ICEM05-1078

EARLY STAGE COST CALCULATIONS FOR DECONTAMINATION AND DECOMMISSIONING OF NUCLEAR RESEARCH FACILITIES

Rolf Sjöblom, Tekedo AB **Staffan Lindskog, Swedish Nuclear Power Inspectorate**

Cecilia Sjöö, Tekedo AB **Anna Cato, Swedish Nuclear Power Inspectorate**

ABSTRACT

The Storage for Old Intermediate Level Waste (SOILW) at Studsvik has been used for interim storage of intermediate and high level radioactive waste from various activities at the Studsvik site including post irradiation investigations. The SOILW facility was in operation during the years 1961 –1984. The waste was stored in tube positions in concrete blocks and in concrete vaults. In some instances, radioactive debris and liquid has contaminated the storage positions as well as the underlying ventilation space.

The Interim Store for Spent Nuclear Fuel (ISSNF) at Studsvik was built in 1962-64 and has been used since for wet storage of spent fuel from the Ågesta Nuclear Power Plant and the Studsvik R2 research reactor. It comprises three cylindrical pools together with facilities and equipment for handling and decontamination.

In the Swedish finance system, adequate funds need to be accumulated long before (most) decommissioning operations take place. Thus, precise cost calculations are needed already at an early stage of planning.

The primary purpose of the present work is to improve and extend the present knowledge basis for cost estimates for decommissioning, with the SOILW and ISSNF facilities as reference cases. The main objective has been to explore the possibilities to improve the reliability and accuracy of capital budgeting for decommissioning costs.

The work has comprised review of previous cost estimates, visits to facilities and information searches.

The following conclusions were made:

- IAEA and OECD/NEA documents provide invaluable advice for pertinent approaches.
- Adequate radiological surveying is needed before precise cost calculations can be made.
- The same can be said about technical planning including selection of techniques to be used.
- It is proposed that separate analyses be made regarding the probabilities for conceivable features and events which could lead to significantly higher costs than expected.
- It is expected that the need for precise cost estimates will dictate the pace of the radiological surveying and technical planning, at least in the early stages.
- It is important that the validity structure for early cost estimates with regard to type of facility be fully appreciated. E g, the precision is usually less for research facilities.
- The summation method is treacherous and leads to systematical underestimations in early stages unless compensation is made for the fact that not all items are included.
- Comparison between different facilities can be made when there is access to information from plants at different stages of planning and when accommodation can be made with regard to differences in features.
- A simple approach is presented for "calibration" of a cost estimate against one or more completed projects.
- Information exchange and co-operations between different plant owners is highly desirable.

BACKGROUND

In the nineteen fifties and sixties, Sweden had a comprehensive program for utilization of nuclear power including uranium mining, fuel fabrication, reprocessing (the plans for reprocessing were never carried out) and domestically developed heavy water reactors. Only one of these was actually taken in operation, the Ågesta reactor, which generated a thermal power of 65 MW of which 10 MW was used for electricity generation and 55 MW for district heating. It was shut down in 1973. The program also included a materials and fuel testing reactor, R2, with light water and heavily enriched uranium fuel. It has a thermal power of 50 MW and is being shut down this year (2005). There is also a hot cell laboratory for post-irradiation investigations still in operation.

The residues from the hot cell laboratory were put in steel boxes which in turn were stored in the Storage for Old Intermediate Level Waste (SOILW). The spent fuel from the Ågesta reactor was kept at the Interim Store for Spent Nuclear Fuel (ISSNF) which is a pool storage comprising three cylindrical concrete tanks.

The development work described above lead to the present nuclear programme comprising 12 modern light water reactors, eleven of which are in operation at present. One more reactor will be taken out of operation this year (2005).

THE SYSTEM FOR FINANCING

The facilities used in the development work described above will need to be decommissioned. It has been decided that it is those who benefit from the electricity generated by the modern nuclear power plants who shall pay the costs for the decommissioning, decontamination, dismantling and waste management which is required when the old research facilities are no longer needed.

