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## Radiological, technical and financial planning for decommissioning of small nuclear facilities in Sweden

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*and*  
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Swedish Radiation  
Safety Authority



**New ordinance in Sweden  
on November 1st, 2008  
that extends the implementation of  
nuclear liability to all nuclear facilities  
and companies, regardless of size**

**Ordinance on financial action for the management of  
residues from nuclear technology activities.**

(Förordning om finansiella åtgärder för hanteringen av  
restprodukter från kärnteknisk verksamhet, in Swedish).

**SFS 2008:715**

**Responsible Competent Authority:  
*The Swedish Radiation Safety Authority - SSM***

# New feature:

## Covers the entire area of nuclear technology

- concerns also small facilities and sites and
- all sizes of enterprises including small businesses

# The Swedish legal system

	<b>Law</b>	<b>Ordinance</b>	<b>Regulation</b>
<b>People of Sweden</b>	Authorisation		
<b>Parliament</b>	Issuing	Authorisation	
<b>Government</b>	Compliance	Issuing	Authorisation
<b>Competent Authority</b>	Compliance	Compliance	Issuing
<b>Everyone</b>	Compliance	Compliance	Compliance

# What is required of a legislation / regulation?

The Swedish constitution states the following:

- A regulation must contain
  - a reasonable balance between different interests, and
  - the benefits must be reasonable in comparison with the costs for compliance
- All must be dealt with in an equal manner.
- There must not be any contradictions with any other legislation
- There has to be
  - a follow-up of the outcome,
  - and adjustments made as appropriate from any lessons learned
- A regulation must be simple and clear

# Not legally binding documents

	<b>Competent Authority</b>	<b>Branch organisations e t c</b>
<b>General advice</b>	Clarify legislation + examples	
<b>Recommendations &amp; guidance documents</b>	Describe good practice and best knowledge	
<b>Standards</b>	Seldom	Often by special institutions

The new ordinance contains authorization from the Government to the SSM to issue regulation as warranted and appropriate for the implementation.

The purpose of the present work is to compile the knowledge base required for such a regulation

# The structure of this presentation

1. Technical prerequisites for precise cost calculations
  1. Issues of interest
  2. Examples
2. Non-technical prerequisites
3. Nuclear technology legislation
4. The Swedish Environmental Code
5. Financial reporting legislation
6. Criminal law and legal consequences
7. Main conclusions



# 1. Technical prerequisites for precise cost calculations

Issues of interest

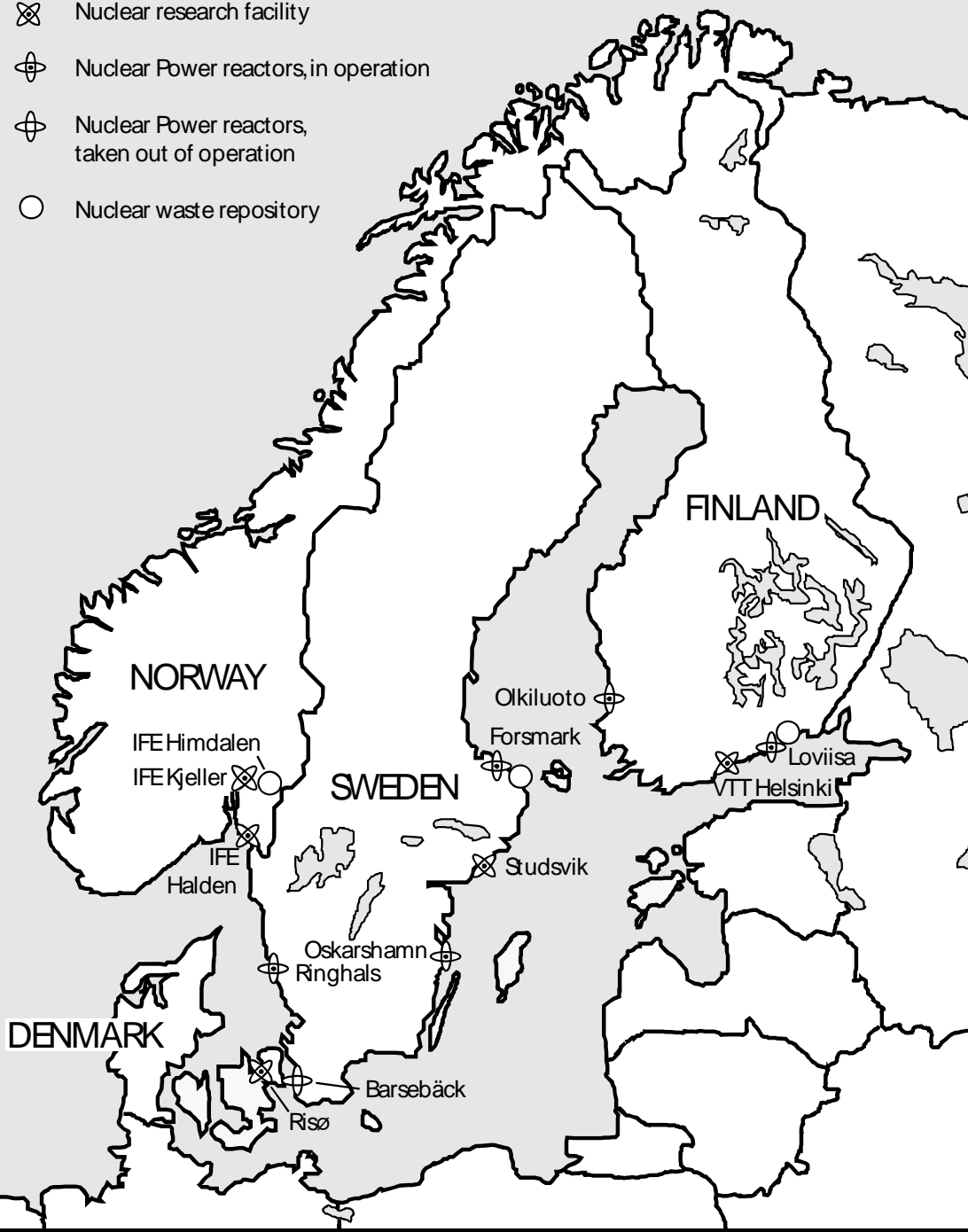
Past experience: it has proven notoriously difficult to obtain reliable and precise cost estimates –  
- especially true for research facilities.

