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FaSa

International Project on Use of Safety Assessment in the Planning and Implementation of Decommissioning of Facilities using Radioactive Material

Preamble - There is an increasing number of decommissioning activities worldwide at facilities that use radioactive material. In most cases this is because these facilities are either reaching the end of their lifetime, have already been shut down as planned or have been shut down prior to their expected lifetime (either as a result of accidents, political, social or other reasons). These facilities are large in number and cover a wide range of types including small research laboratories, research reactors, reprocessing facilities, fuel fabrication facilities, nuclear power plants, mining and mineral processing facilities, etc.

Safety of all facilities using radioactive material needs to be ensured through their lifetime 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. 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 an international project on “Evaluation and Demonstration of Safety during Decommissioning of Nuclear Facilities” (DeSa), in November 2004. 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).

The three year project fulfilled the planned tasks, provided important input to the Safety Guide WS-G-5.2 “Safety Assessment for Decommissioning of Facilities Using Radioactive Material” (published in 2009) and a series of national and IAEA technical projects on decommissioning. The participants in the DeSa project also recognized 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
- Evolution of safety assessment through the facility lifecycle

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Objectives

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

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- 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
- 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)
- Application of the graded approach in the application of safety assessment
- 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)
- Demonstrate the application of these recommendations on selected real facilities planned for or undergoing decommissioning

A decision about the proposed scope, objectives and activities of the FaSa project was reached at its first FaSa project meeting from 17 to 21 November 2008 in Vienna, Austria.

Scope

The FaSa project was aimed at illustrating the dynamic nature of decommissioning safety assessments and the need for their periodic review and updating, in order to take into account the changing facility status and hazards, the complexity of decommissioning activities at key phases, and/or the stage of decommissioning. It addressed initial safety assessments at early optioneering stages once the decommissioning plan was agreed, at key stages of decommissioning after shutdown, including unanticipated circumstances during decommissioning, through to safety assessment on the completion of decommissioning, which could be for the purposes of site release for unrestricted or for restricted use.

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

The project addressed immediate dismantling and deferred dismantling of a large range of facilities with different hazards and complexities, endpoints and end states (release of the site for restricted and for unrestricted use). The project illustrated its recommendation through test cases, based on real decommissioning projects volunteered by Member States. This range of test case applications was extended beyond those addressed by the DeSa project namely, to a nuclear power plant, a large research reactor, a mining facility and a fuel fabrication facility.

The project focused on radiological hazards to workers, the public and the environment. However, it also addressed industrial hazards during decommissioning that contribute to radiological hazards and their potential consequence.

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Main Activities

On this basis, the structure and activities of the FaSa project were undertaken in three steps, described below.

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:

- Decommissioning planning
- Decommissioning conduct
- Termination of decommissioning

The development of the selected test cases commenced at this phase on the basis of real facilities volunteered by Member States:

- A nuclear power plant
- A fuel fabrication facility
- A complex research reactor
- A mining and mineral processing facility

Step 2 – Development of detailed specific recommendations on the use of safety assessment during the decommissioning:

- 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, industrial and safety controls, etc.
- 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

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

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Participation

The FaSa project gathered experts and organizations (e.g. operators, regulatory bodies, and supporting organizations) 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 participants contributed by presenting approaches to the 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. The participants actively participated in the assessments and in the development of project test cases. Through this means the FaSa project provided 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.

Project implementation

The project was implemented during three years. It commenced on 17 November 2008, at an opening meeting at the IAEA Headquarters in Vienna, Austria, where the detailed project scope, objectives and activities, including the work plan, were discussed and agreed upon.

Annual Joint Meetings of all FaSa project working groups were organized to facilitate the coordination of the project activities, recommendations and development of the inputs to the Safety Report. In addition individual working group meetings were conducted in order to facilitate the work of each group according to the agreed FaSa plan. The Coordinating Working Group had its annual meetings, usually in conjunction with other project meetings.

The project was concluded during the Fourth and Final Joint Meeting held on 21-25 November 2011 in Vienna.

Outcomes

The project resulted 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
- 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
- Recommendations for enhancement of the DeSa methodology
- A useful input to the current revision of the Safety Guides on decommissioning of NPPs, research reactors, fuel cycle facilities and medical, industrial and research facilities

Assistance was provided, through the FaSa project, to 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.

The recommendations developed and the project's test cases will be documented in an IAEA Safety Report Series publication.

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Conclusion of the FaSa Project

International Project on Use of Safety Assessment in the Planning and Implementation of Decommissioning of Facilities using Radioactive Material (FaSa)

In 2011, participants of all five FaSa Working Groups (WG) and those of the four Test Cases (TC) continued to work on the relevant parts of the FaSa report, drawing upon their experience of decommissioning safety assessment. Planning, review and coordination of group activities was carried out at various Working Group and Test Cases meetings.

Schedule of Meetings

Two meetings of individual Working Groups were held in 2011 - one in Grenoble, Research Reactor Test Case in March and one in in Rome, Nuclear Power Plant Test Case.

A combined meeting of three Working Groups and Test Cases was held in Paris comprised of the Decommissioning Conduct Working Group, the Implementation of the Safety Assessment Working Group and the Fuel Fabrication Facility Test Case Group, in September, 2011.

A meeting of the FaSa Coordinating Group was organized in Rome, on 4 to 6 May, 2011. At this meeting, progress achieved by all Working Groups and Test Case Groups since the Joint Meeting in 2010 was reviewed, while activities to be completed prior to the Final Joint Meeting in Vienna, November 2011, were planned. The work done by the different Working Groups and Test Case Groups was cross-checked so as to ensure consistency.

The Fourth and Final Joint Meeting of the FaSa project was held in Vienna, on 21 to 25 November, 2011 and was attended by 43 participants from 24 countries. Participants reviewed the progress achieved in 2011 and finalized all the project activities initiated and conducted during the First, Second and Third Joint FaSa Meetings, held in 2008, 2009 and 2010, respectively. The participants also reviewed the implementation of these activities, implemented through several meetings of the Working Groups and Test Cases Groups during the 2009-2011 period.

A few remaining activities to be completed in early 2012 were identified, including the finalization of the FaSa report and its submission for publication by the end of 2012. Materials prepared at the Final Joint Meeting will be reviewed by the FaSa Project Coordinating Group and prepared for publication in 2012.

Summary

The FaSa project was an excellent example of enthusiastic and very efficient joint work carried out by many experts from countries with different regulatory frameworks, different facilities, diverse human and financial resources, and varying levels of progress in decommissioning.

