

REGULATORY REVIEW OF SAFETY ASSESSMENTS FOR DECOMMISSIONING PROJECTS – AN INTERNATIONAL PROJECT

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ABSTRACT

Decommissioning is being planned or has already taken place for a broad range of nuclear facilities worldwide, including nuclear power plants, research reactors, nuclear fuel cycle facilities, research laboratories and industrial facilities, and it is expected that the number of facilities permanently ceasing operations will increase in the next few decades. Ensuring safety during decommissioning is a regulatory requirement, and adequate planning, evaluation and demonstration of safety for decommissioning activities are necessary to meet this requirement. It has also been recognized that it would be desirable for a harmonized approach to be developed taking into account international experience and lessons learned. In view of this, a new international project was initiated by the International Atomic Energy Agency on evaluation and demonstration of safety of decommissioning of nuclear facilities (DeSa). It aims at drawing on international experience in order to develop a harmonized approach for evaluating the safety of decommissioning activities and reviewing safety assessments for these activities for all types of nuclear facilities (e.g. nuclear power plants, research reactors, nuclear fuel cycle facilities, research laboratories, industrial plants). The DeSa project commenced last year and this paper will describe the outcomes and progress of the project to date.

I. INTRODUCTION

There is a broad range of nuclear facilities around the world, including nuclear power plants, research reactors, nuclear fuel cycle facilities, research laboratories and industrial facilities, where decommissioning is planned in the near future. In particular, there will be an increasing number of research and nuclear power reactors closing down in the next few decades, and the associated decommissioning activities will require adequate

planning, evaluation and demonstration of safety [1, 2, 3, 4, 5]. A systematic approach to the demonstration of compliance with safety requirements and the criteria for decommissioning and release of material, buildings and sites from regulatory control is required.

The safety of decommissioning has been emphasized at various international fora, such as the International Atomic Energy (IAEA) Conference on Safe Decommissioning for Nuclear Activities in Berlin (14-18 October 2002) [6] and the OECD/NEA International Seminars on Decommissioning in Taragona, Spain (2-4 September 2003) [7] and Rome, Italy (6-10 September 2004). In its June 2004 meeting the IAEA Board of Governors approved an Agency Action Plan on Decommissioning of Nuclear Facilities [8] which encourages the IAEA to develop an internationally agreed approach to safety assessment of decommissioning and also to develop information for regulators and operators on the preparation and contents of the detailed safety assessment which should be developed in association with the decommissioning plan for each facility being decommissioned.

The first review meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [9, 10] also highlighted the importance of safety of decommissioning. The evaluation and demonstration of safety is one of the set of requirements presented in the IAEA Safety Standards on decommissioning, including Safety Requirements [1, 2] and Safety Guides [3, 4, 5] published by the Agency over the last few years. Supporting reports addressing record keeping [11], dismantling techniques [12], and on the standard content of safety related decommissioning documents [13] have also been developed that provide specific information about technical subjects.

International projects to develop similar recommendations for demonstration of safety of near surface disposal facilities have been carried out in recent years by the Agency, such as the ISAM (Improvement of Safety Assessment Methodologies for Near Surface Disposal Facilities) [14] and ASAM (Application of Safety Assessment Methodologies for Near Surface Disposal Facilities) [15] projects.

In light of these developments, a new International Project on Evaluation and Demonstration of Safety of Decommissioning of Nuclear Facilities (DeSa) has been undertaken by the IAEA to develop an equivalent level of detailed information in the field of decommissioning, taking into account international experience and lessons learned in this field. In addition to information on the preparation of safety assessments by the proponents of decommissioning projects, the DeSa project also aims to provide parallel information for performing reviews of these safety assessments. Such reviews may be carried out by the proponent, by a third party, and/or by the regulatory body.

In Canada, regulations under the Nuclear Safety and Control Act [16, 17, 18, 19] require that decommissioning plans be submitted in support of applications for licenses to construct, operate and decommission nuclear facilities. Guidance to support these regulations has been published as Regulatory Guide G-219 [20], which describes the CNSC's expectations for the contents of decommissioning plans. The regulator requires this information in order:

- a) to support decisions to grant authorizations for the construction or operation of facilities;
- b) to support decisions to grant authorizations for decommissioning nuclear facilities;
- c) to identify the limits and conditions that need to be applied to decommissioning activities to ensure safety; and
- d) to provide a basis for assessment of the conduct of activities during decommissioning.

