
Danish Decommissioning
DANISH DECOMMISSIONING

Risø National Laboratory

- Was established in 1956-58 (officially opened June 5 1958)
  - With a view to paving the way for the introduction of nuclear power in Denmark
- Research areas in the first 20-25 years:
  - Reactor physics, reactor technology, physics, chemistry, health physics, electronics, metallurgy

Risø National Laboratory

- In 1976 the scope of RNL's work was broadened to include research in other energy sources than nuclear, e.g. wind and oil/gas
- In 1985 the Danish Parliament decided that nuclear power should not be introduced in Denmark
- The nuclear related research at RNL consequently was reduced

Risø National Laboratory

- In 2007 RNL became part of the Technical University of Denmark
- Significant research areas today:
  - Fuel cells (SOFC)
  - Medical applications of radionuclides and related techniques
  - Energy systems
  - Biomass and wind energy

Danish Decommissioning

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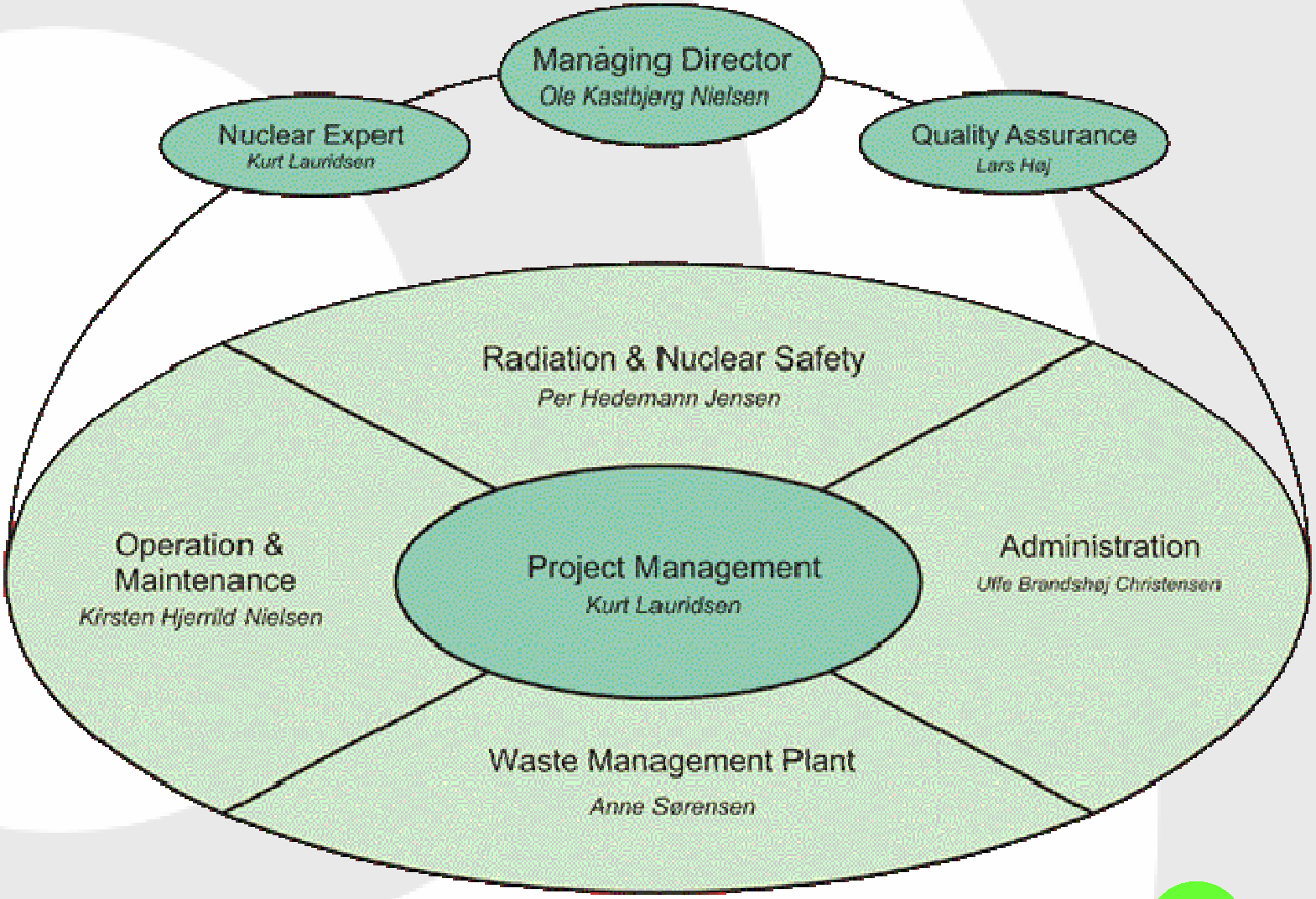
DD's main tasks are to

- decommission the nuclear facilities at Risø National Laboratory to the stage of "greenfield"
- receive, treat and store radioactive waste from Danish users of radioactive materials (e.g. hospitals and laboratories)

DD's formal set up

- Danish Decommissioning was established in 2003 as a separate institution under The Ministry of Science, Technology and Innovation.
- The time frame for the decommissioning is 11-20 years from 2003.
- Estimated total cost of app. 1 billion DKK (~180 M USD).



