



INTERNATIONAL ATOMIC ENERGY AGENCY

**USE OF SAFETY ASSESSMENT IN
PLANNING AND IMPLEMENTATION OF
DECOMMISSIONING OF FACILITIES
USING RADIOACTIVE MATERIAL**

(FaSa Project)

Scope, Objectives, and Activities

(Draft, Version 1.4)

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INTERNATIONAL PROJECT

ON

**USE OF SAFETY ASSESSMENT IN
PLANNING AND IMPLEMENTATION OF
DECOMMISSIONING OF FACILITIES
USING RADIOACTIVE MATERIAL**

-FaSa Project-



EXECUTIVE SUMMARY

There is an increasing number of decommissioning activities worldwide at facilities that use radioactive material. In most cases this is because these facilities are reaching the end of their lifetime; or have already been shutdown as planned or prior to their expected lifetime (e.g. as a result of accidents, political, social or other reasons). These facilities are large in number and cover a wide range of types - small research laboratories, research reactors, reprocessing facilities, fuel fabrication facilities, nuclear power plants, mining and mineral processing facilities, etc. For example, in 2006, of the 442 nuclear power reactors in the world, 88 have been in operation for 30-40 years, 200 for 20-30 years, 109 for 10-20 years, and 45 for less than 10 years [1].

Safety of all facilities using radioactive material needs to be ensured through their lifetime [2] and therefore evaluation and demonstration of safety is essential in the planning and implementation (e.g. instructions, procedures) of decommissioning in accordance with the national legislation and internationally agreed recommendations [3-8]. In order to assist operators, regulators and other experts involved in the planning, performance, control and termination of decommissioning activities, the International Atomic Energy Agency (IAEA) launched in November 2004 an international project on “*Evaluation and Demonstration of Safety during Decommissioning of Nuclear Facilities*” (DeSa). This project was also implemented in response to the International Action Plan on Decommissioning of Nuclear Facilities (approved by the IAEA Board of Governors in 2004 [9]).

The support and active participation of over hundred (fifty actively involved) experts from thirty Member States contributed to the:

- (i) Development of a harmonised safety assessment methodology for decommissioning;
- (ii) Application of the methodology to three real facilities (a nuclear power plant, a research reactor and a nuclear laboratory);
- (iii) Development of recommendations on the application of the graded approach in the development of safety assessments for decommissioning;
- (iv) Development of a procedure for regulatory review of safety assessments for decommissioning.

In addition the DeSa project established a forum for exchange of knowledge, experience and lessons learned in the development and review of safety assessments for decommissioning.

The three year project fulfilled the planned tasks, provided important input to the development of the draft Safety Guide DS376 “Safety Assessment for Decommissioning of Facilities Using Radioactive Material” [10] and series of national and IAEA technical projects on decommissioning (e.g. Ukraine, Romania, China). The participants in the DeSa project have also recognised that further international co-operation and work is required in areas such as structure, content and interface of a decommissioning plan and safety assessment; the use and application of



safety assessment results in planning and conduct of decommissioning; safety assessment for deferred dismantling strategy; and evolution of safety assessment through the facility lifecycle.

The importance of the first international project on safety assessment for decommissioning (DeSa) was also discussed at the International Conference on Lessons Learned from the Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities, held from 11 to 15 December 2006 in Athens, Greece [1] which encouraged the continuation of the project activities in the future. This was reflected in the revision of the International Action Plan on Decommissioning of Nuclear Facilities (2007-2010) completed by the IAEA in September 2007 [11]. The revised Action Plan envisages the “*establishment of a forum for exchange of experience and harmonization of approaches to development and review of safety case (decommissioning plan) for decommissioning (DeSa follow-up project), including recommendations for the application of the graded approach*”.

On the basis of the revised Action Plan and the recommendation made by the DeSa project at the 4th Joint Meeting in 29 October – 2 November 2007, a new international project has been prepared to be launched on 17 November 2008. This project aims to build on the DeSa project outcomes; to review international experience, and to develop agreed recommendations on:

- (i) The use and application of safety assessment in the development and review of decommissioning plans and safety related documents through the life cycle of nuclear facilities and other facilities that use radioactive material;
- (ii) The implementation of the safety assessment results in the conduct of decommissioning activities (e.g. optimization, defense in depth, technical feasibility, safety functions and controls);
- (iii) Application of the graded approach in the application of safety assessment;
- (iv) Update of safety assessment, the operators/regulators review of safety assessments and the implementations of its results during planning and conduct of decommissioning (e.g. single and multi-facility sites);
- (v) Demonstrate the application of these recommendations on selected real facilities planned for or undergoing decommissioning.

It is expected that the new project will assist experts involved in the adequate development, review and implementation of safety assessments and their results and decommissioning plans in practice in accordance with good practice in Member States and international safety standards [3-8, 10].



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1. BACKGROUND

There is a large number and a wide range of facilities using radioactive material worldwide that are being operated, shutdown and under decommissioning. At the same time, new nuclear power plants are being built (e.g. France, Finland, China, India, the Russian Federation etc.), and plans for development and construction of new nuclear power plants (e.g. Bulgaria, China, Slovakia and South Africa), new research reactors (e.g. Australia, China, France) and mining and mineral processing facilities (e.g. Australia, Africa) are being developed. All these facilities require adequate evaluation and demonstration and control of safety through the facility lifecycle, including its decommissioning. The importance of safety during decommissioning has been recently highlighted in the international Safety Fundamentals (SF-1) [2] and the Safety Requirements on Decommissioning of Facilities Using Radioactive Material [3]. These new standards led to the start of the revision of existing IAEA Safety Guides on decommissioning [5-7] in accordance with the consolidated experience, lessons learned and good practice of Member States.

In addition the review meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [12, 13] also emphasised the importance of the evaluation of maintenance of effective control of safety during decommissioning. This is partly because of the diverse range of nuclear facilities around the world that require appropriate planning and implementation of safety and technical measures, as well as adequate human and financial resources to achieve safe and effective termination of practices.

At the International Conference on Safe Decommissioning for Nuclear Activities in Berlin in 2002 the Member States felt that a standardized and harmonized approach to safety assessment that could be applied to all decommissioning projects would help fulfil this aim. In 2004 the IAEA, after consultation with interested Member States, initiated the international project “Evaluation and **Demonstration of Safety during Decommissioning**” (DeSa) whose primary aim was to develop a harmonized methodology for the evaluation and demonstration of the safety of nuclear facilities undergoing or planned to be decommissioned. This methodology was tested using three Test Cases of different complexity – a nuclear power plant (NPP), a research reactor and a Pu-nuclear laboratory.

The DeSa project was successful and attracted continuing interest from more than thirty Member States over the three years of the project. The IAEA is about to publish the outcomes of the project in four-volume Safety Report [14] that presents:

- A harmonized safety assessment methodology (vol. 1);
- Three demonstration safety assessments for a NPP, a research reactor and a nuclear laboratory (vol. 2);
- Recommendations on the application of a graded approach to safety assessment (vol. 3);
- A standardized regulatory review procedure (vol. 4).

At the conclusion of the project in November 2007 [15], there was still a strong interest in Member States for a follow-up project to develop methodology, advice and



further demonstration test cases on other aspects of the control of safety during decommissioning, e.g.:

- Development and evolution of safety assessment during the facility life cycle, i.e. from early stages (i.e. design, operation) through decommissioning termination of practice (i.e. restricted or unrestricted use of the facility or site);
- Periodic review of safety assessment/decommissioning plan by operators and regulators with respect to degrading of structures, frequency, maintenance of safety functions.

These and other aspects were explored in some detail at the concluding 4th Joint DeSa Meeting [15]. The proposals from Member States have been assessed, consolidated and developed into a proposed scope for a follow-up project entitled “Use of Safety Assessment in Planning and Implementation of Decommissioning of Facilities Using Radioactive Material” (FaSa) that is presented in this paper. The FaSa project aims to address all key areas and specific subjects that Member States representatives proposed to the IAEA (e.g. through the DeSa project). The range of proposals was very extensive. To address these proposals in a practical manner, they were reviewed and grouped into a number of theme areas that will be incorporated within the appropriate parts of the project.

2. OBJECTIVES OF THE PROJECT

The fundamental objective of the FaSa project is to provide practical and useful recommendations on the evolution and use of safety assessment in the planning and conduct of decommissioning with the view to ensure safe termination of practices. Indeed these areas were only briefly discussed in the DeSa project [13], or were not addressed at all. The aim for the new project is to build on the outcomes of DeSa and to develop internationally agreed recommendations in the use of safety assessment for decommissioning from planning of a facility through to the release of the facility and the site from regulatory control (see Fig. 1).

PLANNING FOR DECOMMISSIONING				CONDUCT OF DECOMMISSIONING	TERMINATION
<i>Design</i>	<i>Commissioning</i>	<i>Operation</i>	<i>Shutdown / Transition</i>	<i>Decommissioning</i>	<i>Release from regulatory control</i>

FIG. 1 Consideration of decommissioning in the lifecycle of a facility

The FaSa project is intended to provide recommendations and practical demonstration of these recommendations to facility operators, technical support and other specialists, as well as to regulators involved in the planning, regulation, conduct and termination of decommissioning at single or multi-facility sites.