Forming a judgment about the safety of a decommissioning project involves assessment of the risks to health and safety of workers and members of the public arising both from the conduct of decommissioning and from the presence of radioactive and hazardous materials within the facility being decommissioned. The safety assessment and other information provided by the facility operator in support of an application for authorization must address these issues. The regulatory authority must satisfy itself that safety principles have been applied, and good engineering practice has been used in developing proposals for decommissioning and that effective procedural controls have been developed and will be applied during the decommissioning process. The safety assessment and all supporting arguments must provide a high level of confidence that the decommissioning will be carried out safely and that the end-state of the project will meet all regulatory requirements.

II. DeSa PROJECT

The DeSa project aims to develop a harmonized methodology for evaluation and demonstration of safety during decommissioning and to develop safety assessments for selected nuclear facilities by applying this methodology. It also has the objective to assist operators and technical support specialists in planning and undertaking decommissioning activities for all types of nuclear facilities. It will also be of use to regulators, and approaches to regulatory review of decommissioning safety will be also addressed. More specifically, the project aims to [21]:

- a. define the elements of the safety assessment;
- b. investigate the practical applicability of the methodology and performance of safety assessments for the decommissioning of various types of facilities through selected “real-life” test cases;
- c. investigate approaches for review of safety assessments for decommissioning activities and development of a regulatory approach for reviewing safety assessments for decommissioning activities and as a basis for regulatory decision making; and
- d. provide a forum for exchange of experience in evaluation and demonstration of safety during decommissioning of various types of nuclear facilities.

The DeSa project addresses the evaluation of the impacts on workers and the public from normal anticipated decommissioning activities and from potential accidents which might occur during these activities. Attention will be given to the application of the methodology at the different stages of planning and implementation of decommissioning strategy on different types of civilian nuclear facilities up to final release of the site from regulatory control. It will consider the three main decommissioning options, i.e. immediate dismantling, deferred dismantling and entombment. All types of nuclear facilities (e.g. nuclear power plants, research reactors, nuclear fuel cycle facilities, research laboratories, industrial plants, mines and mills) will be covered. It will also address the waste arising from decommissioning activities up to the point of disposal/intermediate storage, free release or transport away from the site.

The DeSa project is being undertaken in three phases as follows (see Fig. 1) [21]:

