioning oriented team before 2002**
- **RA reactor staff significantly reduced after 1984**
- **Lack of experienced personnel from the operating phase**

- **Team established from available Vinča Institute personnel**
- **RA reactor Dept and Nuclear Engineering Lab (research group & RB reactor) merged in Centre NTI**
- **14 engineers, 24 technicians, 4 supporting staff**
- **Centre NTI three main tasks**
 - ❑ **Spent fuel removal**
 - ❑ **RA reactor decommissioning**
 - ❑ **RB reactor operation**

Transition phase - organizational chart & team structure





Dismantling phase - organizational chart & team structure

Transition activities in progress

1. Preparatory activities for SNF shipment
2. Preparation of the safety related documentation
 - documentation, comparison with existing layout, data bases, QMS/RMS
3. **Radiological characterization – next R2D2P meeting**
4. Removal of operational and transition waste from the building – liquids removed from the systems, stored locally
5. Maintenance of the reactor systems and buildings
6. Modifications and upgrade to support SNF repackaging and shipment
 - WM, ventilation, monitoring, transport system, SNF handling system, structural stability, preparations of the working area, some in advance dismantling activities in SNF storage room, physical security

Planning

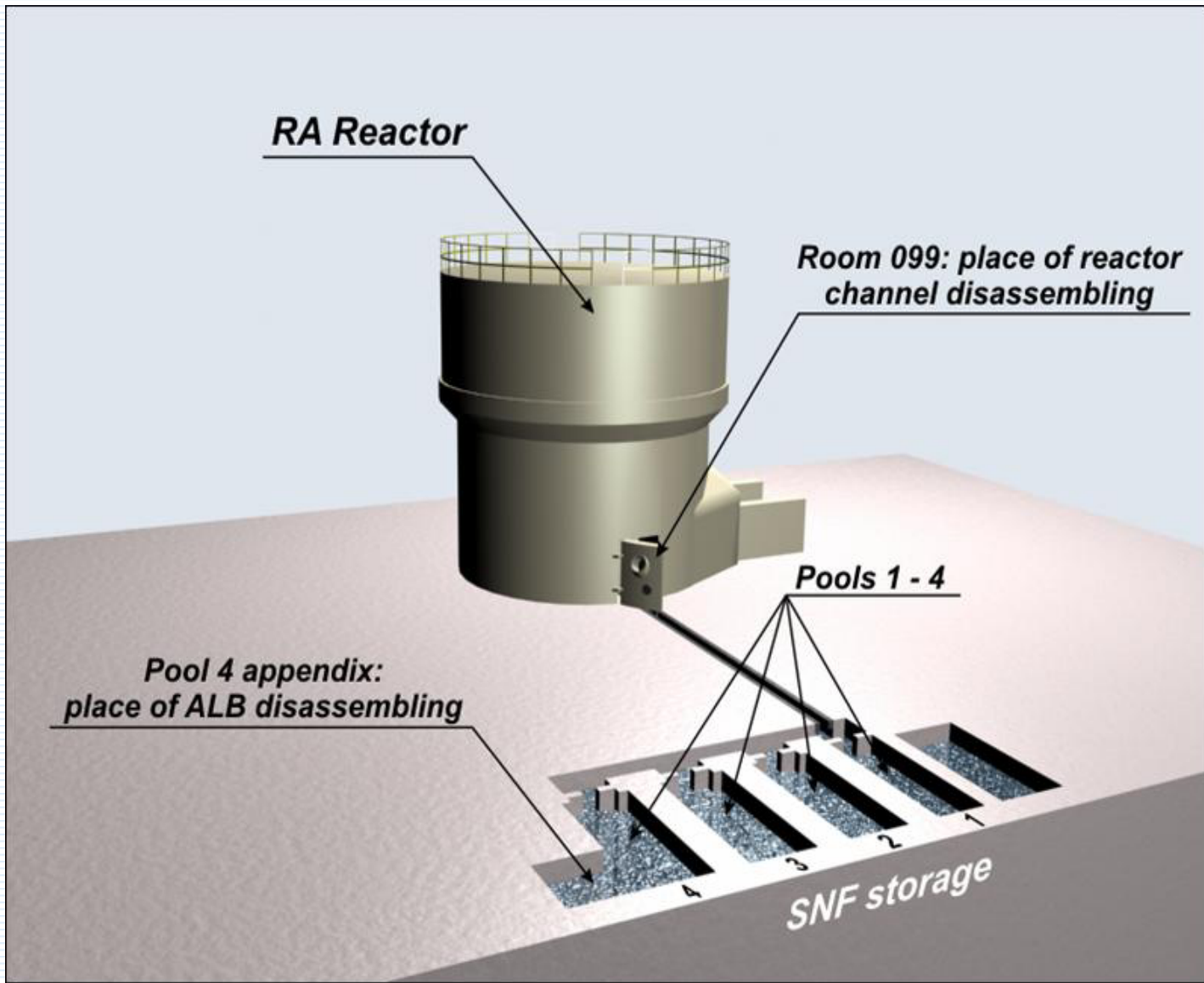
Planning - SNF

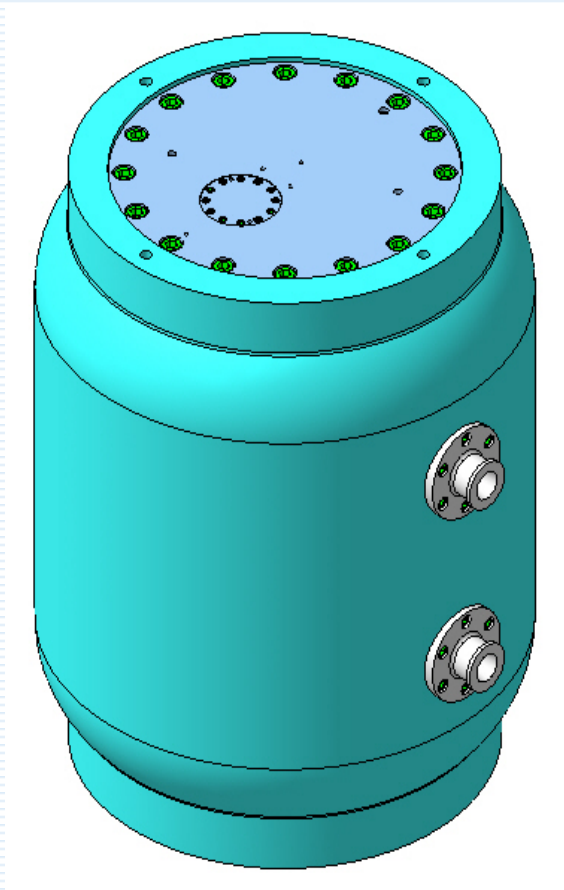
- **Assessment of the physical, chemical and radiological conditions of the RA reactor SNF**
- **Criteria for acceptance of the RA reactor SNF at the “Mayak” reprocessing plant, Ozersk, RF**
- **Conceptual design for SNF repackaging and shipment**
- **Preliminary SARs - for repackaging, for shipment**
- **Technical requirements for the modifications of Vinča Institute infrastructure**
- **Final SARs - for repackaging, for shipment**

