Annual Forum of the IDN

IAEA, Vienna, 3-7 November 2008

Current Status of the VIND Program Realization

Vladan Ljubenov, Milan Pešić, Dragana Nikolić

Vinča Institute of Nuclear Sciences
Centre for Nuclear Technologies and Research "NTI"

P.O.Box 522, 11001 Belgrade, SERBIA
vladan@vin.bg.ac.yu

Institute of Nuclear Sciences

VINČA

Content

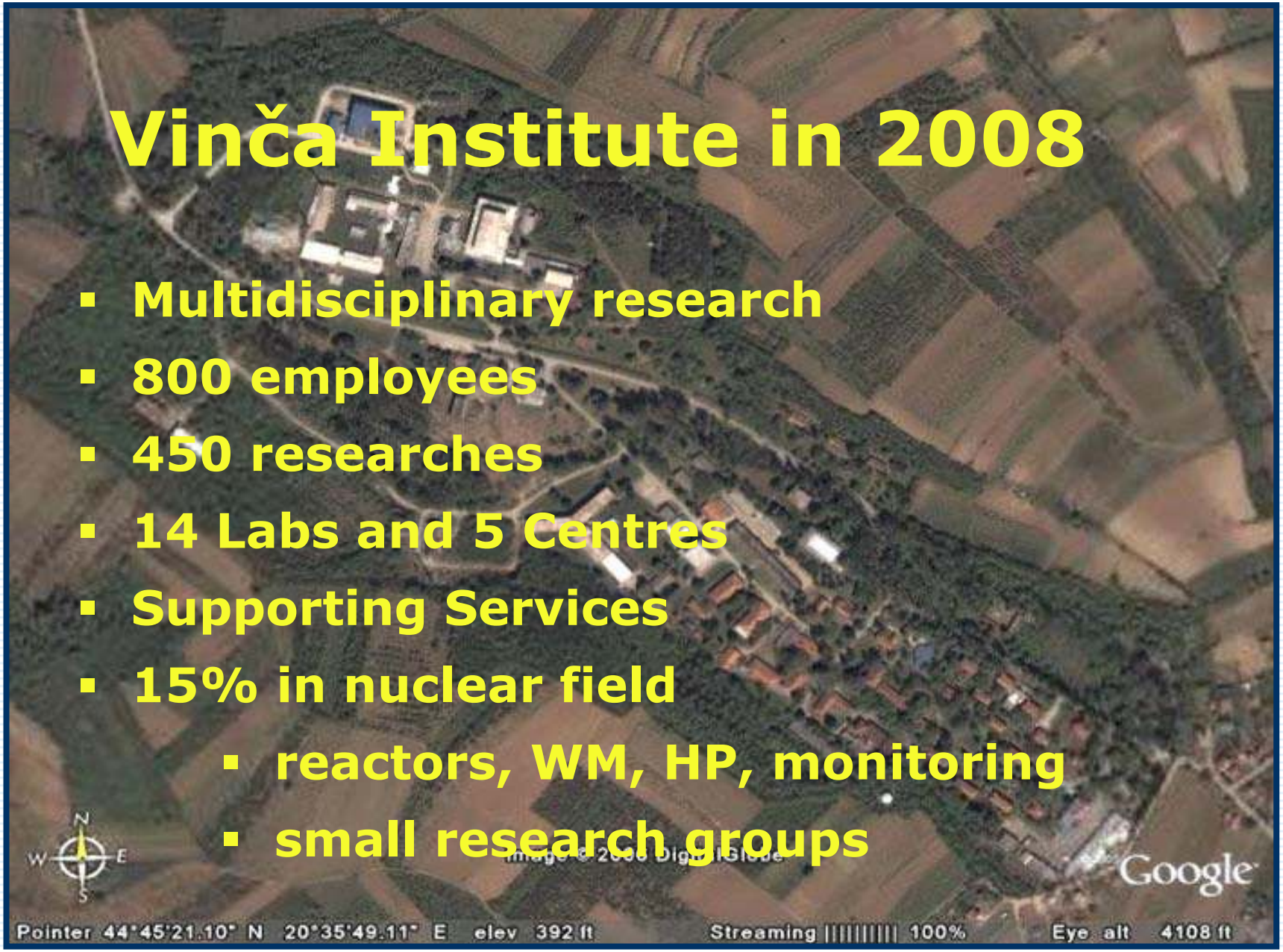
- **Background information**
  - **Institute**
  - **Facilities**
- **Existing safety issues**
  - **RA research reactor**
  - **SNF of the RA reactor**
  - **Historical RAW and storage facilities**
- **VIND Program**
  - **Objectives**
  - **Projects**
  - **Current status**
- **Summary - topics of interest for IDN**