The project provided a forum for collection of best practices in decommissioning safety assessment and their implementation in practice, and for exchange of national experience. It also provided valuable input for the on-going revision of the IAEA safety standards for decommissioning (ppt). Similar projects should be considered in the future to address other priority topics on decommissioning.

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Joint Meeting, Vienna, December, 2008

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SPECIAL PROJECTS

FaSa: International Project on Use of Safety Assessment in the Planning and Implementation of Decommissioning of Facilities using Radioactive Material

URL: http://www-ns.iaea.org/tech-areas/waste-safety/fasa/default.asp?s=3

There is an increasing number of decommissioning activities worldwide at facilities that use radioactive material. In most cases, this is because these facilities are either reaching the end of their lifetime, have already been shut down as planned or have been shut down prior to their expected lifetime (either as a result of accidents, political, social or other reasons). These facilities are large in number and cover a wide range of types including small research laboratories, research reactors, reprocessing facilities, fuel fabrication facilities, nuclear power plants and mining and mineral processing facilities.

Safety of all facilities using radioactive material needs to be ensured through their lifetime and, therefore, evaluation and demonstration of safety is essential in the planning and implementation (e.g. instructions and procedures) of decommissioning in accordance with the national legislation and internationally agreed recommendations.

In order to assist operators, regulators and other experts involved in the planning, performance, control and termination of decommissioning activities and on the basis of the revised Action Plan on Decommissioning of Nuclear Facilities (2007) and the recommendation made by the Evaluation and Demonstration of Safety for Decommissioning of Nuclear Facilities (DeSa) project, an international project was prepared and launched in November 2008.

Fuel fabrication facility 1971-1992

NPP-WWER 70 MW 1966-1990

IAEA
International Atomic Energy Agency

Target Audience

Regulators | Operating Organizations | Educators

Waste Management

Related Technical Areas

FASA: INTERNATIONAL PROJECT ON USE OF SAFETY ASSESSMENT IN THE PLANNING AND IMPLEMENTATION OF DECOMMISSIONING OF FACILITIES USING RADIOACTIVE MATERIAL

This project, FaSa, aims to build on the DeSa project outcomes, to review international experience and to develop agreed recommendations on:

- The use and application of safety assessment in the development and review of decommissioning plans and safety related documents;
- The implementation of the safety assessment results in the conduct of decommissioning activities;
- The application of the graded approach in the application of safety assessment;
- The update of safety assessment, the operator/regulator review of safety assessments and the implementations of its results;
- The demonstration of the application of these recommendations on selected real facilities planned for, or undergoing, decommissioning.

The FaSa project is aimed at illustrating the dynamic nature of decommissioning safety assessments and the need for their periodic review and updating, in order to take into account the changing facility status and hazards, the complexity of decommissioning activities at key phases and/or the stage of decommissioning. It addresses 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 safety assessment on the completion of decommissioning, which could be for the purposes of site release for unrestricted or for restricted use.

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

The 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 the 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 life cycle of a real facility and during different phases of the decommissioning project;
- 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 with respect to the development, review and update of decommissioning safety assessment during all periods of the life cycle of a facility using radioactive material;
- Recommendations, where applicable, for enhancement of the DeSa methodology;
- A useful input to the revision of the Safety Guides on decommissioning of nuclear power plants, research reactors, fuel cycle facilities and medical and research facilities planned to be completed in 2011.

Assistance is provided, through the FaSa project, to 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.

The project was planned for three years and commenced on 17 November 2008, at an opening meeting at the IAEA headquarters in Vienna, Austria. The detailed project scope, objectives and activities, including the work plan, were discussed and agreed upon at this meeting.

Annual joint meetings of all FaSa project working groups have been organized to facilitate the coordination of the project activities, recommendations and development of the inputs to the Safety Report. In addition, individual working group meetings are being conducted in order to facilitate the work of each group according to the agreed FaSa plan. The Coordinating Working Group meets annually, usually in conjunction with other project meetings.

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See: http://www-ns.iaea.org/tech-areas/waste-safety/fasa/default.asp?s=3

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Measures to Strengthen International Cooperation in Nuclear, Radiation and Transport Safety and Waste Management

Revision of the International Action Plan on the Decommissioning of Nuclear Facilities

A. Introduction

1. As the number of facilities reaching the end of their lifetime is continuously increasing, regulators, operators and other interested parties increasingly recognize the need for adequate planning for the safe decommissioning of such facilities, the management of associated waste, and the release of such sites from regulatory control. In the past 40 years, decommissioning has evolved from a small scale activity to a large scale industry covering a broad range of facilities — nuclear power plants (NPPs), fuel cycle facilities, mining and mineral processing facilities, research reactors, laboratories, etc.

2. In June 2004, the Board of Governors approved the International Action Plan on the Decommissioning of Nuclear Facilities (document GOV/2004/40 (Corrected)).

B. Current Status of Implementation of the International Action Plan

1. The **worldwide status of decommissioning** of nuclear facilities was evaluated and presented in a report, *Worldwide Status of Decommissioning of Nuclear Facilities* (2004), and databases on shutdown NPPs and research reactors were also developed.
2. New **Safety Requirements on decommissioning** of facilities using radioactive material (WS-R-5) and a new Safety Guide on release of sites from regulatory control on termination of practices (WS-G-5.1) were developed and published in 2006. On the basis of the new Safety Requirements, revision of the existing Safety Guides on decommissioning (WS-G-2.1, WS-G-2.2 and WS-G-2.4) was initiated and a new Safety Guide on safety assessment for decommissioning of facilities using radioactive material (DS376) is in preparation.