- Plans for decommissioning may not exist
- The facilities were not designed for decommissioning
- The facilities are small (which means that investigations can become expensive in relation to the total cost)
- The facilities are very different in character
- The types of contamination are different
- The buildings were constructed and operated at a time when the regulations were considerably less strict than today
- Incomplete documentation of the operation history, particularly accidents and incidents causing contamination
- Institutional memory has been lost and people who are able to recall what took place may not be around any more

# Standards and recommendations to help

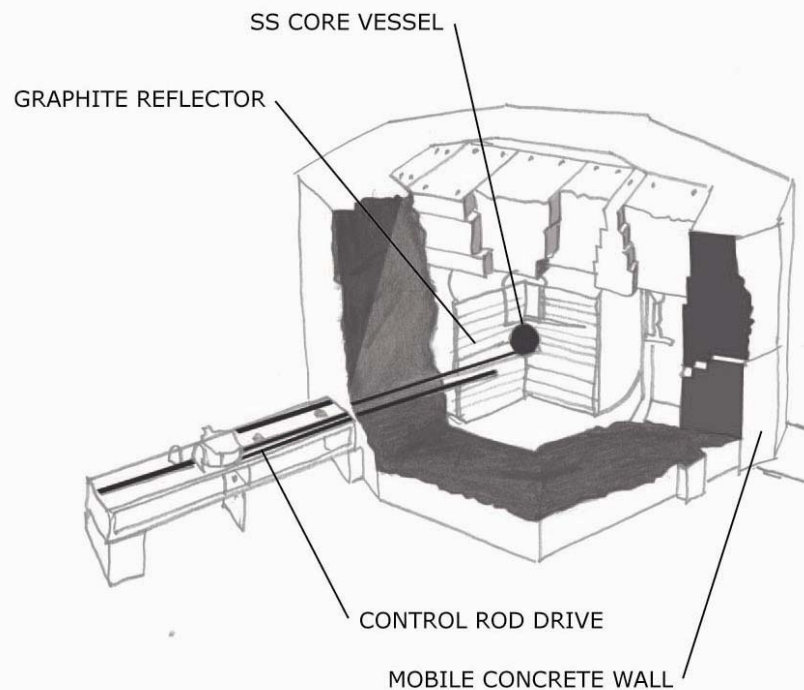
- *Decommissioning of nuclear power plants and research reactors.* Safety Guide. IAEA safety standard series No WS-G.2.1.6
- *Decommissioning of Nuclear fuel cycle facilities.* Safety Guide. IAEA safety standard series No WS-G.2.4.7
- *Decommissioning of medical, industrial and research facilities.* Safety Guide. IAEA safety standard series No WS-G.2.2.8
- *Decommissioning Nuclear Power Plants: Policies, Strategies and Costs.* Nuclear Energy Agency, Organization for Economic Co-operation and development, OECD / NEA, 2003.
- European Union Recommendation “*on the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste*”. Brussels, 24 October 2006. C(2006)3672.
- *Standard Guide for Nuclear Facility Decommissioning Plans.* ASTM standard E1281 89 (2005).
- *Decommissioning Handbook. Procedures and practices for decommissioning.* Office of Environmental Management. U.S. Department of Energy, Washington, D.C. 20585, USA. DOE/EM-0383, January 2000.

- ⊗ Nuclear research facility
- ⊕ Nuclear Power reactors, in operation
- ⊖ Nuclear Power reactors, taken out of operation
- Nuclear waste repository



Co-operation  
between the  
Nordic countries  
on planning for  
decommissioning

Financed by  
Participants  
and  
Nordic Nuclear  
Safety Research

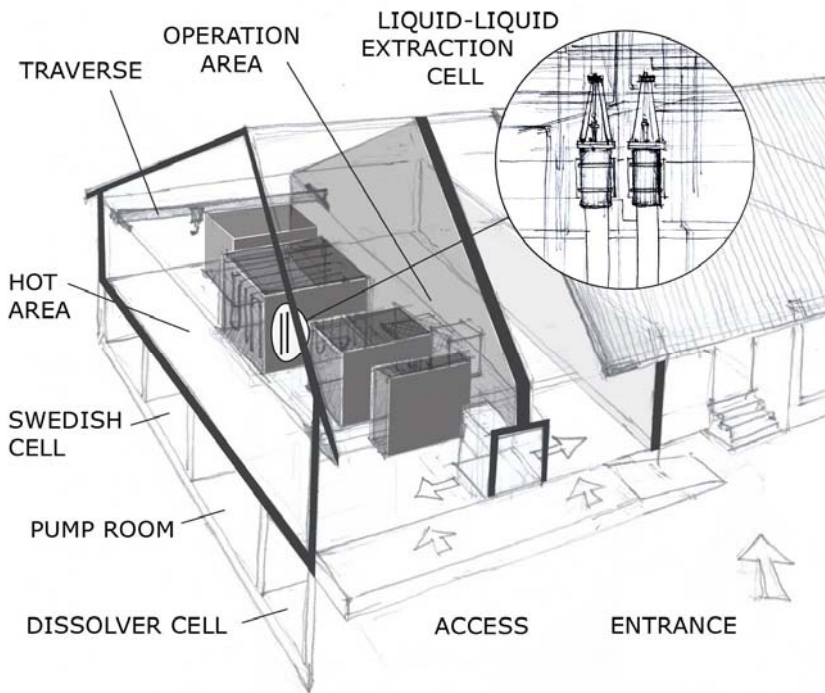
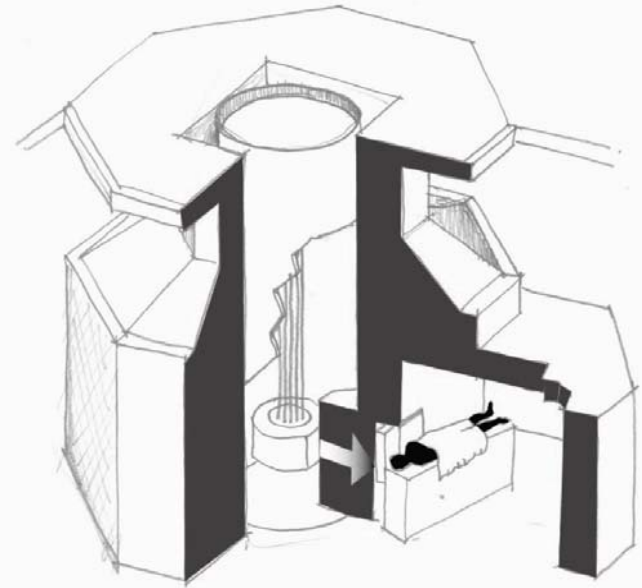