The specific objectives of the FaSa project are to investigate the Member States experience and good practice and on this basis develop recommendations on;



- Use of safety assessment methodologies and safety assessment results and their evolution throughout decommissioning from the planning stage (i.e. establishment of a initial decommissioning plan with its associated initial safety assessment) to the establishment of a final decommissioning plan and the subsequent safety assessments and their management throughout all decommissioning activities up to the planned project and/or site end points.
- The use of safety assessment in identification and practical implementation of safety control measures in decommissioning conduct (e.g. facility instructions, procedures), and their evolution in the decommissioning phases and/or stages, to comply with relevant safety standards and criteria. This will include recommendations on demonstration that exposures to workers and public as low as reasonably achievable (ALARA); application of the concept of ‘defence in depth’; application of formalised change control of facility, its modifications and safety control measures as decommissioning activities proceed. Recommendations on the management of changed facility state and associated hazards beyond the scope of the performed safety assessments, if found to be, will also be addressed.
- The application of a graded approach to safety assessment through the lifecycle of a facility (e.g. commissioning, operation, shutdown, decommissioning); to the application of safety assessment results in the development of decommissioning plans (e.g. initial, ongoing and final) and safety related documents; and in the decommissioning conduct (e.g. through different phases and stages).
- Recommendations on the methodologies/approaches for internal review (by the operator), independent review (on behalf of the operator) and regulatory review of the effective implementation and management of safety assessment recommendations throughout the facility lifecycle. This will include consideration of the interfaces between internal, independent and regulatory reviews, based on the DeSa work in this field. Reviews of safety assessments in preliminary decommissioning plans; reviews of the implementation of results from periodic safety reviews; reviews of the implementation of results from changes to safety assessments; and reviews of safety assessments for termination conditions will be addressed., as well as a demonstration of optimization of safety at all stages of a decommissioning project.
- The practical demonstration of the use of safety assessment in planning, review/revision and implementation of decommissioning activities at real facilities (volunteered by Member States) through the application of the above recommendations to test cases. These test cases will be selected to address broad range of facilities beyond those addressed within the DeSa project which will demonstrate the flexibility of the DeSa methodology and also highlight the specific aspects for evaluation of safety of such facilities (e.g. fuel cycle facilities).

In continuation with the DeSa project [13], and in addition to the above objectives, the FaSa project will also provide a forum for the exchange of lessons learned and good practices in the application of safety assessment for decommissioning from ongoing national and international decommissioning projects and initiatives. By doing so it is



also envisaged that it will provide a forum for information exchange and advice to experts involved in the field of safety assessment for decommissioning around the world (e.g. FaSa meetings, web sites).

3. SCOPE OF THE PROJECT

The FaSa project will provide recommendations on the use of the safety assessment methodology and results in planning and implementation of decommissioning throughout facilities lifecycle. This will illustrate the dynamic nature of decommissioning safety assessments, the need for their periodic review and update (as appropriate) to reflect the changing facility status, hazards, complexity of decommissioning activities at key phases and/or stages of decommissioning. It will address initial safety assessments at early optioneering stages, once the decommissioning plan is agreed, at key stages of decommissioning after shutdown, including unanticipated circumstances during decommissioning through to the completion of decommissioning that could be for the purposes of site release for unrestricted or restricted use [4].

The FaSa project will provide recommendations on the use of the safety assessment methodology and recommendations that were developed in the DeSa project.

The project will focus on immediate dismantling and deferred dismantling of large range of facilities with different hazards and complexities, endpoints and end state (restricted and unrestricted use). The project will demonstrate its areas of application through test cases, based on real decommissioning facilities volunteered by Member States. This will also serve to extend the range of test case applications beyond those addressed in the DeSa project [14] to a NPP, a large research reactor, a mining and mineral processing facility and a fuel fabrication facility.

The project will focus on radiological hazards to workers, public and the environment. However, it is intended that it will also address conventional hazards during decommissioning that contribute to radiological hazards and their potential consequences.

The project will explore the interfaces between the safety assessment for decommissioning and the safety assessment of waste management, such as conditioning, handling and storage. Interactions with other related IAEA projects in this field, such as SADRWMS¹, SAFRAN², will also be explored.

The FaSa project is not intended to address waste disposal and underground mining facilities.

A decision about the proposed scope, objectives and activities of the FaSa project is planned to be achieved at the first FaSa project meeting from 17 to 21 November 2008 in Vienna, Austria.

4. PROJECT APPROACH AND STRUCTURE

The FaSa project aims to provide discussion on:

¹ Safety Assessment Driving Radioactive Waste Management Solutions (SADRWMS) Project

² Safety Assessment Framework (SAFRAN) - 2 Project



- (a) The overarching safety assessment that governs decommissioning activities and its evolution through the lifetime of a facility;
- (b) The detailed safety assessment and its review/revision and update through the decommissioning phases/stages;
- (c) The review of the implementation of safety assessment results by operators and regulators;
- (d) The feedback from the application of the DeSa and FaSa recommendations on broad range of real facilities.

On this basis the FaSa project is planned to be structured and activities undertaken in three steps, also illustrated in Appendix A:

- (a) **Step 1** – Development of recommendations on the role, evolution and interface between safety assessment and its results and the decommissioning plan and supporting documents through the lifetime of a single or multi-facility site (see Appendices A and B). The development of the selected test cases will also commence at this phase.

In order to implement the activities during this step, three Working Groups (WGs) are envisaged to be established at the first FaSa meeting in November 2008 to address safety assessment role in the planning for decommissioning at the stages of design, operation and shutdown; and during conduct of decommissioning phases; and to address issues related to the termination of decommissioning activities and which partially influence the planning and implementation of the decommissioning. In addition, Test Case Working Groups will be established to illustrate the recommendations on real facilities, e.g. a NPP, a fuel processing facility, a complex research reactor, and a mining and minerals processing facility (see Fig. 2). The number of the Test Case Working Groups will depend on the selection of volunteered facilities that will take place in November 2008.

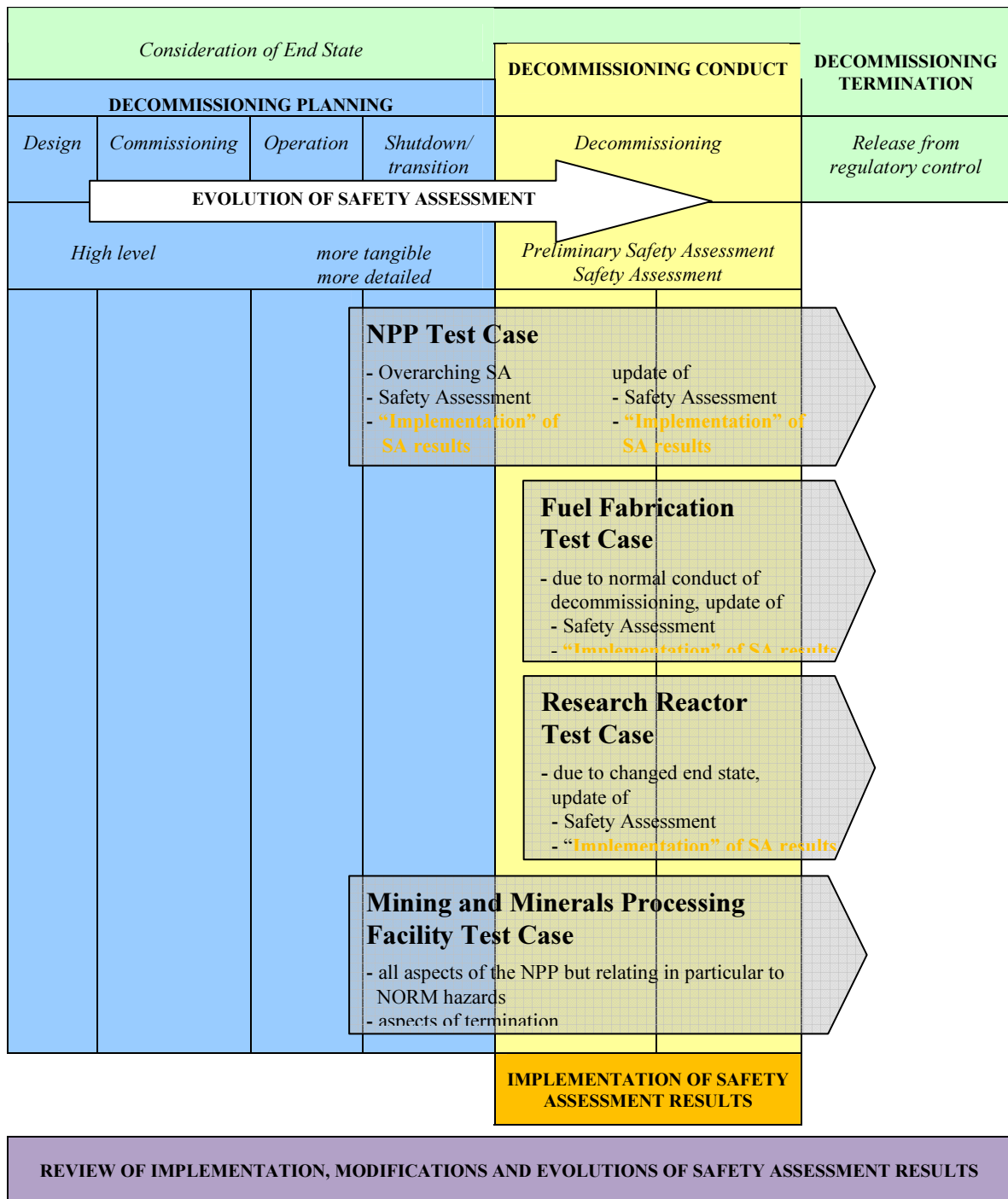


FIG 2. Objectives of the FaSa test cases and their relation to the themes addressed in FaSa Step 1 and 2