3. An international forum for sharing and exchanging information and experience on the application of the methodology for **safety assessment for decommissioning** was established in 2004 through the new International Project on Evaluation and Demonstration of Safety during Decommissioning of Nuclear Facilities (DeSa). The recommendations are expected to be published in a Safety Report in 2008.
4. Assistance to Member States in **decommissioning of research reactors** has been provided through (i) recommendations on safety and technology aspects of decommissioning of research reactors presented in Safety Report No. 50, *Decommissioning Strategies for Facilities Using Radioactive Material* (2007), Technical Report No. 446, *Decommissioning of Research Reactors: Evolution, State of the Art, Open Issues* (2006), and *Decommissioning of Research Reactors and other Small Nuclear Facilities by making Optimal Use of Limited Resources* (in print); and (ii) the launch of R^2D^2P (Research Reactor Decommissioning Demonstration Project).
5. Recommendations on **management and disposal of decommissioning waste** have been developed and presented in Technical Report No. 441, *Management of Problematic Waste and Material Generated During the Decommissioning of Nuclear Facilities* (2006), and *Managing Low Activity Decommissioning Material* (in print).
6. **Information exchange on decommissioning** has been fostered through various Agency mechanisms (development of standards and supporting documents, training, technical cooperation, etc.) and in particular through the International Conference on Lessons Learned from the Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities.
7. Advice to Member States on a **funding mechanism for decommissioning** was provided through the publication of IAEA Technical Document (TECDOC) No. 1476, *Financial Aspects of Decommissioning* (2005), supported by advice on cost estimation for decommissioning, organized through the regional technical cooperation projects RER/3/005 and RER/9/058;
8. Experience of Member States in the **release and reuse of materials and sites** after decommissioning was collected and presented in Technical Report No. 444, *Redevelopment of Nuclear Facilities after Decommissioning* (2006), and two Safety Reports planned to be published in 2007 — *Monitoring for Compliance with Clearance Values* and *Monitoring for Compliance with Site Remediation Criteria*.
9. Experience, good practice and advice related to the **long term preservation of decommissioning information** has been summarized and presented in a new Technical Report, *Long Term Preservation of Information in Decommissioning Projects*, expected to be published in 2007.
10. Recommendations on addressing **social aspects during decommissioning** have been developed and presented in a Technical Report, *Managing the Socio-Economic Impact of the Decommissioning of Nuclear Facilities*, planned to be published in 2007.

C. Background to the proposed actions

3. The outcomes of the Athens Conference[1], and the increasing number of requests from Member States for Agency support to regulators and operators in decommissioning planning and implementation demonstrate the need for continuation of Agency assistance, in particular in the application of the safety standards and in the transfer of experience and good practice from advanced decommissioning projects to countries with less experience in this field. Accordingly, the Action Plan has been reviewed to ensure the right priorities for the 2008/2009 programme cycle in the following areas:

(i) Development of an international safety regime for the management of radioactive waste (Programme 3.4.1);

(ii) Facilitating exchange of information on radioactive waste management (Programme 3.4.1.2);

(iii) Developing and implementing guidance on the safe termination of nuclear activities (Programme 3.4.4.1);

(iv) Facilitating the transfer of sustainable technologies for decommissioning of facilities (Programme 3.4.4.3).

4. The primary objectives of the revision of the Action Plan are to:

(a) Enable the Agency to focus its future activities on decommissioning by addressing key areas identified at the Athens Conference and other relevant international events and to develop the international safety regime in the field of decommissioning;

(b) Establish the Agency as the international focal point to assist Member States with planning, undertaking and termination of decommissioning in accordance with the relevant internationally agreed safety standards and state-of-the-art recommendations, in particular in the case of the decommissioning of small facilities.

D. Proposed Actions

D.1. Development of an international safety regime for the management of radioactive waste

Governmental roles and responsibilities for decommissioning

5. The Athens Conference concluded that it was important to increase the awareness of governments and interested parties of the need for early planning, adequate governmental funding and other support and long term strategies for decommissioning, waste and spent fuel management.

[1] For the main outcomes see GOV/INF/2007/1; the conference proceedings are expected to be published in 2007.

6. The aim of this action is to assist Member States in achieving this task through existing international mechanisms.

Action 1: *Technical support and advice to Member State governments in establishing adequate legal and regulatory frameworks, strategies, and financial and human resources for decommissioning through (i) the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and its peer review mechanism; (ii) regional cooperation and technical assistance to decision makers on legal, regulatory and technical aspects.*

Desired outcomes: (i) Legal and regulatory frameworks in place in Member States relevant to decommissioning and the management of decommissioning waste; (ii) decommissioning and waste management strategies and plans in place for all facilities; and (iii) financial mechanisms for decommissioning in place and resources available.

Decommissioning strategies

7. The discussions at the Athens Conference demonstrated that for many facilities, and in particular small facilities, the preferred option is immediate dismantling. However, deferred dismantling may be a justified option for some facilities. In this connection, more clarity is needed on the concept of entombment, considered in some Member States to be a storage rather than a disposal option.

8. The aim of this action is to provide specific recommendations on application of the entombment strategy and the liabilities associated with decommissioning activities.

Action 2: *(i) Review of international experience and development of specific recommendations for planning and implementation of an entombment strategy; (ii) update international financial liabilities of decommissioning of different facilities worldwide (including facilities using naturally occurring radioactive materials); and (iii) develop recommendations on the legal liabilities upon termination of practices (i.e. for unrestricted and restricted use of sites).*

Desired outcome: Increased awareness by Member States of factors and considerations relevant to the selection of adequate decommissioning strategies and release of sites from regulatory control.

D.2. Facilitating exchange of information on radioactive waste management

Maintaining competence in decommissioning

9. The Athens Conference highlighted the need for national and international mechanisms to preserve and maintain the operational knowledge and decommissioning experience that is important to the safety of decommissioning. It also recognized the important challenges experienced in many countries to retain and maintain the necessary levels of knowledge (including long term maintenance of records) and skilled personnel during decommissioning, in particular, in the case of long term projects.

10. The aim of this action is to establish mechanisms to assist Member States in developing and maintaining adequate competence and qualified personnel for decommissioning (particularly relevant for small countries with limited resources or no experience). It also aims to establish the Agency as an international focal point for operators and regulators regarding exchange of information on

decommissioning to discuss specific technical and regulatory aspects of planning, authorization, performance of decommissioning, and site release.

Action 3: *Facilitating regular exchange of knowledge and lessons learned between Member States through establishment and implementation of: (i) an international network of decommissioning centres based on ongoing decommissioning projects for different facilities and technologies used; and (ii) an international training mechanism and forum for preparation and qualification of decommissioning experts from regulatory bodies, operators, etc.*

Desired outcomes: (i) Decommissioning centres in place in every region and for different types of facilities; (ii) specialized training centres and programmes for experts in decommissioning using the safety standards and Agency training tools; and (iii) regular updates on the progress of decommissioning projects around the world, and feedback for safety standards and supporting technical documents relevant to decommissioning.

Independent review of decommissioning of facilities

11. During the past few years, the number of requests for the Agency to provide technical assistance in planning or undertaking decommissioning of various nuclear facilities has increased. This assistance has been mainly provided on a case by case basis through national or regional technical cooperation projects.