Reactor  
DR-1  
Denmark

<=

=>

TRIGA  
reactor  
Finland

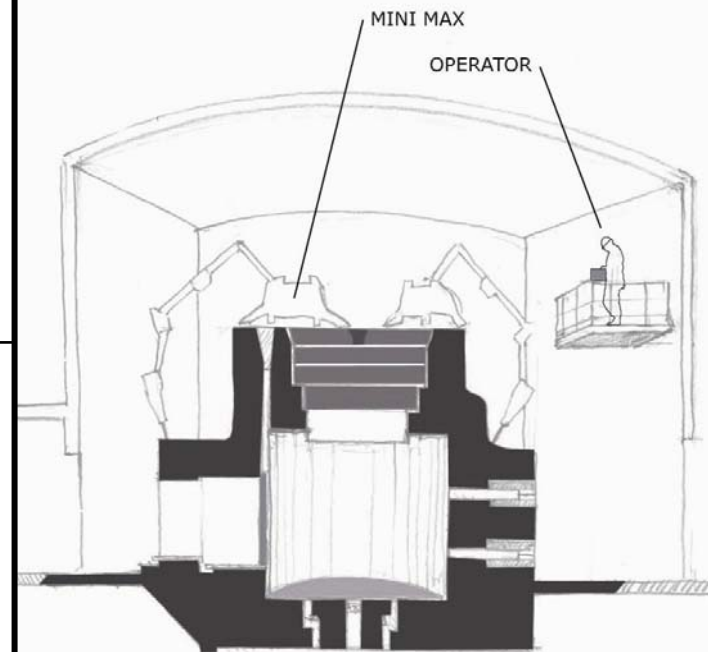


Uranium re-  
processing  
pilot plant  
Norway

<=

=>

R1 reactor  
Sweden



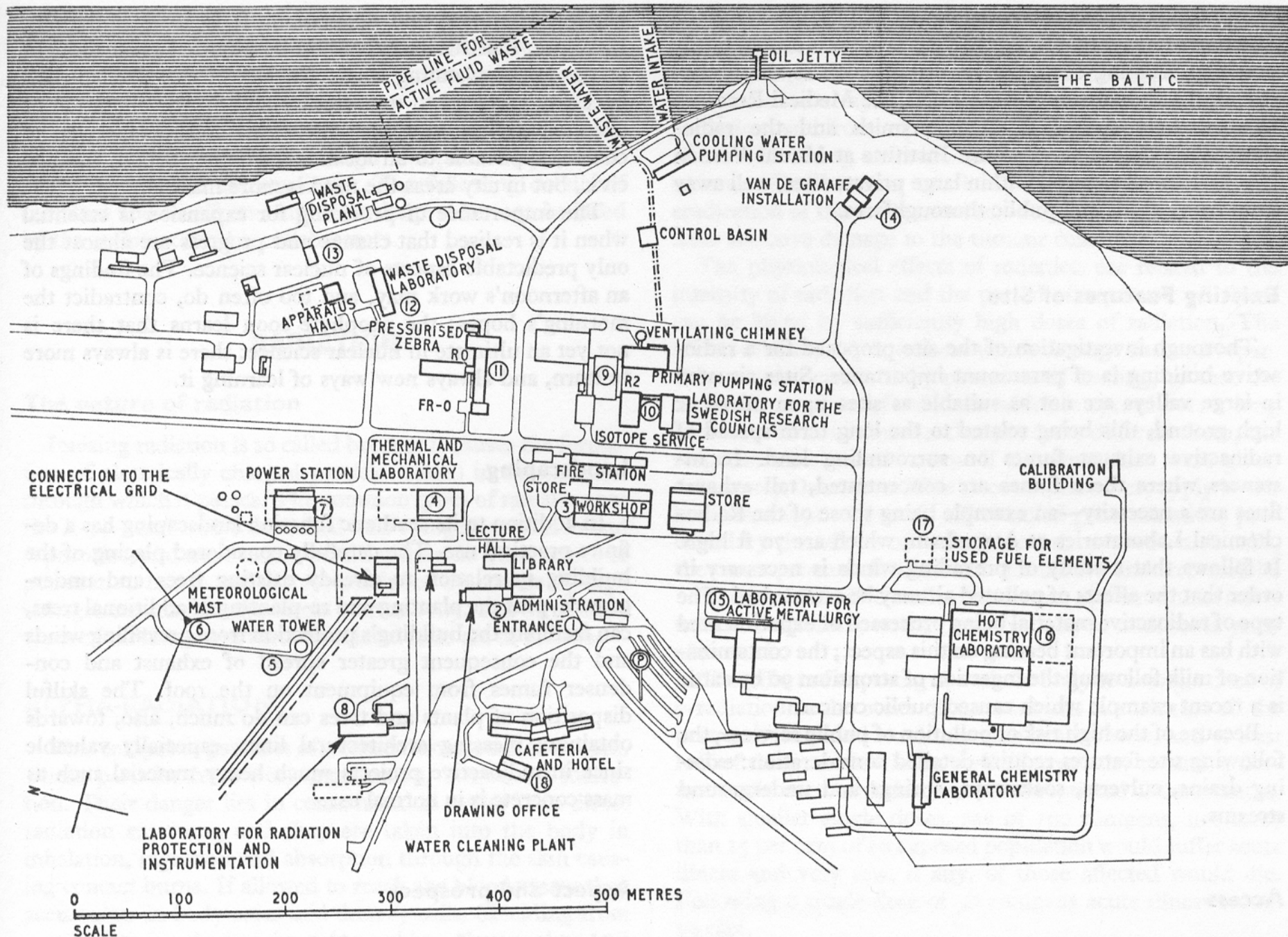
# Conclusions from Nordic work

It was found that adequate planning and reasonably