Thus, the Law on financing of the management of certain radioactive waste e t c (SFS 1988:1597) states (§1) that "*fee shall be paid to the Government in accordance with this law as a cost contribution*" to amongst other things "*decontamination and decommissioning of*" … "*the Storage for Old Intermediate Level Waste (SOILW)*" ... and ... "*the Interim Store for Spent Nuclear Fuel (ISSNF)*".

The Ordinance (SFS 1988:1598) on financing of the handling of certain radioactive waste e t c states (§4) that the funds collected should be paid to cover the costs incurred. It also states (§4) that "*payment will be carried out only for costs which are needed for*" the decontamination and decommissioning "*and which have been included in the cost estimates*" required.

According to the Law on financing of the management of certain radioactive waste e t c (SFS 1988:1597, §5), cost calculations shall be submitted to the Swedish Nuclear Power Inspectorate (SKI) each year. They shall comprise estimates of the total costs as well as the costs expected to be incurred in the future with special emphasis on the subsequent three years.

The SKI has the responsibility (SFS1988:1598, §5) to review the cost estimates and to report to the Government if there is a need to change the level of the fee. The SKI also has the responsibility (SFS 1988:1598, §4) to decide on the payments to be made.

It might be added that according to its instruction (SFS 1988:523, §2) SKI also has the responsibility "*in particular … to take initiative to such … research which is needed in order for the Inspectorate to fulfil its obligations*".

RATIONALE FOR THE PRESENT WORK

It is thus a solid prerequisite for the responsible planning and management of the decommissioning of the various research facilities concerned that realistic and reliable cost estimates can be made.

The estimates must be based on a sufficiently ambitious program to guarantee that all the pertinent requirements of the society are met. At the same time, unjustified fees should not be levied on the users of the nuclear electricity.

It is actually far from trivial to meet these requirements. It is not unusual that cost estimates be raised each time they are updated as further details become apparent.

Therefore, high requirements apply to cost estimates themselves as well as to the knowledge base on which they rely. In particular, there is a need to identify in what way feedback of experience might be utilized in order to achieve sufficiently robust estimates.

The purpose of the presently reported work is to identify methodology to be used in order to achieve the precision and reliability required. The purpose is also to identify what knowledge might be required in order for such methodology to be successfully applied.

This is achieved by going through two reference cases: the *Storage for Old Intermediate Level Waste* (SOILW) and the *Interim Store for Spent Nuclear Fuel* (ISSNF). Details of these cases can be found in [1] and [2], respectively, and references therein.

Previous cost calculations rely on data on contamination levels, assumptions on methods to be used and on estimates of various volumes of work and waste based on drawings. The methodology applied is similar to that used for nuclear power plants and utilizes a summation type of methodology. The experience from such calculations is that the costs estimated increase with the level of detail, and thus escalate as the work progresses and time passes. The scope thus includes to attempt to identify time and stage invariant methodology.

The work has comprised the following activities:

- To review previous cost estimate reports
- To visit facilities and meet with those responsible
- To carry out various information searches

GUIDANCE DOCUMENTS

The financial planning relies heavily on an appropriate technical planning. Invaluable advice in this regard is provided in IAEA[3-7] and OECD/NEA[8] guidelines and similar.

In these guidelines, so-called "*critical decommissioning tasks*" are identified. They include the following:

1 *Characterization of the facility.*
   - A survey of the radiological and non-radiological hazards which is used as an input for the safety assessment for decommissioning and for implementing a safe approach during the work.
   - An adequate number of radiation and contamination surveys should be conducted to determine the radionuclides, maximum average dose rates, and contamination levels for inner and outer surfaces throughout the facility.
   - A survey of all hazardous material in the facility.

2 *Removal of the residual process material.*

3 *Decontamination*, including selection of technique with regard to effectiveness and to potential for reducing the total exposure

4 *Dismantling*, including an analysis of each dismantling task and the most effective and safe method to perform it.

5 *Demolition, surveillance and maintenance, and final radiological survey.*

It is also stated that the cost estimate should reflect all activities described in the decommissioning plan, including e g development of specific technology.