12. The aim of this action is to set up and offer advice to Member States on adequacy and compliance of the planning and implementation of decommissioning of the facilities with the international safety standards and good practice in this field. It aims to assist regulators and operators from Member States in their work to decommission nuclear facilities in accordance with the internationally agreed safety standards..

Action 4: *Establishment of an international peer review and advice mechanism (including self assessment) that will complement the Agency's services (e.g. Operational Safety Review Teams (OSARTs), Waste Management Assessment and Technical Review Programme (WATRP)) for different types of facilities (e.g. NPPs, fuel cycle facilities, research reactors) at the request of Member States.*

Desired outcomes: Exchange of good practice between Member States, and improvement of the safety and efficiency of decommissioning of facilities worldwide.

Lessons learned from decommissioning in the design of new facilities

13. With the recent increase in interest in the development of nuclear facilities worldwide, the Athens Conference recommended that the lessons learned from decommissioning to date be used as an input in the design, operation and maintenance of all new nuclear facilities.

14. The aim of this action is to transfer up-to-date knowledge and lessons learned from decommissioning that can be beneficial for new facilities and their future decommissioning.

Action 5: *Consolidate the experience to date from decommissioning projects that can be used in the design and operation of planned and new facilities in order to facilitate their operation and decommissioning; minimize waste generation and improve protection of the public, workers and the environment and facilitate the release of material and sites from regulatory control.*

Desired outcomes: Main recommendations for different facilities based on international decommissioning experience to be applied in the planning of decommissioning of new facilities.

D.3. Developing and implementing guidance on the safe termination of nuclear activities

Decommissioning of small facilities

15. International support for decommissioning of small facilities (e.g. research reactors, research laboratories) in countries with limited human and financial resources through further elaboration of international centres in the different regions, complementing the experience of R^2D^2P (Research Reactor Decommissioning Demonstration Project) was strongly encouraged at the Athens Conference.

16. The aim of this action is to have mechanisms in place to facilitate the safe decommissioning of small facilities on a national or regional basis.

Action 6: *Organization of Member State support on safety and technology aspects and development of regional projects for demonstration of decommissioning of small facilities (following the experience of R^2D^2P) in Africa, Europe, and Latin America.*

Desired outcomes: Decommissioning plans developed and being implemented; knowledge and experience at a regional level regularly exchanged.

Establishment and application of safety standards for decommissioning

17. With the approval of the new Safety Requirements WS-R-5, *Decommissioning of Facilities Using Radioactive Material*, the suite of international safety standards for decommissioning of facilities using radioactive material now covers all relevant areas. However, there is significant experience worldwide that needs to be utilized and reflected in the revision of the existing Safety Guides. The importance of establishing clear regulatory policy, safety requirements and criteria, record keeping mechanisms, approaches and criteria for review of safety cases and interaction mechanisms between regulators and operators was clearly recognized at the Athens Conference. The differences between operational and decommissioning activities and the need for flexible and graded approaches to the application of regulatory frameworks were also recognized there.

18. The aim of this action is to revise the Safety Guides on decommissioning taking into consideration lessons learned and experience in Member States and the outcomes of the Athens Conference, and to recommend mechanisms for demonstrating safety during decommissioning.

Action 7: *(i) Revision of the Safety Guides on decommissioning with specific recommendations on the entombment option, preliminary decommissioning plans and environmental impact assessment for decommissioning;*

(ii) Establishment of a forum for the exchange of experience and harmonization of approaches to development and review of safety cases (decommissioning plan) for decommissioning (follow-up to the International Project on Evaluation and Demonstration of Safety during Decommissioning of Nuclear Facilities (DeSa)), including recommendations for the application of the graded approach; and

Desired outcomes: Comprehensive set of up-to-date safety guides on decommissioning; consolidation of experience from Member States and recommendations on the development and review of safety cases for decommissioning.

Management of material and sites during decommissioning

19. Early planning together with clear waste management and spent fuel strategies are vital for the success of decommissioning projects. There was agreement at the Athens Conference that a lack of waste disposal facilities is not a reason for delaying decommissioning, particularly in the case of facilities that represent a legacy and small facilities.

20. There is international consensus on the values for the clearance of material and sites from regulatory control contained in the Agency safety standards. However further work is required at a national level to implement these values in order to ensure harmonization at the international level and to develop strategies and mechanisms for monitoring compliance with them. The release of sites for restricted use may become a preferred endpoint of decommissioning in some cases, particularly in countries where new nuclear facilities are contemplated. Developing new, viable activities for decommissioned sites is a new trend offering a large potential for workforce redeployment and local revitalization.

21. Early involvement of relevant stakeholders in planning for decommissioning and in the definition of a clear endpoint of decommissioning are important, in particular in relation to the release of material from control and the reuse of sites. Such involvement contributes to the building of public confidence, staff motivation and the consideration of the social aspects relating to decommissioning.

22. The aim of this action is to (i) assist Member States, without available waste disposal routes, on measures to optimize waste generation and manage decommissioning waste in a safe and cost effective manner (e.g. through clearance, adequate decommissioning technologies, and restricted use of material and sites); (ii) assist Member States in application of the reference values for clearance of bulk material (see Safety Guide RS-G-1.7) and site release (see Safety Guide WS-G-5.1).

Action 8: *(i) Cooperation with regulators, operators, and international organizations and entities (e.g. World Trade Organization (WTO), United Nations Economic Commission for Europe (UNECE), West European Nuclear Regulators' Association (WENRA)), for the harmonized application of the reference values given in Safety Guide RS-G-1.7;*

(ii) Use the proposed forums to exchange experience to raise awareness of the importance of socio-economic factors and the development of clear strategies for the management of decommissioning wastes.

Desired outcome: Broad practical application of the international safety standards on release of material and sites from regulatory control and application of adequate strategies for the management of decommissioning waste.

Funding and cost estimation

23. The establishment and management of funding mechanisms supported by realistic cost estimates are of high importance in the majority of countries. Governmental support and funding is particularly important for the successful and safe decommissioning of small state owned facilities and cleanup of sites that represent a legacy.

24. The aim of this action is to provide (i) tools to assist operators and regulators in Member States to develop and review costs estimates for decommissioning, and (ii) detailed guidance on other significant components of management of decommissioning projects.