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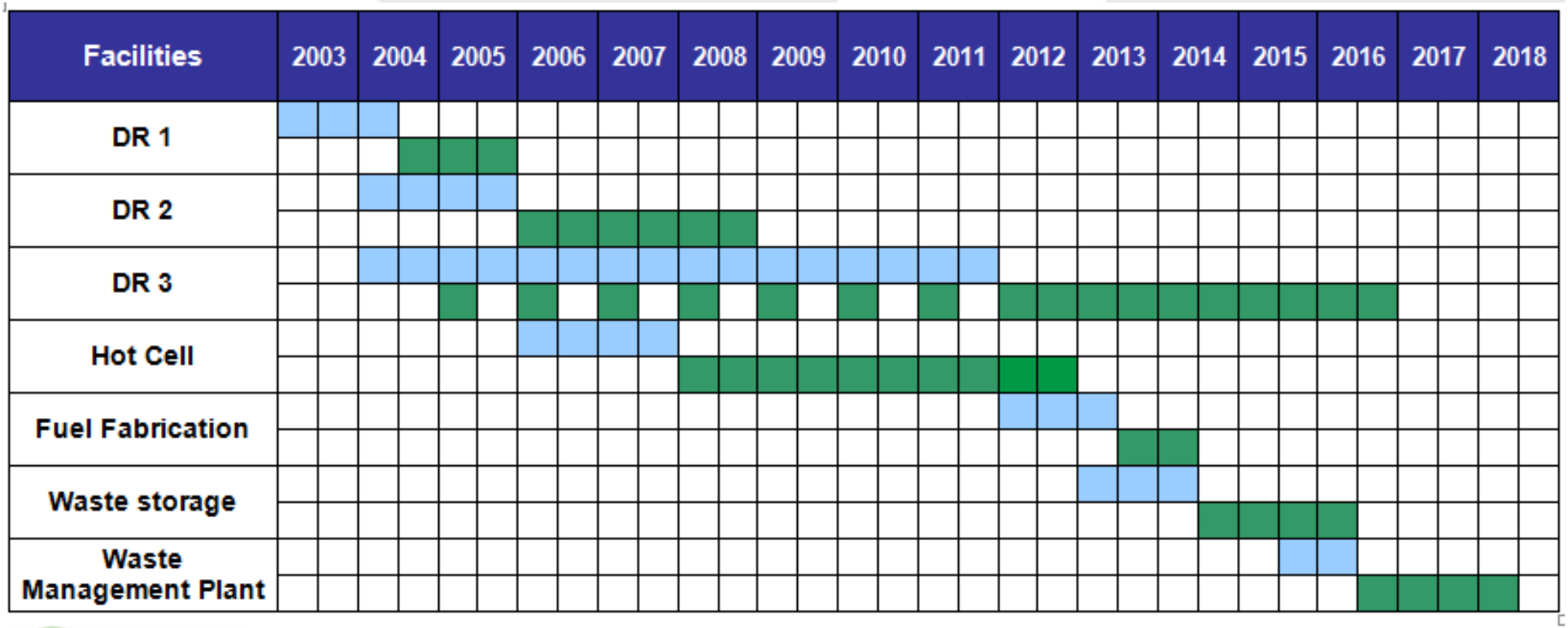
The 6 facilities to be decommissioned

- Reactor DR 1
- Reactor DR 2
- Reactor DR 3
- A Hot Cell facility
- A small fuel fabrication facility ("The Technology Hall")
- The Waste Management Plant

Schedule



The broken line for DR 3 indicates the dismantling of peripheral systems.

■ Planning ■ Execution

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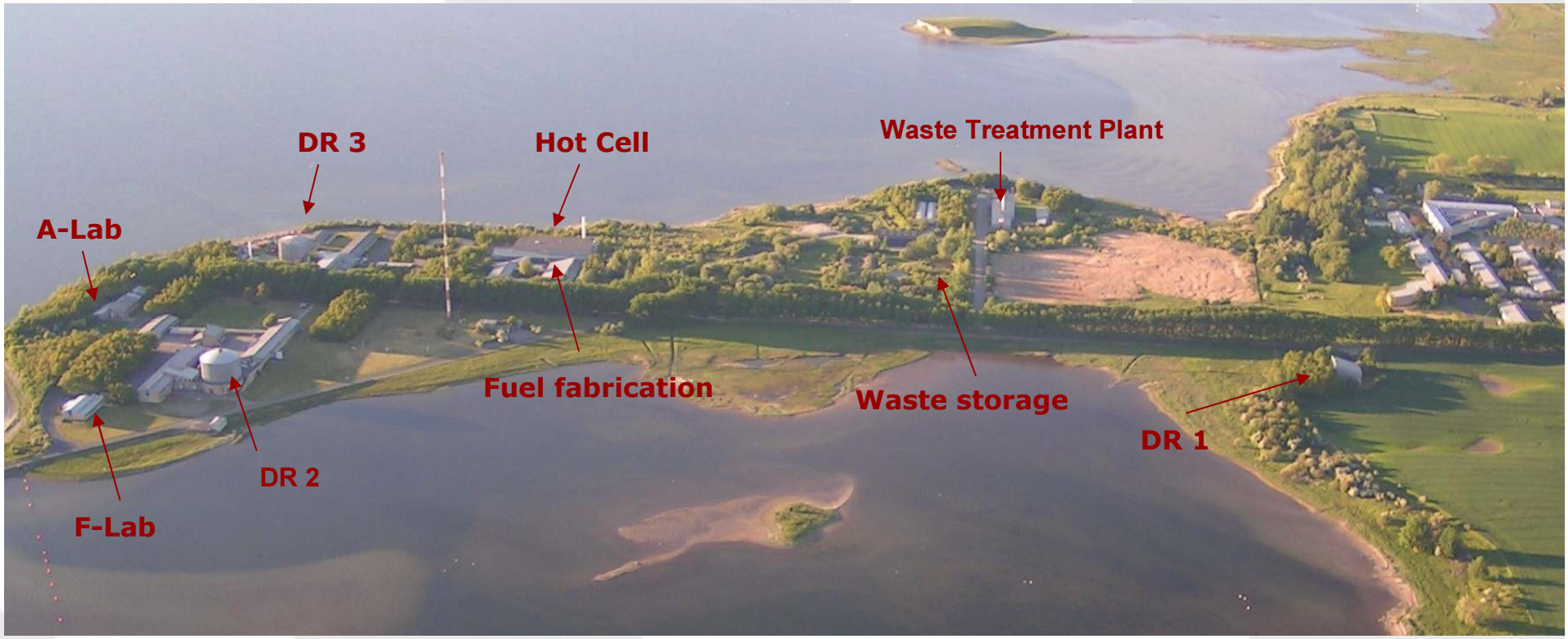
Location of DD facilities




DR 1

DR 1

- **Reactor type:** homogeneous, light-water cooled and moderated.
- **Max. output:** 2 kW.
- **In service** 1957-2001.
- **Primary activity:** education (reactor experiments, reactor physics experiments and neutron radiography).