Planning - Decommissioning

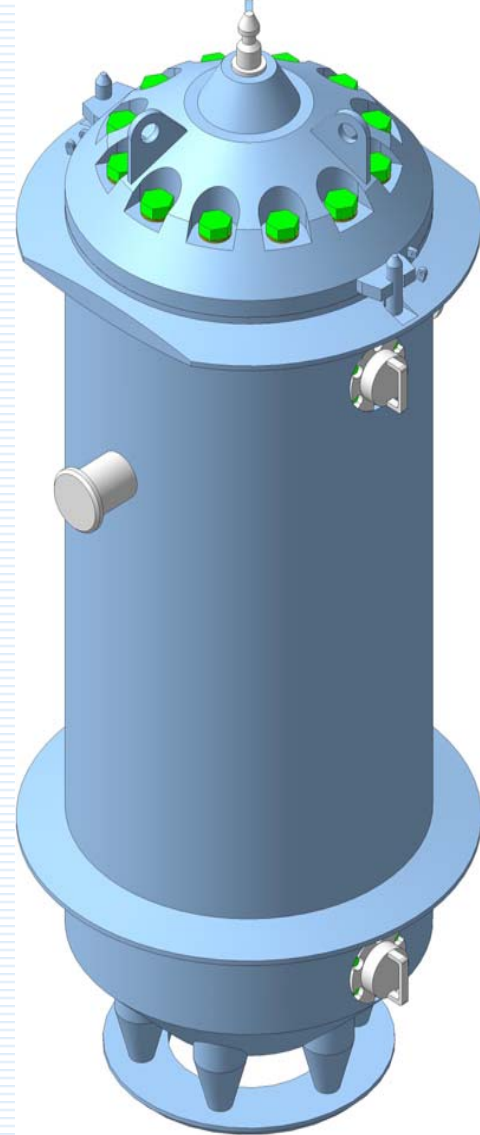
- **Decommissioning strategy for RA Reactor**
- **Transition Plan**
- **Characterization Plan**
- **Characterization Report**
- **Decommissioning Plan**
- **Procedures, manuals, training materials**
- **Update of the Institute documents, plans and rulebooks**
 - **RP, EP, WM Strategy, WAC, QAP**