Action 9: *(i) Development of detailed recommendations on the application of the cost estimation methodology for the different types of facilities with difference hazard potential and complexities; and (ii) development of recommendations for regulatory review of cost estimates and funding mechanisms.*

Desired outcomes: Improved cost estimation for decommissioning and funding mechanisms for ongoing and planned decommissioning projects, as well as improved project management in compliance with planned resources.

D.4. Facilitating the transfer of sustainable technologies for decommissioning of facilities

Decommissioning technologies

25. The Athens Conference demonstrated that straightforward, proven and available decommissioning technologies are generally preferable to new and innovative technologies. Where new technologies are foreseen, provisions for their testing and demonstration of their suitability need consideration in planning for decommissioning. It is also important to involve the operational workforce in the application and, as appropriate, in the development of the decommissioning technologies.

26. The aim of this action is to establish mechanisms to assist Member States in the selection of adequate and simple technology solutions (particularly for countries with limited resources).

Action 10: *Development of recommendations for (i) selection and implementation of technologies and (ii) adequate and economic solutions for developing countries.*

Desired outcomes: Decommissioning plans in preparation or implementation in Member States with appropriate decommissioning technologies, based on the selected decommissioning strategy, availability of resources, skills and other relevant factors.

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)

20 November 2008

WASTE AND ENVIRONMENTAL SAFETY SECTION
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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].

CONTENT

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 **De**monstration of **Sa**fety 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 Sa**F**ety **A**ssessment in Planning and Implementation of Decommi**S**sioning of F**a**cilities 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
Design	*Commissioning*	*Operation*	*Shutdown / Transition*	*Decommissioning*	*Release from regulatory control*

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 SADRWMS[1], SAFRAN[2], 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.

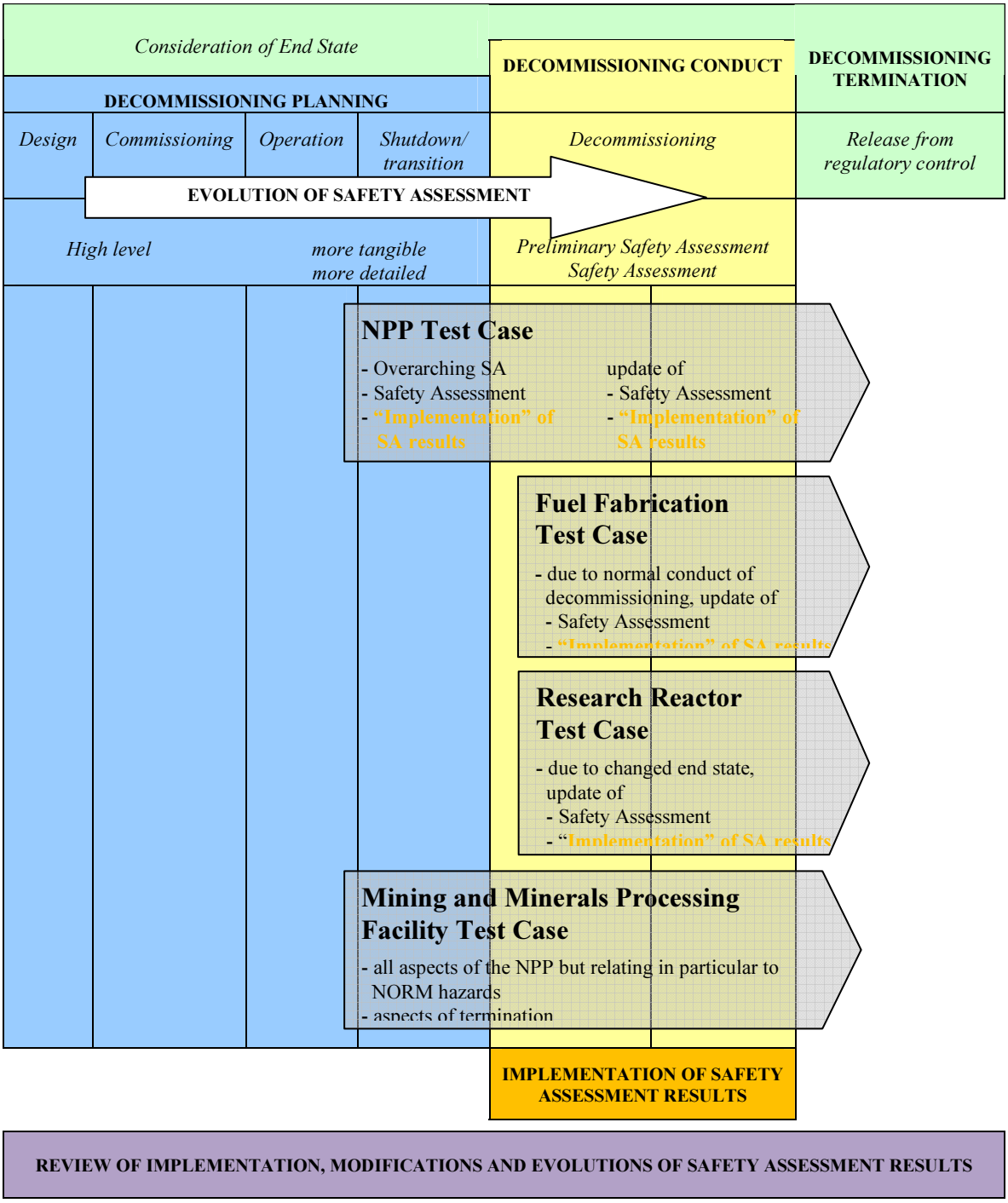


FIG 2. Objectives of the FaSa test cases and their relation to the themes addressed in FaSa Step 1 and 2

(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 co-ordinates 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;

(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 mutli-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 optionering, 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 then 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 panned 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

FaSa Project	***Planned Meetings***	***Scheduled Dates***
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 1st project meeting in November 2008	7-11 April 2008
	Invitations to Member States	April 2008
	Preparatory meeting 3 to prepare the 1st 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.

REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, "Proceedings of an International Conference on Lessons Learned from the decommissioning of Nuclear Facilities and the Safe termination of Nuclear Activities, 11-15 December 2006, Athens, Greece", Vienna (2007).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Series No. SF-1. Safety Fundamentals, Vienna (2006).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities Using Radioactive Material, Safety Standards Series No. WS-R-5, IAEA, Vienna (2006).