Decommissioning of DR 1

- DR 1 was decommissioned in 2004-2005.
- The reactor building and surrounding areas were released for unrestricted use in January 2006.
- The building is now being used by Risø National Laboratory for other purposes

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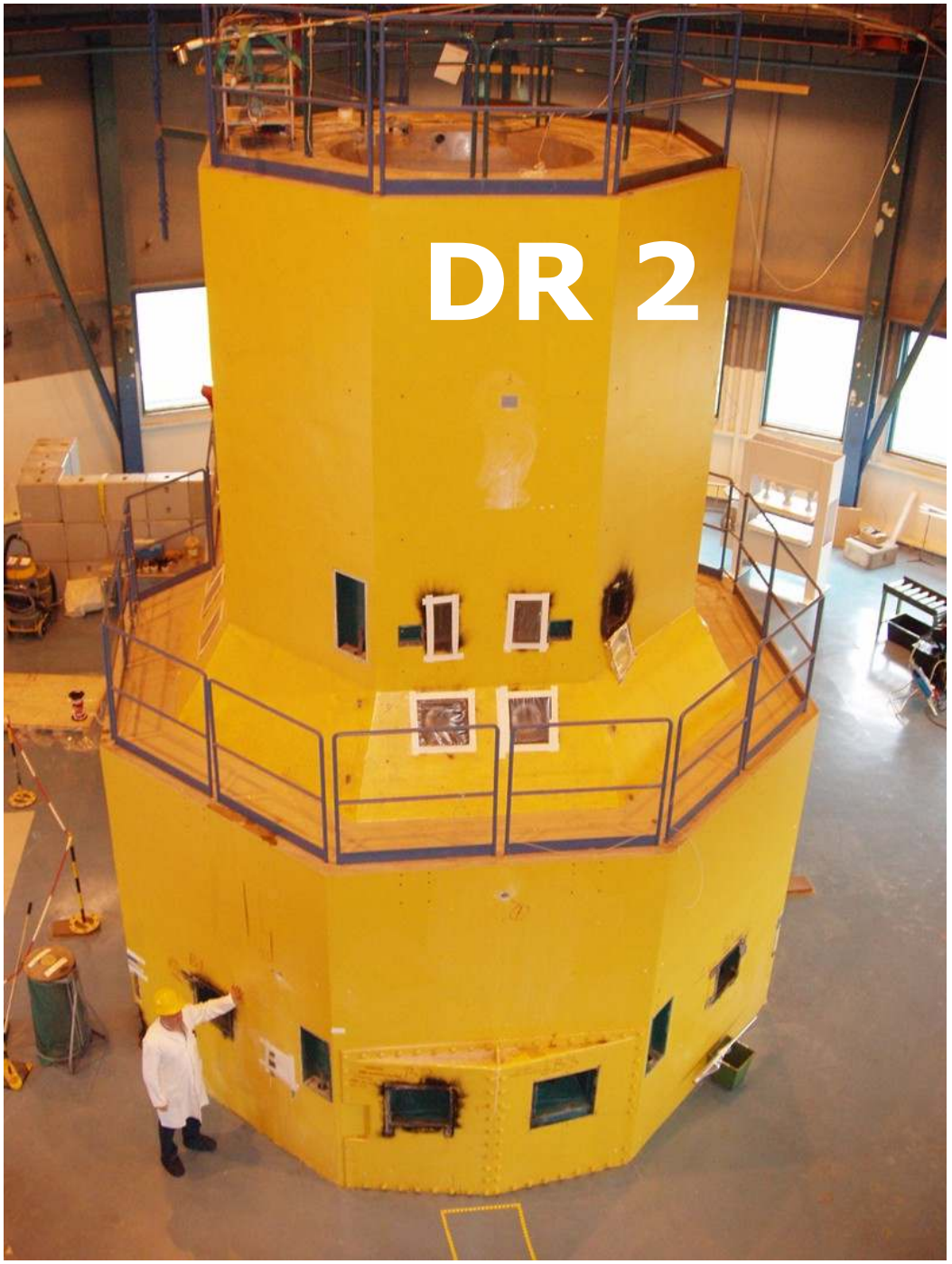

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DR 2

- **Reactor type:** Light-water cooled and moderated open tank type.
- **Max. output:** 5 MW.
- **In service:** 1958-1975 (subsequently brought to state of ”safe enclosure”).
- **Primary activity:** Physics research and production of isotopes.

Decommissioning of DR 2

- April 2006: funding granted.
- May-December 2006: removal of irradiation facilities and beam tubes.
- January–March 2007: removal of thermal column and grid plate.
- April-December 2007: demolition of concrete reactor block.
- 2008: clearance measurements.