It should be recognized, however, that these guidelines - at least for the most part - are issued with regard to the technical planning and its pertinent logistic and timing constraints. This implies that unless a comprehensive view is taken - including the financial planning requirements - data may be insufficient for cost estimates having the precision required as presented above. Therefore, iteration is required between steps 1 - 5 above and the cost estimates. This may well imply that the timing of the technical planning is dictated by the need for sufficient precision in the cost estimates, at least in the early stages of planning.

STORAGE FOR OLD INTERMEDIATE LEVEL WASTE

Plant description

The *Storage for Old Intermediate Level Waste* (SOILW) was commissioned in 1961 and waste emplacement was discontinued in 1984. All waste was removed in 2001.

Further detail on the information below can be found in [1] and references therein.

SOILW has been used for interim storage of intermediate and high level radioactive waste from various activities at the Studsvik site, including test reactor and hot cell laboratory operation. Some of the waste came from outside Studsvik, e g the Swedish Military.

Much of the high level waste originated from fuel tests and subsequent post irradiation investigations. It comprised fuel debris and in some cases also slurry used for polishing of specimens. The material was packed in tins made from sheet metal.

An overview of the SOILW facility is shown in Figure 1. The SOILW comprised a number of storage compartments of two kinds, concrete blocks with vertical pipes for storage of tins as just described and compartments with no internal structures for storage of intermediate level waste of various kinds. At the bottom, the vertical pipes enter into a ventilation area which is about 5 – 10 centimeters high. All storage compartments have thick concrete lids for radiation shielding. The facility has been emptied from radioactive waste but not cleaned. Significant levels of contamination are believed to exist on the surfaces of the vertical pipes and at the bottoms of the compartments.

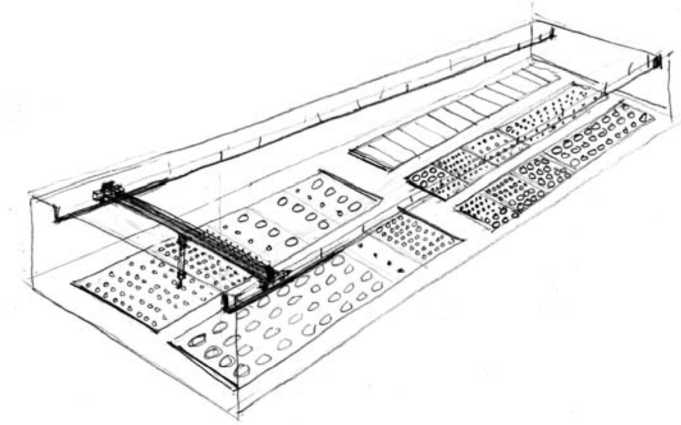

Figure 1. Layout of the Storage for Old Intermediate Level Waste (SOILW) at Studsvik (artist’s view). Compartments having large lids are open inside and most compartments with circular lids contain vertical pipes in concrete blocks which are about 3 meters thick.

The handling space above the compartments and the concrete lids is classified as “yellow” which implies that the surface contamination is between 40 and 1000 kBq/m2 for beta plus gamma radiation and between 4and 100 kBq/m2 for alpha.

The dose rates in the compartments with no internal structures are on the order of 0,5 mSv/h which is too high for work by man in situ (except possibly for very limited periods of time).

The dose rate in the pipes used for stacking tins is believed to be high, at least at certain locations. The reason is that the tins contained not only fuel debris but also liquid, supposedly absorbed in vermiculite, containing nitric acid which caused corrosion of the tins as well as leakage and contamination of the pipe shafts. Also, it is known that small objects have dropped down to the ventilation area underneath and possibly caused contamination.

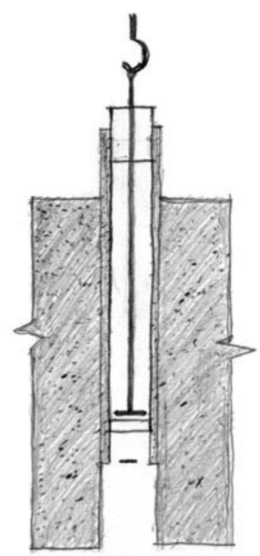

Figure 2. A pipe position in the Storage for Old Intermediate Level Waste (SOILW) at Studsvik showing the removal of a pipe after an overcoring operation (artist’s view).

