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Estimations of costs for decommissioning of nuclear facilities and their relations to various features and processes

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The Swedish Radiation Safety Authority

- Finance
- RD&D programme review
- Radioactive waste management and disposal
- Radiation protection
- Nuclear facility operational safety
- Non-proliferation

- Research
- Review of plans & cost calculations for decom-missioning of nuclear facilities
- Review of plans and cost calculation for management and disposal of nuclear waste including spent nuclear fuel
- Analyses of level of fee required & proposal of fee to Government
- Disbursement

Full title

- Estimations of costs for
  - dismantling,
  - decommissioning and
  - associated waste management of nuclear facilities,
- and associated impact on
  - decision processes,
  - functioning of markets and
  - the distribution of responsibilities between generations

Nuclear legacy - negative value

Worldwide maybe on the order of	1 T€
Sweden total on the order of (including incurred costs)	10 G€
Decommissioning Swedish nuclear power plants	1,6 G€
Decommissioning facilities built before 1970*	0,2 G€

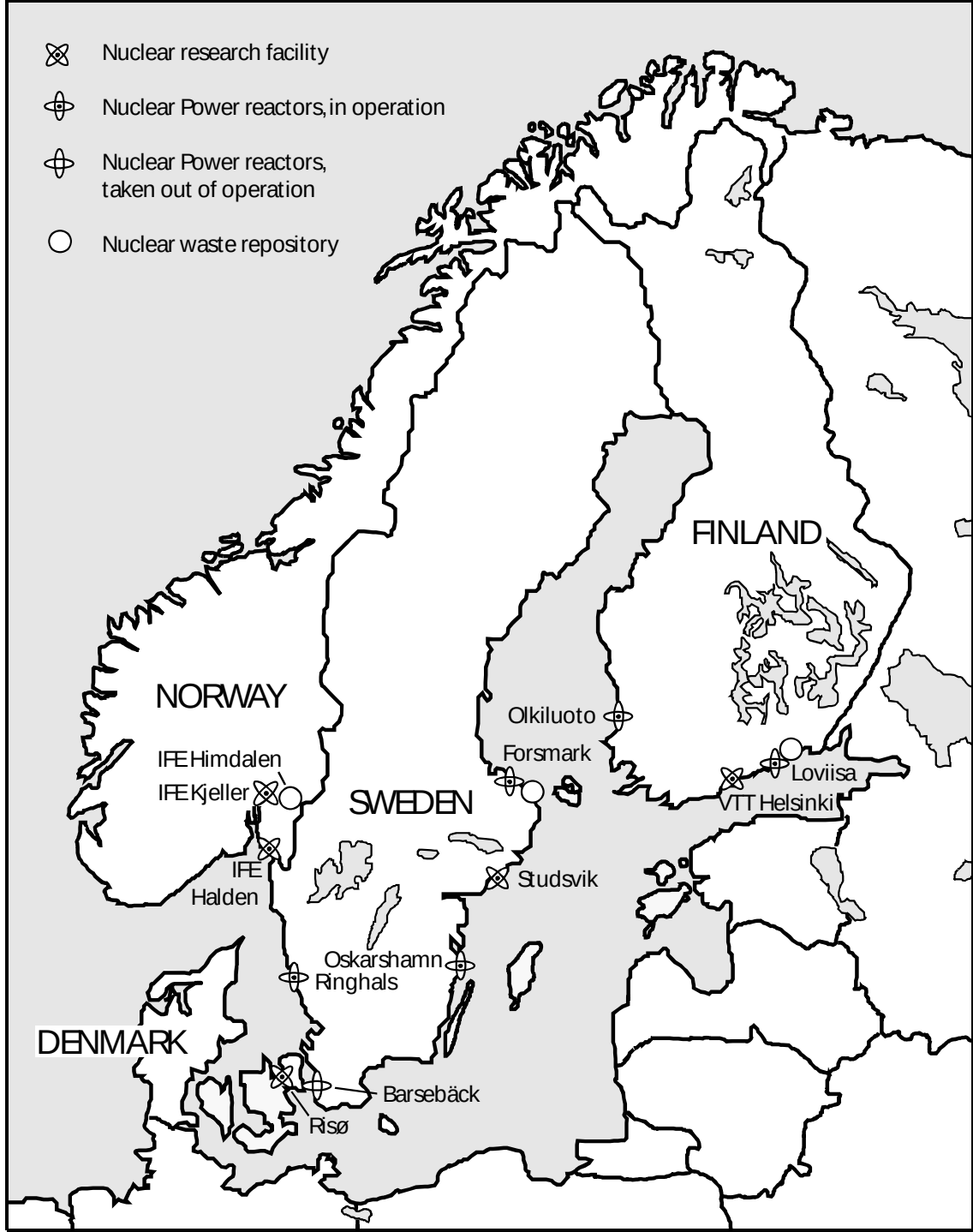
* Not designed for decommissioning, costs difficult to assess