- (b) **Step 2** – Development of detailed specific recommendations on the use of safety assessment during the decommissioning (see Fig.1, Appendices A and B):
- (i) the implementation of safety assessment results in the development, revision



of decommissioning plans, supporting documents and working documents (e.g. facility instructions, procedures) in particularly addressing issues such as optimization, defence in depth, uncertainties, conventional and safety controls, etc. (see Appendix C); and (ii) review of implementation of safety assessment results by operators and regulators, including inspections. The development of the test cases will continue at this phase of the project in coordination with the remaining FaSa Working Groups.

Two working groups are envisaged to address:

- The implementation of safety assessment results during decommissioning;
- The review of implementation of safety assessment results during decommissioning planning and implementation.

These groups will replace the three Working Groups in Step 1 of the project and will complement the Test Case Working Groups. In this step it is envisaged that the draft test case reports will be reviewed by the two cross-cutting groups (Implementation of Safety Assessment Results Working Group and Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group) to provide independent evaluation and recommendations before finalization of these reports.

- (c) **Step 3** - Evaluation of the lessons learned and development of recommendations from the Working Groups and the whole FaSa project. The draft report of the FaSa project will be finalized on the basis of the outcomes of the working groups' activity.

The outcomes of all Working Groups presented in draft Working Group reports will be reviewed by all participants to ensure consistency, and also will focus on development and agreement on lessons learned and conclusions from this project.

At each Step of the project (see Appendix A) each expert will be able to participate in:

- Step 1 in one of the thematic Working Groups (Decommissioning Planning; Decommissioning Conduct; Decommissioning Termination) and one of the Test Cases;
- Step 2 in one of the thematic Working Groups (Implementation of Safety Assessment Results; and Review of Implementation, Modifications and Evolutions of Safety Assessment Results) and one of the Test Cases;
- Steps 3 in the development and finalization of the project outcomes and conclusions.

The detailed proposals for the project activities will be discussed at the opening meeting of the FaSa project (17-21 November 2008) and further developed at this and following project meetings.

The project will be coordinated by a Coordinating Working Group comprised of a chairman for the project, leaders of the working groups, and the IAEA Scientific Secretary. This Coordinating Working Group will have the responsibility to provide effective coordination of the project activities; coordinate the tasks and outcomes of the individual Working Groups in accordance with the agreed scope, objectives and outcomes of the FaSa project, as well as to finalise the project reports for publication.



It will then cooperate with the Working Groups, organizing the necessary technical work and Joint Working Groups meetings, and convening at least once a year (see Table 1).

5. WORKING GROUP ACTIVITIES

5.1. Decommissioning Activities (Planning, Conduct and Termination)

- ***Rationale***

The DeSa project activities were aimed at the development of an agreed decommissioning safety assessment methodology. However at the end of the DeSa project it was recognised that further recommendations are needed with respect to the use of the safety assessment through the lifecycle of a facility.

The initial safety assessment is generally developed at the beginning of a decommissioning project. It is typically a high level evaluation of the overall scope of decommissioning of a facility at a single or multi-facility site, as initially planned. The initial safety assessment provides a strategic mapping of the project which defines the approach to decommissioning. It typically defines the targeted end state, establishes the number of phases that will be required to reach the end state, and identifies the options that are to be evaluated, discusses the technical feasibility of the selected option and provides a regulatory envelope which represents the boundaries of risk expected during the planned decommissioning activities. Inputs to the initial safety assessment include resources, schedule, environmental assessment, etc.

The initial safety assessment includes insight into the decisions that affect the approach to performing any given decommissioning. Specific decisions that must be included in the initial safety analysis include consideration of optioneering and those actions necessary to demonstrate technical feasibility. This may also include a demonstration of the consideration of methods to optimize the decommissioning activities and minimise exposure to workers and the public. This integrates the consideration of engineered controls with those required to provide conventional safety protection as the decommissioning activities progress. Establishment of decommissioning phases may be determined by issues such as removal of engineered features. It is important to note that these considerations may also be addressed through the development of the more detailed safety assessment documents to be addressed in Step 2 of the FaSa project (see also Section 5.2.).

Detailed safety assessment is developed to support license applications or execution of the decommissioning activities. Multiple safety assessment documents may be required to address multiple phases or multiple facilities within a larger decommissioning project. The detailed safety assessment is relied upon to demonstrate compliance with safety criteria during each stage and phase of the decommissioning project. Recommendations will be developed in the FaSa project to address requirements for maintenance of the detailed safety assessment as well as change management processes to address discovered new conditions, new information or changes to the strategy (e.g. change of endpoints and end states) that may affect the detailed safety assessment during conduct of decommissioning activities.



Termination of a decommissioning project may be different for different facilities, release for unrestricted or restricted use. In large, complex sites, the end state for decommissioning of a single facility may be representative of an interim end point for the whole site, awaiting multiyear actions of the remaining facilities. Step 1 of the FaSa project will provide a review of Member States experience and explore how the selected/amended end state can influence the decommissioning safety assessment.

FaSa project will further continue the original objectives by applying the DeSa methodology to additional facilities (e.g. a fuel fabrication, mining facilities), and will illustrate how the individual detailed safety assessment transition between decommissioning phases. The outcomes of Step 1 will provide the participants with insight into the planning, scheduling and preparation of such documents.

- ***Objectives***

On this basis Step 1 of the FaSa project aims to develop and further illustrate the evolution of the safety assessment from the initial planning of the decommissioning; the update during operation of a facility and the implementation up to termination. The three periods of the decommissioning lifecycle will be specifically addressed by three working groups (see Appendices A and B):

- Planning for decommissioning (initial safety assessment);
- Conduct of decommissioning (overarching safety assessment and detailed safety assessments);
- Termination of decommissioning.

- ***Scope***

The three working groups will summarize the key recommendations in the preparation of initial safety assessment for decommissioning at early stage of facility development; the approaches for review and update of safety assessment during planning, during conduct, as well the use in completion of decommissioning with the view of restricted or unrestricted use. The recommendations of these Working Groups will apply to all types of facilities.

- ***Activities***

Decommissioning Planning

The Decommissioning Planning Working Group will review and provide examples of Member States experience in the development of initial safety assessments in the lifecycle of a facility (e.g. when such assessment is required, level of detail). The Working Group will define the input necessary to support development of the initial safety assessments. Specific effort will be made to illustrate the criteria necessary to properly develop the initial safety assessments. In other words, the criteria to be used for a small, single facility, as well as a complex facility or multi-facility decommissioning project.

The recommendations of this group will be used as input into other working groups (e.g. test cases, working groups in Step 2). It will provide useful input to the development of the main project report, the Decommissioning Conduct Working



Group and Decommissioning Termination Working Group (see also Section 8.2, Appendices A and B).

During the meeting participants are expected to contribute by sharing their practical experience, ideas or suggestions on approaches for the development and use of initial safety assessments for planning for decommissioning.

Decommissioning Conduct

The Decommissioning Conduct Working Group will investigate Member States experience and will provide examples of approaches to update and maintain detailed safety assessments in support of final decommissioning plans through the implementation of decommissioning activities. It will also address the necessary control and implementation considerations for safety assessments developed for different phases of a decommissioning project. Different approaches and tools can be used to perform periodic review and updates to detailed safety assessments and management of those changes that result either from new information or approach of the next phase of the decommissioning project. In addition, the Working Group will clarify the relation between the detailed safety assessment, for a specific phase of decommissioning, and the overarching safety assessment related to the overall decommissioning of the facility.

On the basis of the review of Member States experience the Working Group will provide recommendations on:

- The content of the overarching safety assessment and its relation to the detailed safety assessment;
- Update of the detailed safety assessments, event driven updates and considerations such as rapidly changing facilities as well as those that have lengthy periods with minimal change;
- Periodic review, including the time frames, review authority and depth of review conducted;
- Methods available for change management which includes the mechanisms to determine if a license amendment or approval from the regulatory body is required;
- Practices for eliminating the need for compliance with established requirements for facility operation as the need for the control is eliminated through decommissioning activities;
- Practical approaches to the phased detailed safety assessment.