Institute of Nuclear Sciences VINČA

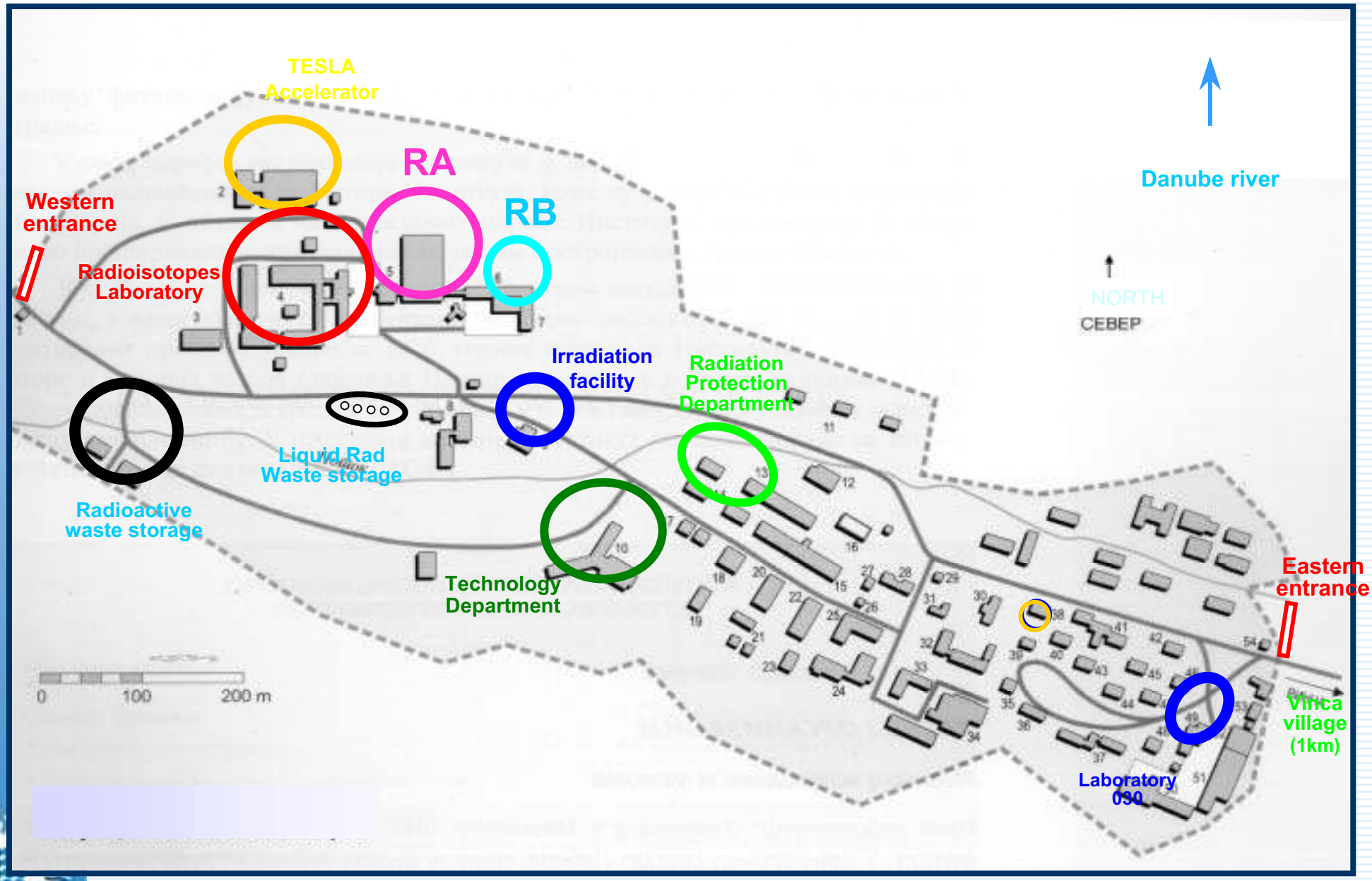
Institute of Nuclear Sciences
VINČA

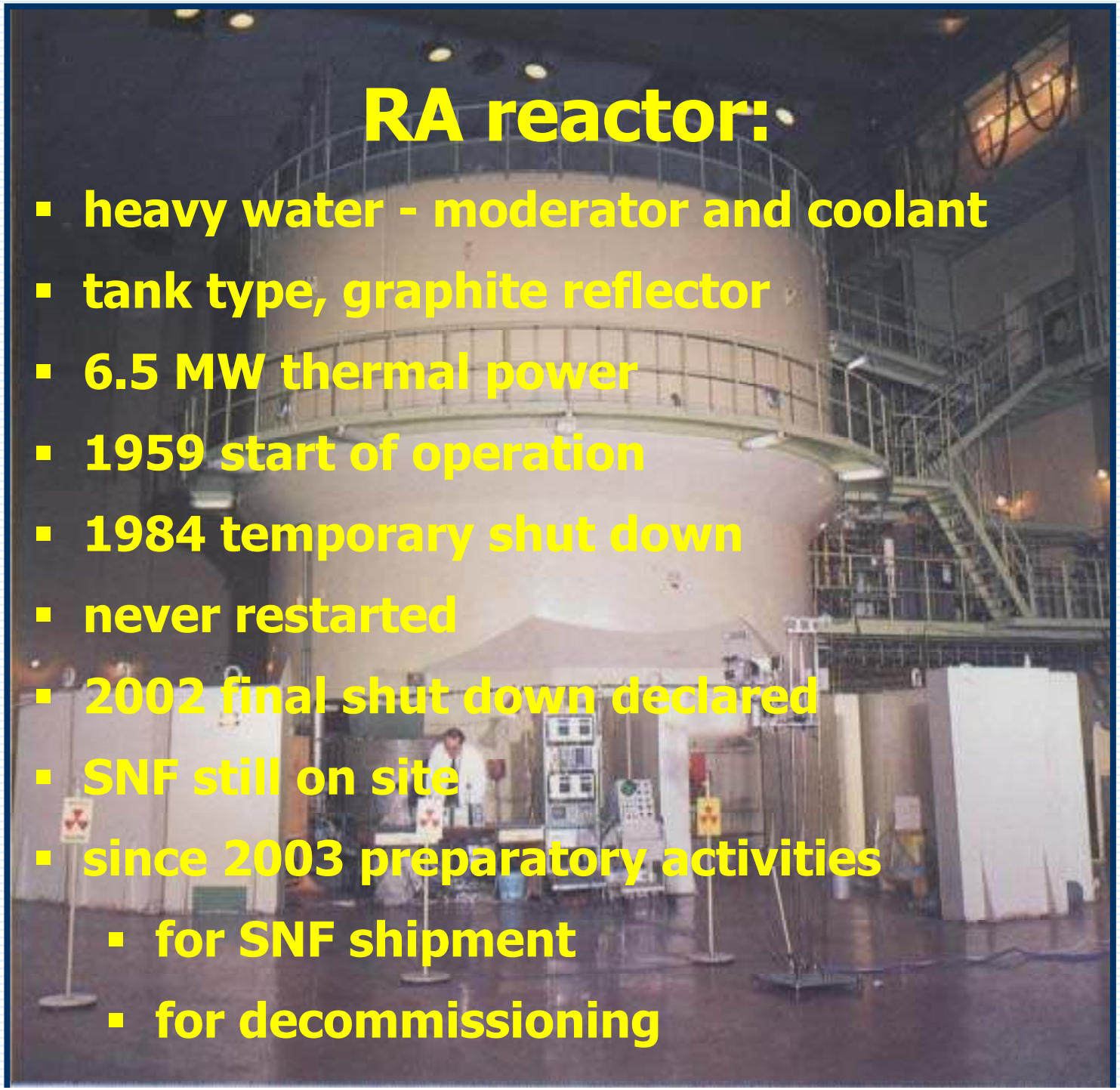
Vinča Institute in 2008

- Multidisciplinary research
- 800 employees
- 450 researches
- 14 Labs and 5 Centres
- Supporting Services
- 15% in nuclear field
  - reactors, WM, HP, monitoring
  - small research groups



Institute of Nuclear Sciences
VINČA


TESLA
Accelerator
RA
RB
Western
entrance
Radioisotopes
Laboratory
Irradiation
facility
Radiation
Protection
Department
Danube river
NORTH
CEBEP
Liquid Rad
Waste storage
Radioactive
waste storage
Technology
Department
Eastern
entrance
0
100
200 m
Vinca
village
(1km)
Laboratory
030

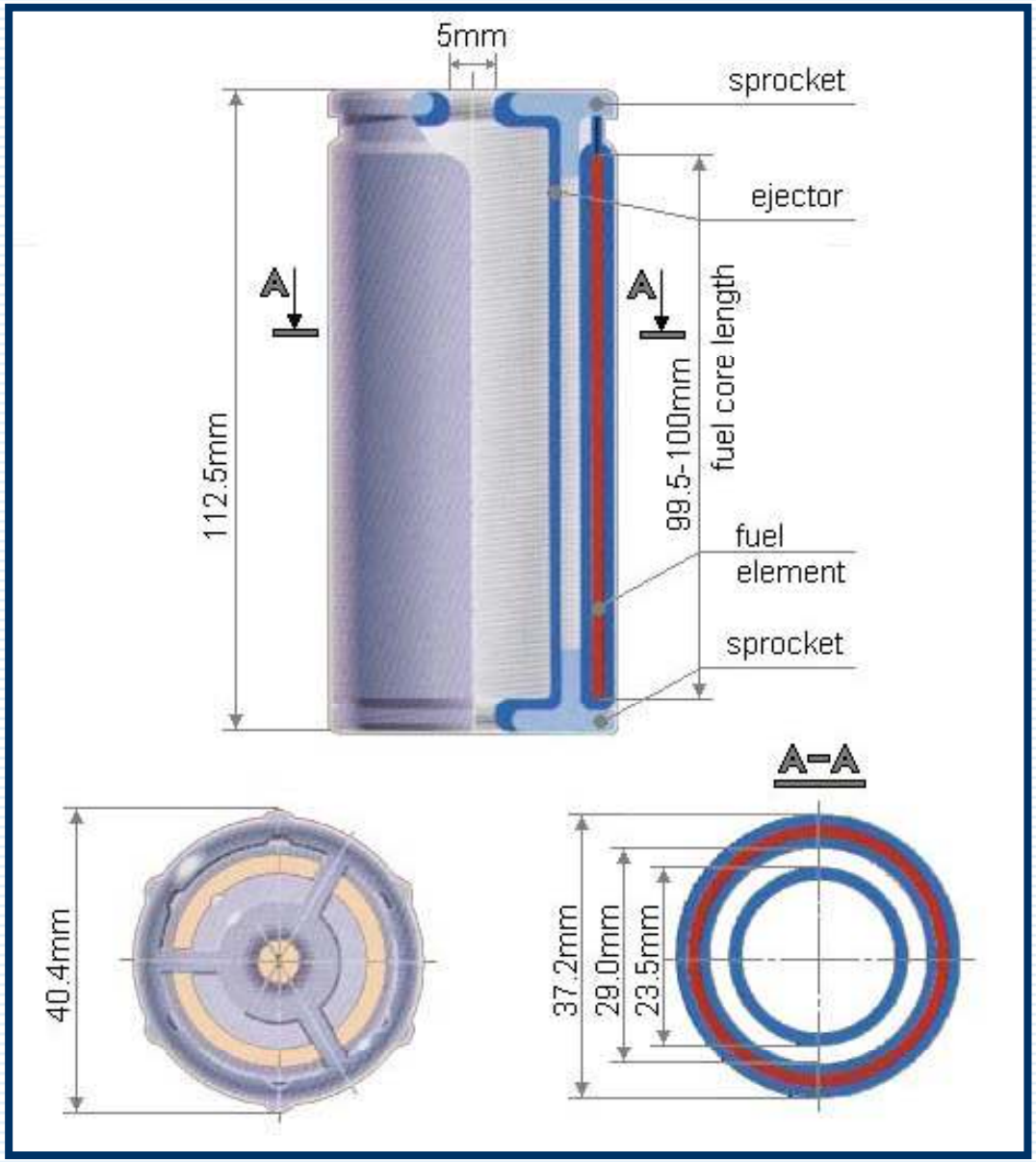


RA reactor:

- heavy water - moderator and coolant
- tank type, graphite reflector
- 6.5 MW thermal power
- 1959 start of operation
- 1984 temporary shut down
- never restarted
- 2002 final shut down declared
- SNF still on site
- since 2003 preparatory activities
  - for SNF shipment
  - for decommissioning