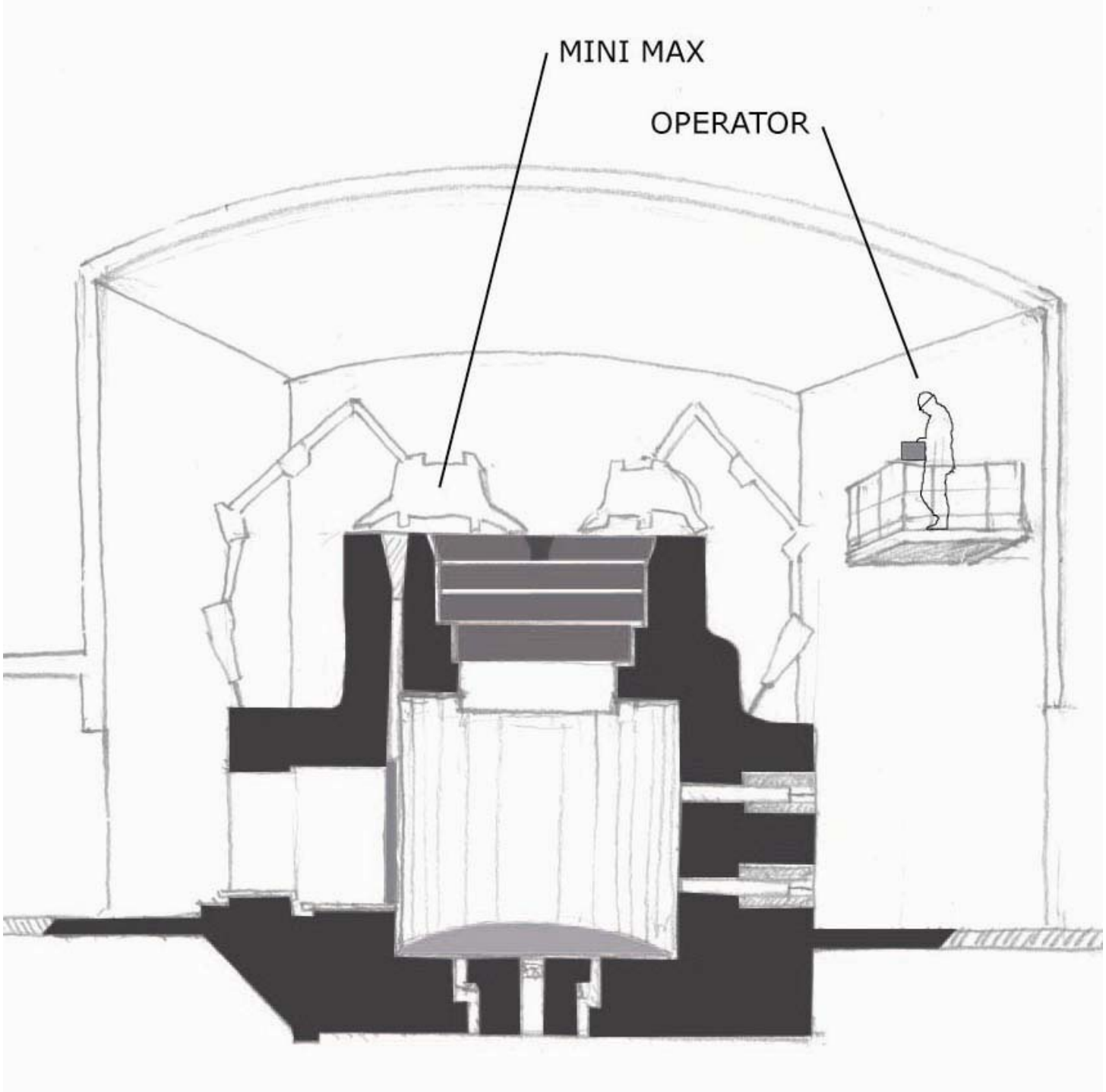
Origin of Swedish nuclear legacy -
Swedish nuclear technology development