The work produced by this group will be used as input into other working groups (e.g. Test Cases) and in particular the Implementation of Safety Assessment Results Working Group in Step 2. The outcomes of this Working Group will also feed the development of the main project document (Safety Report, see Section 8.2) that coordinates the input from the Decommissioning Planning and Decommissioning Termination Working Groups.

During the project participants in this Working Group are expected to contribute by sharing their practical experience, ideas or suggestions on approaches for management



of detailed safety assessments for decommissioning through the decommissioning stages and phases.

Decommissioning Termination

The term “*decommissioning termination*” covers the technical and administrative actions implemented after the end of dismantling operations. At the decommissioning termination stage, the aim is to demonstrate that the end state, as defined in the decommissioning plan, has been successfully reached.

The Decommissioning Termination Working Group will:

- Document Member State experience in regard to decommissioning termination; and
- Provide guidance to assist the planning, conduct and implementation of activities directly related to operator applications to terminate a license (i.e. build upon the guidance provided in Safety Guides WS-G-5.1 and RS-G-1.7).

In order to achieve this, the Decommissioning Termination Working Group will need to work alongside / interface with the Decommissioning Planning, Decommissioning Conduct, Decommissioning Implementation and Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Groups, avoiding duplication of activities. As a guide, FaSa project work will fall within the remit of the Decommissioning Termination Working Group if it relates *directly* or *predominantly* to the activities undertaken by an *operator* when applying to terminate a licence. For instance, work undertaken by the operator to demonstrate that its proposed end states will meet relevant criteria will fall within the remit of the Decommissioning Termination Working Group even though this is formally part of the operator’s decommissioning planning. However, the planning and conduct / implementation of the activities needed to achieve these end states would not be included within the remit as they are neither directly nor predominantly relevant. Equally, activities associated with the regulatory review of an application to terminate a licence would not fall within the remit as these are not undertaken by the operator.

Other matters beyond the remit of the Decommissioning Termination Working Group (i.e. to be addressed by the Decommissioning Planning and Decommissioning Conduct Working Groups) include:

- the selection of the end state, taking into account all relevant parameters: e.g. facility characteristics and operating history, availability of waste disposal, reuse options, national regulations...;
- the management of changes to the proposed end state during the conduct of decommissioning.

It should be noted that this remit extends slightly wider than the general objective to consider the implementation and evolution of safety assessments.

In order to achieve the above, the Decommissioning Termination Working Group will investigate Member States’ experience of:

- (i) methodologies implemented by operators to demonstrate that an appropriate end state has been achieved;



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- (ii) licence termination applications, including the documentation required by the regulatory body (e.g. long term impact assessment/safety assessment, final decommissioning report, feedback experience);
 - (iii) facility/land use after release (e.g. restricted or unrestricted use, termination of a licence for the purpose of a new one)
 - (iv) the implementation of institutional controls.

However, Member States' experience of matters such as:

- (i) regulatory review of licence termination application (e.g. documentation, on site inspections and radiological measurements etc);
 - (ii) results of regulatory review, including what do when release criteria are not met;
- will instead be addressed by the Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group.

During the project, participants in the decommissioning termination Working Group will be expected to contribute by sharing their practical experience, ideas or suggestions on approaches on decommissioning termination and achieving termination of a licence.

- ***Outcomes***

The work produced by the three Working Groups will be used as input into other working groups of FaSa project, particularly the Decommissioning Implementation Working Group and the Test Case Working Groups. The outcomes will feed the development of the main project report (Safety Report) that will consolidate the inputs from all project Working Groups. The relevant sections of the draft project report will be initiated in Step 1, updated in Step 2 and finalised in Step 3 of the project. The bulk of the work of the Working Groups should however be completed by the end of Step 1.

Especially the Decommissioning Termination section of the FaSa project report will, at a minimum, document Member State experience and provide supporting detailed guidance to address the following high-level questions:

- What range of national legal / regulatory frameworks and approaches is employed associated with licence termination applications?
- What activities should operators undertake (e.g. analysis, on-site measurements / surveys etc) to demonstrate that the end state will be (or is) appropriate (e.g. in accordance with relevant criteria)?
- How do multi-facility site considerations affect the activities undertaken by operators (e.g. what extra needs to be done; what aspects are not needed for a multi-facility site)?
- What requirements could be necessary for a site to be released under restricted use conditions?
- What information should operators supply to the regulator, when applying for a licence termination, to justify that the end state will be (or is) appropriate?



- ***Interfaces with other Working Groups***

During Step 1 of the project the three Working Groups will co-ordinate their activities with those of the parallel Test Case Working Groups (see Appendix A). During the later Step 2 and 3 former members of the Working Groups will participate in the review of the Test Case reports generated concerning the application of the developed methodology (in Step 1) to provide comments to the Test Case reports and will feedback experiences into an update of the methodology.

5.2. IMPLEMENTATION OF THE SAFETY ASSESSMENT RESULTS

- ***Rationale***

Many operators follow a systematic phased approach for decommissioning which in principle can be described as follow:

- Removal of spent fuel (where applicable), radioactive waste and dangerous substances used and produce during the operating life of the facility (transition phase between operation and decommissioning);
- Preliminary operations to prepare the decontamination/dismantling work (e.g. new working areas, supporting facilities, interim storage of waste, etc.);
- Decontamination/dismantling activities in order to reduce the source term of the facility using a step by step approach;
- Final cleanup activities (buildings, etc.) and release (or reuse) of buildings or site.

With respect to this approach, the operators have to identify, according to the facility state evolution:

- Which safety functions and related SSCs designed for and used during the operating of the facility will remain;
- If new safety functions and related SSCs are necessary during the decontamination/dismantling operations;
- When the safety functions and related SSCs are no more needed and when associated controls can be terminated.

Generally at the end of a given phase, according to the results of the safety assessment of the next phase, the decision to terminate the implementation of a safety function and the associated controls can be taken by the operator. In some cases, according to the input of new data, the decision to maintain the implementation of that safety function(s) may also need to be taken.

The end of the implementation of a safety function implies the removal of the related SSCs. As far as the removal of the SSCs can be irreversible, the decision of the operator should be taken after an independent review. An engineering assessment of the SSCs must be performed by the operators and if necessary compensatory safety measures must be implemented during a short period of time in order, for example, to complete the dismantling activities of a given phase. In some cases, and especially



when the implementation of compensatory safety measures is needed, the end of the implementation of a safety function and/or the removal of SSCs are approved by the regulatory body.

In order to make adequate decisions on the removal, replacement or maintenance of SSCs the results of the safety assessment are needed to support the demonstrate compliance with the regulatory requirements. Therefore, the results of the safety assessment should be used to identify the safety measures, safety limits, dose limits and dose constraints and other controls and conditions that should be applied to the decommissioning activities. In addition, safety measures and controls should also be identified in order to mitigate abnormal events which could occur during decommissioning. Potential changes to site discharges as a result of the safety assessment should also be considered.

According to the complexity of decommissioning activities and facilities (e.g. multi-facilities site, complex facilities), a phased (step-by-step) approach to decommissioning and safety assessment can be selected. Experience feedback shows that even for small in scale facilities, a phased approach is also relevant as the nature of the dismantling operations and the hazards associated with may differ for each phase (see DeSa Laboratory Test Case in Ref [14]). In any case the safety measures and the safety limits must be commensurate to the level of risk of each phase.

For these reasons the Working Group on Implementation of Safety Assessment Results will be established at the end of Step 1 of the FaSa project to address these aspects. The Working Group will build on and further develop the recommendations developed in Step 1, and in particular those of the Decommissioning Conduct Working Group.

The Working Group on Implementation of Safety Assessment Results and the Working Group on Review of Implementation, Modifications and Evolutions of Safety Assessment Results will run through the Step 2 of the FaSa project, complementary to the Test Case Working Groups (see Appendices A , B and C).

- ***Objectives***

The main objective of the Working Group on Implementation of Safety Assessment Results is to provide recommendation for the implementation of the safety assessment results in a detailed decommissioning plan during its implementation in individual phases of a decommissioning project. This will be performed with the view to identify the relevant safety functions of each phase (criticality, radioprotection, confinement, etc.) and the related SSCs and other safety measures (e.g. technical and administrative) needed.

The objectives of this FaSa Working Group are also to provide recommendation on the independent review and update of safety assessments during decommissioning phases by operators on the implementation of the safety assessments results and on the interfaces between operators and regulators.

- ***Activities***

The Working Group on Implementation of Safety Assessment Results will review the Member States experience and develop recommendations on the approaches for demonstration of the application of the concept of defence in depth; optimization of



protective measures to achieve exposure as low as reasonably achievable, and also recommendations on the application of a graded approach to implementation of safety assessment results.