Removal of irradiation tubes

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Removal of beam tubes

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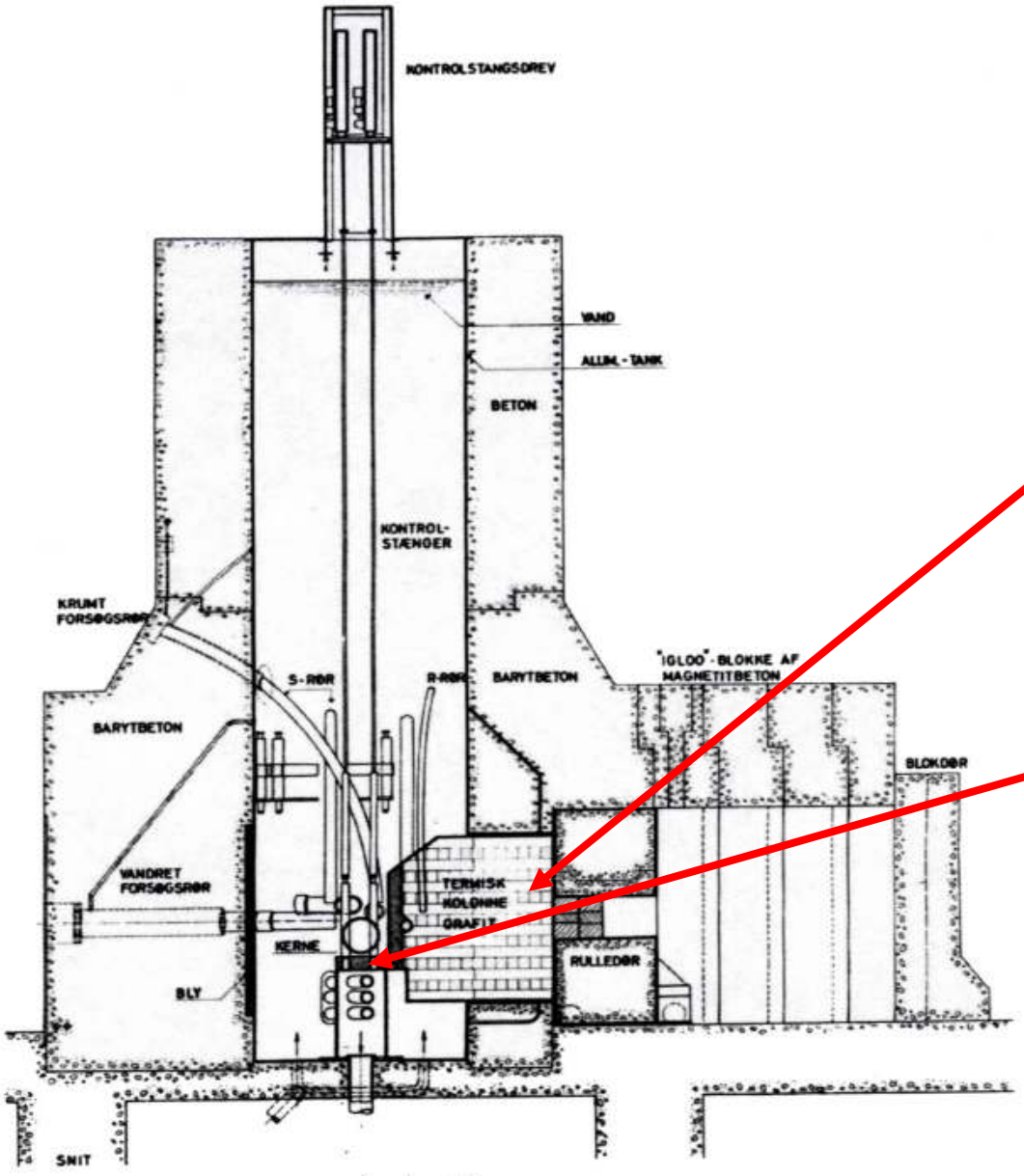

Thermal column

Grid plate

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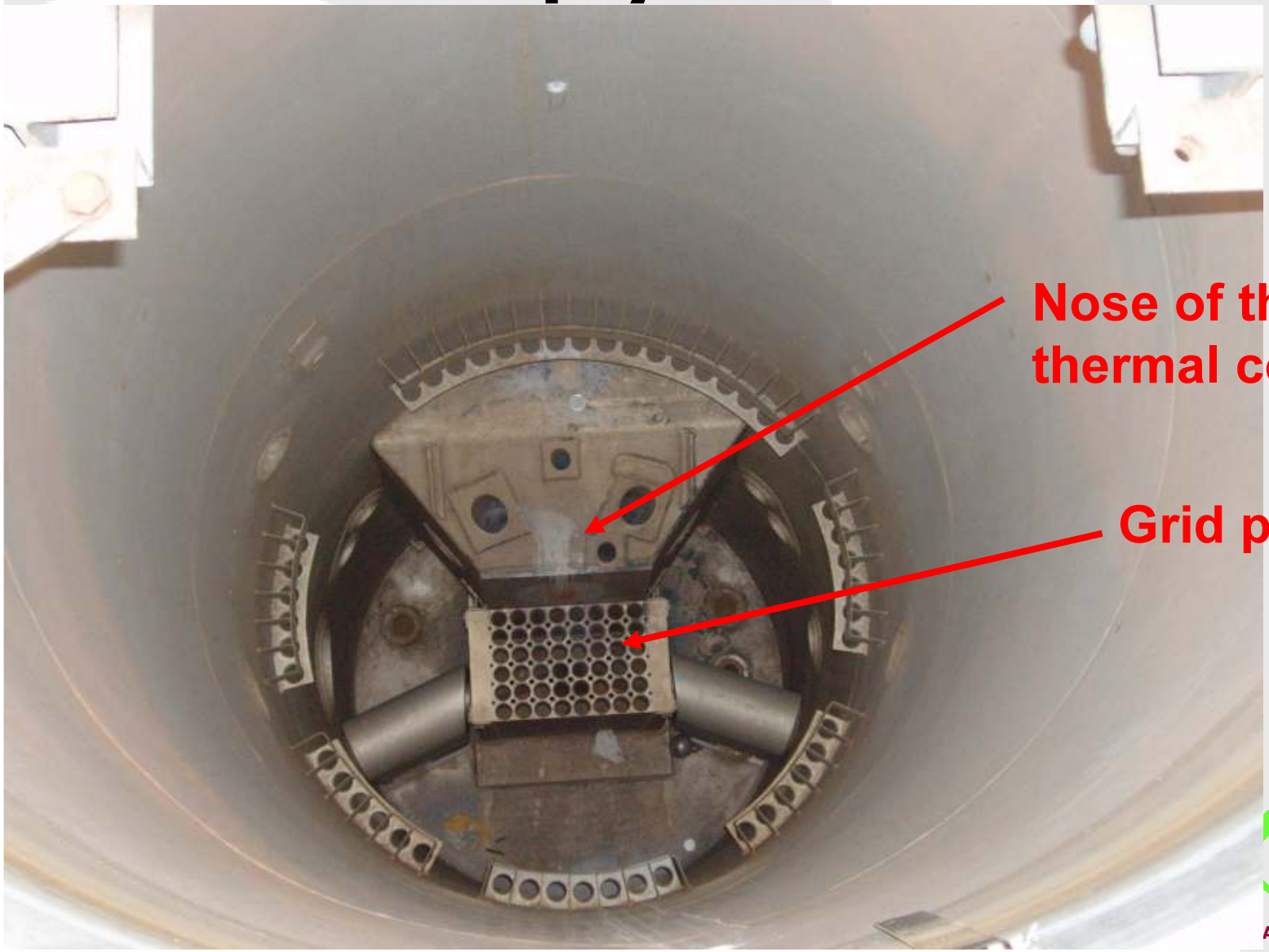
A view into the – almost – empty tank