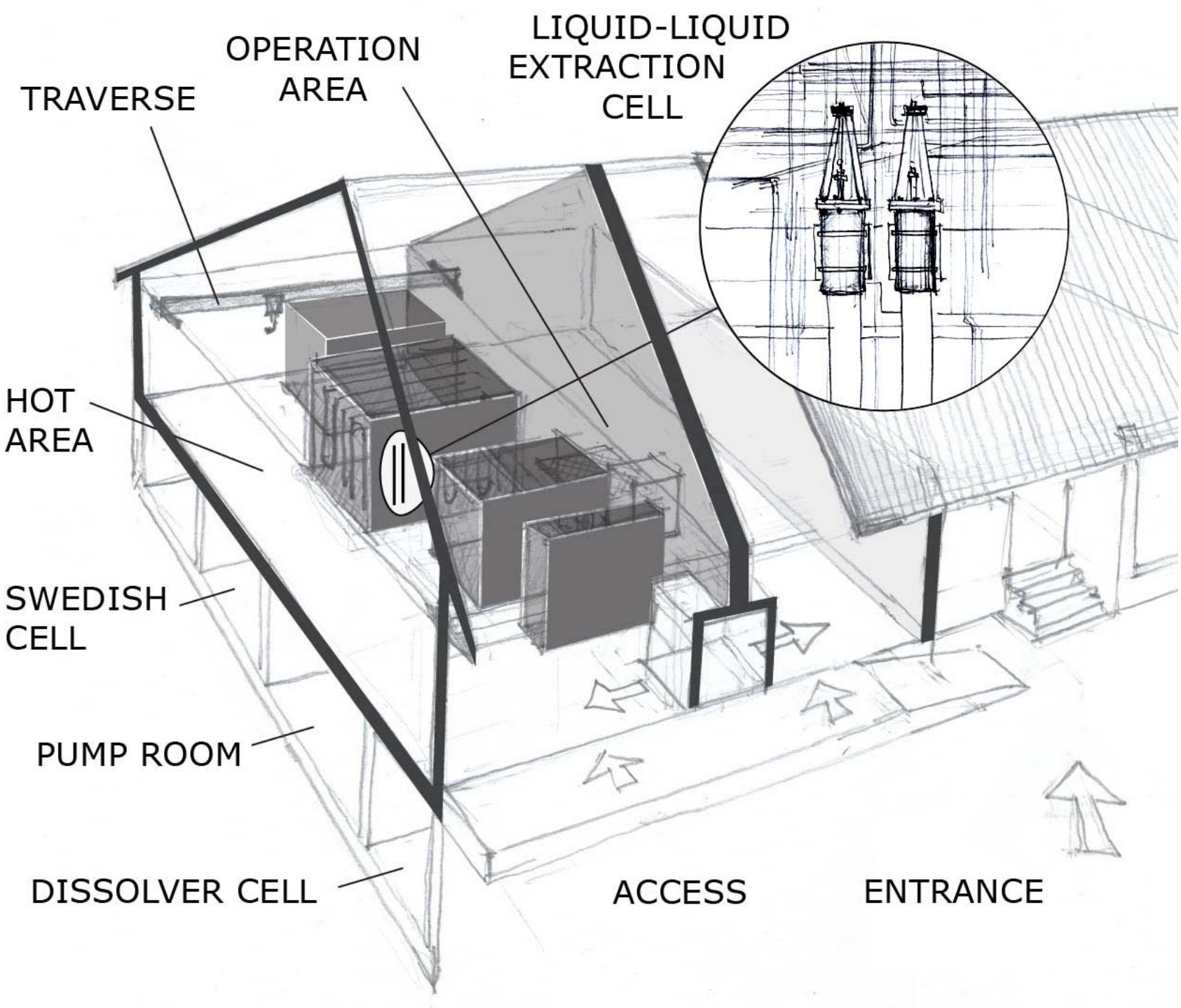
1950'ies - 1973	Development and operation of heavy water reactors and possibility to use natural uranium
1972 - 1985 - - present	Commissioning of modern light water reactors. 10 of totally 12 still in operation. Most nuclear energy per inhabitant in the world.
1975 – present	Development of systems for the management of the nuclear waste