SNF Repackaging and Shipment

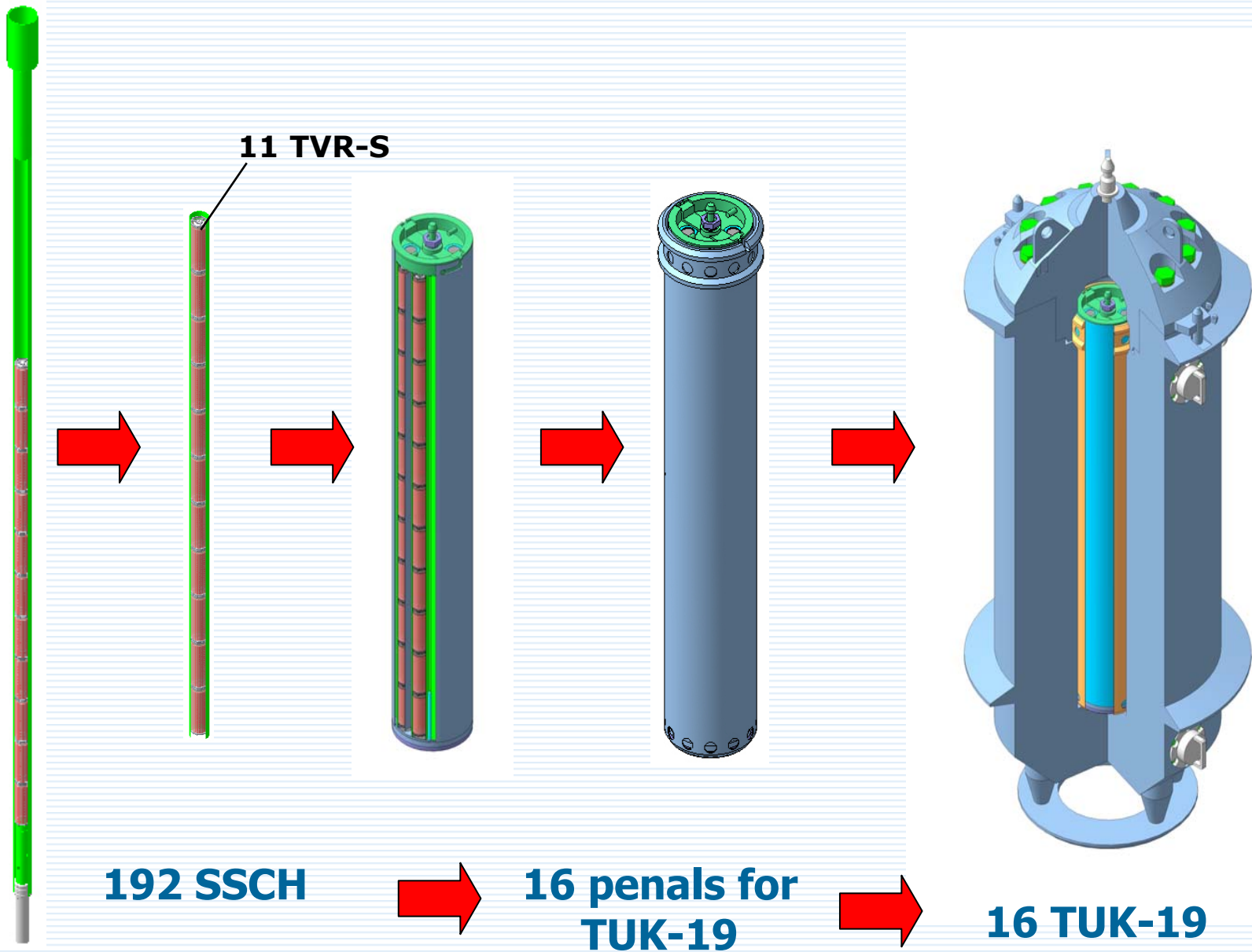




SKODA VPVR/M cask

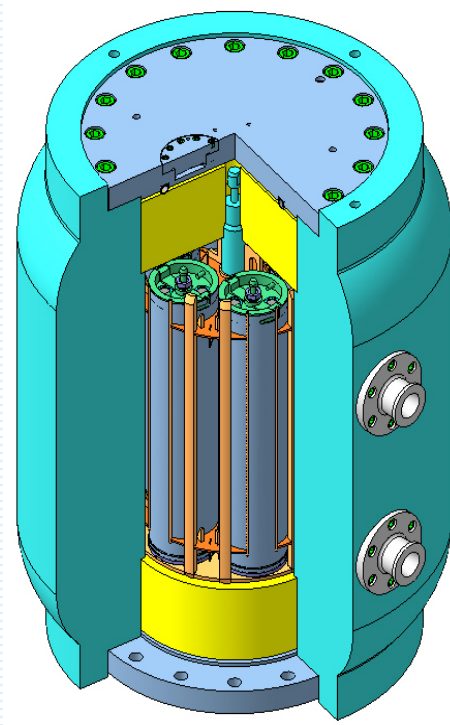
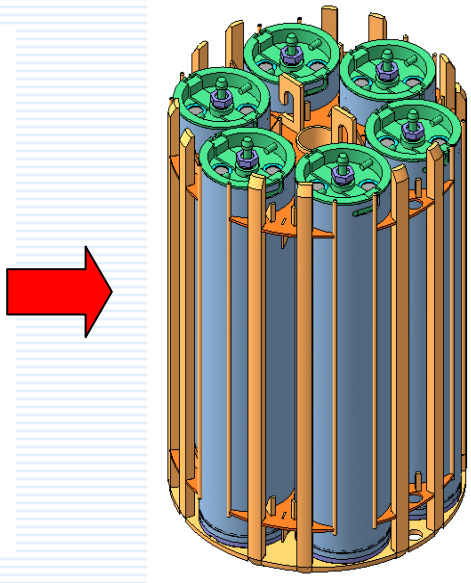
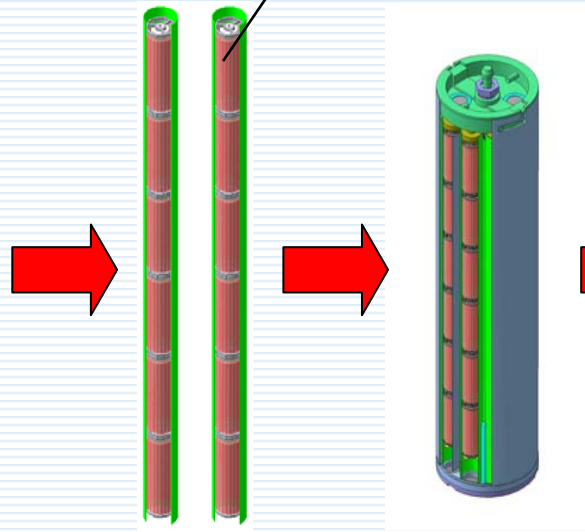


