

WORKING MATERIAL (EXCERPT FROM CURRENT DRAFT MAIN REPORT)

3 DECOMMISSIONING PLANNING

In modern nuclear industry, planning for decommissioning starts with the design of a new facility. It continues through the operational life of a facility, with the keeping of all design changes and plant modifications. AS the facility gets near the end of its operational life a decommissioning plan will be prepared. This is good practice and is required by international guidance [IAEA guidance on decommissioning]. It is normally good practice to develop a safety assessment plan as part of developing the initial hazard management strategy and as part of specifying the working practices for removing the radioactive inventory and the radioactive plant equipment. Essential components for this planning work are the waste inventory, the plant characterization and the inventory of equipment to be removed. These will allow the hazards and risks to be assessed.

The decommissioning plan and its associated safety assessment are produced for a number of purposes:

- For regulatory approval
- To help develop more detailed safety analysis
- To confirm that risks will be ALARP
- To confirm that the work can be done with the resources and funding available.

If decommissioning is to be undertaken in a number of stages a bounding safety assessment for the whole project encompassing bounding consequences of accident scenarios for each stage is valuable, particularly as this will allow better planning of the safety assessment work programme. It will allow each stage to be classified in respect of safety significance which in turn will allow a graded approach to be applied to safety assessment, the arising safety controls and safety assessment review.

If the decommissioning strategy or methods have involved the assessment of a number of options, then the basis of selection of the selected options should be justified. Such selections are often influenced by a number of factors and multi attribute analysis may well have been used to assist the choice of option. Safety is one, albeit very important consideration. It is good practice therefore at this early planning stage of a project to justify within an initial safety assessment the chosen option, in respect of safety. The actual work stage safety assessments can then be confined to only the intended work and its safe conduct.

The outcome of preliminary safety assessments may well influence decommissioning strategy and influence working methods. This may be because the predicted worker dose exceeds the allowable exposure on the workforce available, or because risk is shown not to be ALARP, and that is an important purpose at this planning stage. Likewise the overarching safety assessment helps to demonstrate that progressive hazard reduction will be achieved and that no avoidable increases in risk will occur, such as might occur if containment were breached at too early a stage, and not under optimal conditions. Equally, the output of preliminary safety assessments will be important in setting priorities for multi phase projects, and to help resolve limitations of resources or of funding.

The preliminary safety assessment and the associated decommissioning plan will also set out the end state for the project. This may be one of many possible outcomes. It may be that a facility is

being completely removed with the expectation that the associated land will be released easily from regulatory control and the site will then be available for unrestricted use. It may be that there will be restrictions on use. It may be that the end state is merely a hold point in a much longer decommissioning programme and the facility will go into care + maintenance awaiting another round of decommissioning.

The experiences of Member States and their specific uses of safety assessments at the decommissioning planning stage have been included in the detailed recommendations and advice developed in later chapters of this report.

IAEA has published Safety Guides for Decommissioning (WS-R-5, *Decommissioning of Facilities Using Radioactive Material*, WS-G-2.4, *Decommissioning of Nuclear Fuel Cycle Facilities*, and WS-G-2.1, *Decommissioning of Nuclear Power Reactors and Research Reactors*) that describe three phases of planning, initial, ongoing and final. Additional information on the initial decommissioning plan can be obtained from GS-G-4.1 *Format and Content of the Safety Analysis Report for Nuclear Power Plants*.

SRS 45, *Standard Format & Content of Safety Related Decommissioning Documents*, states “The decommissioning plan is the key document in the entire decommissioning process. It contains the information on which the regulatory body will base its decision regarding the relative safety of the decommissioning concept as proposed by the operator. There is a range of support documentation that will probably be referenced and summarized briefly in the decommissioning plan. This is particularly likely for large, complex decommissioning projects. In some countries, and for smaller facilities, these support documents are integrated into the decommissioning plan itself.” It may be important to note that while the IAEA document suggests that a decommissioning plan be prepared as a single document, it is common practice in several Member States to include the information in a series of documents which collectively provide the information that would constitute a decommissioning plan. In other words, it is not necessary to create a single comprehensive document. The discussion that follows uses the terminology of “decommissioning plan” to include financial data, schedule and sequencing, technical methodologies, safety assessment, and end state considerations.