Thermal column with graphite (2 tons, ~200 stringers)

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Graphite stringers removed by use of vacuum lifting device

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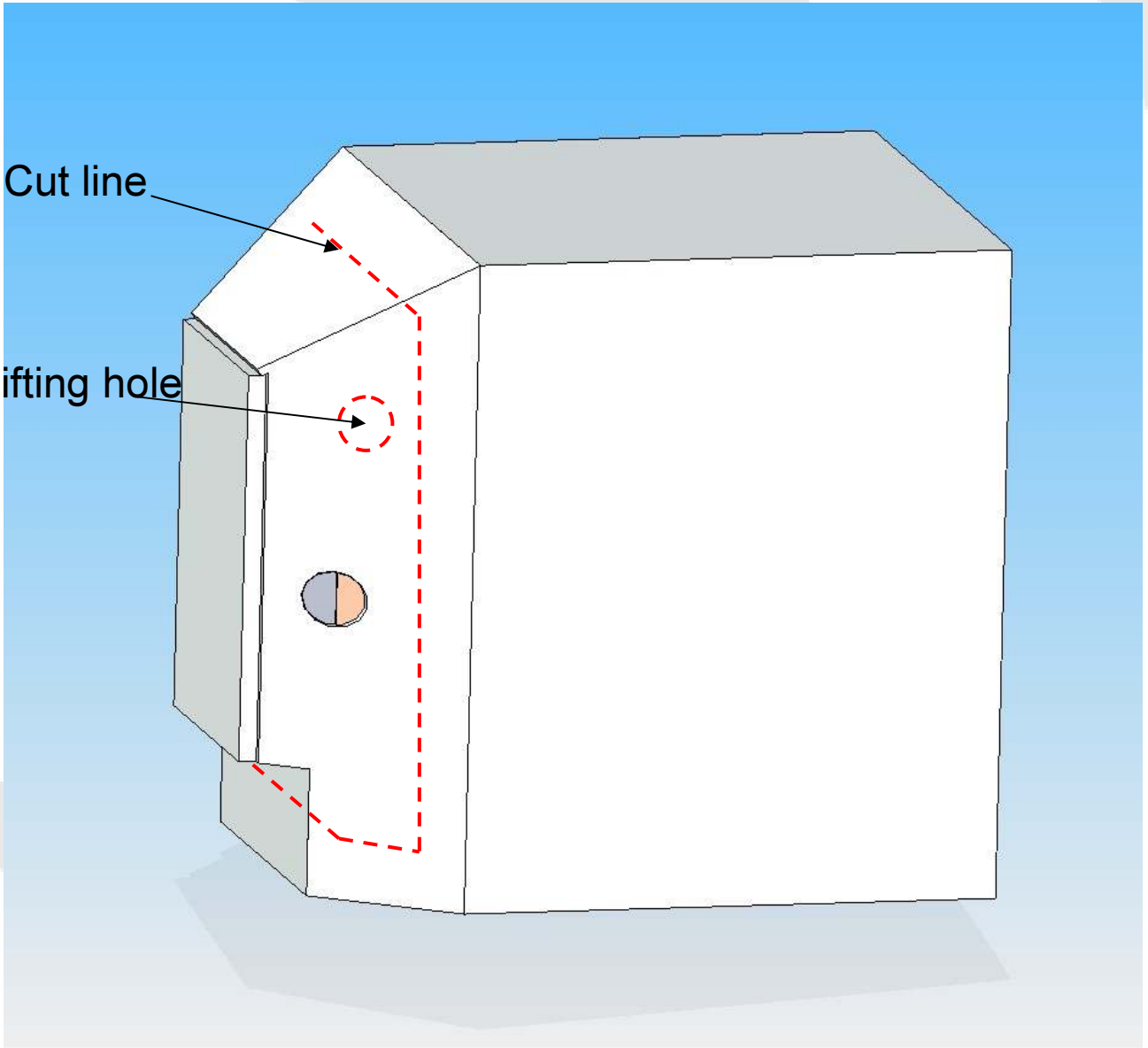
Thermal column, sketch for cutting off the lead nose



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Plasma cutting of the lead nose

Lead nose removed to container by crane

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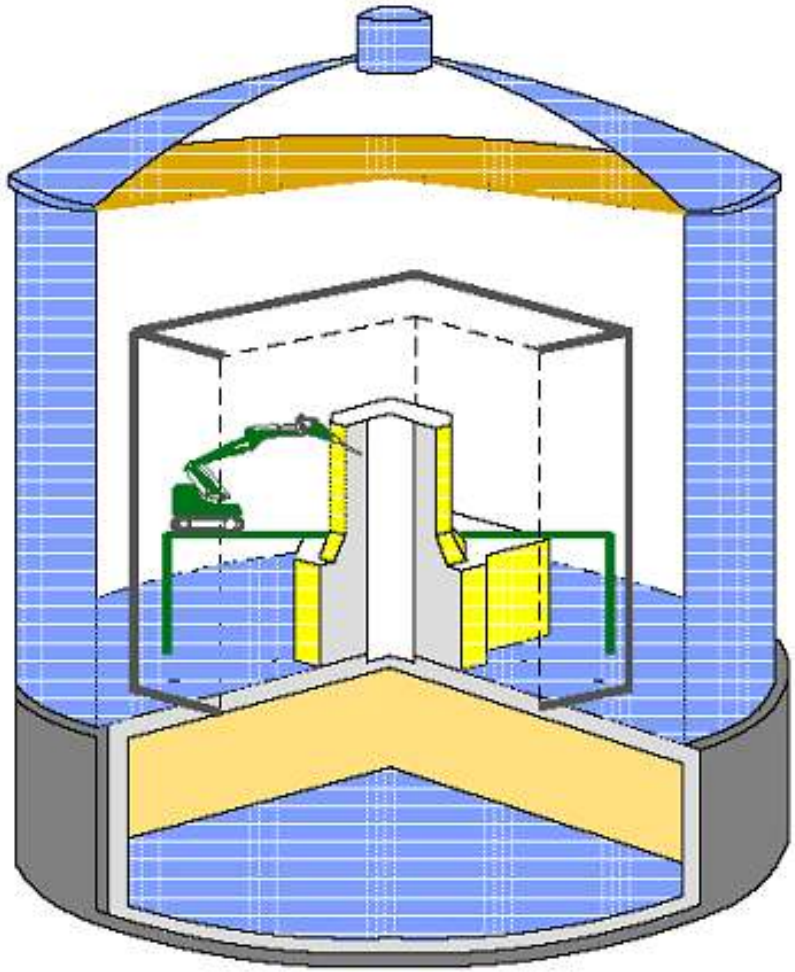
Plasma cutting of the grid plate