TUK-19 cask





6 TVR-S max

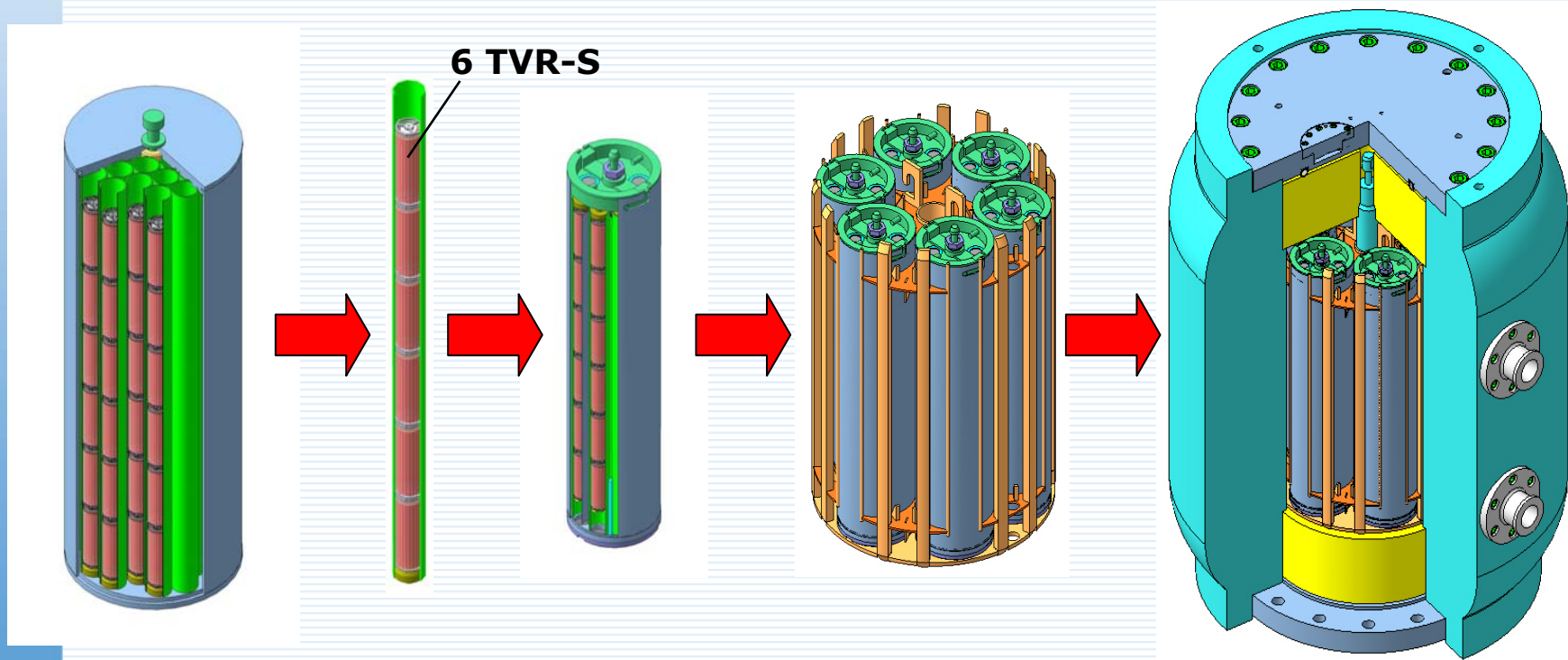


104
SSCH

208 SSCH
fragmenats

18 penals for
SKODA VPVR/M

3 SKODA
VPVR/M

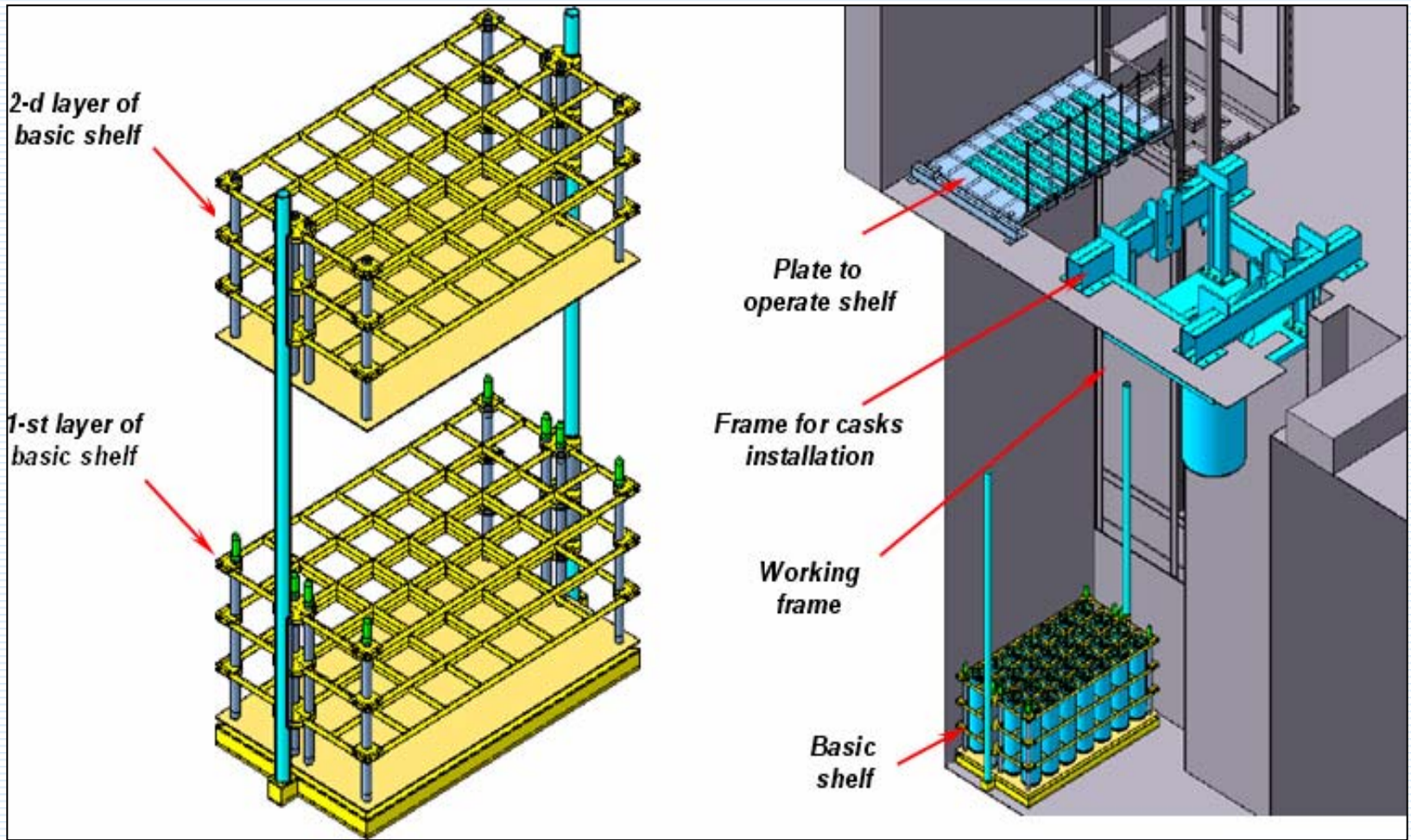


30 ALB

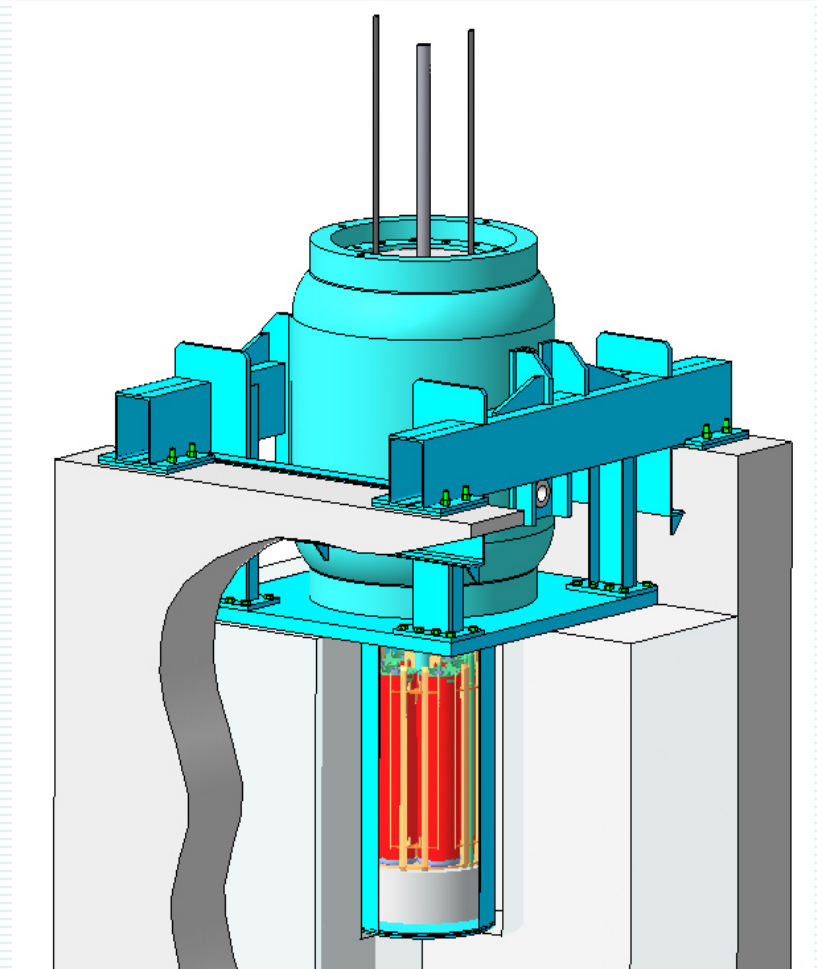