reliable cost estimates can be obtained if the following is used as a basis:

- Radiological surveying
- Technical planning and methodology selection
- Financial risk identification and evaluation

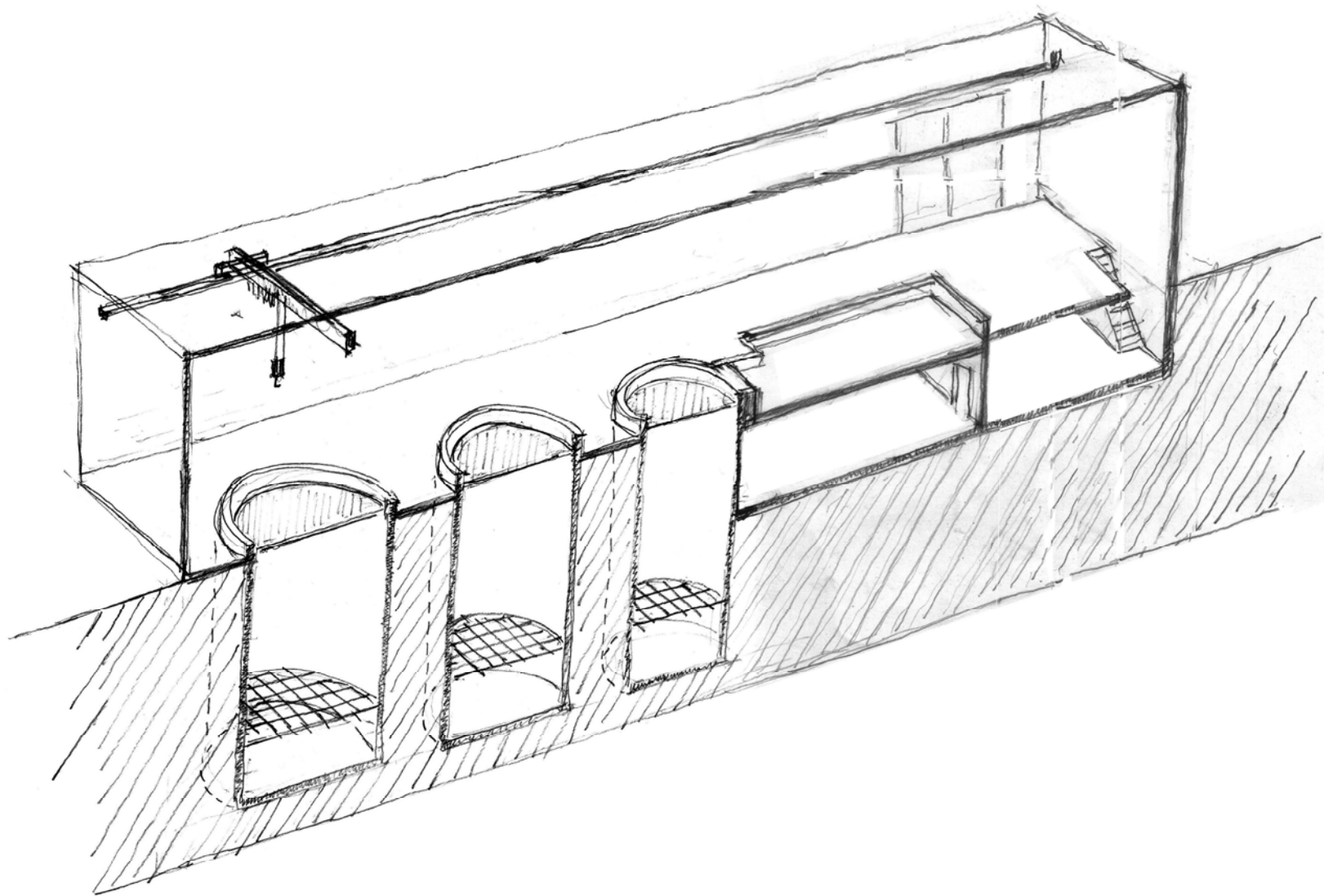
# 1. Technical prerequisites for precise cost calculations