Institute of Nuclear Sciences VINČA

SPENT FUEL



LEU 2%

metal U

HEU 80%

UO_2 in Al

8030 spent FE

Storage period 25 - >40 years

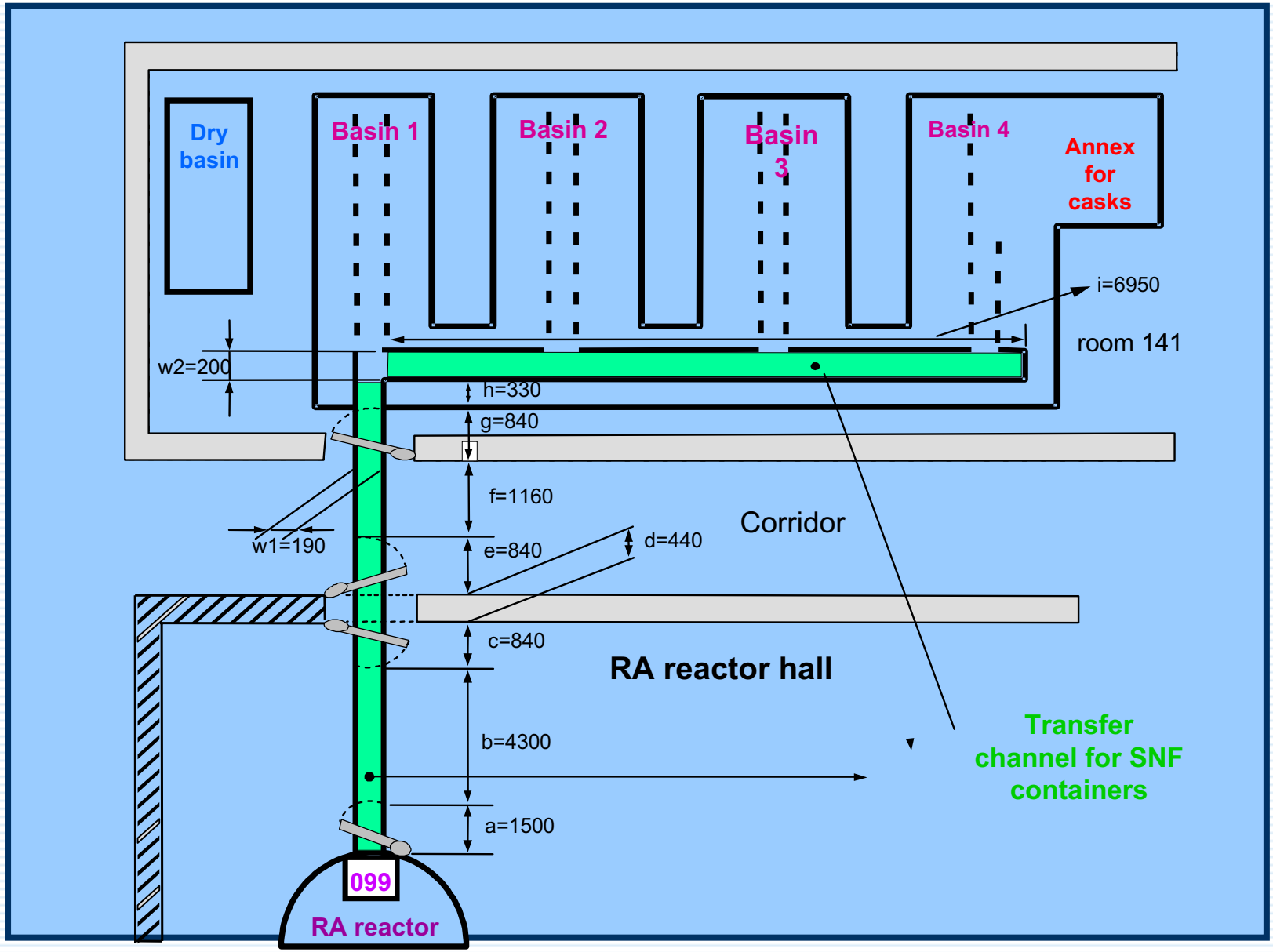
300 stainless-steel containers
30 aluminium barrels