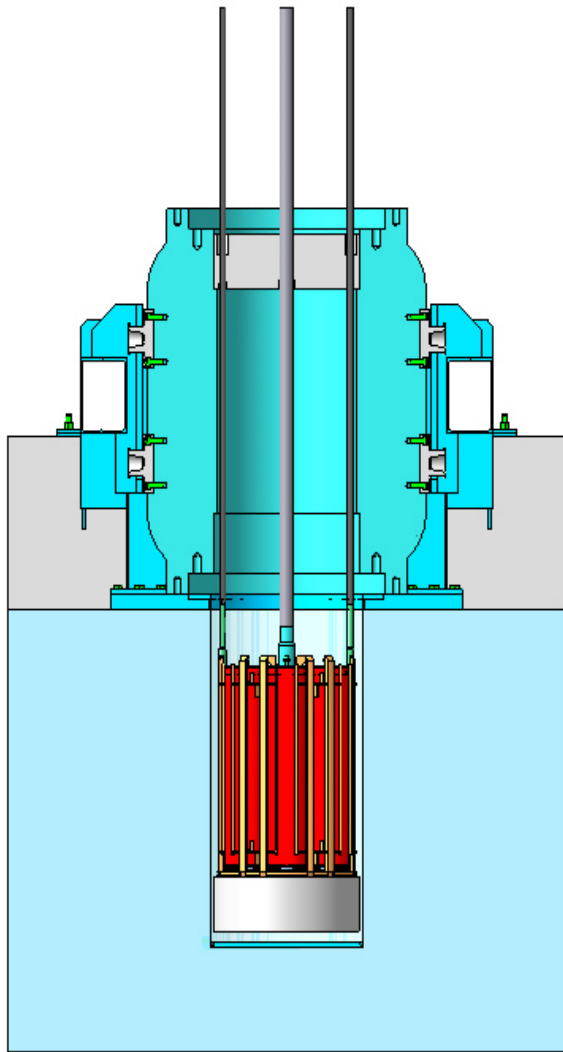
**900 tubes
with TVR-S**

**75 penals
for SKODA
VPVR/M**

**13 SKODA
VPVR/M**



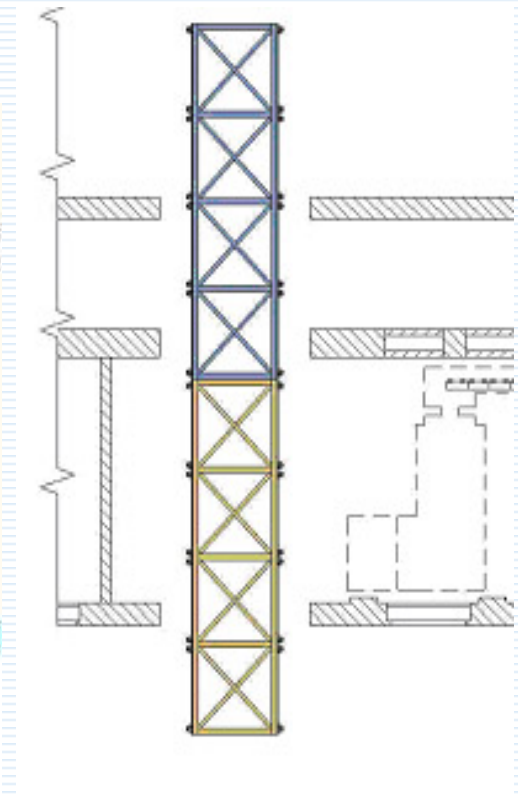
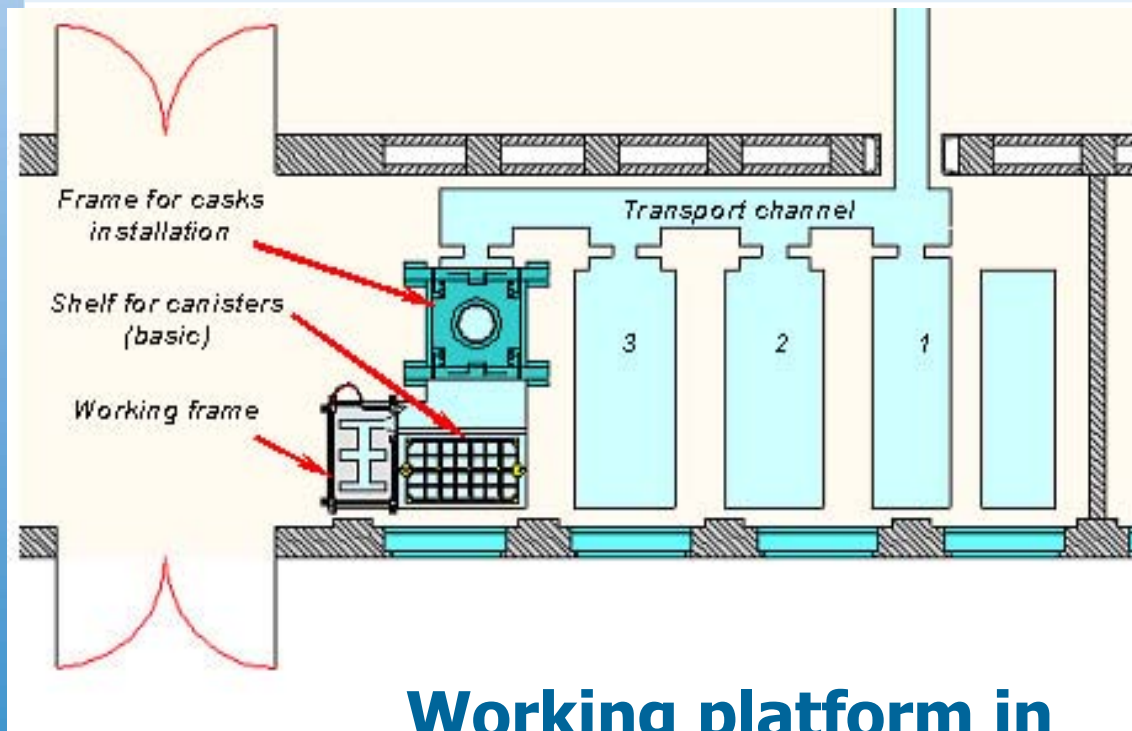
Temporary storage of repacked SNF on shelves at the bottom of pool No.4