Examples

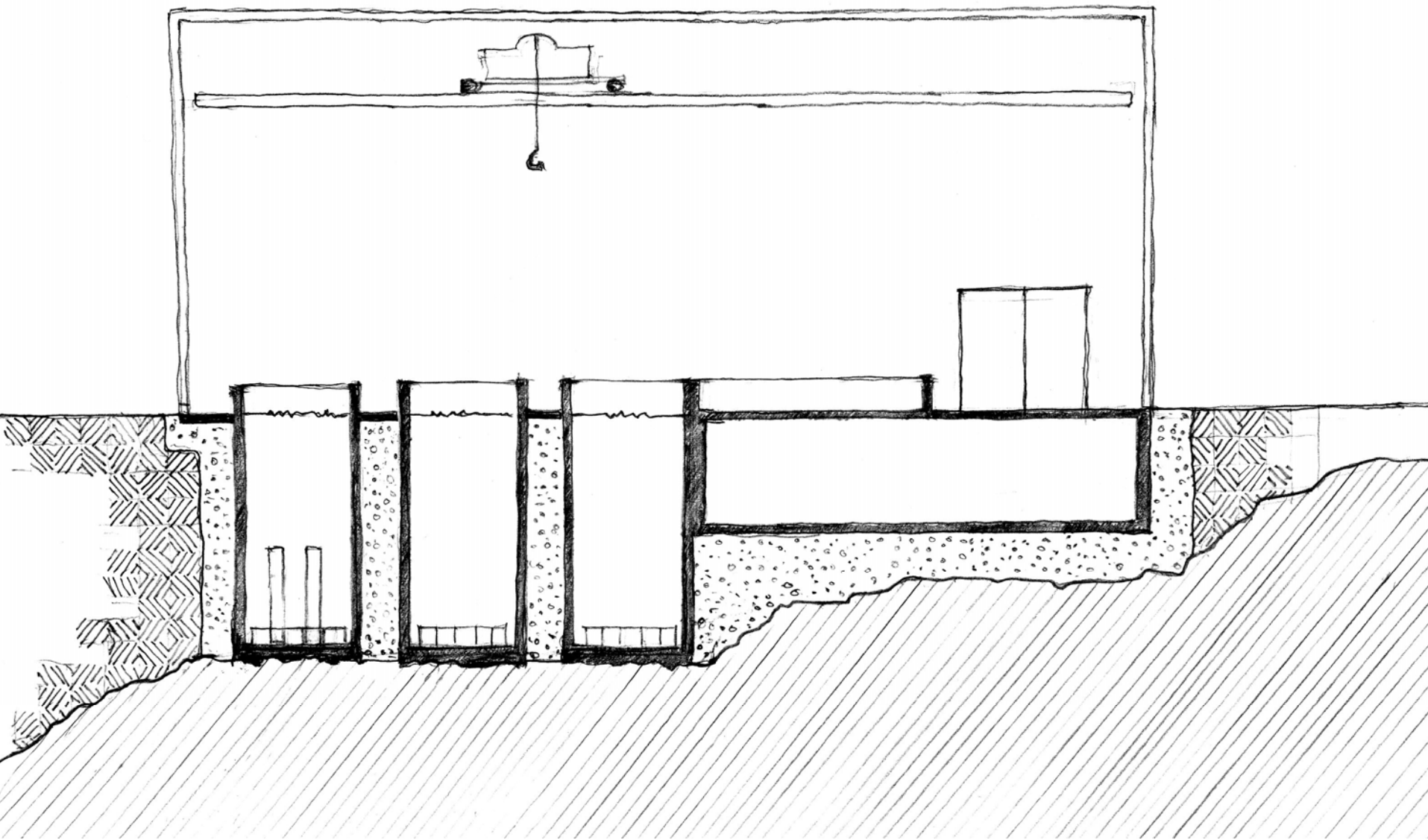


Site layout of the Atomic Energy Company Research Establishment, Studsvik, Sweden





