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

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and
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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

<table>
<thead>
<tr>
<th></th>
<th>Law</th>
<th>Ordinance</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>People of Sweden</strong></td>
<td>Authorisation</td>
<td></td>
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<tr>
<td><strong>Parliament</strong></td>
<td>Issuing</td>
<td>Authorisation</td>
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<tr>
<td><strong>Government</strong></td>
<td>Compliance</td>
<td>Issuing</td>
<td>Authorisation</td>
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<tr>
<td><strong>Competent Authority</strong></td>
<td>Compliance</td>
<td>Compliance</td>
<td>Issuing</td>
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<tr>
<td><strong>Everyone</strong></td>
<td>Compliance</td>
<td>Compliance</td>
<td>Compliance</td>
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</tbody>
</table>

- **Law** refers to Acts of Parliament.
- **Ordinance** refers to Decrees issued by the Government.
- **Regulation** refers to Orders issued by the Government.
- **Authorisation** refers to authorization granted by the Competent Authority.
- **Issuing** refers to the issuance of regulations or ordinances.
- **Compliance** refers to the adherence to the legal framework.
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

<table>
<thead>
<tr>
<th></th>
<th>Competent Authority</th>
<th>Branch organisations e t c</th>
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</thead>
<tbody>
<tr>
<td><strong>General advice</strong></td>
<td>Clarify legislation + examples</td>
<td></td>
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<tr>
<td><strong>Recommendations &amp; guidance documents</strong></td>
<td>Describe good practice and best knowledge</td>
<td></td>
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<tr>
<td><strong>Standards</strong></td>
<td>Seldom</td>
<td>Often by special institutions</td>
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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
Co-operation between the Nordic countries on planning for decommissioning

Financed by Participants and Nordic Nuclear Safety Research
<table>
<thead>
<tr>
<th>Reactor</th>
<th>Location</th>
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<tbody>
<tr>
<td>DR-1</td>
<td>Denmark</td>
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<tr>
<td>TRIGA reactor</td>
<td>Finland</td>
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<tr>
<td>Uranium re-</td>
<td>Norway</td>
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<tr>
<td>processing</td>
<td></td>
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<tr>
<td>pilot plant</td>
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<tr>
<td>R1 reactor</td>
<td>Sweden</td>
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</table>

**Diagram:**

- **SS Core Vessel**
- **Graphite Reflector**
- **Control Rod Drive**
- **Mobile Concrete Wall**
- **Operation Area**
- **Liquid-Liquid Extraction Cell**
- **Swedish Cell**
- **Pump Room**
- **Dissolver Cell**

**Images:**

- Reactor diagram
- TRIGA reactor diagram
- Uranium reprocessing pilot plant diagram
- R1 reactor diagram
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-irradiation 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


➢ 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

• 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
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 riped
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
International Financial Reporting Standards (IFRSs™)
including International Accounting Standards (IASs®)
and Interpretations as approved at 1 January 2008

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

- 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"
- Eloffson method: maximum deviance tolerated 30 %
Penal law, detection

- Auditors typically analyse even in minor details
- Environmental liabilities might escape detection <= 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