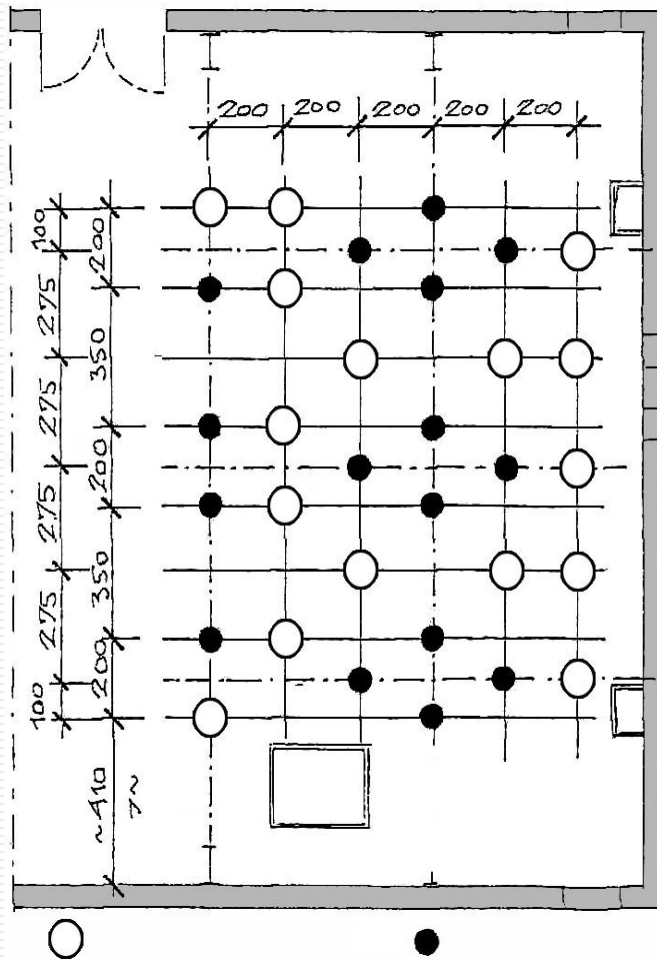
Loading of SKODA VPVR/M cask with SNF

Preparation of working areas

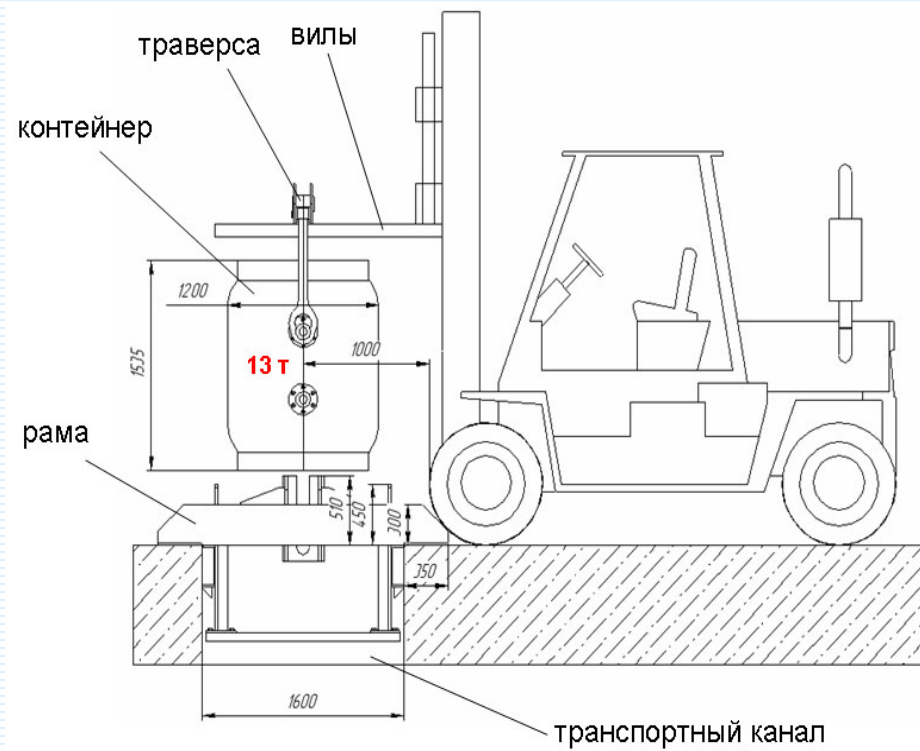
Railway transport system for cask transfer



**Working platform in
SNF room**



Casks in reactor room



Casks manipulation in SNF room



Carbonic strips – improvement of structural stability of the floor



Operational waste to be removed



Removal of waste from the reactor room



Former research laboratory room

In advance dismantling operations in SNF room





SNF pool platform to be removed



Sedimentation vessel for sludge removal



Segmentation of the upper parts of the reactor channels



Reducing dose rate from the "dry pool"