In practice, the safety functions, the associated controls and the related SSCs are described by the operator in an operational document, or set of documents (e.g. operating rules, see Appendix C). According to the phased approach, the operating documents should be updated by the operator and could be reviewed and revised according to the outcomes of the revised safety assessment, in most cases approved by the regulatory body. The Working Group will develop recommendations on the practical application of the safety assessment results in the operating documents at a single and multi-facility site, where decommissioning is underway.

The Working Group will also review and provide feedback to the draft reports of the Test Cases of FaSa project.

- ***Outcomes***

It is envisaged that the work of the Working Group on Implementation of Safety Assessment Results will result in recommendations on:

- A methodology to identify the safety functions and the associated SSCs (evolution through the phases) and the way to end the implementation of safety functions and the associated SSCs, including regulatory considerations;
- The application and demonstration of the concept of defence in depth;
- Demonstration of optimization of protective measures;
- The application of the graded approach to implementation of safety assessment results in decommissioning activities and decommissioning plan;
- Relevant approaches for the implementation of the safety assessments results in decommissioning plan, supporting documents, working instructions and procedures, etc.

The outcomes of Working Group on Implementation of Safety Assessment Results activities will provide an input to the main project report (Safety Report). It could be also used as an input into the development of the Tests Cases, Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group and as feedback to the recommendations developed in Step 1 of the project.

- ***Interfaces with other working groups***

The Working Group activities will build on the outcomes of Step 1 of FaSa project. During Step 2 the Working Group will ensure strong interface with the test cases and the Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group. Nevertheless, it is expected that the Working Group can also provide feedback on the outcomes of the Working Groups of Step 1.

5.3. REVIEW OF THE IMPLEMENTATION, MODIFICATIONS AND EVOLUTIONS OF SAFETY ASSESSMENT RESULTS

- ***Rationale***



The implementation of safety assessment results, as well as modifications and evolutions of the safety assessment due to changing facility state in decommissioning may require a review by the operator and by the regulatory body (where appropriate) to ensure that the risks to health and safety of workers and members of the public are as low as reasonably achievable below defined limits and in compliance with regulatory requirements and criteria.

The independent review of the implementation of the safety assessment results complements the review by the regulatory body, and is aimed to ensure an efficient, appropriate and transparent system of control of safety during decommissioning. The DeSa project focused mainly on the development of recommendations for regulatory review of safety assessment. It is envisaged that the FaSa project will elaborate further and develop recommendations on the review of the implementation of safety assessment results during the entire lifecycle of a facility.

- ***Objectives***

Main objective of the Working Group on Review of Implementation of Safety Assessment Results is to develop recommendations and tools to assist regulatory bodies, independent reviewers and operators regarding:

- (a) The review of the implementation of the safety assessment results associated with a multiphase decommissioning project, taking into account the DeSa methodology (from initial to final decommissioning plan);
- (b) The review of implementation of modifications resulting from changes to the safety assessment (e.g. due to an incident, new information available), both from operator and regulator sides, taking into account the DeSa methodology;
- (c) The review of the implementation of the safety assessment results, by the operator and the regulator, including inspections;
- (d) The review of the license termination application;
- (e) In general, the interfaces between independent and regulatory reviews.

- ***Activities***

During Step 2 of the FaSa project this Working Group will analyse the Member States experiences and approaches in independent and regulatory review of the implementation, modifications and evolutions of safety assessments. On this basis an agreed approach will be developed and documented. At the end of Step 2 the Working Group will perform a review for each of the Test Cases developed in the FaSa project to test the harmonised review approach developed by the Working Group and to provide feedback to the Test Case draft reports. The review will take into account the related results of all working group activities of the FaSa project, as well as the DeSa methodology on regulatory review.

In addition, the Working Group will incorporate experience resulting from recent applications of the DeSa methodology on regulatory review [14] in the Member States into that methodology.

- ***Outcomes***



The expected outcomes of the Working Group on Review of Implementation, Modifications and Evolutions of Safety Assessment Results at the end of Step 2 are the following:

- (a) Recommendations on the independent reviews and regulatory reviews of initial safety assessments;
- (b) Recommendations on independent reviews and regulatory reviews of the implementation of safety assessment results during conduct of decommissioning, including inspection;
- (c) Recommendations on independent reviews and regulatory reviews of modifications and evolutions of safety assessments;
- (d) Recommendations on specific periodic reviews by operators of decommissioning safety assessments;
- (e) Recommendations on the review of the license termination application;
- (e) Feedback to the outcomes of the Working Group on the Implementation of Safety Assessment Results of this project (Step 2);
- (f) Feedback and recommendations on the Test Cases of this project developed in Step 1 and Step 2 of the project.

During the meeting participants are expected to contribute by sharing their practical experience on the conduct of independent and regulatory reviews of (i) safety assessment and (ii) the implementation of safety assessment results and (iii) the license termination application. It will also provide recommendations on the procedures to be followed to review the implementation of modifications resulting from changes to safety assessment. In addition, the meeting participants are expected to participate in the review of the draft Test Case reports developed in the FaSa project. They are also encouraged to report on their experiences on the application of the DeSa methodology in regulatory reviews [13].

- ***Interfaces with other working groups***

It is expected that the working group will benefit from the results of Working Groups performed during Step 1 of this project and can provide feedback on the outcomes of the working groups of Step 1, as well as of Step 2.

Finally, it is expected, that members of the Working Group will perform independent reviews of the test case reports to provide feedback to the test cases same as to gain feedback on the review methodologies developed.

5.4. APPLICATION OF SAFETY ASSESSMENT TO REAL FACILITIES (TEST CASES)

The recommendations that are planned to be developed in Step 1 and Step 2 of the FaSa project are intended to be illustrated on several real facilities, volunteered by the participating Member States. The aim is to select a range of facilities with different hazards, complexities, endpoints and endstates, and also to complement the Test Cases of the DeSa project [14]. The test cases are also intended to illustrate the use of



safety assessment in different stages of decommissioning planning and conduct. The proposals for the specific test cases will be discussed and decision is expected to be made at the first project meeting in 17-21 November 2008 at the IAEA headquarters in Vienna, Austria.

The Test Cases are expected to develop the assessment framework, description of the facility and decommissioning activities and hazard analysis in Step 1 of the project. Analysis of consequences and assessment results are envisaged to be carried out in Step 2, together with development of specific recommendations on the application of the assessment results in decommissioning planning and conduct. The draft Test Case reports are then planned to be presented to the Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group and the Implementation of Safety Assessment Results Working Group at the end of Step 2 of the project. In addition, members of the former Working Groups on Decommissioning Planning, Decommissioning Conduct and Decommissioning Termination participate in reviews of the Test Case reports. Comments and recommendations on the test cases same as on the individual methodologies (developed by the various Working Groups) will be considered in the finalization of the Test Case reports and Safety Report in Step 3.

5.4.1. Nuclear Power Plant

- ***Rationale***

Decommissioning of a NPP is a complex task that involves variety of decommissioning activities at different systems, structures and components, some related and others not related to safety during operation and/or decommissioning. Due to the large scale of work required to evaluate the safety of decommissioning of an NPP, DeSa project developed a Test Case that covered the assessment for decommissioning of two systems of a NPP unit. This was considered useful and sufficient to demonstrate the applicability of the safety assessment methodology developed by the DeSa project [14]. Nevertheless it was recognised by the DeSa participants that it will be beneficial for operators, regulators and other experts to assess the overall impact of a NPP (a reactor unit) decommissioning by applying the DeSa methodology.

- ***Scope***

The FaSa project is planned to undertake this task to a NPP for which the immediate dismantling is planned.

The safety assessment will need to address all decommissioning activities, such as removal of the reactor pressure vessel, reactors internals, their segmentation, packaging and handling. Radioactive waste and clearance will also be addressed. Where possible, in-depth analysis for specific decommissioning task(s) will be performed.

- ***Objectives***

The aim of developing the NPP Test Case is to:

- (a) To illustrate the DeSa methodology for evaluation of safety of decommissioning of a large and complex facility and to develop an overarching safety assessment;



- (b) To illustrate the evaluation of the technical feasibility, defence in depth and to demonstrate the optimization of protection measures to a large complex facility;
- (c) To illustrate the implementation of the safety assessment results in the practical decommissioning activities and the development of a decommissioning plan, as well as the application of the graded approach.

- ***Activities***

The overall safety assessment for the reactor decommissioning will be performed; the SSCs will be identified; and recommendations made on the implementation of the safety assessment results in the NPP internal procedures.

The draft safety assessment will be submitted for review to the Review of Implementation of Safety Assessment Results Working Group at the end of Step 2 of the FaSa project, before finalization of the report in Step 3.

- ***Outcomes***

It is envisaged that the NPP Test Case will demonstrate the application of the DeSa methodology to a whole complex facility. It will also illustrate the application of the safety assessment results in decommissioning conduct; and will test the internal independent review recommendations (developed by the Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group).

The Working Group will provide input to the Safety Report that will summarise the work of the FaSa project, lessons learned and conclusions.

- ***Interfaces***

The NPP Test Case Working Group will coordinate its activities with all Working Groups in the project.