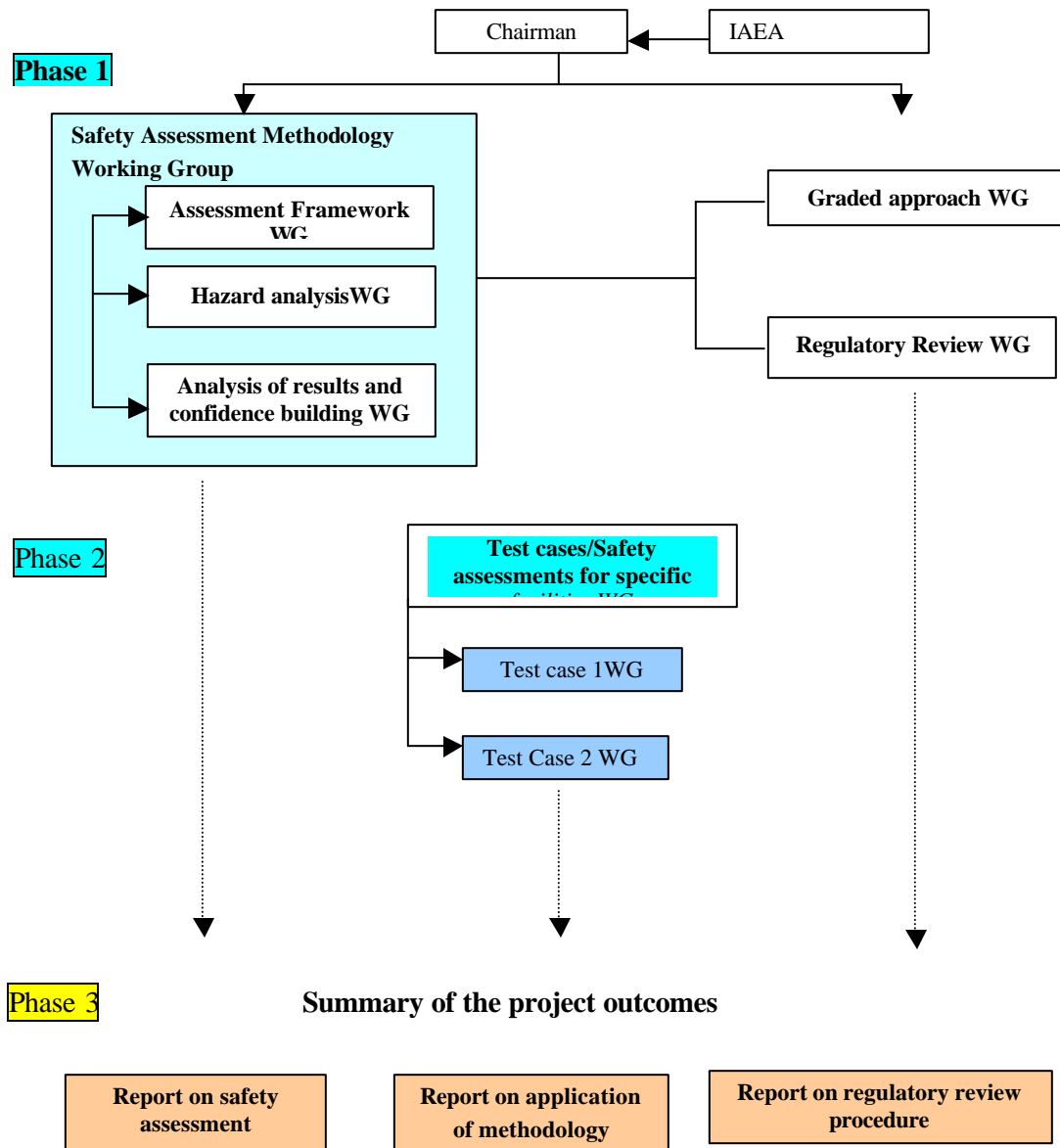
- Phase 1 – development of safety assessment methodology, safety assessment content and review procedures;
- Phase 2 – application of the methodology to test cases; and
- Phase 3 – evaluation of the lessons learned and development of information and recommendations.

The project commenced on 1 November 2004. Phase 1 is focusing on several areas – formulation of a consensus on a safety assessment methodology; initiation of review and development of a review procedure, and application of the graded approach in development and review of safety assessment. At present there are five working groups established by the project participants who contribute to the fulfilment of these tasks (see Fig. 1): Assessment Framework Working Group, led by Mr. Adriaan Joubert (National Nuclear Regulatory Body, South Africa); Hazard Analysis Working Group led by Mr. Kurt Lauridsen (Danish Decommissioning, Denmark); Analysis of the Results and Confidence Building Working Group led by Mr. Jean-Guy Nokhamzon (CEA, France); Graded Approach Working Group led by Mr. Stefan Thierfeld (Brenk Systemplanung GmbH, Germany); and Regulatory Review Working Group led by Mr. Richard Ferch (CNSC, Canada). The consistency and coordination of the project is maintained through the DeSa coordinating group established at the meeting, consisting of the working group leaders, the Chairman of the project, Mr. Ken Percival (UKAEA, United Kingdom), and the IAEA scientific secretary, Ms. Borislava Batandjieva.

The outputs of this project are intended to assist regulators, safety assessors, operators and independent reviewers of decommissioning projects worldwide in:

- a) decision making on the adequacy and acceptability of safety assessments;
- b) decisions on approval of proposed decommissioning options; and
- c) identifying and resolving safety issues arising during decommissioning.