Demolition



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Start of demolition of the “chimney”

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Demolishing by means of a Brokk demolition robot with local dust exhaustion

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Lower part, steel face plates being removed

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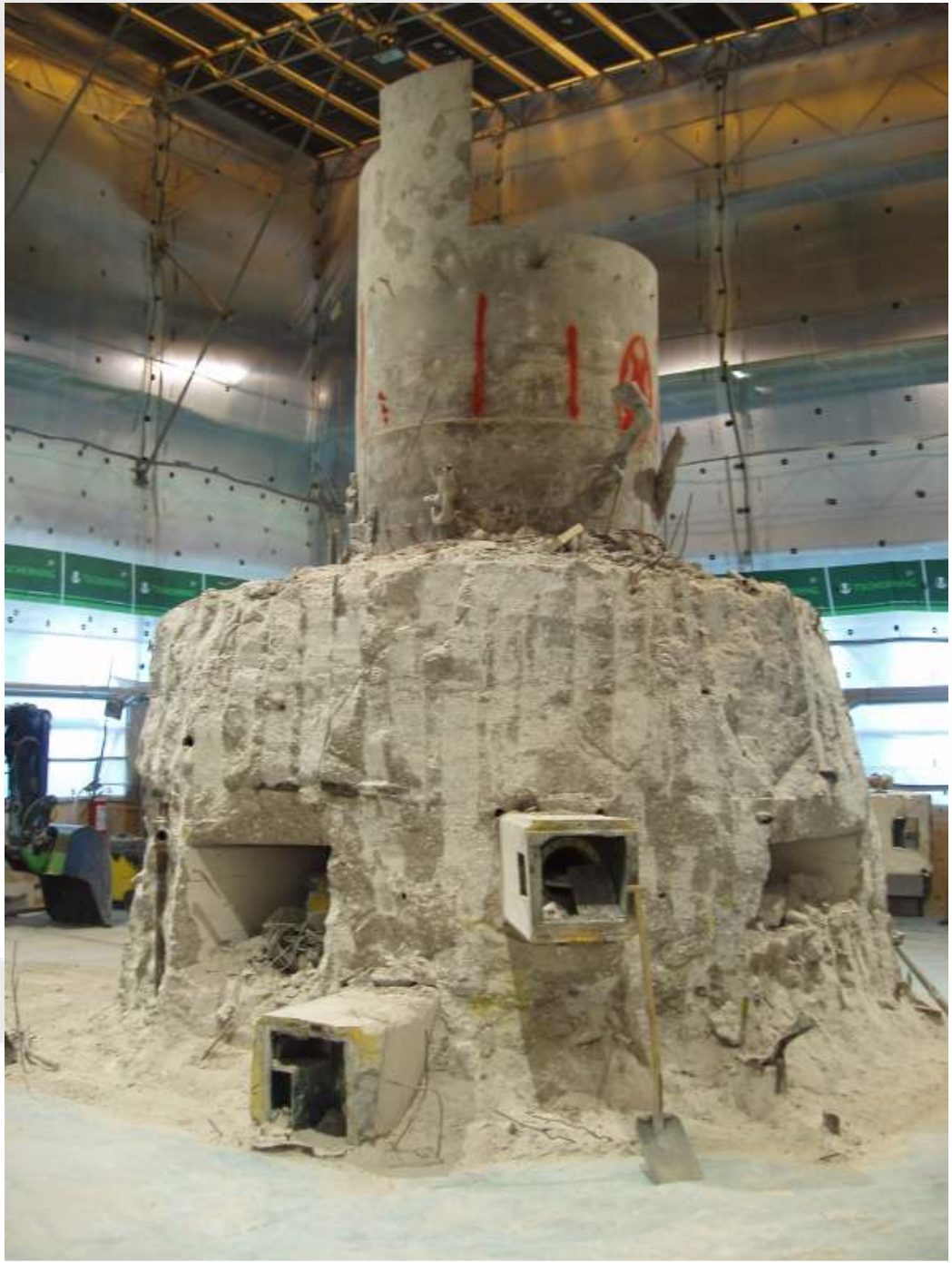