Present plan for decontamination and dismantling

It is assumed that the insides of the vertical pipes are heavily contaminated by leakage from the cans containing the high level waste. Thus, the plan is to decontaminate them by using carbon dioxide jets. It is assumed that all pipes having welds will become clean enough for unconditional release but that those that are spirally welded will not become completely clean in the seams (or on the outside).

It is thus assumed that those pipes that have seams – which comprise the vast majority – need to be removed by core drilling (after decontamination of the inside). The drilling is to be made using a conventional drilling rig and water as coolant and lubricant.

The floor underneath the ventilation space under (most) concrete blocks having vertical pipes is expected to hold surface contamination. Thus, any operation that may involve accessing this area will need special consideration. It is anticipated that some preliminary removal of specimens and vacuum cleaning in this area will take place as a first step. Then, plugs are inserted at the bottoms of the pipes, whereafter the decontamination is carried out of the insides of the pipes. The core drilling is wet only to immediately before penetration, at which stage dry drilling is applied instead. The removal of an overcored pipe position is shown in Figure 2.

After the vertical pipes have been removed – alternatively cleaned completely – the concrete blocks are to be size reduced into pieces which can be handled by the crane which is at most 10 tons.

It is anticipated that the surfaces of the concrete blocks be relatively clean at this stage. A positive factor in this regard is the fact that there is a steel sheet metal plate at the bottom of the blocks. This implies that it may be feasible to clean the bottom surfaces from whatever contamination they might have.

The breaking up of the blocks is intended to be made by means of drilling and mechanical fracturing. Once the blocks have been removed, surfaces become accessible for (further) cleaning and for removal of the contaminated surfaces of concrete. Such cleaning and removal of surface material is also expected to be warranted for those compartments which did not have any interior structures. It is assumed in the report that a surface layer of 3 centimeters will have to be removed by using hand tools.

Regarding level and precision of calculated costs

It is obvious from the above cited guidance documents that a radiological mapping of a facility provides the necessary basis for technical planning and precise cost calculations. Such a survey should include the presence of hot spots, approximate radionuclide distribution and at least to some extent also the penetration depth.

A highly important factor for the cost level and precision is the selection of technology. For large and flat surfaces remotely controlled billing may be preferential to manual billing. If the penetration depth is small (e g less than 5 millimeters) a laser based technique might be considered.

Splitting of blocks using the technique put forward might be difficult due to lack of tools of the appropriate length on the market. Therefore use of expanding concrete might be warranted instead.

The literature survey conducted revealed[9] the existence of a similar but completed project: the East Map Tube Facility at Argonne National Laboratory in Illinois. Further information has been compiled subsequently.[10]

The approach applied was rather similar to that described above for SOILW. The experience is briefly as follows.

A concrete coring rig was used to cut each pipe from the concrete matrix. Each pipe was cut from the structure in one continuous 21 foot long coring operation through solid concrete. To reduce waste quantities, the core diameter was selected to minimize the amount of concrete removed along with the pipe. Careful control of the coring operation was required to prevent the core tool from cutting into the pipe or joint.

It became apparent during the operation that the pipes were not quite vertical in orientation. It was therefore deemed desirable to angle the coring, but attempts to this effect were unsuccessful. Eventually the drilling was carried out strictly vertically using a larger diameter drill.

The coring drill originally used was too light to maintain the orientation of the core and therefore a larger rig had to be brought in.

On several occasions, voids as well as incidental objects were encountered in the concrete. Loss of cooling liquid took place at a number of occasions so that injection of fresh concrete had to be applied.

Small or moderate amounts of activity were transferred to the drill water slurry. However, the potential for such contamination is substantial in an operation of the present kind.