Fig. 1 Organization of DeSa Project



III. SAFETY ASSESSMENT APPROACH

A documented assessment of safety of decommissioning activities is generally a requirement of the regulatory body. This is sometimes referred to as a safety analysis report, but for the purpose of this paper it will be referred to as a safety assessment. The safety assessment can have a number of purposes [22]:

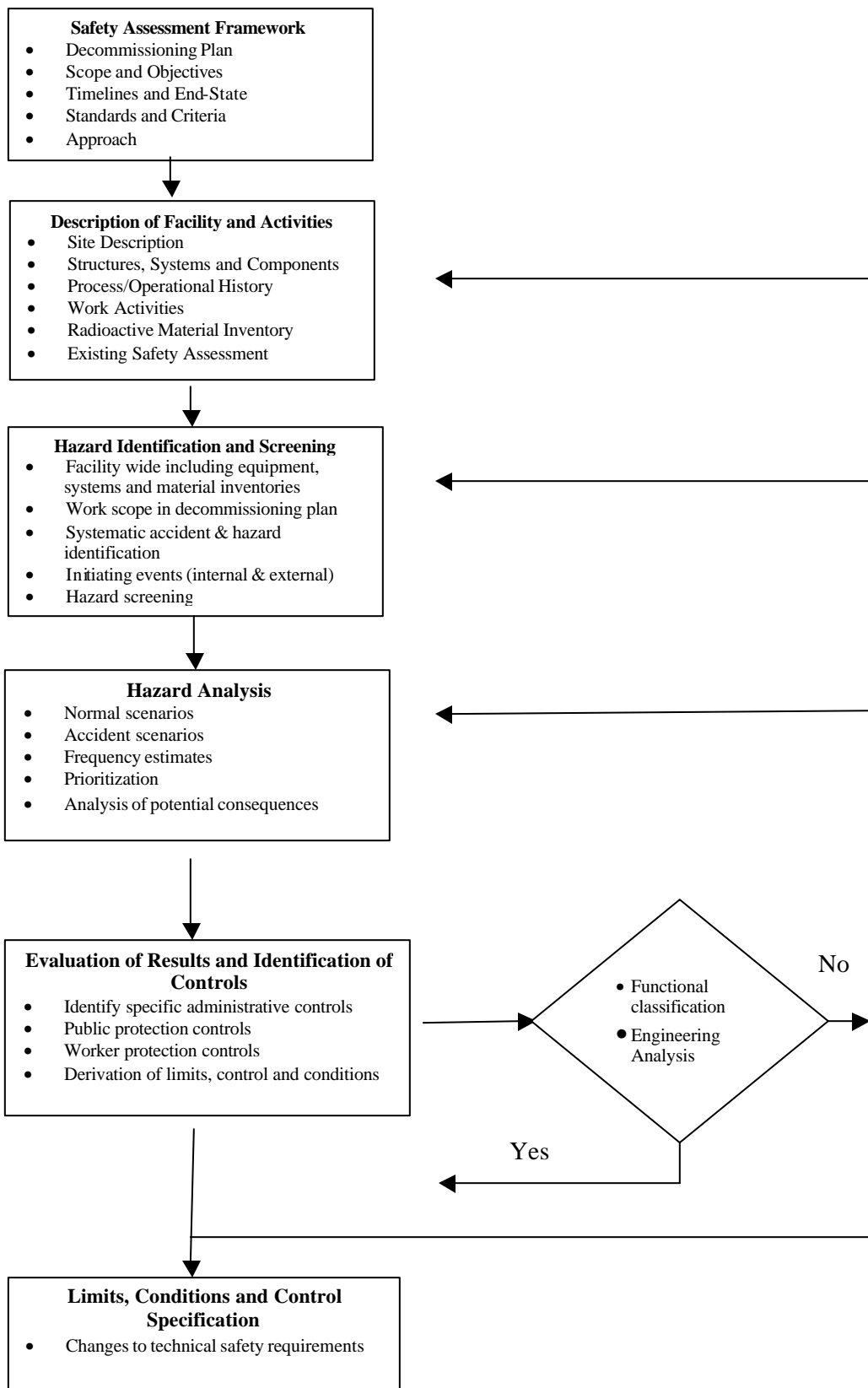
- to provide a documented demonstration that the proposed decommissioning operations can be carried out safely and meet regulatory requirements for protection of the workers and members of the public;

- to provide a basis against which the safety of the proposed activities can be assessed, independently of the decommissioning project team, by the regulatory body and/or internally to the operator organisation;
- to document safety assessment results that can be used by the regulatory body and/or operator, as appropriate, to give formal approval to the proposed decommissioning operations;
- to provide a systematic evaluation of consequences of planned operations and to test their robustness in normal and accidental conditions;
- to support the justification for the selection of a decommissioning option;
- to identify the limits and conditions that will be applied to decommissioning activities to identify a safe envelope and ensure the requisite safety standards are met and maintained.