Radioactive parts exposed

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Almost done

End of story – January 2008

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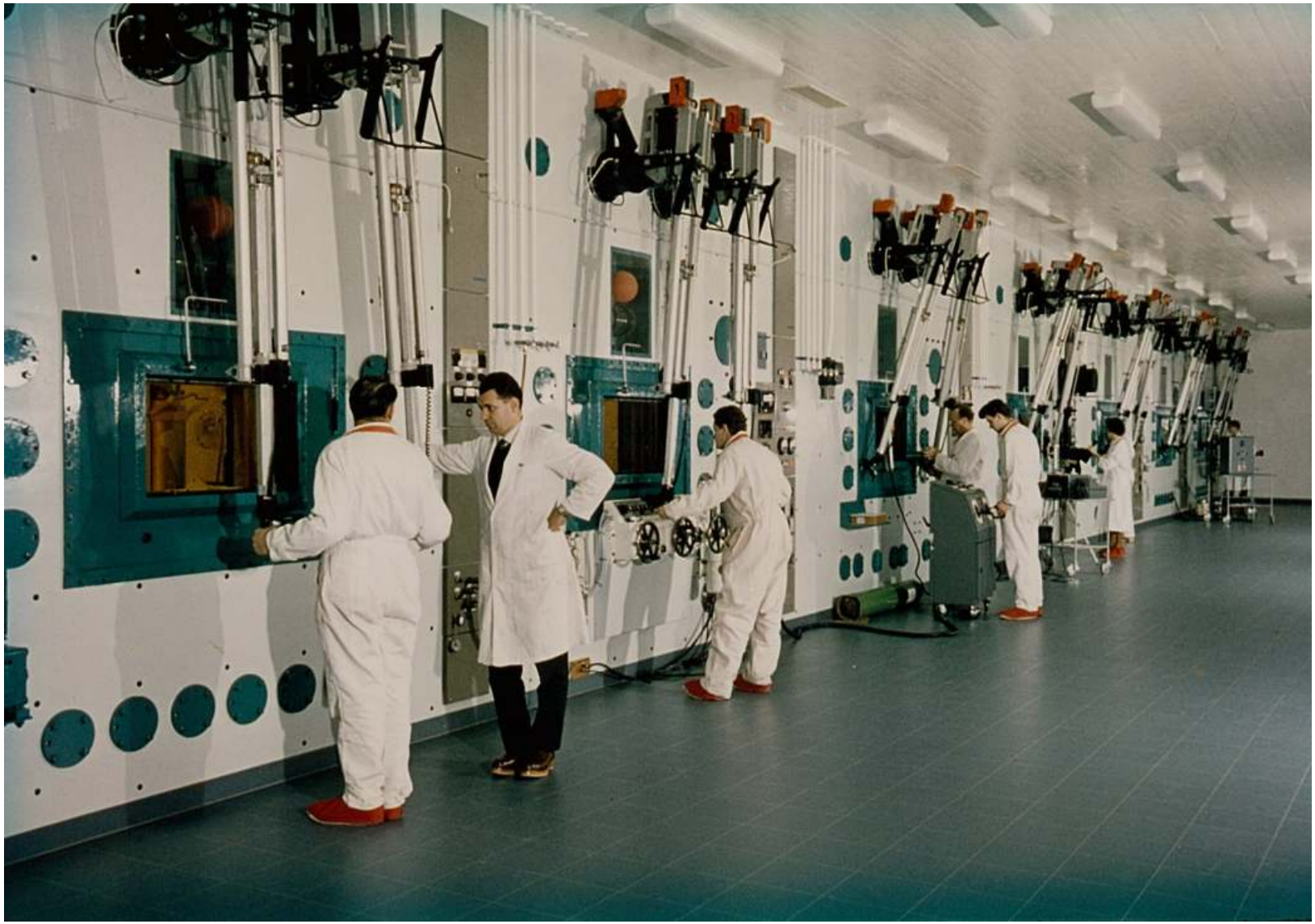
DR 3

- **Reactor type:** Heavy water cooled and moderated materials test reactor (Pluto-type).
- **Max. output:** 10-12 MW.
- **In service:** 1960-2000.
- **Primary applications:** Physics experiments, production of isotopes and silicon transmutation doting.

Decommissioning of DR 3

- Characterization of DR 3 2005-2006.
- Characterization of storage facilities 2006-2007
- Dismantling of secondary systems sporadically until 2012.
- Decommissioning of DR 3-block and auxiliary buildings 2012-2016.

The Hot Cell facility



Hot Cells

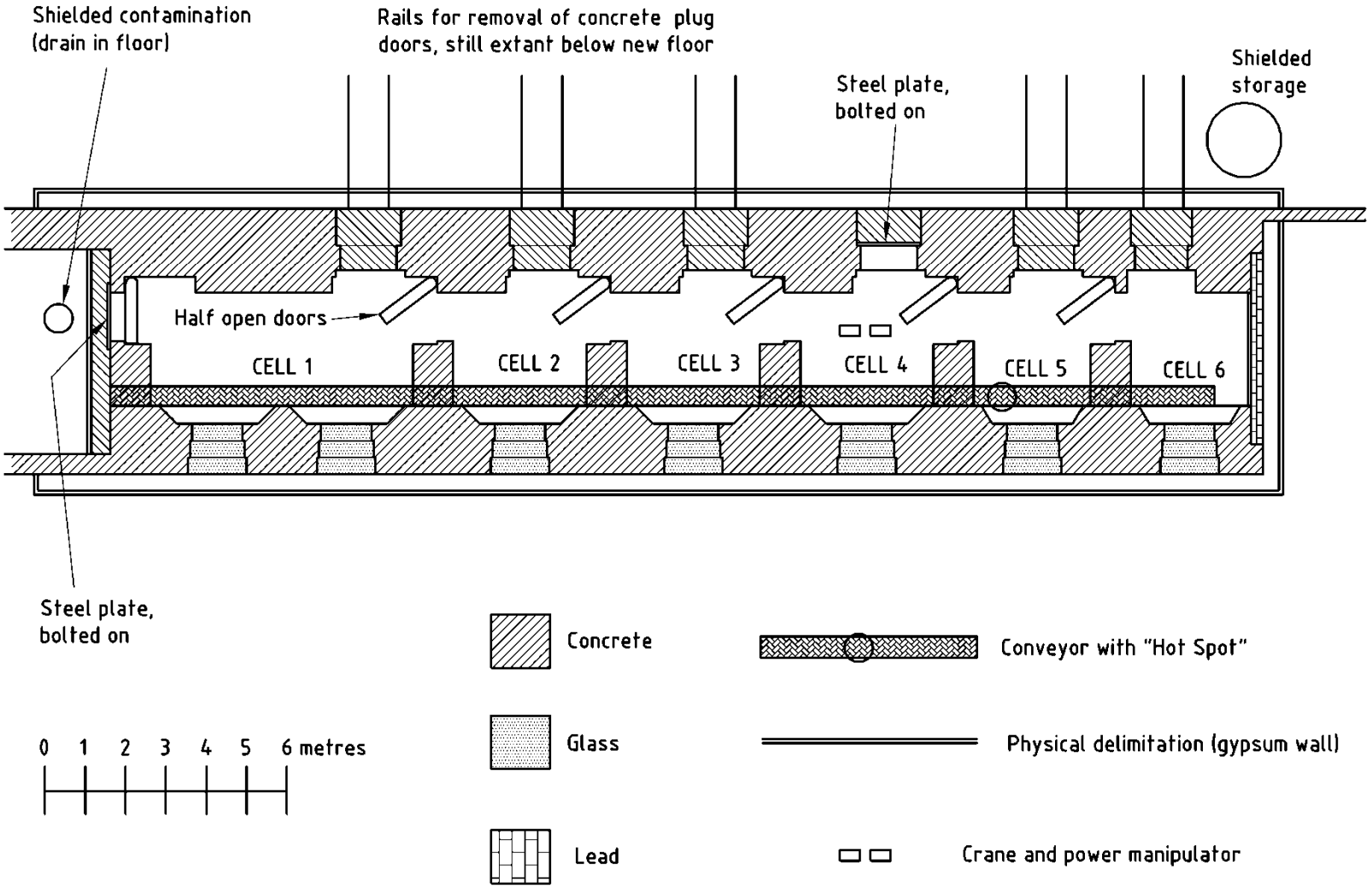
- Used for investigating irradiated reactor fuel and for packaging of radioactive sources.
- Partly decommissioned in 1990-1993. A row of six concrete cells remains in a building with other activities.
- To be fully decommissioned in 2008-2012.