5.4.2 Fuel Fabrication Facility

- ***Rationale***

A number of fuel cycle facilities are under decommissioning worldwide and safety assessment for these activities is needed to terminate the license and release the facility or site from regulatory control (e.g. unrestricted or restricted use). Such facilities were not addressed as test cases in the DeSa project and for this reason developing a test case in the FaSa project can complement the examples of application of the DeSa methodology to a broad range of facilities and will also illustrate the application of the safety assessment results in an ongoing decommissioning project.

The proposed test case is intended to evaluate safety of decommissioning of a fuel fabrication facility that was operated from 1971 to 1992 at a multi-facility site. The facility was used for manufacturing Mixed-oxide fuel assemblies for Prototype Fast Reactors. Part of the facility is under decommissioning, and part of the facility is also used for plutonium waste receipt/dispatch operations, thus giving it a “dual” role.

- ***Scope***

The scope of the Fuel Fabrication Test Case is the facility undergoing decommissioning using a “phased” approach, with the project currently in Phase 3



implementation, which is the most technically challenging phase. Assessment work for the final phase is planned to start, and the scope of this phase will include the removal of the mobile filtration unit and the building ventilation extract ductwork.

- **Objectives**

The Fuel Fabrication Facility Test Case has the following objectives:

- (a) To demonstrate the role of a safety assessment during a “phased” decommissioning project, including how this approach aids both operators and regulators;
- (b) To demonstrate how a safety assessment is used to carry out optioning, hazard analysis (both radiological and conventional) and the identification of the appropriate controls (both managerial and engineering).
- (c) To demonstrate how a “graded approach” is adopted throughout the safety assessment process and how “defence in depth” and optimization are achieved;
- (d) To demonstrate how the safety assessment is implemented and incorporated into the working documentation, including the appropriate compliance activities (both managerial and engineering);
- (e) To demonstrate how the safety assessment is amended following a change in the decommissioning strategy – addressing changes outside the license conditions and demonstrating compliance.

- **Activities**

By using this facility as a test case it will allow the decommissioning safety assessment methodology defined during DeSa to be demonstrated on a fuel fabrication facility.

Furthermore to this methodology, additional aspects will be demonstrated such as change control process, defence in depth and the identification and integration of the conventional safety hazards/controls.

The application of the Fuel Fabrication Facility as a test case will demonstrate the following:

- How the overarching safety assessment evolves through the decommissioning project phases;
- How the waste management strategy affects the decommissioning activities;
- The safety assessment and operational issues of having a “dual” purpose facility, a decommissioning project in implementation and carrying out plutonium waste receipt/dispatch operations within the same facility;
- Revaluation of safety in case of change of technology or end state.

- **Outcomes**

The outcome of the working group on the Fuel Fabrication Facility will document:

- Recommendations on the role of the safety assessment during a “phased” decommissioning project and how this aids both operators and regulators;



- Recommendations on how to use a safety assessment to carry out optioneering, hazard analysis (both radiological and conventional) and the identification of the appropriate procedures (both managerial and engineering);
 - Recommendations on how to adopt a “graded approach” throughout the safety assessment process and how to achieve “defence in depth” via the safety assessment and its results;
 - Recommendations on how to implement a safety assessment and incorporate the findings into the working documentation;
 - Recommendations on how to amend a safety assessment, following a change in the decommissioning strategy, controls including the information flow into the working documentation.
- ***Interfaces with other working groups***

The Test Case is envisaged to illustrate the recommendations developed in Step 1 of the project and therefore will coordinate its activities with the all Working Groups in Step 1. It will also provide feedback on the recommendations developed in Step 2 that will be reflected in the main project report. The draft report of the Fuel Fabrication Facility will be submitted to the two working groups (Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group, and Implementation of Safety Assessment Results Working Group) for comments and recommendations at the end of Step 2.

5.4.3 Complex Research Reactor

- ***Rationale***

In a complementary manner to the DeSa project [14], the follow-up FaSa project is considering a more complex research reactor at a multi-facility site – a nuclear research centre. It is proposed that for this reactor an immediate dismantling strategy is being adopted with the view to complete decommissioning before 2012. In addition the site includes three research reactors, a laboratory for activated materials and a treatment facility for liquid and solid radioactive waste.

The proposed research reactor subject of the FaSa project is a 35 MW light water research reactor built in 1963 and operated until 1997. The final shut-down and post-operation clean-up operations were carried out until 2004. Its decommissioning phase began in 2005 allowing dismantling and decontamination works until 2010.

For the Research Reactor Test Case two major input data changed after the decommissioning commenced:

- (a) The main reactor pool proved to be much more activated than expected. Therefore the manual removal of the liner as initially planned had to be replaced by a mix remote and manual removal technology;
- (b) Due to the development of the area surrounding the research centre, the end state has evolved from “re-use of the decommissioned buildings at the research centre site” (restricted use) to “use of the site for an urban motorway” (unrestricted use). The project of the local administration unveiled the necessity



to demolish the reactor building and to cleanup the site for practical release of the land of the research centre for unrestricted use.

- ***Scope***

The Research Reactor Test Case will focus on the evaluation of the safety impact of two changes of input data observed during the decommissioning. This will include re-evaluation of safety assessment and application of the safety assessment results in ongoing decommissioning, limits, controls, conditions and related procedures.

The safety assessment to be performed will be based on real documents about the facility (e.g. waste inventory, radiological characterisation and zoning, site rules, technical specifications for operating and maintenance, specific safety analysis, list of tasks, permits of work, etc.) and the “internal authorization” system applied at the site.

The test case will analyze how the changes can be dealt with the application of the DeSa methodology [14]; e.g. hazard analysis, graded approach, regulatory review, etc.

- ***Objective***

The objectives of this test case are to:

- Illustrate the use of the DeSa methodology in re-evaluation of safety with the view to address changes occurring during a decommissioning project (i.e. change of the end state);
- How to use the safety assessment results in demonstrating compliance with safety criteria, taking into account new input data/modifications;
- Develop recommendations to optimize the interface between the regulatory body and the operator during a decommissioning project affected by changes.

- ***Activities***

It is envisaged that the Test Case will re-evaluate safety of decommissioning taking into account the new changes (e.g. end state); will analyse and provide recommendation on whether the facility is within the safety envelope and whether the existing SSCs are sufficient and if other safety measures need to be in place during decommissioning.

The Test Case is envisaged to illustrate the recommendations developed in Step 1 of the project and therefore will coordinate its activities with the other Working Groups in Step 1. It will also provide feedback on the recommendations developed in Step 2 that will be reflected in the main project report. The draft report of the Research Reactor Test Case will be submitted to the two working groups (Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group, and Implementation of Safety Assessment Results Working Group) for comments and recommendations at the end of Step 2.

- ***Outcomes***

The outcome of the working group on this test case will be a document detailing:

- The evaluation of safety of the changes according the DeSa methodology;
- Recommendations on the use of safety assessment results in confirmation of originally planned safety measures or for the proposal of amendment of the



safety measures (taking into account the changes in the decommissioning project).

- Feedback to the recommendations of Steps 1 and 2 of the FaSa project, as well as to the DeSa methodology (if applicable).
- ***Interfaces with other working groups***

The Research Reactor Test Case will coordinate its activities with all Working Group in Step 1 and Step 2 of the project.

5.4.4 Mining and Mineral Processing Facility

- ***Rationale***

The methodology for safety assessment of decommissioning developed in the DeSa project was illustrated to facilities different than fuel cycle facilities. Therefore it has been considered useful to illustrate the methodology to decommissioning of a mining or mineral processing facility and to investigate the specific aspects related to hazards, scenarios, etc. In addition during the Step 1 of the FaSa project further recommendations on the safety assessment and its evolution during the lifecycle of a facility will be developed. To explain in more detail their application and thus to assist the Member States with decommissioning of mining and mineral processing facilities, a Test Case of a mining and mineral processing facility is proposed to be developed in the FaSa project.

- ***Scope***

The Test Case is intended to cover a gold mining facility, which has the processing of natural uranium for use in a fuel fabrication facility (including old processing facilities, tailings, shafts, etc.). It has been in operation for several tens of years with nominal capacity of several hundreds TPD. The facility has been used for producing uranium concentrate as a byproduct in the mining industry. The facility needs to develop a decommissioning strategy and an initial decommissioning plan, in accordance with regulatory requirements. The Test Case will be developed on the basis of the description of a real volunteered mining and mineral processing facility.

- ***Objectives***

The Test Case is expected to illustrate:

- (a) The application of the DeSa methodology to a mining and mineral processing facility;
- (b) The application of the recommendations related to the development of a initial safety assessment (Step 1 of FaSa project);
- (c) The considerations of radiological (e.g. NORM) and conventional hazards, related safety functions, etc.;
- (d) The use of an initial safety assessment and its results in development of initial decommissioning plan for such facilities.

- ***Activities***



The initial safety assessment will be developed in preparation of a later shutdown and decommissioning of the mining and mineral processing facility. The proposed end state is unrestricted site release. Recommendations for the use of the safety assessment results in the preparation of the initial decommissioning plan will also be developed.