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Release of Site from Regulatory Control on Termination of Practices, Safety Standards Series No. WS-G-5.1, IAEA, Vienna (2006).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Nuclear Power Plants and Research Reactors, Safety Standards Series No. WS-G-2.1, IAEA, Vienna (1999).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Medical, Industrial and Research Facilities, Safety Standards Series No. WS-G-2.2, IAEA, Vienna (1999).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Nuclear Fuel Cycle Facilities, Safety Standards Series No. WS-G-2.4, IAEA, Vienna (2001).

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, Application of the Concepts of Exclusion, Exemption and Clearance, Safety Standards Series No. RS-G-1.7, IAEA, Vienna (2004).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, International Action Plan on Decommissioning of Nuclear Facilities, GOV/2004/40, Vienna (2004).

[10] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Decommissioning of Facilities Using Radioactive Material, Safety Standards Series DS376, IAEA, Vienna (in preparation).

[11] INTERNATIONAL ATOMIC ENERGY AGENCY, Measures to Strengthen International Cooperation in Nuclear, Radiation and Transport Safety and Waste Management, Revision of the International Action Plan on the Decommissioning of Nuclear Facilities (Appendix 2), GOV/2007/25-GC(51)/3, IAEA, Vienna (2007).

[12] INTERNATIONAL ATOMIC ENERGY AGENCY, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, INFCIRC/546, IAEA, Vienna (1997).

[13] http://www-ns.iaea.org/conventions/waste-jointconvention.htm

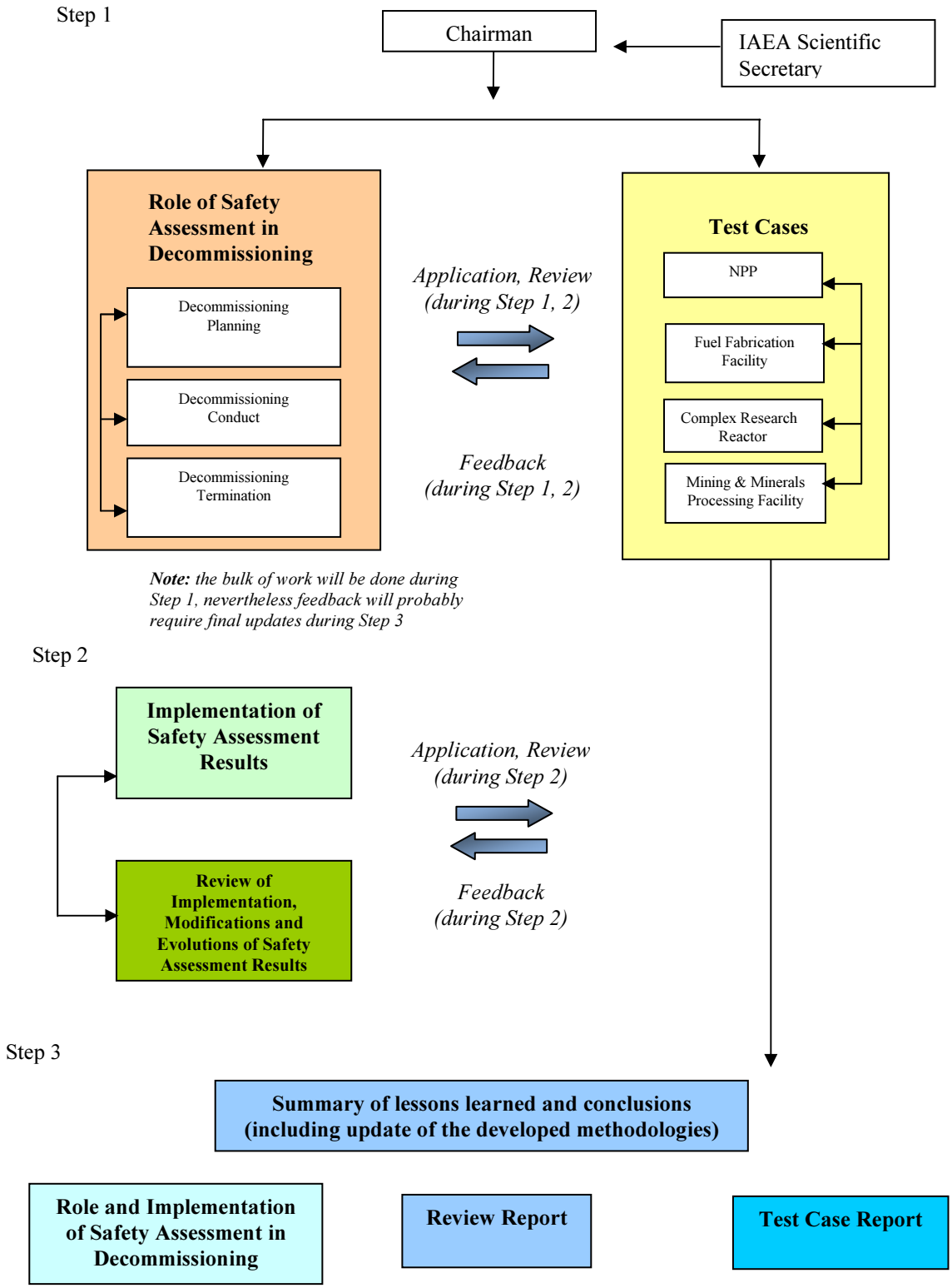
[14] INTERNATIONAL ATOMIC ENERGY AGENCY, International Project on Evaluation and Demonstration of Safety for Decommissioning of Nuclear Facilities (DeSa), Draft Safety Report No. DD741, IAEA, Vienna (in preparation).

[15] Minutes of the 4th Joint DeSa Meeting, 29 October – 2 November 2008, IAEA, Vienna (http://www-ns.iaea.org/tech-areas/waste-safety/desa/start.asp)