This section of the report builds from the DeSa project to further illustrate the evolution of the safety assessment from the initial planning of decommissioning, through the commissioning and operation of the facility to preparation for initiation and conduct of decommissioning actions. This provides specific focus on the relationship between decommissioning plans and the safety assessment. Maintenance and change of the safety assessment during the conduct of decommissioning activities is addressed in Section 4 and . termination of decommissioning is addressed in Section 5.

Ideally, initiation of decommissioning planning should begin at facility design. Many member states require that the design of new facilities must consider their eventual decommissioning and that there is specific discussion of decommissioning in the safety assessment that is developed to support initial commissioning. Addressing decommissioning in the design allows inclusion of features that support safe, efficient decommissioning. For example....*insert several specific examples that capture lessons learned from decommissioning projects that have been included in new design.* The level of information that is available at the design stage is limited in nature as the facility is facing the start of operations. Radiation and contamination levels are not known, technologies may be significantly different after completion of a 40 year mission, etc. The initial decommissioning planning developed at the design stage may be limited to proposed options available at the time of initial commissioning. Consideration of decommissioning at this point in the safety assessment of a facility’s lifecycle is represented as Safety Options, discussed only from a bounding perspective to provide the regulatory body some assurance that

decommissioning is technically feasible. At this point the decommissioning plan is accompanied by an overarching safety assessment strategy that describes the phases of decommissioning and identifies the points at which detailed safety assessment and regulatory review may be required. A safety assessment is not needed at this stage.

Legacy facilities may not have included decommissioning in design and must begin to plan for decommissioning from their current state, but certainly before initiating decommissioning activities. Decommissioning Planning is an evolutionary process. Each report represents a more comprehensive level of understanding of the facility's condition as it approaches decommissioning. The initial decommissioning plan is reviewed periodically during the facility's operational life. Maintenance of the document during the period of operation is intended to capture information that will be useful in the planning and performance of decommissioning. The periodic review should consider changes to the facility configuration, mission, and operational events that may affect the course of decommissioning. The periodic review may also consider technical advances or regulatory changes that could influence the decommissioning strategy by presenting new options, validating technical feasibility of equipment or techniques, or collecting vital characterization data that will be necessary to develop the final decommissioning plan. The decommissioning preliminary safety assessment is not typically affected during the operational period unless the proposed changes alter the Safety Options such that the basis for regulatory authority approval is changed. This period in the facility lifecycle will be used to perform "optioneering" studies and other value engineering reviews to support development of the final decommissioning plan and detailed safety analysis.

Once the end of the operational mission is established, the final decommissioning plan can be developed. This plan will provide the basis for regulatory approval of decommissioning activities. The safety assessment document will represent the results of preliminary planning. It will chart the planned course of decommissioning activities and include detailed safety assessment for the first phase of decommissioning activities. The plan will also serve as the initial decommissioning plan for subsequent phases of decommissioning (e.g. identify actions to proceed in coming phases and identify safety options for future activities). Further evolution of the safety assessment is managed through change management as the decommissioning project progresses.

This report provides additional discussion on the information necessary to produce these documents as well as the level of information and use of each.

[Specific topics to be addressed by the Working Group and this chapter of the report]:

[Working Group to develop content describing the process of planning decommissioning, including evaluating decommissioning options and the role the safety assessment in support of the selection. Include those items listed above as they influence the selection of decommissioning strategies.]

3.1 Designing for Decommissioning

- Design the plant with decommissioning in mind.
- Keep knowledge of all design changes and plant modifications

3.2. Selection of Decommissioning Options

- Optioneering of decommissioning methods
- Waste Management strategy and Safety
- Defining an End Point/End State
- Preliminary dose budget leading to refinement of decommissioning technique

- Define the hazard using the waste inventory and plant characterization

3.3. Decommissioning projects deferred for extended timescales

- Definition of hold points and safety cases for care and surveillance at this hold point condition.
- Long term aspects for care and maintenance, aging management programmes.
- Analysis and evaluation of the effectiveness and required duration for functionality during long term period
- Maintenance of SSCs
- Additional hazards
- Inspection, etc.
- Care and Maintenance Phase

[The group should specifically discuss consideration of deferred decommissioning projects. The focus of the initial decommissioning plan can be compared with an ongoing decommissioning plan when applied to a facility in a degraded state (at start, after some period of time – identified in periodic review)]

3.4 Content of decommissioning plans during the facility's life cycle and their relationship to associated safety assessment documents.