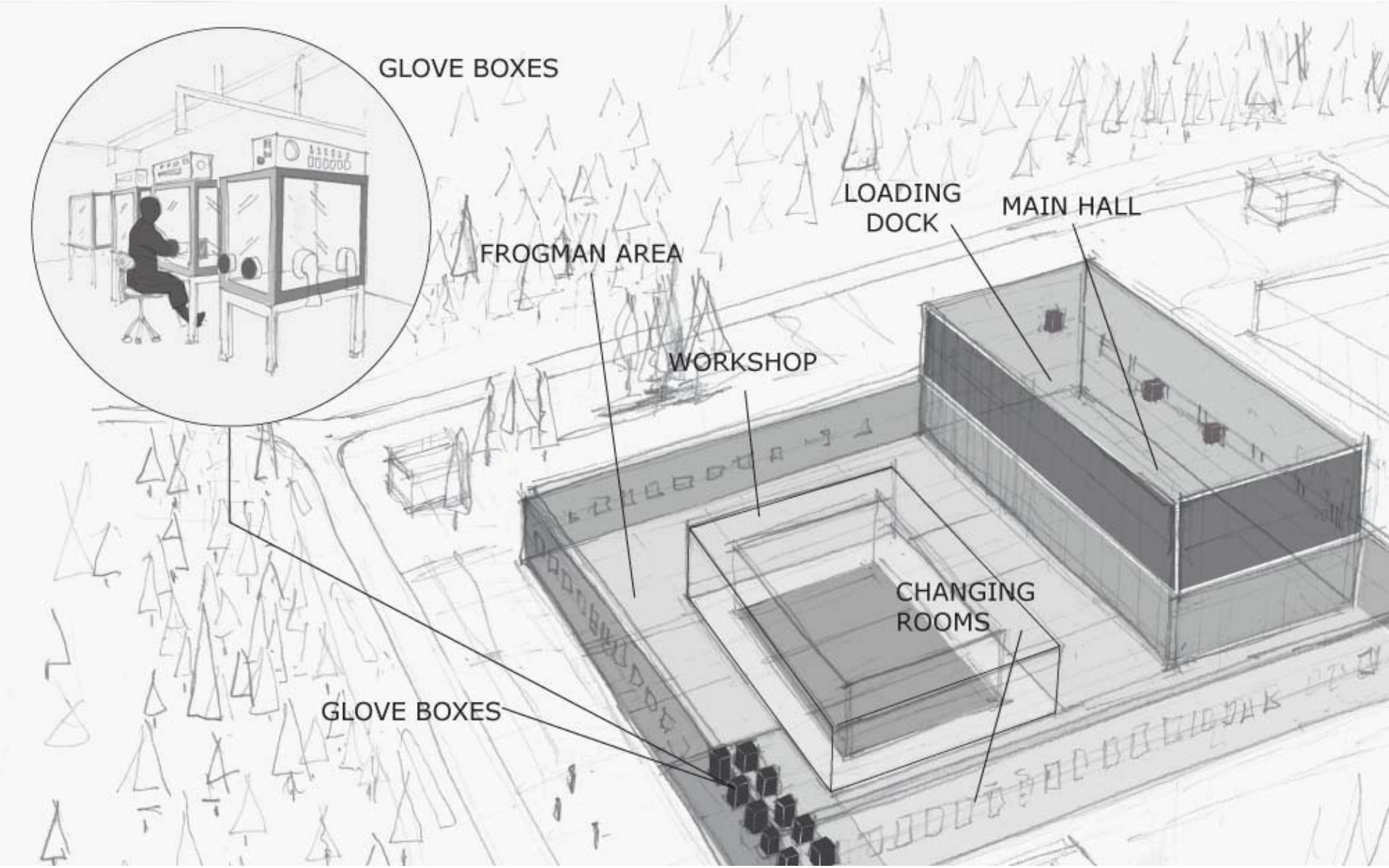
Old nuclear technology development facilities in the Nordic countries