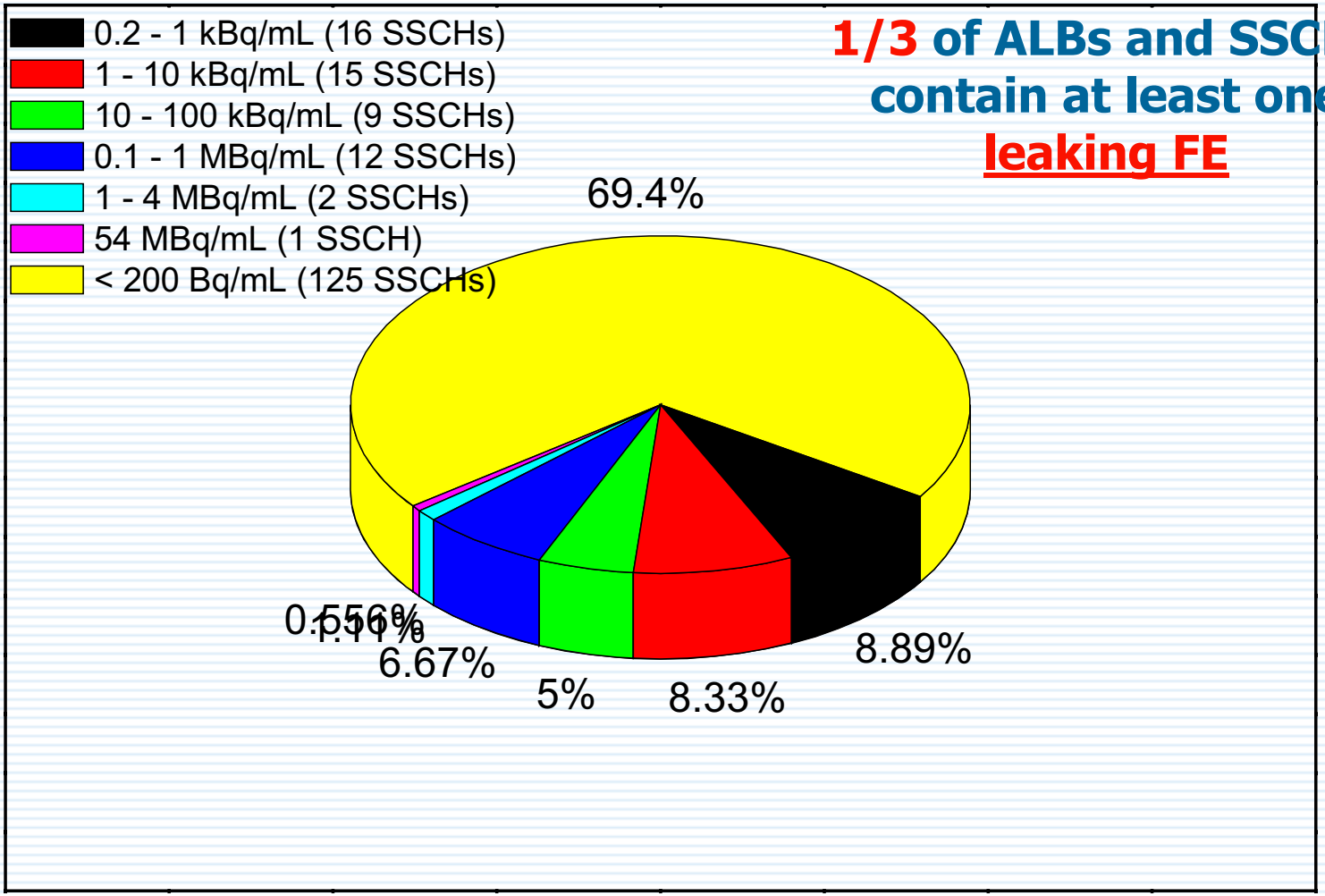
6656 LEU FE

894 HEU FE

Removal of last core charge in progress

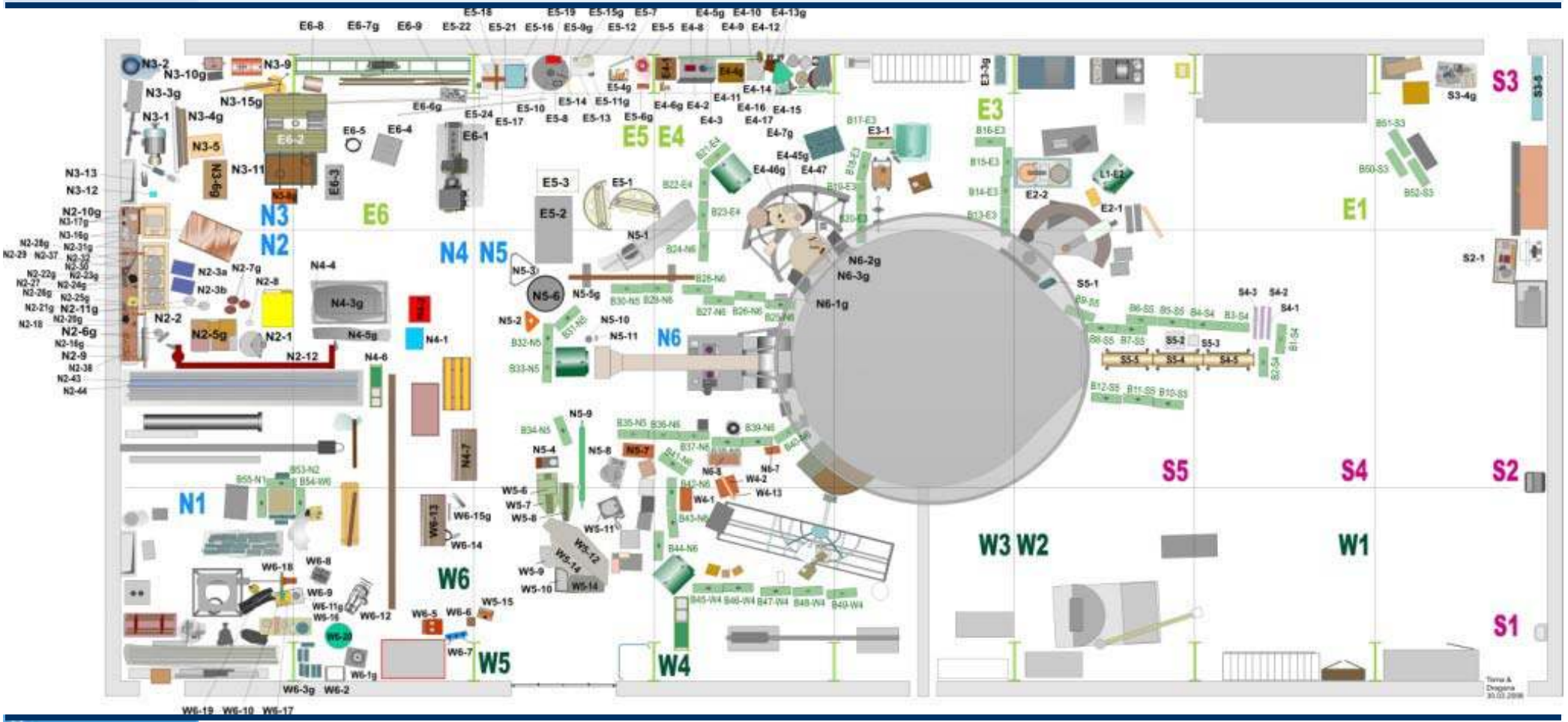
Institute of Nuclear Sciences VINČA


Dry basin
Basin 1
Basin 2
Basin 3
Basin 4
Annex for casks
i=6950
room 141
w2=200
h=330
g=840
f=1160
Corridor
w1=190
e=840
d=440
c=840
RA reactor hall
b=4300
Transfer channel for SNF containers
a=1500
099
RA reactor

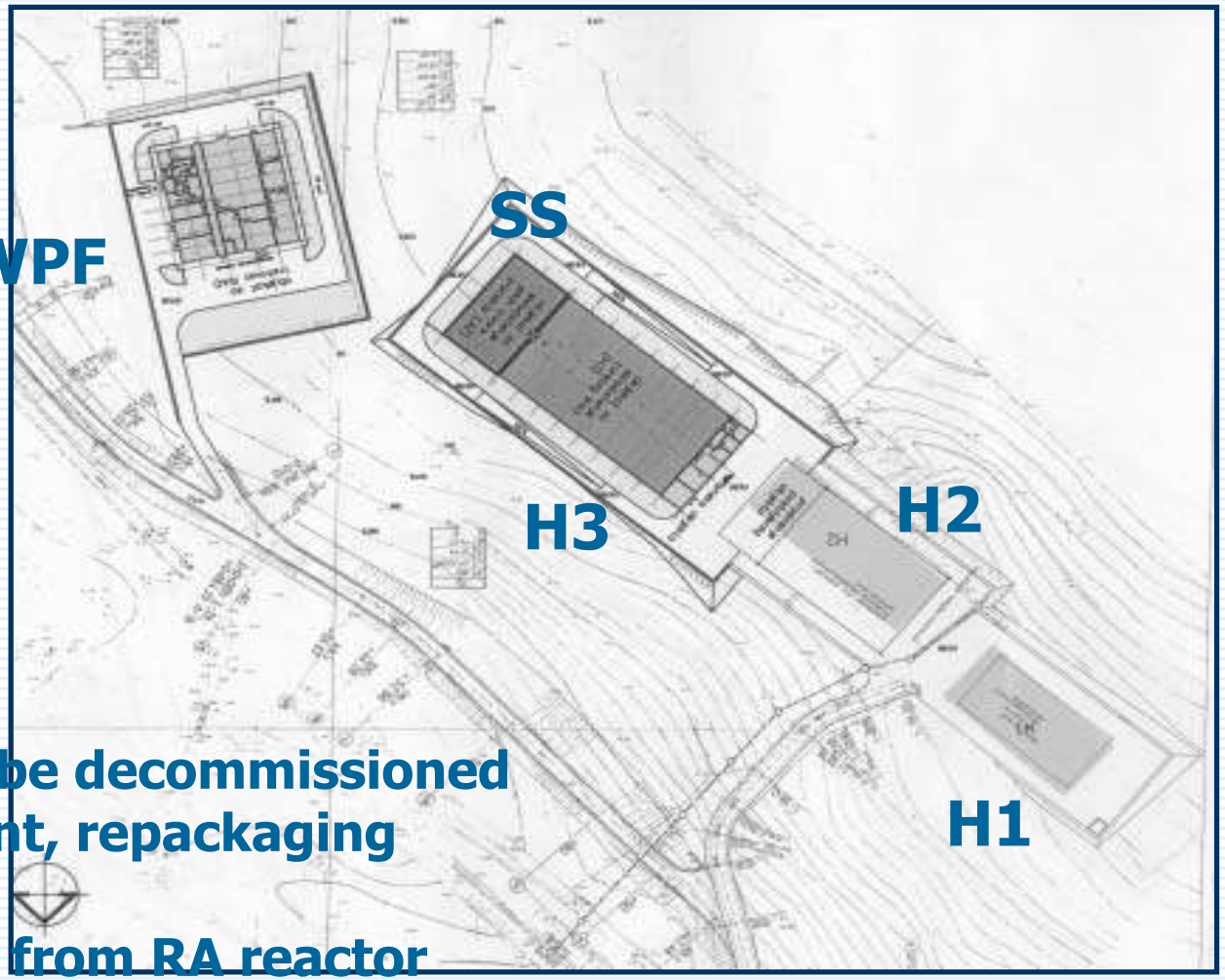


1/3 of ALBs and SSCHs contain at least one leaking FE

Activity of ^{137}Cs in water samples from SSCHs


N1
N2
N3
N4
N5
N6
W1
W2
W3
W4
W5
W6
E1
E2
E3
E4
E5
E6
S1
S2
S3
S4
S5

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



No disposal

Existing:

H1 full, closed, to be decommissioned

H2 - rearrangement, repackaging

New:

H3 to accept RAW from RA reactor

SS to accept high activity sources

WPF to treat new and historical RAW

Institute of Nuclear Sciences VINČA

VINČA INSTITUTE NUCLEAR DECOMMISSIONING PROGRAM (VIND)

- Removal of highly irradiated, partially leaking SNF
  - complex repackaging operation before shipment
  - number of upgrades of the facility systems
- Removal of radioactive materials and structures, safe reuse of the building
  - waste from operational and transition phase, from SNF related activities
- Construction of new facilities for treatment and storage of LILRAW
  - Historical waste, new waste
  - Decommissioning of old storage facilities

Institute of Nuclear Sciences VINČA

Activities in progress

- Preparatory activities for SNF repackaging
  - Preparation of safety related documentation
  - Upgrades of the systems
    - ◇ Ventilation, overhead cranes, transport vehicles, trolleys, radiation monitoring in working areas, environmental monitoring, power supply, waste collection and packaging
  - Preparation of working areas
    - ◇ SNF storage pools, reactor hall, shielded room within the reactor block
    - ◇ Removal of materials and wastes
      - ✓ Characterization, clearance, decontamination, conventional waste, radioactive waste
      - ✓ Several complex dismantling operations
    - ◇ New equipment, working platforms, tools
  - General and specific training of personnel

Activities in progress

- Radioactive waste facilities
  - Planning for decommissioning of H1 and liquid waste tanks
  - Repackaging and rearrangement of waste packages in H2
  - Construction of H3 and SSS
  - Adaptation of an existing building for WPF
  - Cleanout activities in some areas
  - Waste inventory, data bases, QMS
- Reactor decommissioning
  - Planning
  - Characterization
  - Support to SNF preparatory activities
  - Regular maintenance of the safety systems and the building