INTERIM STORE FOR SPENT NUCLEAR FUEL

Plant description

The Interim Store for Spent Nuclear Fuel (ISSNF) was commissioned around 1964 and is still in operation. It has been used for the interim storage of spent fuel from the Ågesta nuclear power plant and the R2 research reactor. The former had incidents of severe fuel damage[11] although it appears that at least some of the most damaged fuel was sent to Eurochemic for reprocessing and accordingly never received at ISSNF[12].

The plant comprises a main hall with three cylindrical pools for spent fuel storage and a drained stainless steel surface for decontamination, see Figure3. The insides of the tanks are covered with glass fibre impregnated epoxy which has become deteriorated in patches. The hall also contains an overhead crane and equipment for shielded handling of the fuel.

The basement contains equipment for water management including purification.

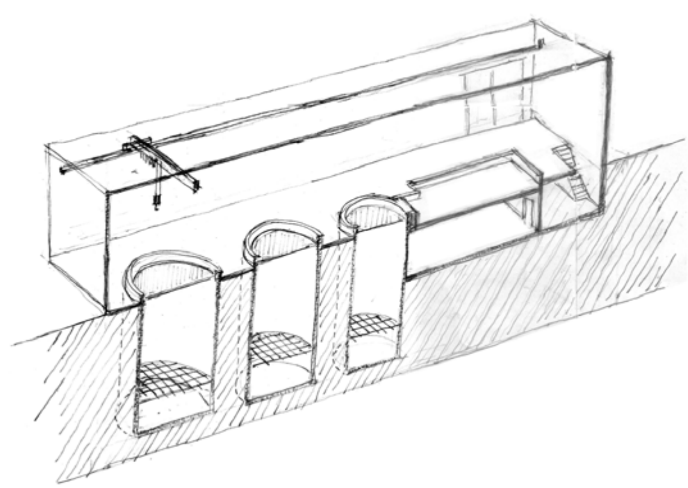

Figure 3. The spent fuel store at Studsvik showing the main hall as well as the interface between the building structrues and the underlying soil and rock (artist's view). (Lifting device shown is not that used for fuel transfer.)

The handling space above the compartments and the concrete lids is classified as “yellow” which implies that the surface contamination is between 40 and 1000 kBq/m2 for beta plus gamma radiation and between 4 and 100 kBq/m2 for alpha.

The pool water has historically had activity concentrations on the order of MBq/m^3. Recent levels of activity concentrations are as follows (in kBq/ m^3):

total alpha	< 1,3
total beta	614
Cs-134	22
Cs-137	96

Present plan for decontamination and dismantling

The existing plans give only a general idea of the methodology to be used for the decontamination and dismantling of the ISSNF facility, see [2] and references therein. This might not appear unreasonable in view of the low levels of activity detected.

It is assumed that part of the surfaces of the insides of the concrete tanks will have to be billed. The same is also assumed for part of the concrete surface under the sheet metal in the decontamination unit.

The dismantling of the pipe systems will be made based on dose rates on the outsides of the pipes and components.

Regarding level and precision of calculated costs

The few radiological measurements made can probably form a basis for a reasonable technical approach to the decontamination and dismantling, at least in general terms. However, it is again clear from the guidance documents cited above that a detailed mapping is required in order for a precise cost calculation to be made. In particular, it is important to know the alpha to gamma ratios as well as the present of any contaminated sludge and deposits in the water system.

Since the pool system is old, it does not have the redundancy of barriers against leakage to the surrounding soil that modern systems do. An example the types of events that might take place in an old system is presented in [13] where potentially contaminated water was released to ground and surface waters. One source for this was the foundation drainage from the Oak Ridge Research Reactor which was mistakenly pumped to a storm drain, and the other was a leak to groundwater from underground coolant pipes.

Similarly to the case of SOILW, cost may be strongly affected by the choices made regarding technology as well as unexpected features encountered.

DISCUSSION AND CONCLUSIONS

The above examples illustrate the significance of making appropriate radiological surveying and mapping as well as technology selection before sufficiently precise cost calculations can be performed.

Actually, it may well be the need for cost calculation precision that dictates the comprehensiveness and timing of such activities, at least in the early stages of planning.