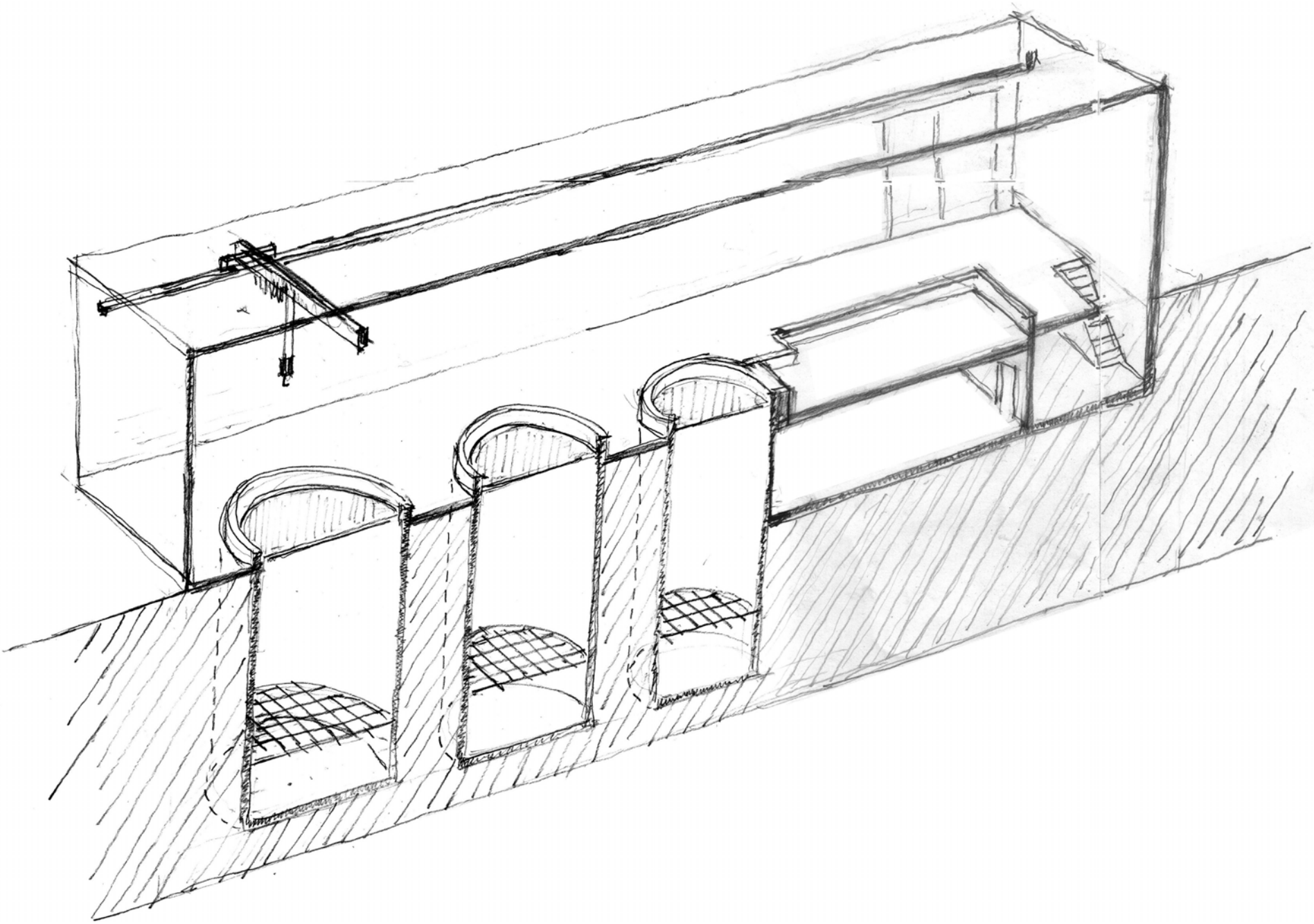
10 nuclear power plants in operation in Sweden, and 4 in Finland