Upgrade of systems to ensure safety

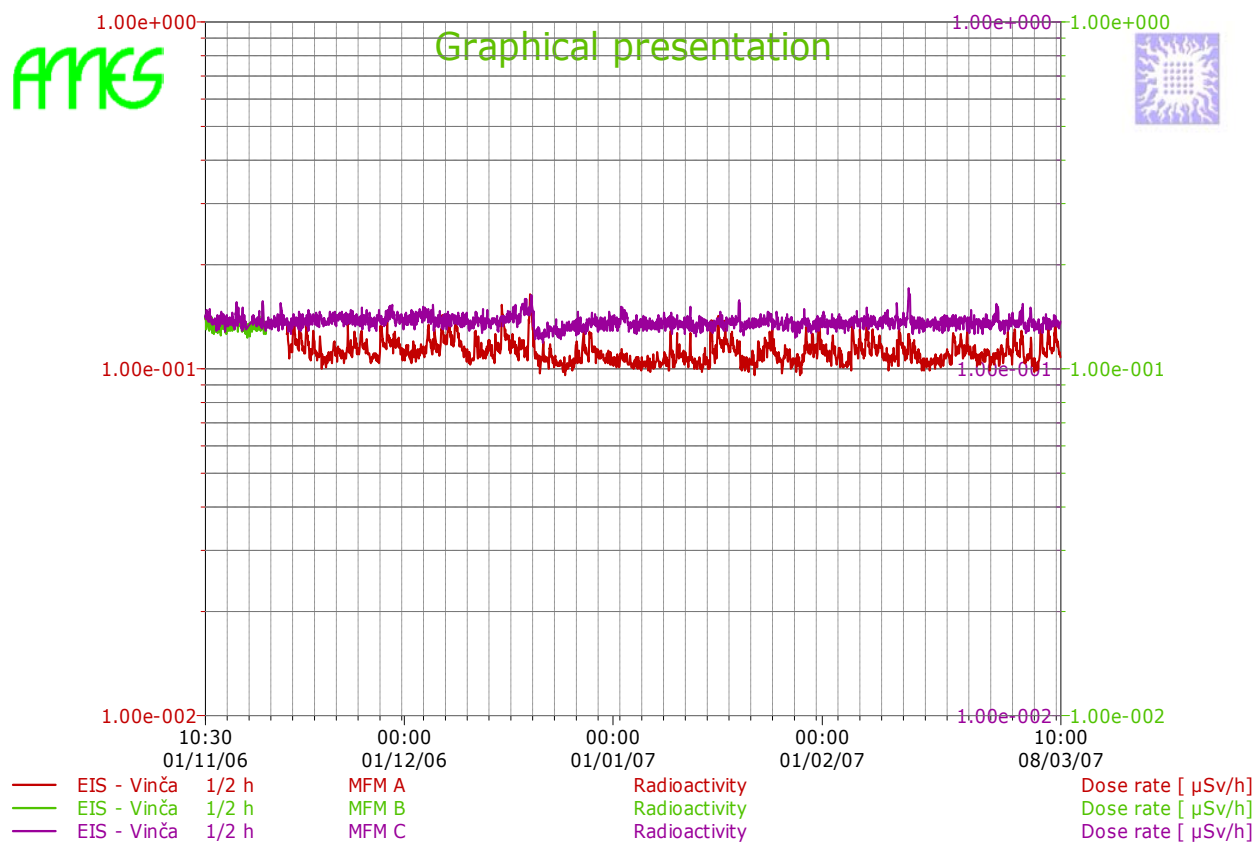


Upgrade of the ventilation system, mobile filtration

Merno mesto: Svetli otvor ventilacionog ispusta "RA" (visina 40m)

Meteorološki stub 

Ventilacioni ispušt "RA" 



Radiological monitoring at the exhaust stack



Setup

Sample Period [ms]

Channel

Channel Type

Number of Samples

Time Window [s]

Chamber

C:\Trajan\RA\Calibration of Ionization Chambers\BDRS-01P #1\Ion Chamber
BDRS-01P #1 11 maj 07.cal

DV graph

Y axis

Max Volt [V]

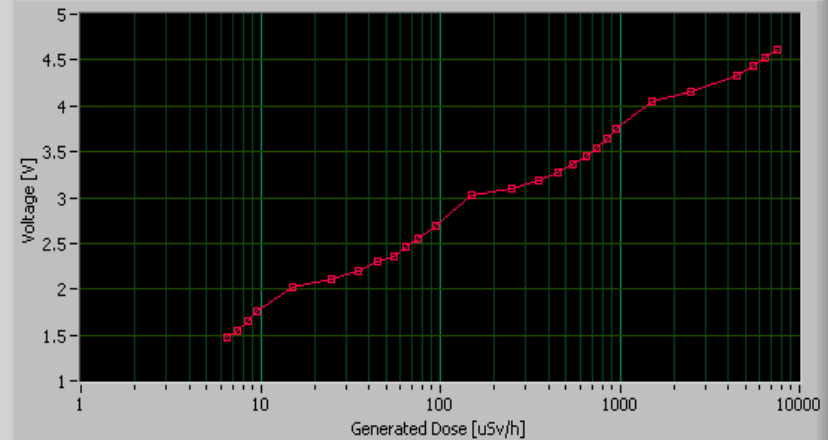
Min Volt [V]

X axis

Max Dose [$\mu\text{Sv/h}$]

Min Dose [$\mu\text{Sv/h}$]

Scale



Measuring/Calculating

HP 3468A [V]	Abs.Err [V]
1.471	0
NI-6009 [V]	Rel.Err [%]
1.4706	0.03
Gen. Dose [$\mu\text{Sv/h}$]	Dose Rel.Err [%]
6.5	6.39
Calc. Dose [$\mu\text{Sv/h}$]	Lin Fit Dose [$\mu\text{Sv/h}$]
6.1	5.9
Avg. Calc. Dose	Avg Value [V]
6.1	1.4706