Moreover, uncertainty in cost calculations may occur in a manner similar to that of a risk for an accident. Thus some sort of risk assessment may be warranted in which conceivable more severe but presumably less likely cases are identified and their probability characteristics evaluated.

The above presented real cases on completed projects illustrate how unexpected events might come about, and when they do, costs will usually escalate. Such features of the cost probability structure are of particular interest in cases where adequate funds are to be collected long before costs are to be incurred.

It is not necessarily so that an unexpected event has a low probability as might be the case for the hypothetical leak in a fuel storage tank. In the case of the drilling with overcoring, the frequency of deviation was substantial. Many pipes deviated from strictly vertical orientation and 10 out of 129 pipe positions had to be temporarily abandoned and grout injected in the core hole to fill the voids before the overcoring could be completed.

It is therefore proposed that some sort of deviation risk assessment be carried out as a part of the *critical decommissioning tasks* presented in the guidelines[3-8].

The methodology to be used may well resemble those of ordinary hazard evaluation[14].

Frequently, cost calculations for research facilities are made using calculation tools developed for the case of nuclear power plants. This may be appropriate if the differences in character are fully appreciated and accordingly compensated for. Nuclear power plants are huge facilities with large components that lend themselves to detailed analysis. They also have auxiliary facilities with large volumes of similar equipment where per unit economic data may be applied successfully.

Research and test facilities, on the other hand, are widely different in character. Radionuclide distribution patterns and contamination patterns vary and so do also the technologies that are suitable to apply.

Examples of application of this philosophy can be found in [15].

It should be realized that the precision of cost calculations vary strongly between different types of facilities[16]. Deviations are also more likely to be increases than decreases. Deviations are more likely for unusual projects such as research and/or test facilities. The larger the step in technological development, the greater is the deviation. The main reason for this is that “surprises” are encountered in the process.

In conventional cost calculations for new technical facilities five stages of calculation are identified[17]. In the first stage, *predesign cost estimates*, the analysis is based mainly on comparison between similar plants and the probable accuracy is typically larger than 30 %. In the last one, *contractor’s estimate*, the accuracy is perhaps 5 % and the calculation is based on summation over essentially known items.

Application of the summation method at early stages gives rise to systematic errors which lead to underestimated costs since not all items have been identified. Nonetheless, it is not unusual that calculations of costs for research facilities at early stages of planning are carried out using the summation method based on methodology and cost parameters for nuclear power plants. Such an approach will invariably lead to calculated costs that increase for each calculation.

It is therefore highly desirable to somehow “calibrate” results of early estimates against known costs of already completed projects of similar kind. One simple approach to this may be as follows[2].

Let the cost for a plant be given by the equation:

$$K^c = \sum_i p_i \qquad (1)$$

Where
K^c = the total calculated cost
p = cost item, and
i = index for cost item

A fit to actual cost K^a for a completed project can be made using the weighing factors w_i and a scaling factor s according to the following equation:

$$K^a - K^c = s \sum_i w_i p_i \qquad (2)$$

The weighing factors may be obtained by assessment of which items should have a small, intermediate, large or very large influence on the difference between calculated and actual values. For instance, a weighing factor can be given one of the values 1, 2, 4 or 8. The scaling factor can then be calculated using the equation:

$$s = (K^a - K^c) / \sum_i w_i p_i \qquad (3)$$

For a plant for which a refined cost calculation is to be made, the cost items can be calculated first, and then the total cost according to the equation (1) above.

After that, an adjusted calculated total cost can be calculated using the equation:

$$K^{adjusted} = \sum_i (1 + sw_i) p_i \qquad (4)$$

where s and w_i have been derived from a similar reference plant and p_i for the plant for which a refined calculation is to be made.

The application of equation (4) implies an improvement compared to a simple over all scaling since differences in the assessed cost structure influences the result.