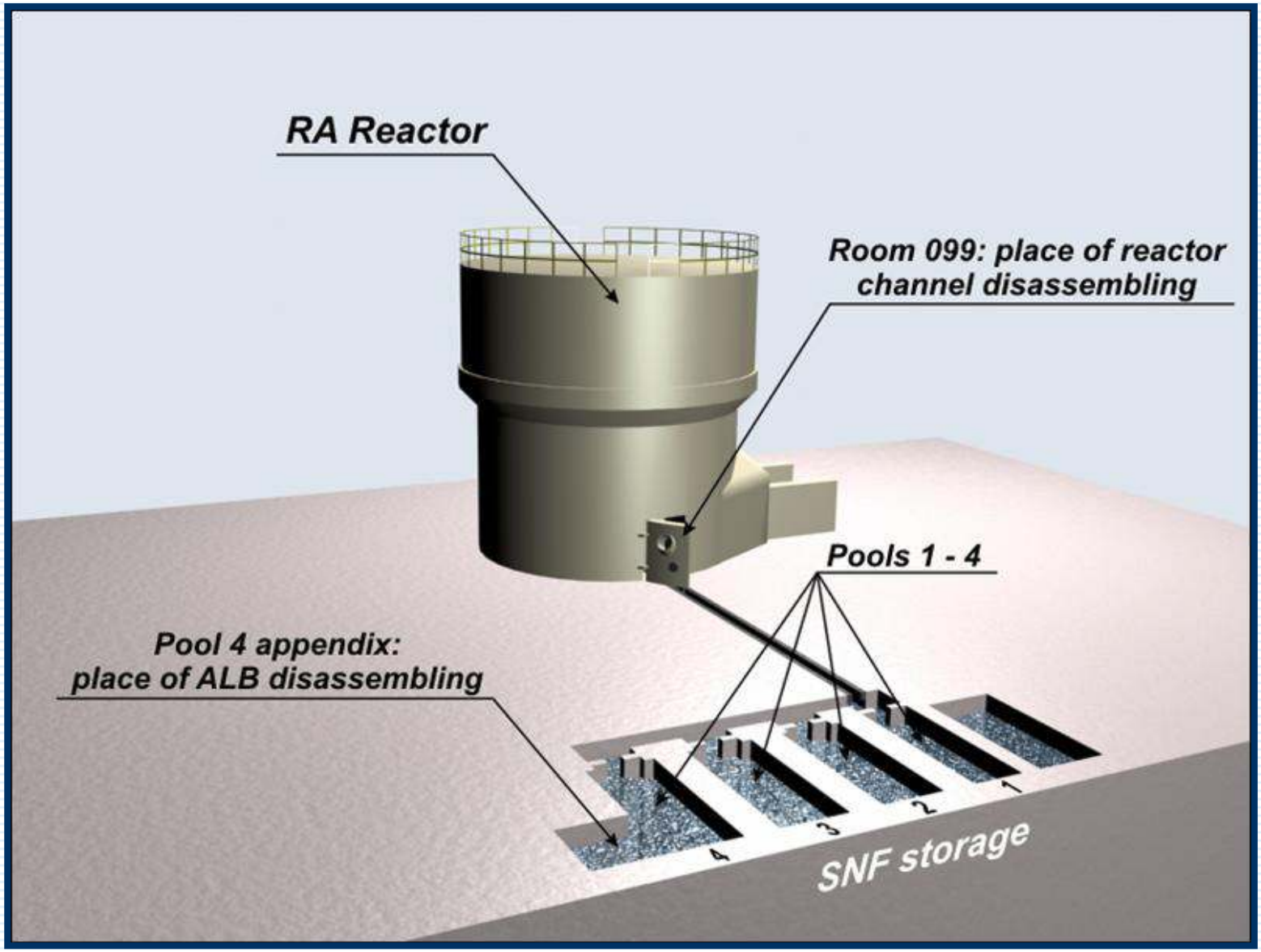
Institute of Nuclear Sciences VINČA

SNF Repackaging and Shipment

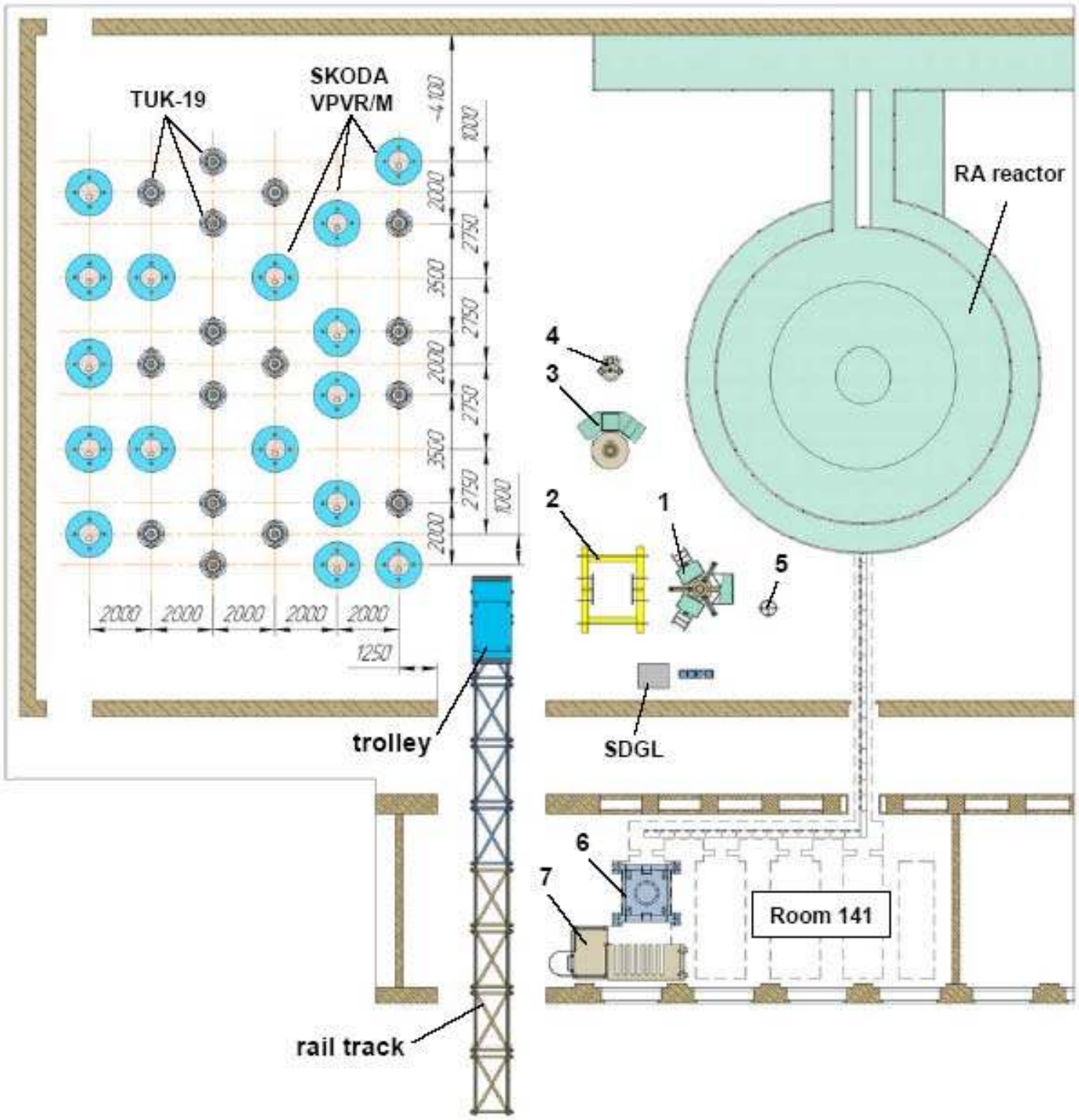
- Metal uranium fuel of high burnup, stored 40 years in water with bad chemistry, corrosion, leakage
- Non-suitable containers for shipment, repackaging needed before loading into transport containers
- High dose rates, contaminated water in the pools
- High activity in the containers
- Reactor infrastructure not adequate to support planned operations

Institute of Nuclear Sciences VINČA

Critical operations - under water or in shielded rooms



Institute of Nuclear Sciences VINČA


TUK-19
SKODA
VPVR/M
RA reactor
4
3
2
1
5
trolley
SDGL
6
7
Room 141
rail track
~4100
1000
2000
2750
3500
2750
2000
2750
3500
2750
1000
2000
2000
2000
2000
2000
2000
1250

Carbonic strips – improvement of bearing capacity of the floor

16 t fork truck for manipulation with TC in the SNF storage room

Institute of Nuclear Sciences
VINČA

Structures removed from the SNF pool

- Underwater contact arc cutting, portable ventilation, respiratory protection
- Training on mock-ups to reduce time
- Non-standard waste packages – to skip exposure during segmentation