In summary the safety assessment is necessary to be carried out in a systematic, transparent and logical manner that could provide sufficient level of confidence in the approach and assessment result to be presented to the national regulatory body, other competent authorities (e.g. responsible for environment or health aspects) and other stakeholders. The ongoing work of the DeSa project suggests the following main steps of the safety assessment for decommissioning of nuclear facilities (see Fig. 2) [22]:

- a) establishment of assessment framework;
- b) description of the facilities and decommissioning activities;
- c) hazard identification and screening;
- d) hazard analysis;
- e) evaluation of results and identification of controls;
- d) establishment of limits, conditions and control specification.

It should be noted that as compared with safety assessments for operating nuclear facilities, there is a relatively strong emphasis in the DeSa project on occupational safety and on hazard assessment assessment and analysis, reflecting the high importance of workplace hazard control during decommissioning.



IV. APPROACH FOR REGULATORY REVIEW OF SAFETY ASSESSMENT

As part of the DeSa project the Regulatory Review working group attended by over thirty experts aims:

- a) to identify strategies and mechanisms to review decommissioning safety assessments and safety cases for decommissioning projects;
- b) to develop procedures for regulatory review of decommissioning safety assessments of nuclear facilities;
- c) to test and illustrate these procedures on test cases; and
- d) to document the review procedure and the findings from the practical application of this regulatory review procedure within the overall DeSa project.

The work of this DeSa working group aims also to assist in definition of screening and evaluation criteria to provide answers to the following questions:

- Is there an unanalyzed hazard, change, or increase in uncertainty in analyzed hazards or a change in hazardous substance type, form, or quantity, as a result of the proposed activity, or a discovery that could affect (directly or indirectly) the health and safety of workers at or around the job site?
- Are prescribed safety controls (including personal protective equipment) adequate to protect workers, as established by approved hazard baseline documentation, and have the safety controls been reviewed and approved?

The main challenges of the development of recommendations in the field of regulatory review of safety assessment for decommissioning of nuclear facilities could be summarised as follows:

- review of safety assessment as part of the review of the decommissioning plan;
- evaluation and justification of the graded approach in the development and review of safety assessments;
- review and acceptability of sufficient engineered barriers and application of defence in depth principle;
- review and adequacy of consideration of radiological and non-radiological hazards and their evolution with time; and
- link between safety assessment results and proposed limits, controls and conditions.

IV. APPLICATION TO THE CANADIAN SITUATION

Existing Canadian regulatory guidance on decommissioning [20] focuses on the preparation of decommissioning plans. This guidance deals with not only Detailed

Decommissioning Plans submitted in support of applications for decommissioning licences, but also Preliminary Decommissioning Plans prepared during the construction and operation phases of the facility life cycle. A safety assessment for the decommissioning work is an important component of a Detailed Decommissioning Plan.

As the number of projects entering decommissioning increases, and as their size and complexity also increases, the importance of these safety assessments will also increase. It is anticipated that the role of the regulator in reviewing these assessments and in assessing compliance with the decommissioning plans, programs and procedures will also increase. This will lead to increased needs for regulatory guidance, criteria and review procedures.

In keeping with current CNSC policy regarding the use, where possible, of international experience and international consensus documents in developing the CNSC's own regulatory documents, it is anticipated that the outputs from the DeSa project will contribute directly to future CNSC regulatory documentation on the subject of decommissioning.

V CONCLUSION

The new IAEA project creates an opportunity for review of the experience of over thirty Member States and also development of consensus and recommendations on the development and review of safety assessment for decommissioning of nuclear facilities. Within Canada, it is expected that the reports produced during this project will contribute to the Canadian Nuclear Safety Commission's review processes for future decommissioning safety assessments.

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