In view of the need for comparisons between different research and test facilities in different stages of planning and decommissioning, the Swedish Nuclear Power Inspectorate has taken initiative to a now (2005) ongoing project within the framework of *the Nordic Nuclear Safety Research*. The main purpose of the work is to find improved methodology for accurate cost calculations at early stages of planning by preparing guidance documents, by making plant data available to the participants and by establishing a network for communication and co-operation.

ACKNOWLEDGMENTS

The authors wish to express their gratitude to the members of staff at Studsvik and SVAFO who have generously shared their knowledge and expertise on the SOILW and ISSNF facilities.

Any errors or misinterpretations are the sole responsibility of the present authors, however. Figures 1-3 are based on drawings presented in [1-2,9] as interpreted by Fabian Sjöblom, Tekedo AB, who is an architect and has not seen the plants. The sketches are intended to illustrate general principles only and must not be consulted for any technical detail.

REFERENCES

1 Sjöblom R and Lindskog S. *An applied study of the storage for old intermediate level waste at the Studsvik site.* SKI Report 2004:11. The Swedish Nuclear Power Inspectorate, February 2004.

2 Sjöblom R, Sjöö C, Lindskog S and Cato A. *Cost studies on decontamination and dismantling of nuclear facilities* (in Swedish). The Swedish Nuclear Power Inspectorate, in print.

3 *Decommissioning of nuclear power plants and research reactors.* Safety Guide. IAEA safety standard series No WS-G.2.1.6

4 *Decommissioning of Nuclear fuel cycle facilities.* Safety Guide. IAEA safety standard series No WS-G.2.4.7

5 *Decommissioning of medical, industrial and research facilities.* Safety Guide. IAEA safety standard series No WS-G.2.2.8

6 *Predisposal management of radioactive waste including decommissioning.* Safety Requirements. IAEA safety standard series No GS-R-2.

7 *Transition from operation to decommissioning of nuclear installations.* Technical report series 420. IAEA April 2004.

8 *Decommissioning Nuclear Power Plants: Policies, Strategies and Costs.* Nuclear Energy Agency, Organization for Economic Co-operation and development, OECD / NEA, 2003.

9 Moos L P, Wescott J B, Flemming D L, Subbaraman G and Horton P, *Decontamination and dismantlement of the Argonne National Laboratory - East Map Tube Facility*. One of the papers in [15],volume 1, pp 164-167.

10 Varley G. *An applied study on the decontamination and decommissioning of the map tube facility, 317 area, Argonne National Laboratory, USA.* Swedish Nuclear Power Inspectorate, in print.

11 Sandstedt K E and Mogard H. *Operating experience with the Ågesta nuclear power plant.* Proceedings of the fourth international conference on peaceful uses of atomic energy. Jointly sponsored by the United Nations and the International Atomic Energy Agency and held in Geneva 6 - 16 September, 1971.

12 Österlundh C G. Former member of staff at Studsvik. Private communication.

13 Stover R L, Anderson G E, Finger J M and Skipper D D *Decontamination and decommissioning preparation of Oak Ridge National Laboratory*. In Editors Gerry White M, Norman N and Thomas R. *Decommissioning, Decontamination, and Environmental Restoration at Contaminated Nuclear Sites (DDER-'94),* Vol. 1, American Nuclear Society, 1995.

14 *Guidelines for hazard evaluation procedures*. Center for Chemical process safety of the American Institute of Chemical Engineers, 1992. ISBN 0-8169-0491-X.

15 Lauridsen, K. *Assessment of the costs of decommissioning the nuclear facilities at Risø national laboratory.* Nuclear Decom 2001, Ensuring Safe, Secure, and Successful Decommissioning. IMechE Conference Transactions 2001-8. Professional Engineering Publishing, 2001.

16 Segelod E. Comparison between planed and actual costs for large projects. Presented at A seminar on Nuclear waste - costs and financing held by the Swedish National Council for Nuclear Waste at Gimo Herrgård, Östhammars kommun on February 16th, 2005. (Can be obtained from siv.milton@sustainable.ministry.se).

17 Peters M S and Timmerhaus K D. *Plant design and economics for chemical engineers, 4th edition.* McGraw-Hill, Inc., New York 1991. ISBN 0-07-049613-7.