Institute of Nuclear Sciences VINČA

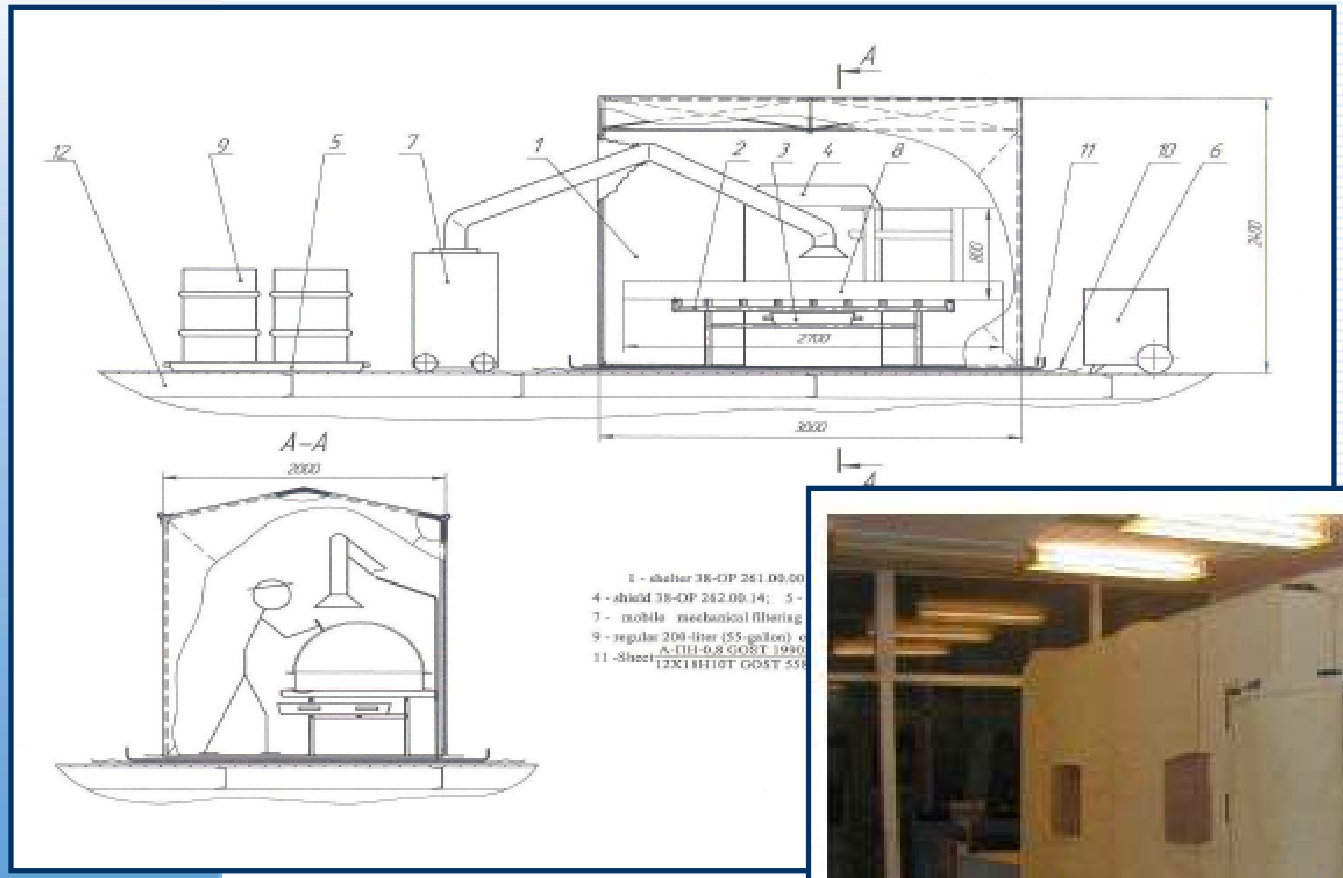
Structures removed from the SNF pool

- Devices for remote handling
- Contact dose rates up to 2 mSv/h (characterization !)
- Maximal individual dose 1.2 mSv for 3 months