The Mining and Mineral Processing Facility Working Group will also submit the draft report for review to the Working Group on Implementation of Safety Assessment Results and the Working Group on Review of Implementation, Modifications and Evolutions of Safety Assessment Results at the end of Step 2.

- ***Outcomes***

The outcomes of the Mining and Mineral Processing Facility Working Group are envisaged to cover:

- (a) Documentation of the initial safety assessment for a mining and mineral processing facility, including explanations on the integration of recommendations from the DeSa project and FaSa projects;
- (b) Recommendations on the application of safety assessment results in the preparation of a initial decommissioning plan for a mining and mineral processing facility;
- (c) Feedback on the recommendations on the safety assessment for the early stages of facility lifecycle and use of the results in a initial decommissioning plan;
- (d) Feedback to the review of the recommendations on implementation of safety assessment results and their review, as developed during Step 1 and Step 2 of the project.

During the project participants are expected to contribute by sharing their practical experience on the conduct of safety assessments for decommissioning of mining and mineral processing facilities.

- ***Interfaces with other working groups***

The Mining and Mineral Processing Working Group takes into account the results of the Steps 1 and 2 of the FaSa project. In addition, members of the Working Group on the Review of Implementation, Modifications and Evolutions of Safety Assessment Results and the Working Group on Implementation of Safety Assessment Results are expected to perform an independent review of the draft test case initial safety assessment at the end of Step 2 of the FaSa project.

5.5. Summary of Lessons Learned

In the Step 3 of the FaSa project is envisaged to collect the experiences of all working groups and to consolidate all recommendations in a Safety Report (containing several volumes, see Appendix A).

The Working Groups and Test Cases will provide their input to the Safety Report that will capture a comparison of approaches, agreed recommendations and identified differences and areas for further work and improvement. Feedback from each of the Test Case Working Groups will also be captured to evaluate the effectiveness of the DeSa and FaSa recommendations. The results of the independent reviews of the Test



Cases and their analysis will be also presented in the Safety Report (see sections 8.2 and 8.3).

6. EXPECTED OUTCOMES OF THE PROJECT

The project is expected to result in recommendations on the implementation of safety assessment results for decommissioning of facilities using radioactive material (planning, conduct and termination of decommissioning). These recommendations will complement the recommendations developed during the DeSa Project, which were based on the Member States experiences [14].

The recommendations will serve the Member States with more diverse practical examples on the application, practices and procedures used for a safety assessment for decommissioning.

In detail, the FaSa project is expected to result in:

- Recommendations on the role of the decommissioning safety assessment in the lifecycle of existing facilities and the development of decommissioning plans;
- Recommendations on implementation of decommissioning safety assessment results during individual phases of the decommissioning of a facility;
- Documentations on the test cases performed to demonstrate the application of decommissioning safety assessment methodology and the implementation of decommissioning safety assessment results during the different periods of the lifecycle of a real facility and during different phases of the decommissioning project. It is expected, that this documentation will provide:
 - (a) an illustration of the application of the decommissioning safety assessment methodology to fuel cycle facilities and mining processing facilities, which were not part of the DeSa project, as well as to a whole NPP and a complex research reactor;
 - (b) an illustration of decommissioning safety assessments for single and multi-facility sites;
 - (c) an illustration of optimization of protection, technical feasibility, defence in depth, etc. during decommissioning;
 - (d) an illustration of the consideration of waste management activities related to decommissioning activities in the decommissioning safety assessment and interface with other relevant international projects.
- Recommendations on the independent review by operators and by the regulatory body on the implementation of decommissioning safety assessment results, including inspections and periodic safety reviews, as well as on the interactions between operators and regulatory body regarding the implementation of decommissioning safety results;
- Improvement of capabilities of the Member States in this field and enhancement of the exchange of information between Member States on lessons learned related to the development, review and update of decommissioning safety



assessment during all periods of the life cycle of a facility using radioactive material.

The FaSa project is also envisaged to develop recommendations, where applicable, for enhancement of the DeSa methodology.

It is also expected that the FaSa project will provide a useful input to the revision of the Safety Guides on decommissioning of NPPs, research reactors [5], fuel cycle facilities [7] and medical and research facilities [6] planned to be completed in 2011.

The project will produce a Safety Report (in several volumes), Newsletters as well as a CD-ROM with supporting information.

7. PARTICIPATION

The FaSa project is open to experts and organizations (e.g. operators, regulatory bodies, and supporting organisations) from Member States that are or will be involved in the planning, evaluating, undertaking or regulating the decommissioning of facilities using radioactive material.

During the working group meetings, all the participants are expected and encouraged to contribute by presenting approaches to use and application of safety assessment in the planning, undertaking and termination of decommissioning and sharing experiences from relevant national projects and by participating in technical discussions and FaSa project activities. It is envisaged that the participants will take active part in the assessments and in the development of project test cases. By this means it is expected that the FaSa project will provide a valuable forum for the exchange of experience, knowledge and lessons learned between countries with on-going decommissioning programmes and countries that are in the planning stage of decommissioning.

Official letters with invitation to all Member States are envisaged to be sent through the Permanent Missions in Vienna in May 2008. The official nominations of experts who wish to participate in the project need to be sent to the IAEA not later than **15 September 2008**. The participants will be requested to indicate to the Agency before the working groups in which they are interested to participate.

Requests for additional information about the project need to be sent to the IAEA Scientific Secretaries - Ms. Borislava Batandjieva (email: B.Batandjieva@iaea.org) prior end of June 2008) and to Mr. Mark Hannan (email: M.Hannan@iaea.org).

8. WORK PLAN

8.1. Project Meetings

The project is planned for three years and will commence on **17 November 2008**, at an opening meeting at the IAEA Headquarters in Vienna, Austria. At this meeting the detailed project scope, objectives and activities will be discussed and agreed, including the work plan - individual Working Group meetings and Joint Working Group meetings. Annual Joint Meetings of all FaSa project working groups will be organized that will facilitate the coordination of the project activities,



recommendations and development of the inputs to the Safety Report. In addition individual working group meetings are planned to be conducted in order to facilitate the work of each group according to the agreed FaSa plan (see Table 1, page 25). The Coordinating Working Group will meet annually, usually in conjunction with other project meetings.

8.2. Development of Project Documentation

The project is planned to commence with the review and further development of a draft Safety Report on “Use and Application of the Safety Assessment and its Results in Planning, Performance and Termination of Decommissioning” – vol. 1 (see Section 6).

Volume 1 is aimed to be the main report to which all Working Groups will contribute through the project. It is the objective of Step 1 of the project to develop the draft report, to maturity before continuing Step 2 of the project. This is primarily to be accomplished with input to the main part of the document but should be supplemented by material for annexes and appendices, if necessary, where e.g. technical detail could be outlined or country specific information could be given.

Table 1 Proposed work plan for the FaSa project

<i>FaSa Project</i>	<i>Planned Meetings</i>	<i>Scheduled Dates</i>
Preparation of the proposed project scope, objectives, activities and description of test cases	Preparatory meeting 1 for preparation of the terms of reference of the project	3-7 Dec 2007
	Preparatory meeting 2 to prepare the first draft of the main project report to be discussed at the 1 st project meeting in November 2008	7-11 April 2008
	Invitations to Member States	April 2008
	Preparatory meeting 3 to prepare the 1 st project meeting and draft specifications for the proposed test cases	13-15 Oct 2008
	Official nomination of participants	15 Sept 2008
Step 1 Development of detailed specific recommendations on the use of safety assessment in from planning to termination of decommissioning	Coordinated Working Group meeting First project meeting (opening)	17-21 November 2008
	Working Group meetings Coordinated Working Group meeting	Jan – Oct 2009
Step 2 Development of detailed specific recommendations on the use of safety assessment in the decommissioning conduct	Second project meeting	Dec 2009
	Working Group meetings Coordinated Working Group meeting	Jan – Oct 2010
	Third project meeting	Nov 2010
Step 3 Preparation of summary, lessons learned and final report	Working Group meetings Coordinated Working Group meeting	Jan – Oct 2011
	Fourth project meeting (closing)	Nov. 2011
	Publication of final proceedings	2012



Volume 1 is aimed to be the main report to which all Working Groups will contribute through the project. It is the objective of Step 1 of the project to develop the draft report, to maturity before continuing Step 2 of the project. This is primarily to be accomplished with input to the main part of the document but should be supplemented by material for annexes and appendices, if necessary, where e.g. technical detail could be outlined or country specific information could be given.

The second volume expected to be developed is related to Review of Implementation, Modifications and Evolutions of Safety Assessment Results Working Group. This should possibly be considered in the work of these working groups from the beginning.

A third volume of the Safety Report will be created from the evaluation of Test Cases, which is to take place through the entire project.

8.3. Dissemination of information on FaSa project

The outcomes of the FaSa project will be summarized in a Safety Report (containing several volumes) published by the Agency and made available through a project website specifically developed for the purpose of the project.