[Working Group to develop content with MS examples for each stage of the planning process. The basis for the content should be consistent with WS-R-5, Decommissioning of Facilities Using Radioactive Material, WS-G-2.4, Decommissioning of Nuclear Fuel Cycle Facilities, and WS-G-2.1, Decommissioning of Nuclear Power Reactors and Research Reactors, SRS 45, Standard Format & Content of Safety Related Decommissioning Documents, the DeSa Regulatory Review Report Annex.]

- a. Initial Decommissioning Plan, Initial radiation protection plan, initial hazard management strategy, initial waste management plan, initial funding estimate;
- b. Safety assessment at the stage of the initial decommissioning plan,
- c. Ongoing Decommissioning Plan (during facility operation);
 - Pre decommissioning cleanup and preparation;
 - Post shutdown planning and WBS;
- d. Final Decommissioning Plan.

3.5. Safety Assessment Strategy – very high level document that identifies the safety assessment

- a. Preliminary Safety Assessment (including a Preliminary identification of risks to guide application of the graded approach in detailed work)
- b. Outline of issues for detailed Safety Assessment

3.6. Consideration of Engineering Assessment and 'fit for purpose' SSCs in development of initial-final decommissioning plans and representation in the associated safety assessment

- Site Management Control and Human Factors
- Design considerations
- Construction techniques and materials
- Safety Management programme

- Integration of non-radiological and radiological aspects

[Working Group to develop content that describes the use of engineering assessment in planning the phases of decommissioning applicable in the initial planning stages. This should discuss the initial concepts with respect to sequencing equipment removal, use of temporary equipment and balancing reduced reliability with administrative controls and safety management programs.]

3.7. Multi Facility Site Considerations

[Include discussion of the role of an overarching decommissioning strategy for multi-facility sites. Include consideration of common equipment, cessation of subordinate mission activities, interaction (e.g. impact of decommissioning techniques on neighbouring operating facilities or facilities under construction, or vice versa) between decommissioning and continued operations. This discussion should be limited to the preliminary planning stages and bounding safety assessment level. There is an interface with the conduct of decommissioning WG to describe the detailed considerations associated with these topics when the facility is performing decommissioning activities]

Safety Assessment work Plan useful for complex projects and multi-facility sites to lay out the relationship of the safety assessments in each Decommissioning Planning Phase:

- Safety Assessments can be at:
 - Site Level
 - Facility Level
 - Project Level
 - Project Stage Level
- Safety Assessments need to be consistent with and support decommissioning plan WBS (work breakdown structure);
- May be a need for new Waste facilities and associated safety assessments e.g. Preliminary, Pre-construction and Operational.
- Overall safety assessment/ safety case for site
 - Mutual aspects – e.g. Site release, discharge limits
 - Cleanup of part of site (long term aspect) and reuse of site (change of use)
- A prioritisation tool for resolving sequence of decommissioning multi facilities and for resolving funding and resource constraints.

3.8. Special Consideration in Decommissioning planning

- a. Facilities shutdown as a result of serious accidents
- b. Legacy facilities with poor records of plant state and design basis
- c. Contaminated land and ground water

3.9. Periodic Review and Triggers for Update of Initial or Ongoing Decommissioning Plan and associated Preliminary Safety Assessment

[Working Group to develop content that describes the frequency of review and the conditions that would lead to the update of a Preliminary Safety Assessment. There is a required interface with the Review Working Group to establish the criteria for review/acceptance if update is necessary.]

- Finding the balance between being driven by a time table or being driven by significant changes (e.g. change of strategy, changed regulatory requirements, changed end state, new information on the facility).
- Difference of the operators need for review and the regulatory body's need for review.