Mobile ventilation units with HEPA filters

Institute of Nuclear Sciences VINČA

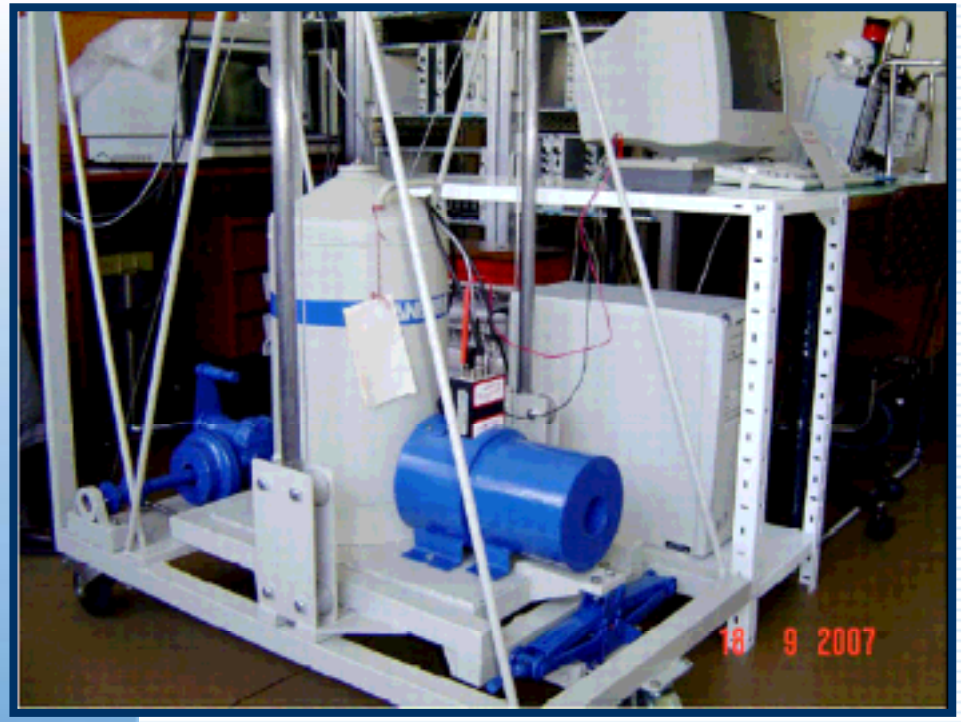
Mobile protective tents



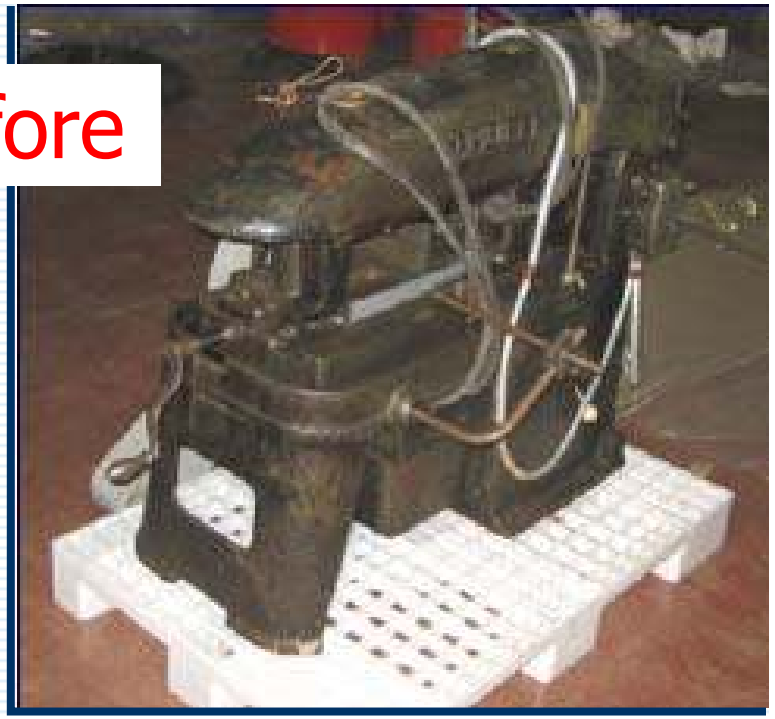
Institute of Nuclear Sciences VINČA

Institute of Nuclear Sciences
VINČA

Institute of Nuclear Sciences
VINČA



before



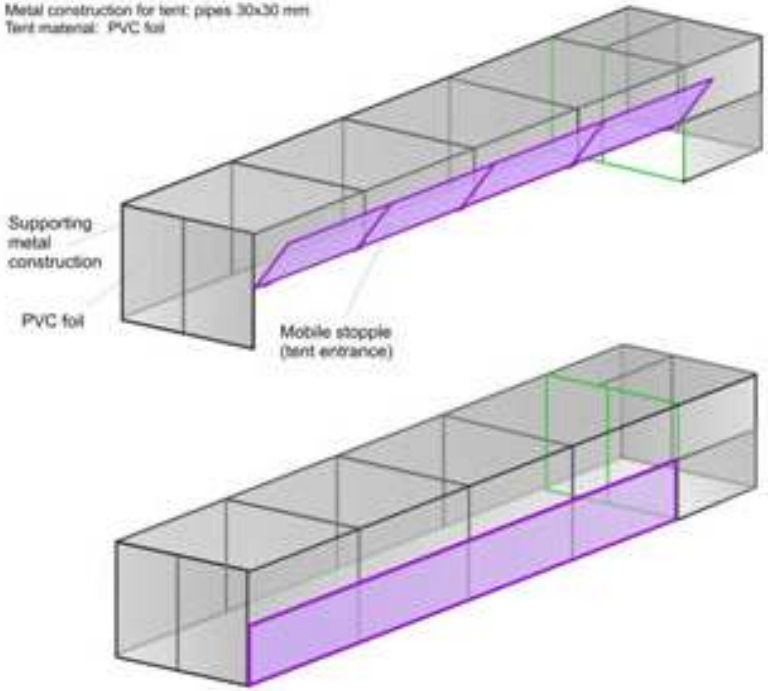
after

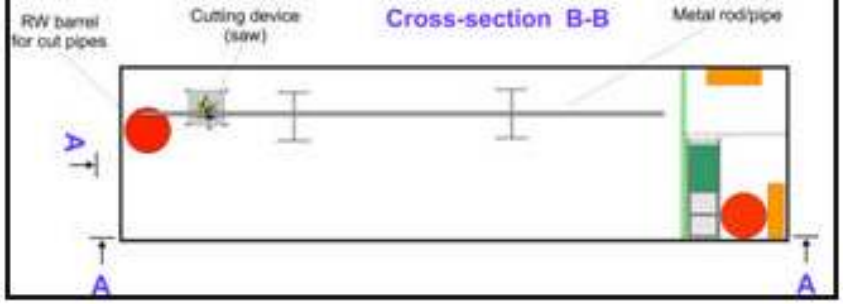
Institute of Nuclear Sciences VINČA

Appendix : Decontamination tent

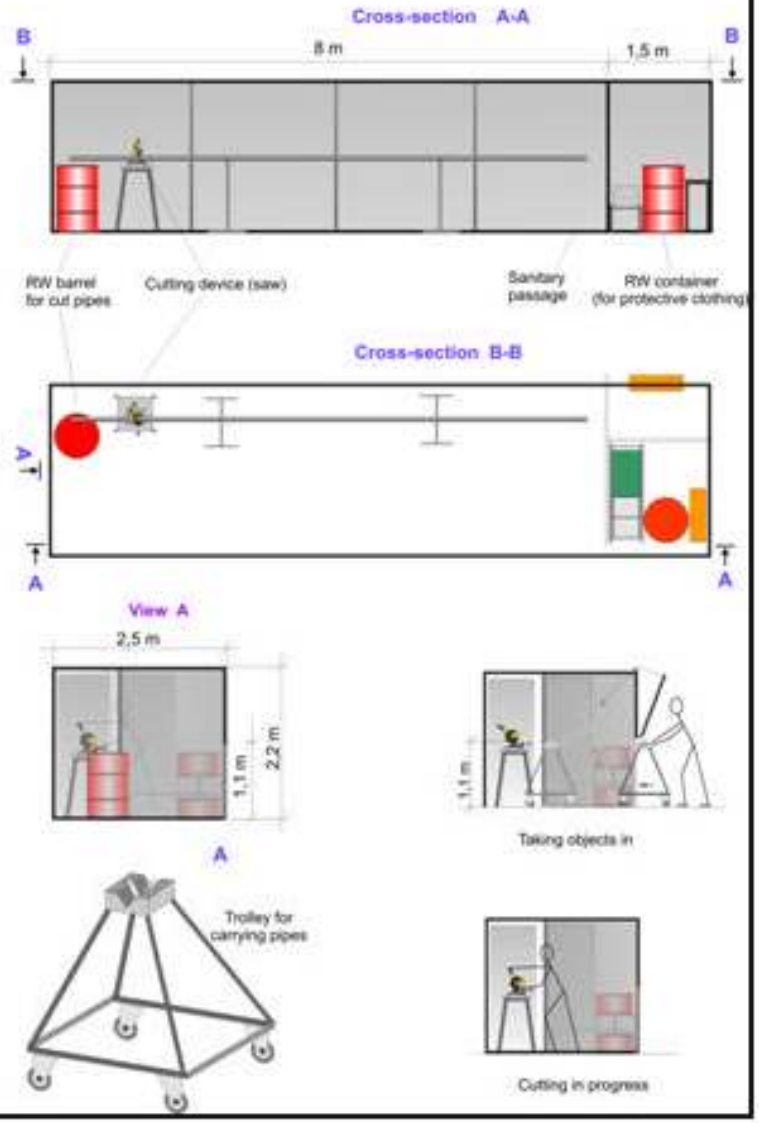
Schematic presentation of the decontamination tent and the equipment for cutting pipes and objects - metal profiles in reactor RA hall

Metal construction for tent: pipes 30x30 mm
Tent material: PVC foil





Disposition of objects inside the tent and illustration of the working procedure



- At the beginning – an open land waste storage
- Later – metallic hanger, corroded drums, unknown inventory
- Contamination and high dose rates

- Radioactive waste storage
- All waste amounts from industrial, medical and research activities in former Yugoslavia

Institute of Nuclear Sciences VINČA

DEKLARACIJA RADIOAKTIVNOGOTPADNOG MATERIJALA | JKO | BPH2060001

1. Osnovni podaci

poreklo: Kućišta

Mesto nastanka: -

Lice koje prijavljuje RAO: -

Telefon: Faks:

Kategorija RAO: 1 Tip RAO: ZKIS (zatvoreni radioaktivni izvori)

Tip pakovanja: bure 200 l sa dlanova

Masa (kg): 300 Zapremina (m^3): 0.2

- [ ] Kompaktibilna
- [ ] Organski
- [x] Neorganski
- [ ] Zapaljiv
- [ ] Generiše toplotu
- [ ] Eksplozivna

Opis RAO (opis, značajne fizičke i hemijske karakteristike)

Standardna 200l bure sa dodatnom zaštitom. U bure se ... radioaktivni ... izvori sa Eu-152 i Eu-154

Sastav

	materijal	zapremina	maseni ude
▶		0	0

Record: 1 of 1

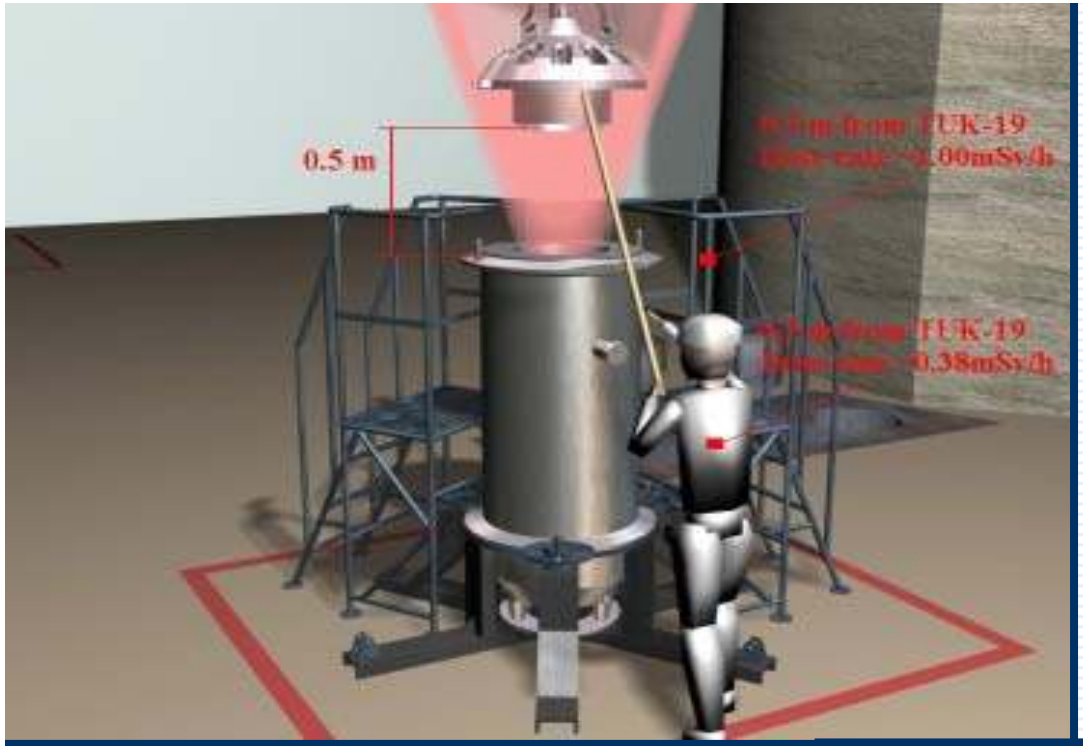
Komentar (bilo koji dodatni podaci o otpadu)