Some challenges

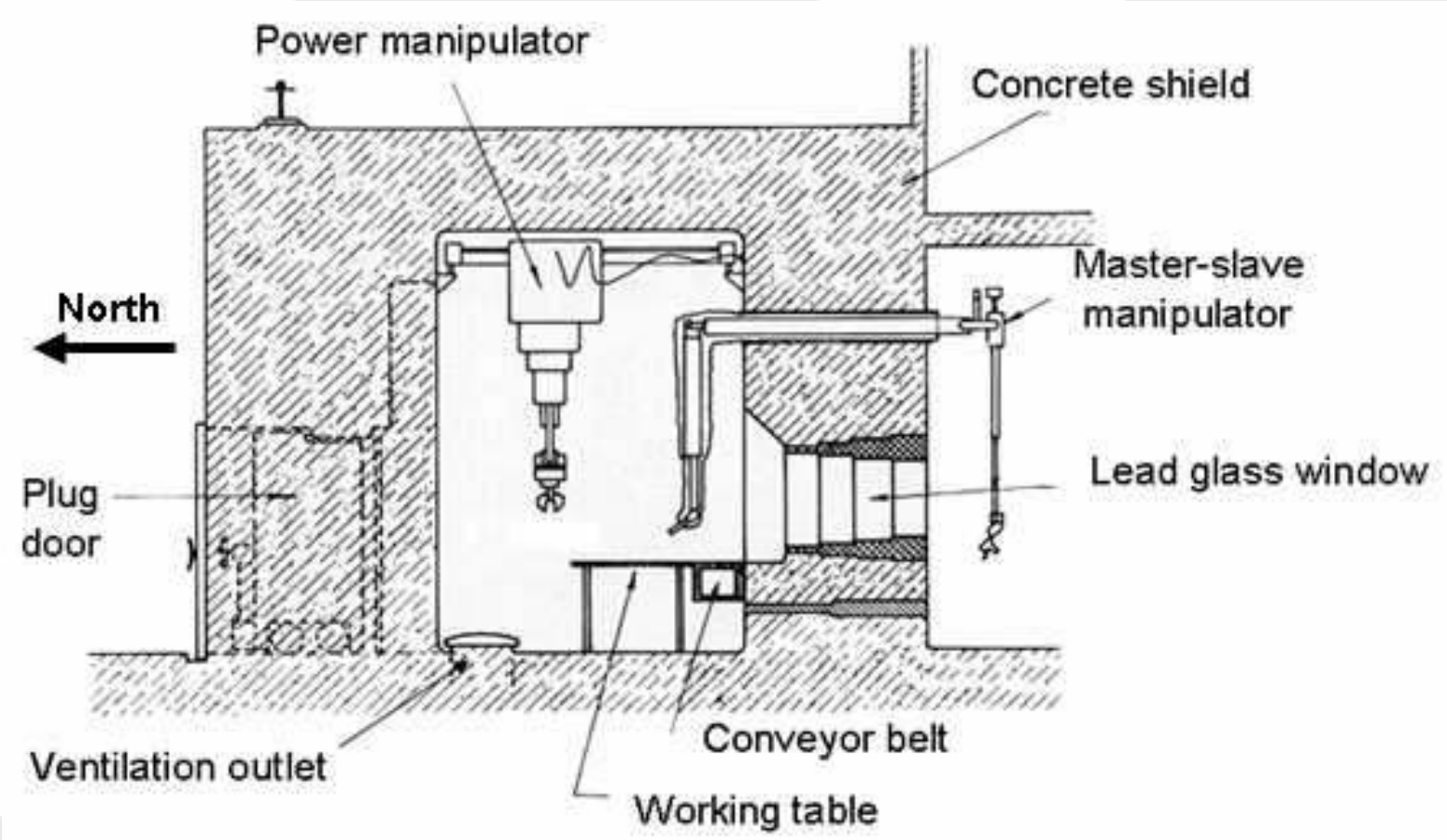
- Contamination with α- activity
- Limited space for decommissioning operations
- Access difficult
- Initial decontamination to be carried out remote controlled
- Risø-laboratories, offices and staff on all sides of DD's working area

DD's work areas – ground floor

Horizontal cross section of the row of concrete cells



Vertical cross section of a cell



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Plan for the Hot Cell project

- 2011: Preliminary decontamination by remotely controlled grit blasting, entering the blasting equipment through Ø260 mm penetrations from the cell front
- 2011: Entry into the cells
- 2011-12: Finishing the decontamination of the cells by manual means
- 2012: Clearance measurements
- 2012: Removal of temporary airlock
- 2012: Return of the building to Risø National Laboratory

Waste Management Plant

Waste Management Plant

- Treatment and storage of low and intermediate level radioactive waste.
- Handling and storage of radioactive waste from Danish users of radioisotopes (e.g. hospitals and laboratories).

Waste volumes

- Existing waste: ~ 3,000 m^3.
- Remains from experiments with uranium extractions: ~ 1,000 m^3.
- Estimated decommissioning waste: ~ 3,000 m^3.
- Waste from external sources: ~ 6-8 m^3 annually.


www.dekom.dk