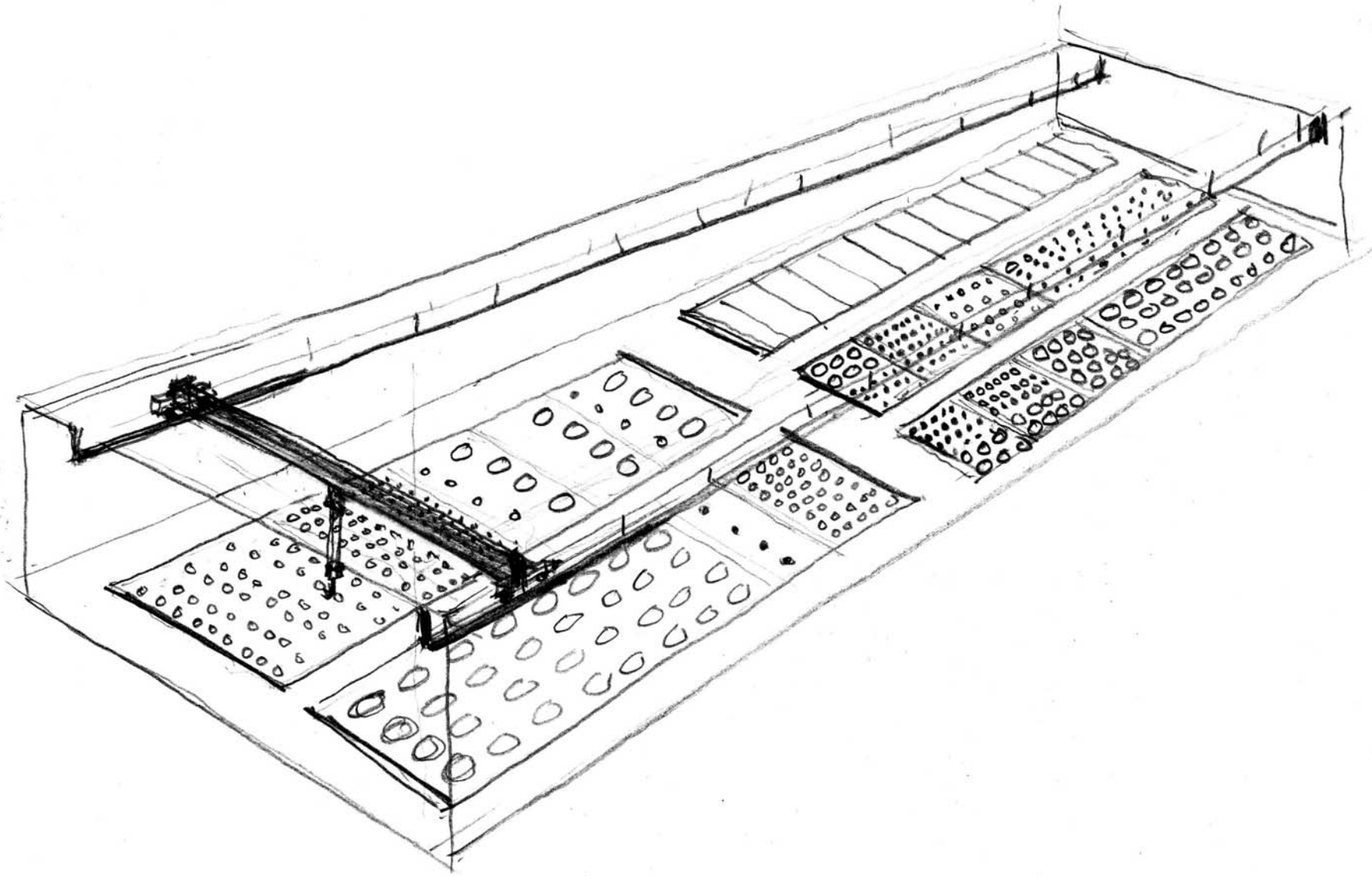



MINI MAX
OPERATOR


TRAVERSE
OPERATION AREA
LIQUID-LIQUID EXTRACTION CELL
HOT AREA
SWEDISH CELL
PUMP ROOM
DISSOLVER CELL
ACCESS
ENTRANCE


GLOVE BOXES
LOADING DOCK
MAIN HALL
FROGMAN AREA
WORKSHOP
CHANGING ROOMS
GLOVE BOXES





The Ågesta nuclear power plant in operation 1963-1973

Technical features of the problem

- Decommissioning not considered initially
- => spreading of radioactivity & difficulty to clean up
- Demanding undertaking to decommission, perhaps larger than the task of building
- Old nuclear development facilities very different from each other
- Plant and radiological ”archaeology”
- Previous unawareness of the problem

Financial, societal & ethical aspects

- Funding must be available at the time when it is needed
- Sufficient but not superfluous
- Polluter pays principle applies
- The polluter is the one reaping the benefits
- => no burden on future generations
- Green field conditions afterwards
- Clear link between the polluter and the restoration
- Need for harmonization
- Proper priority to liabilities

System of finance needed

- Funds controlled by the government
- Sufficient quality of the planning process
  - Dissimilar to that of construction
  - Quality of planning ⇔ quality of cost calculations
  - Costs ⇔ radiological situation & design & operation
- Sufficient robustness of a system of finance

Suitable approaches

- Multidisciplinary & heterogeneous groups, including
  - Special decommissioning competence
  - Combination of technical and financial competence
  - Not dictatorship of majority (e g nuclear engineers)
- Cost calculation methodology
  - Not sufficient with materials, volumes & prices
  - Radiology decisive
  - Difficulty & risk also usually decisive – especially for old nuclear technology development facilities
  - Comparison with projects completed & their incurred costs essential