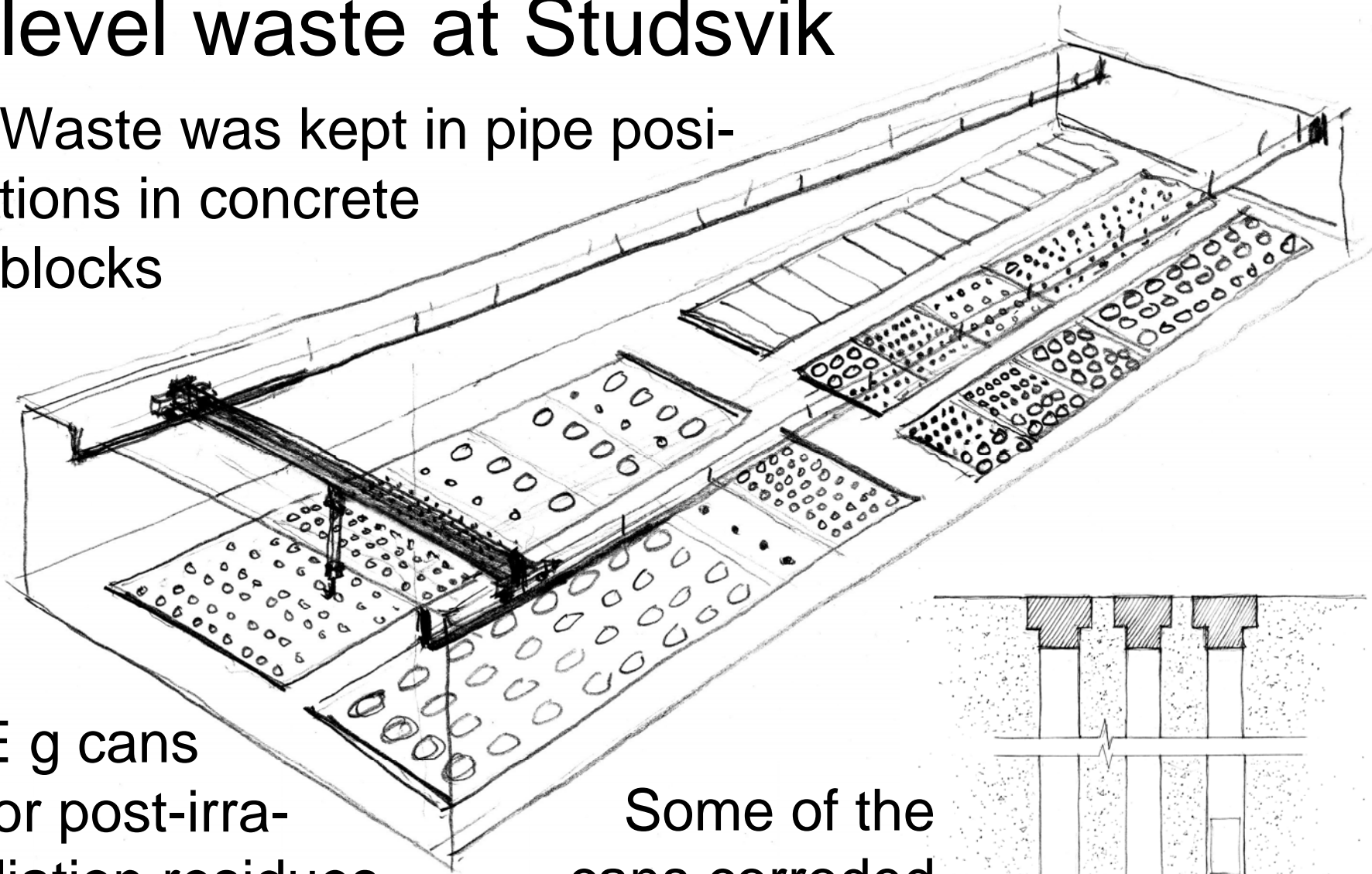
Spent fuel store at Studsvik



Only single containment

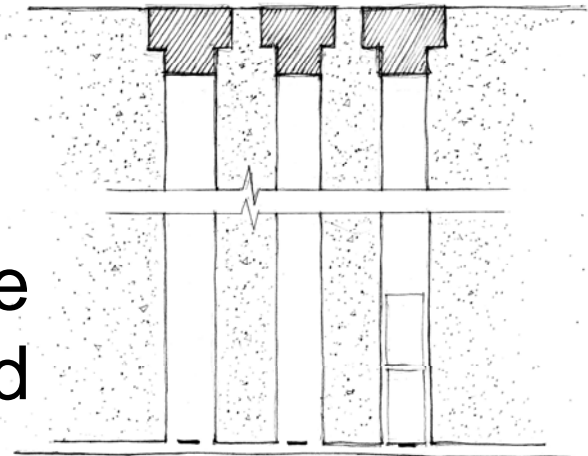
# Storage for old intermediate level waste at Studsvik

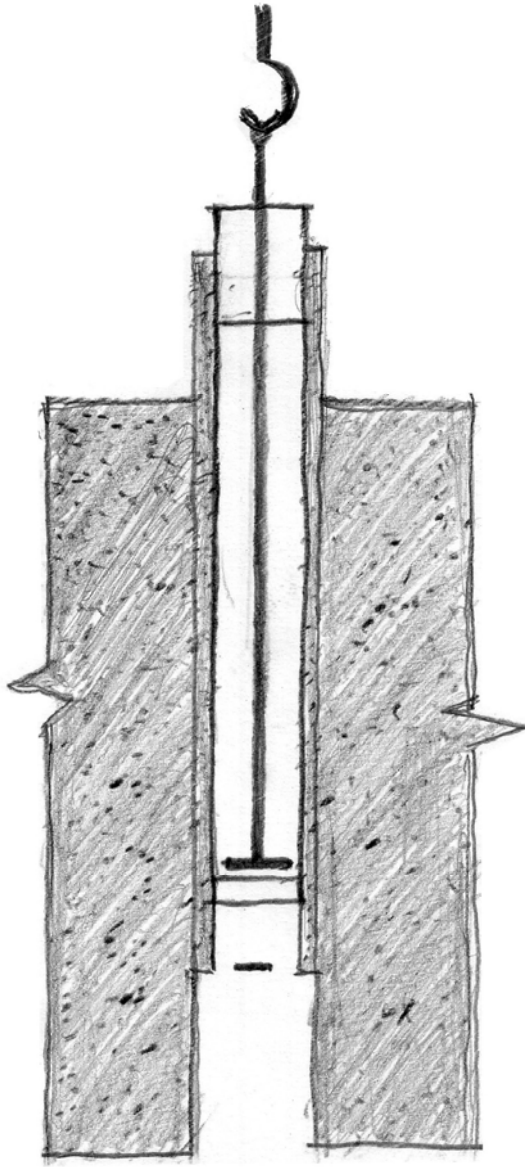
Waste was kept in pipe positions in concrete blocks