4. Izvori radioaktivnih gramatrana (XGB)

	Tip	Radioizotop	Aktivnost (MBq)	Datum snimanja	Datum preuzimanja	Izvršilac posla	Broj	Broj ponude/ugovora
▶		Eu-152, Eu-154	6500		8/19/2008	Hadzic	1	5284-7
		Eu-152, Eu-154	5500		8/21/2008	Mrdovic	1	5284-8
		Eu-152, Eu-154	5500		8/21/2008	Mrdovic	1	5284-9
		Eu-152, Eu-154	6500		8/22/2008	Hadzic, Sipka	1	5284-11
		Eu-152	6500		9/1/2008	D.Kosutic(rukovodilac)	1	5284-16
		Eu-152	8500		9/1/2008	D.Kosutic(rukovodilac)	1	5284-17
		Eu-152 Eu-154	6500		9/9/2008	Hadzic, Mrdovic	1	5284-18
		Eu-152, Eu-154	5500		9/18/2008	Hadzic	1	5284-20
*			0				0	

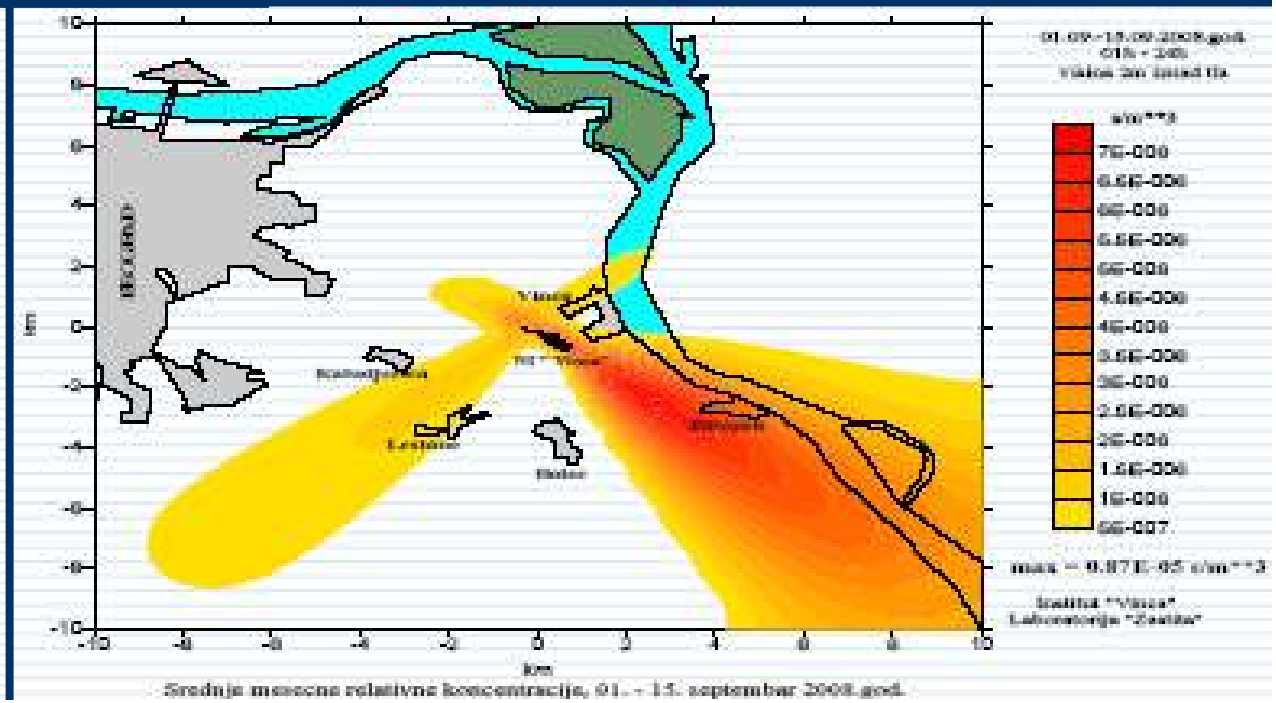
Record: 1 of 2

Institute of Nuclear Sciences VINČA



- **Complex 3D simulation models for Monte Carlo calculation of dose rate fields, computer clusters**

- **Modeling of atmospheric dispersion of effluents**



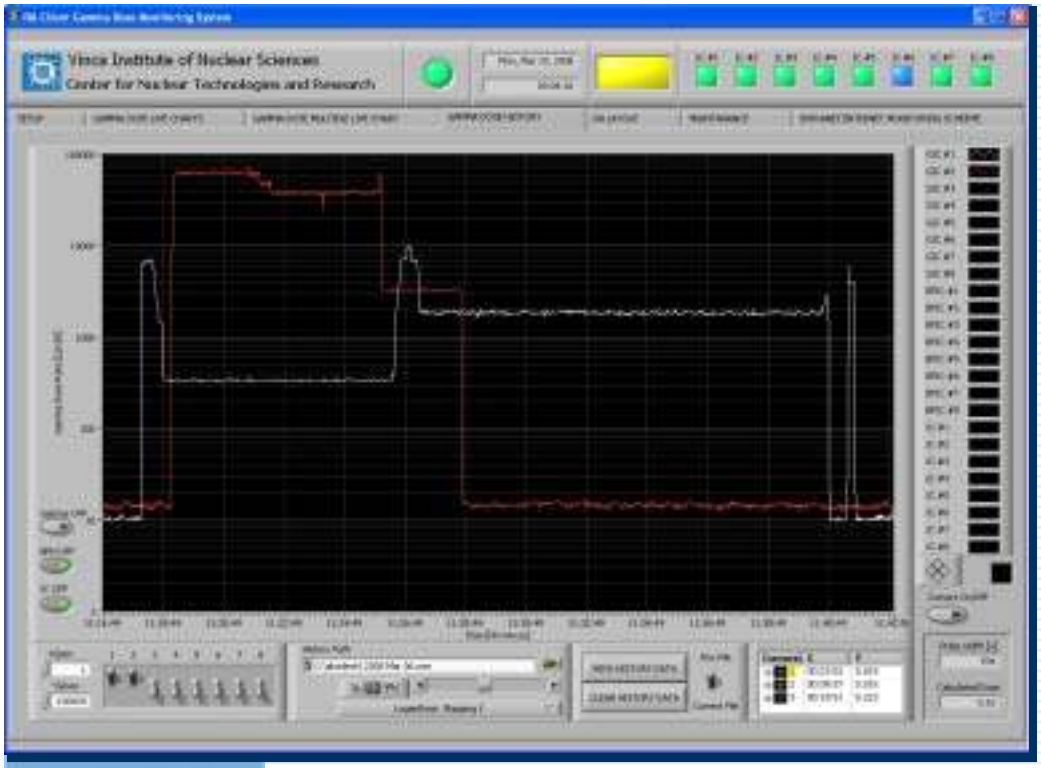
Institute of Nuclear Sciences
VINČA

Monitoring

AMS-4 and iCAM contamination in air monitors

GEM-5 whole body contamination monitor

Institute of Nuclear Sciences VINČA



Stationery dosimetry system in the reactor building

Personal contamination monitoring

Institute of Nuclear Sciences
VINČA

Summary – topics of interest for IDN

- Number of activities in progress – SNF, waste facilities, reactor decommissioning
- Main criteria – safety
- Number of upgrades in order to ensure safety
- Planning
  - Significance of transition from operation to decommissioning
  - Early arrangements for SNF, availability of waste facilities
- Record Management System
  - Software tools and databases for documentation, characterization, monitoring (radiological, meteorological), radioactive waste, exposure control
- Regulatory infrastructure to support ongoing activities

Summary – topics of interest for IDN

- Good experience in characterization
  - Spent fuel, activated structures, contamination, historical waste
  - Both sampling/measurement and modeling/simulation/calculation approaches
  - Good chemistry needed to support sample preparation and activation modeling (trace elements)
- Safety Assessment
  - Integration of radiological and industrial issues
  - Operational history – fuel burnup – source term/activation – dose rates for particular operations – protective measures
- Technologies
  - Dismantling - practical experience, hands-on training for technicians
  - Waste treatment technologies
- Clearance
  - Efficient procedure/equipment to release bulky items

Institute of Nuclear Sciences VINČA