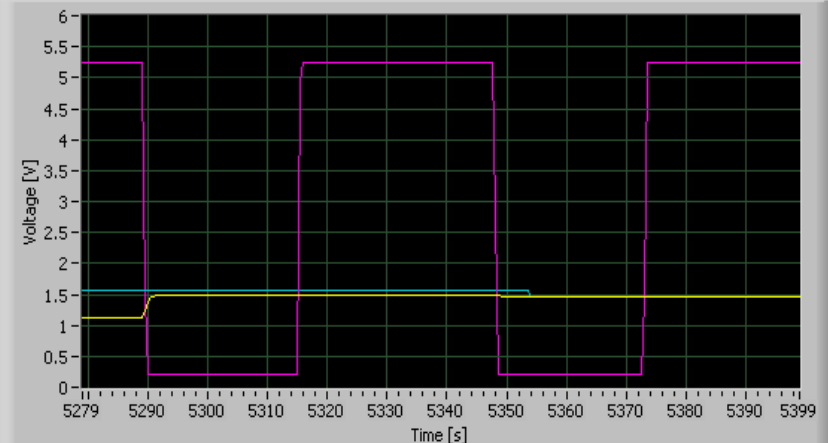
Live Data

Y axis

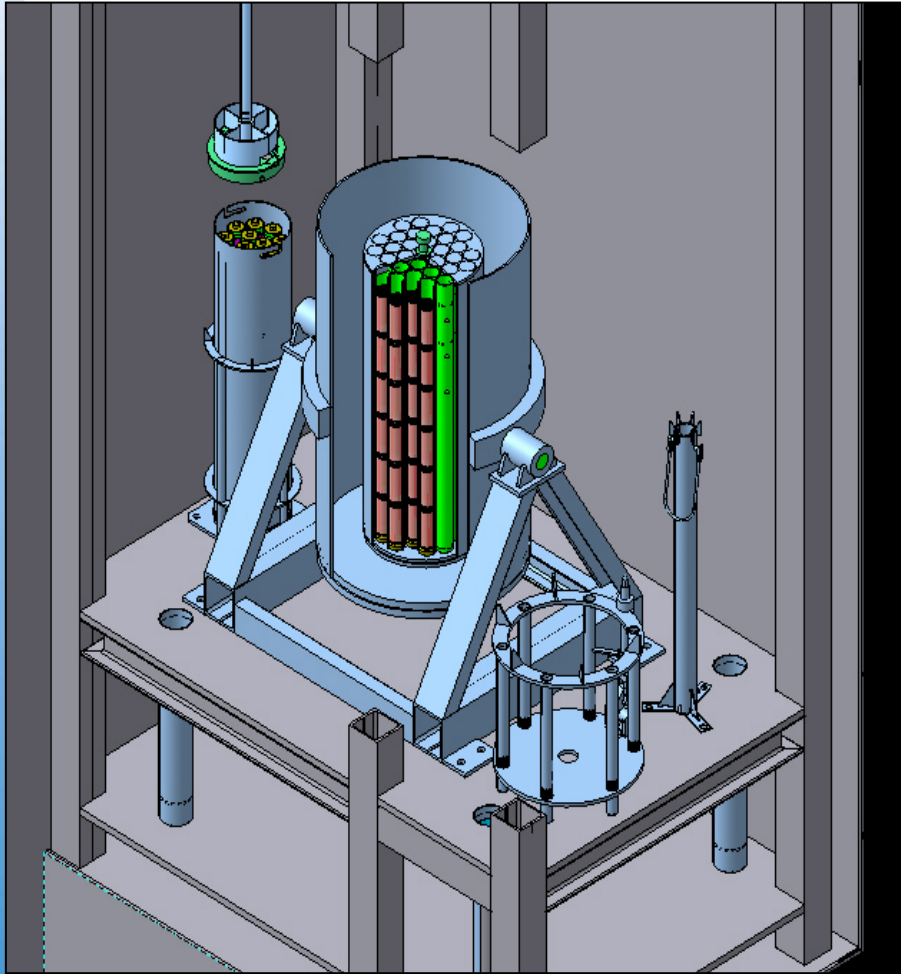
Max Volt Live [V]

Min Volt Live [V]

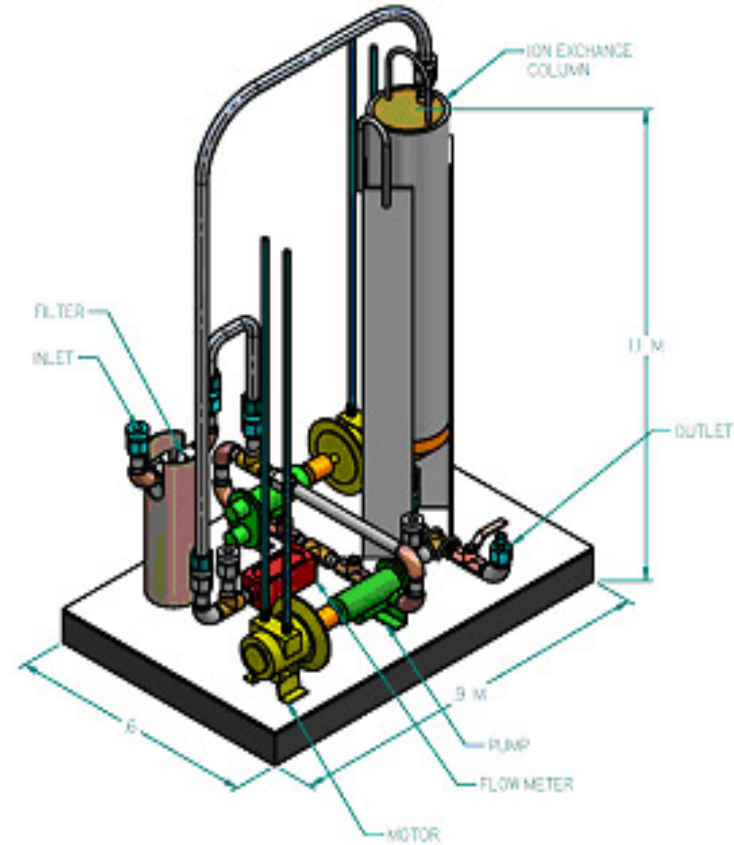
Averaging Avg Time [s]



Stationery dosimetry system in the reactor building



**Underwater SNF
repackaging**



**Water chemistry
cleaning system for
Cs-137 removal**

Summary and lessons learned

- **Operation – stable, routine, hazards well known**
- **Decommissioning – dynamic, new challenges, new hazards, industrial safety issue**
- **Long extended shutdown period to be used for DP**
- **Operational organization not adequate for decom work**
- **Regulatory framework for operation not enough for decommissioning**
- **SNF and WM (operational and transition waste) – key issues for to be addressed during the transition period**
- **Ageing management**
 - ❑ **long extended shutdown or safe enclosure period**
 - ❑ **modifications to support operations not planned 50 years ago**

Thank you for your attention



- **Nuclear Technology & Radiation Protection**

- ❑ International journal, open access
- ❑ <http://ntrp.vin.bg.ac.yu>



- **CONUSS 2008**

- ❑ Sixth International Conference of the Nuclear Society of Serbia, Sep 29 - Oct 2, 2008
- ❑ <http://nss.vin.bg.ac.yu/CoNuSS2008.htm>