APPENDIX A

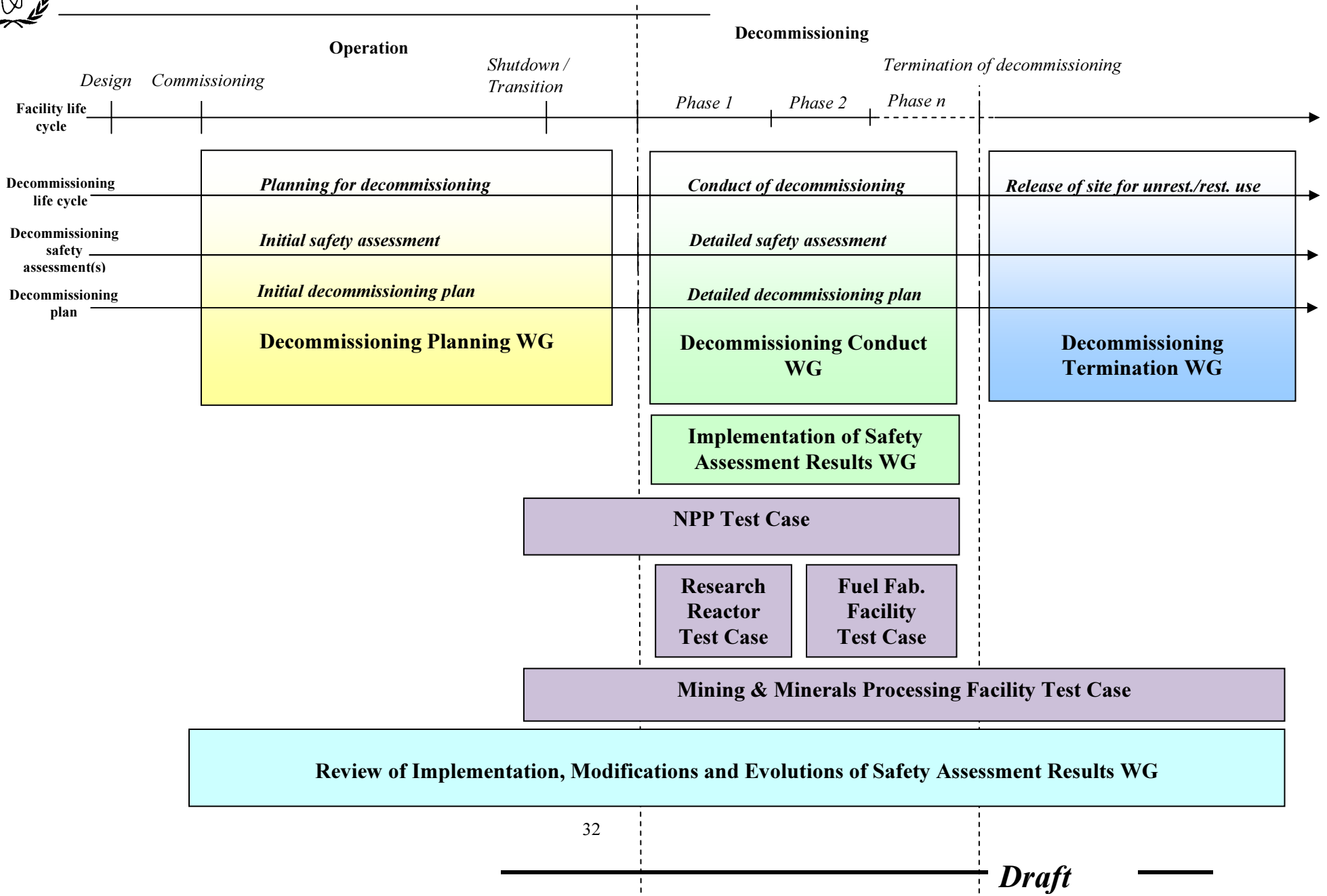
Proposed Organization of FaSa Project

(incl. simplified dependencies between WGs)



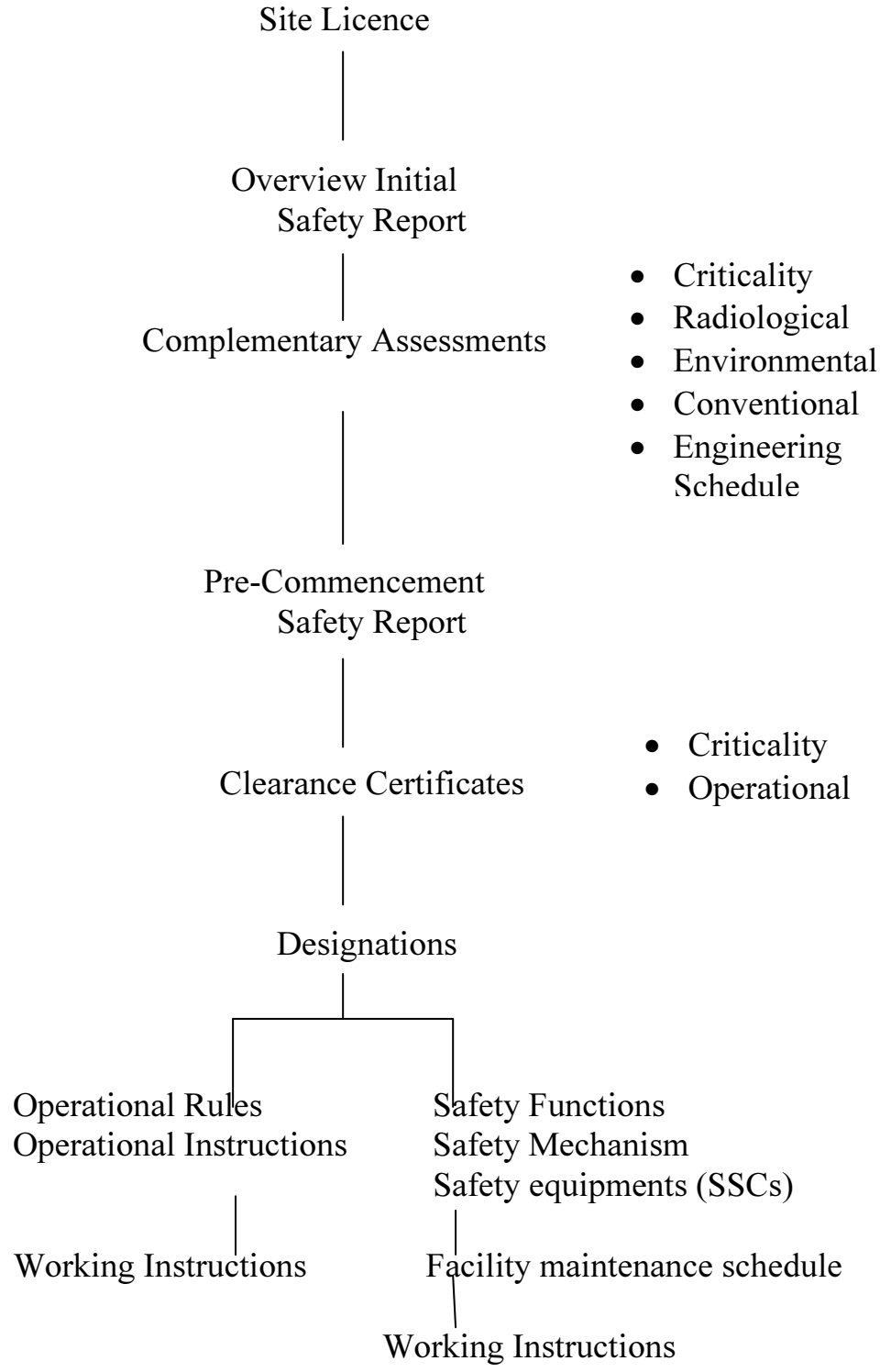
Relation of the Project Working Groups to the Decommissioning Activities (Planning, Conduct and Termination)