During the project implementation key information about the project achievements, planned activities and draft reports will be developed and it will comprise:

- An *introductory document* describing the project scope, objective, content and work plan of FaSa (this document planned to be updated regularly as necessary);
- *FaSa Newsletters* produced reflecting the progress made by the individual working groups and a general summary of the issues of interest of the project participants and other interested experts;
- *FaSa Project web site* to be launched before the project commences in November 2008.
- *Working Group documents*, supporting the main Safety Report and presenting the working group progress, lessons learned, conclusions and recommendations;
- *Proceedings of each project meeting* (incl. minutes of the meeting and the presentations and documents uploaded on the project web site);
- Presentation of *articles, papers, presentations* on FaSa activities, progress, outcomes, etc. at international conferences and events related to decommissioning;
- *FaSa final outcomes and recommendations* that will be published as volumes of one Safety Report (including a final proceedings CD-ROM).

As mentioned a project web site is planned to be developed where draft FaSa documents, reference materials, etc. will be uploaded for use and review by all participants in the project.



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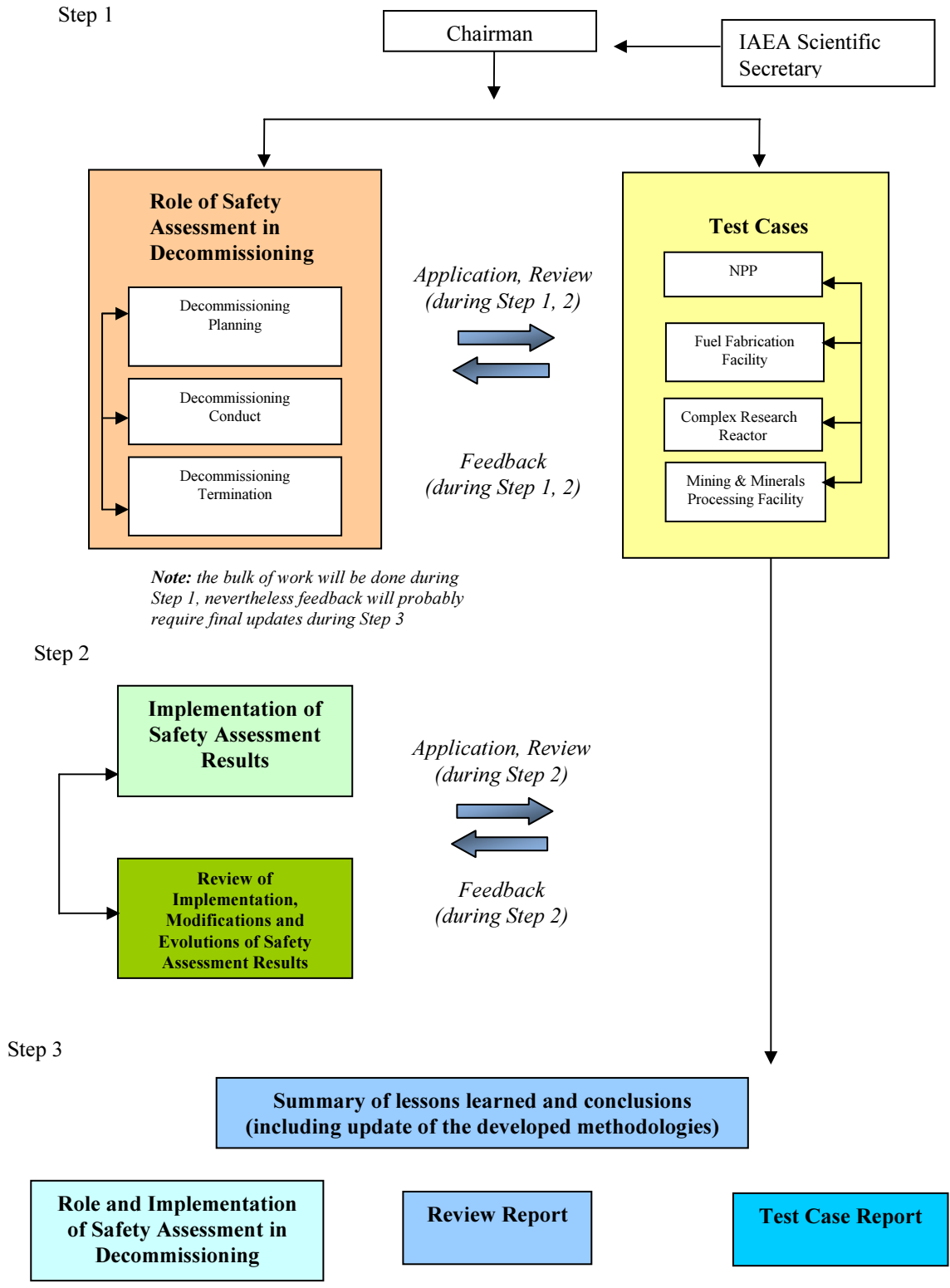
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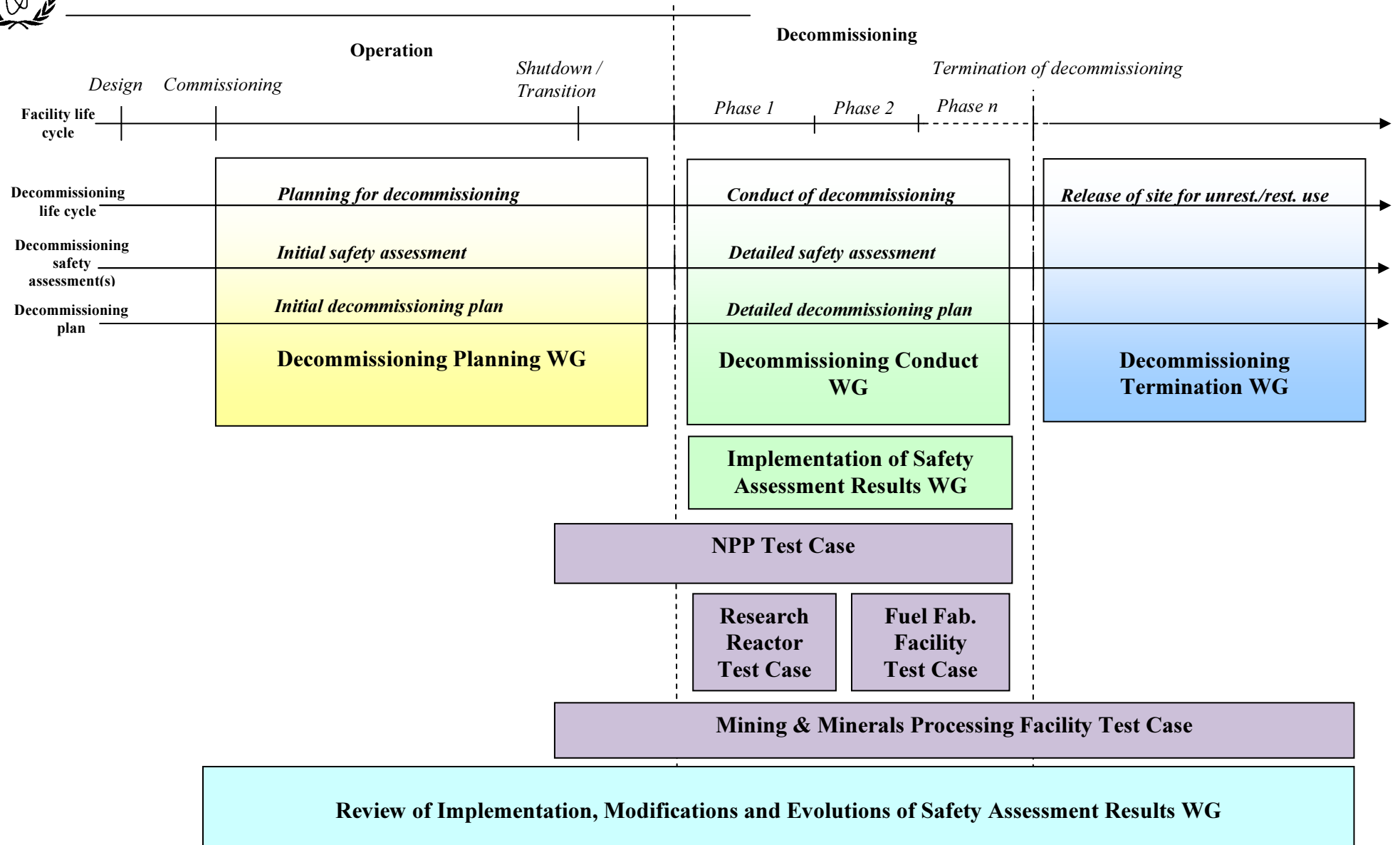


Proposed Organization of FaSa Project (incl. simplified dependencies between WGs)





Relation of the Project Working Groups to the Decommissioning Activities (Planning, Conduct and Termination)





APPENDIX C

AN EXAMPLE OF RELATION OF SAFETY ASSESSMENT TO SAFETY RELATED DOCUMENTS