E g cans  
for post-irra-  
diation residues

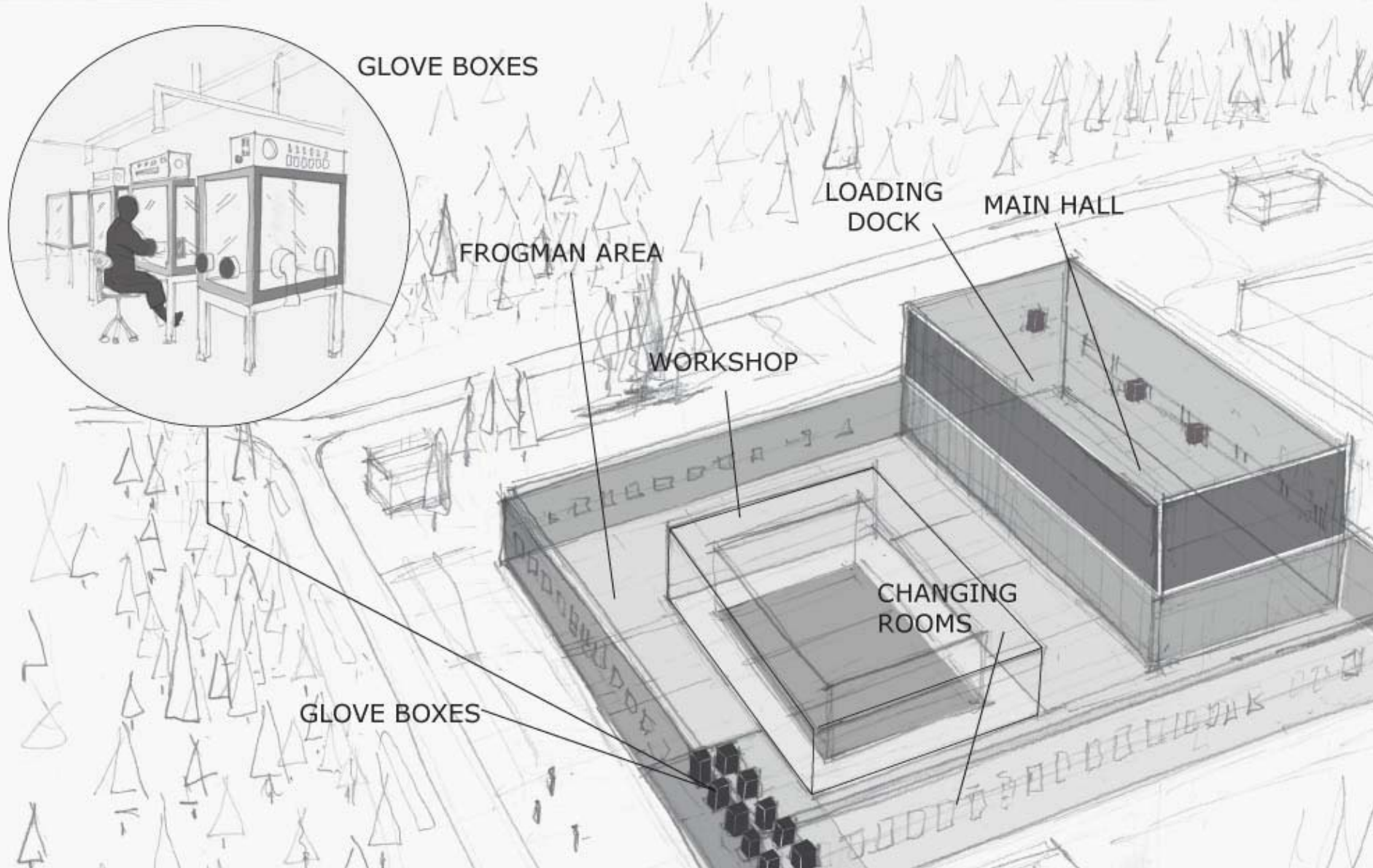
Some of the  
cans corroded





# Present plan to remove pipes by overcoring

- Possibility of contamination through leakage of drill fluid through voids in the concrete
- Experience available from a similar project on the map tube facility in the 317 area at *Argonne National Laboratory*



Active Central Laboratories (ACL) at Studsvik. Used for re-processing and mixed oxide fuel development. Now green field.

# Experiences from ACL

- The experiences
  - High alpha to gamma ratios – cumbersome to measure
  - Unexpected variations in contamination levels
- Strategy supported by the experiences made:
  - Careful planning
  - Preparedness for replanning

## 2. Non-technical prerequisites

# Long-term perspective of higher management

- Duty of the higher management in a company to plan for the long term, > 5 years
- But median time in office of higher managers < 5 years
  - => temptation to focus on quarterly reports
  - => uphill battle to pay adequate attention to long-term environmental liabilities



### 3. Nuclear technology legislation

# The Swedish Nuclear legislation

- *Act on Nuclear Activities.* (In Swedish: Lag om kärnteknisk verksamhet). SFS 1984:3.
- *Radiation Protection Act.* (In Swedish: Strålskyddslag). SFS 1988:220.
- *Nuclear Liability Act.* (In Swedish: Lag om finansiella åtgärder för hanteringen av restprodukter från kärnteknisk verksamhet). SFS 2006:647.
- Oversight by the Swedish Radiation Safety Authority - SSM

# Act on Nuclear Activities

- Applies to facilities with
  - chain reactions and related
  - material that is fissile or can be activated to become fissile
- De minimis levels apply for permitting
- Permit =>
  - obligation to manage waste
  - financial responsibility  
(in accordance with the Nuclear Liability Act)

# Nuclear Liability Act

- Two compartments for securities and fees:
  - 1) the anticipated costs for decommissioning and waste management
  - 2) a risk fee intended to cover the risk that the Government takes in its management of the fund system
- Total liability = securities + accumulated fees
- Fees are paid into segregated funds
- Securities are lifted at the same rate as that of the payment of the fees
- Securities are unlimited in time

# Role of SSM in finance

- Operational
  - to review recurrent plans and cost calculations
  - propose the level of the fee to be paid to the Government
- Proactive
  - Research to compile a knowledge base for decommissioning planning and cost calculations
  - Issuing of ordinances and "general advice"

# **EUROPEAN UNION RECOMMENDATION**

## ***on the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste***

**Brussels, 24 October 2006. C(2006)3672**

- *a segregated fund with appropriate controls on use is the preferred option for all nuclear installations*
- *a clear recommendation to this effect is made for new installations*
- *as regards the estimation of decommissioning costs, ... the Commission recommends a prudent calculation of costs based on appropriate risk management criteria and external supervision*
- *experience shows that exchange of information between national experts concerning the various approaches to and financial arrangements for decommissioning and waste management is an excellent way of facilitating a common response to safety challenges*

## 4. The Swedish Environmental Code

**Förbud om Swedjande uti Bergslagerne; samt om theras belöning, som sådant tilkänna gifwa. Dat. Grehro then 19 Martii 1639.**

**W**i Christina ic. Gøre witterligit, at efter som Wi hafwe fattat och nu nyligen af trycket låtit utgå och publicera et Placat, ther med Wi alswar-och strengeligen biude alle Wåre Undersåtare, som boendes äro i Bergslagen, efter thenna dag at hålla inne med alt swediefäl-lande och skadeligit skogsbruk, efter som Wåre Bergsbruk ther af i längden för mangel på skog och wed, stor och märkelig skada tagandes warda; oansedt Wi wåre Lands-höfdingar och Befalningsmän hafwa befallat, här öfwer noga inseende hafwa, och tilbörligen låta straffa them, som the befinna at fördrifta sig emot Wårt Mandat at handla och brnta; likwäl på thet at Wår alswarlike wilje theste flitigare må blifwa efterkommen, wele Wi uti thetta Wårt öpne bref alle Wåre trogne Undersåtare uti bemålte Bergslager förmanne hafwa, at ther the förnimma någon emot Wårt Förbud at handla, the sådant Wåre Landshöfdingar, Befalningsmän och Länsmän tilkänna gifwa. Och wele Wi nådigst unna och efterlåta honom, som någon ther med beslår och thet uptäcker, at han then tredie penning af the böter ther falla kunna, skal bekomma. Här alle och hwar och en i synnerhet hafwe sig fulkomligen at efterrätta. Til yttermera wiiso ic. Datum ut supra.