Important steps for cost estimates

- A radiological survey tailored especially to meet the needs for cost calculations. Such a survey may include e g core sampling from a biological shield.
- Sampling design, including use of equipment for measuring
- Methodology selection based on the radiological survey. The selection should include alternative methodologies in case new information is appearing during the work
- Identification of potential cost risers as well as evaluation of the most important ones.

Cost raisers & lessons learned

- Much of deviance estimate – outcome ⇔ cost raisers
  - Positive with good examples – gladly published
  - But necessary to share lessons learned – networking
  - Nordic collaboration example of networking
  - => 15 % precision attainable even for old nuclear technology development facilities

On credibility

- There exists suitable methodologies for cost calculations
- There exists demands from society e g IFRS & IAS
- Essential that estimates and requirements have error margins
- And that they reasonably agree
- Otherwise case for deviance, disappointment and loss of confidence

Essential features and goals

- Better estimates at an early stage of the expected live span of each individual site
- Better financial systems where funds are pin-pointed for each facility/site.
- Clearer and non-ambiguous rules for free release and alternative use of land
- Robust cost calculations such that any myopia of the present generation cannot give rise to any costs to the future generations.
- Development of methodologies for evaluation of environmental liabilities (including descriptions, demonstrations and calculations) in European Union and other international co-operation.

Amphitheatre at the ancient Roman town **Italica** outside Sevilla

We deal with the past in order better to shape the future

FEEDBACK WANTED!