(L. S.)

Gabriel Oxenstierna.	Clas Horn.	Carl Gyldenhielm.
Gustaffson / S. R. Droget.	i R. Marst. ställe.	S. R. Ammiral.
Axel Oxenstierna.	Gabriel Oxenstierna.	
S. R. Cansler.	S. R. Skatmästare.	

# First Swedish environmental legislation?

Ban on burn-beating by the penalty of banishment.

Queen Kristina,  
March 18th 1639.



# Polluter pays principle in the present *Swedish Environmental Code*

- *“Persons who pursue or have pursued an activity or taken a measure that causes damage or detriment to the environment shall be responsible, until such time as the damage or detriment ceases”*
- Corollary 1: Funds must be available at the time when they are needed ⇔
  - Corollary 2: adequate planning required for assessment of long-term liabilities
  - Corollary 3: financial resources must be secured at the time when benefits are ripened

# Polluter pays principle

- Minted by OECD in 1972
- Policy by European Union in 1973
- Included in Swedish Legislation since 1961
- Details on implementation and oversight varies between different areas, e g
  - Securities to cover costs for final covers of landfills
  - Various legislation for producer's responsibility  
(including producers of radiation sources)

## 5. Financial reporting legislation

2008

# International Financial Reporting Standards (IFRSs®)

including International Accounting Standards (IASs®)  
and Interpretations as approved at 1 January 2008

# IFRS



**IFRS** *International Financial Reporting Standards*  
**IAS** *International Accounting Standards*

- Stringent requirements on assessing and securing assets for liabilities (financial accruals)
- Precise calculations are to be presented each year
- In case estimation is difficult, various scenarios should be considered and a weighed average presented

# Swedish legislation and general advice on financial reporting

- Accounting Act. (In Swedish: Bokföringslag). SFS 1999:1078
- Annual Reports Act. (In Swedish: Årsredovisningslag). SFS 1995:1554
- The Swedish Companies Act. (In Swedish: Aktiebolagslagen). SFS 2005:551.
- Bokföringsnämndens allmänna råd om årsredovisning i mindre aktiebolag. (General advice on annual reporting in small companies issued by the Swedish Accounting Standards Board, In Swedish).

# Different for small and large companies

- Large companies are obligated to follow the *International Financial Reporting Standards and International Accounting Standards* (IFRS/IAS)
- Small companies are obligated to follow the general advice issued by *Swedish Accounting Standards Board* (in Swedish: Bokföringsnämnden, BFN)

# Comparison

- Both have strict requirements on how liabilities are to be specified
- IFRS/IAS provides relatively detailed instructions on how to evaluate liability
- The general advice provides little guidance, but
  - prohibits comparison with IFRS/IAS, and also
  - prohibits that internal costs for research and development be distributed over time

# Potential conflict with financial rules

- Financial rules (general advice) for small companies prohibit distribution over time of R & D costs
- Considerable R & D work may be warranted early in the process
- Could lead to unjustified taxation & cash flow problems



## 6. Criminal law and legal consequences

# *The Swedish Penal Code*

(In Swedish: Brottsbalk)

SFS 1962:700

- Same for all
- Harsher punishments than under other laws (maximum 6 years in prison)
- Higher requirements on proof and intent
- Penalty when deviation from  
*"essentially correct financial situation"*
- Elofsson method:  
maximum deviance tolerated 30 %

# Penal law, detection

- Auditors typically analyse even in minor details
- Environmental liabilities might escape detection  $\leq$  requires substantial insight and technical knowledge
- Possibility of late discoveries of large deviances (and associated risk of harsh punishments)
- Implications:
  - Document as early as possible
  - Plan and estimate costs according to state of the art (e g ASTM standard)

# Penal law, uncertainties

- Frequently observed that costs estimated increase with time
- Not a good situation with regard to e g criminal law
- (But overestimation might lead to problems with the tax laws)
- Imperative to make cautious estimates upfront, including identification of uncertainties
- Important that planning be properly documented

## 7. Main conclusions

# What facilities should be included under the new ordinance?

- *Act on Nuclear Activities and Radiation Protection Act* have de minimis levels based on activity content
- Not applicable to environmental liabilities  
≤ in general: environmental liabilities are not related to activity content in any simple manner
- Decommissioning planning and associated cost calculations provide good basis
- Reasonable ≤ the requirement already exists in financial legislation

# Possible alternatives for securing financing

- *Exemption*
- Securities
  - Limited in time
  - *Unlimited in time*
- (Insurance)
- Funds
  - Internal
  - *Segregated*

# Exemption

- Complications will arise if system of finance harsher than other requirements
- Small companies need not declare environmental liabilities under kSEK 25 (about k€ 2,4 and k\$ 3,4)
- A similar limit exists in the tax domain  
=> liabilities below at least kSEK 25 (or similar) should be exempted



# Boundary between [time unlimited] securities and [segregated] funds

- No feature was found to support any particular level of boundary
- There is a certain amount of administration associated with a fund => level not too low.
- A segregated fund is a more robust alternative than securities => level not too high
- Perhaps MSEK 1,00 (about k€ 96 and k\$ 135) is a reasonable compromise
- For short term liabilities, securities should suffice (provided that the business in question is financially sound)

# What to do with existing facilities?

- Ordinarily, money is collected during the useful lifetime
- For older facilities it might appear reasonable to implement liability over time
- Not compatible with financial legislation
- However, possible to start with securities and gradually collect money in segregated funds

# Final comment

- The *Polluter Pays Principle* is included in policy and legislation in many countries
- Substantial efforts are often required in order to comply in practice
- Compliance is essential for
  - Protection of man and the environment
  - Earned and deserved good reputation of the nuclear community