APPENDIX B



APPENDIX C

AN EXAMPLE OF RELATION OF SAFETY ASSESSMENT TO SAFETY RELATED DOCUMENTS



Forth Annual Meeting of the IAEA FaSa Project

21 – 25 November 2011
International Atomic Energy Agency, Vienna

2. Chairman's Report on the Project Status

J. Kaulard, Germany

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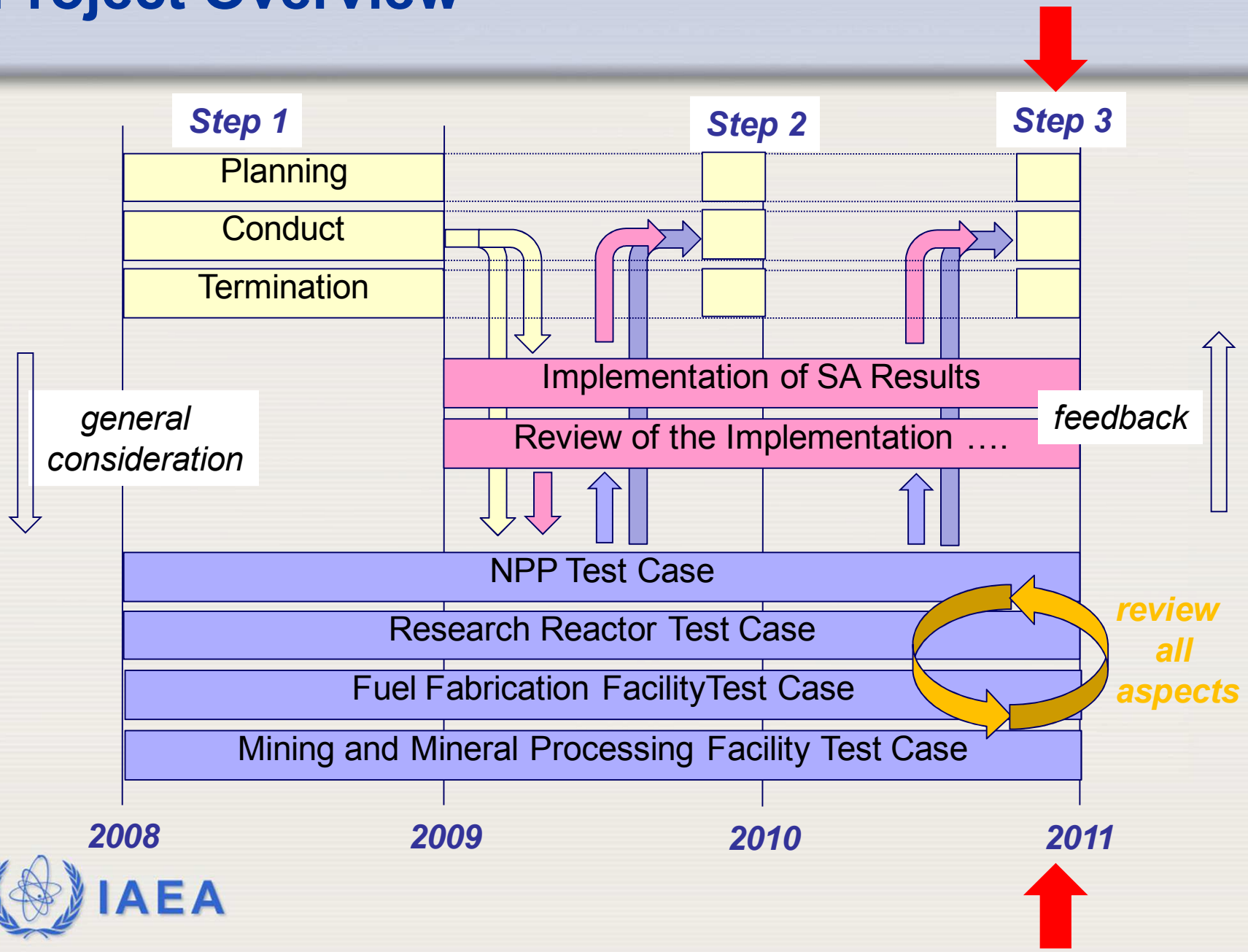
Project Overview



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Work Performed in 2011 (1/2)

- ***Work on methodologies***
  - Chapter on **Overview** of FaSa Methodology **created**
  - Chapter on Decommissioning **Planning revised**
  - Decommissioning **Conduct** and **Implementation** further **developed**
  - Already finalized: **Review of Implementation** and **Decommissioning Termination**
- ***Work on test cases***
  - **Drafting continued** for NPP, Research Reactor and Fuel Fabrication Facility
  - No activities at Mining and Mineral Processing Facility

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Work Performed in 2011 (2/2)

- ***WG meetings***
  - RR TC — March 2011, Grenoble
  - Coordinating WG — May 2011, Rome
    - Focus Planning and Conduct
  - NPP TC — June 2011, Rome
  - Joint DC / DI / FFF TC WG — September 2011, Paris

  and a **lot of homework** done by the participants
- ***Publications / Promotion***
  - Contribution to Annual Meeting of IAEA International Decommissioning Network (IDN)
    November 2011, Vienna

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Expectations for the 4th Annual Meeting

- Completion on the FaSa methodologies, focus on
  - Planning (➔ chapter 3)
  - Conduct (➔ chapter 4)
  - Implementation (➔ chapter 5)
  - Overall presentation (➔ chapter 2)
- Completion of NPP / RR / FFF TC reports, with focus
  - on the illustration of FaSa methodologies
  - on lessons learned with respect to the FaSa methodology
- Drafting of MMPF TC status report
  - summarizing the use of safety assessment
  - integration of available country examples

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Expectations for the 4th Annual Meeting

- Note:
  - **Completion of drafting** means
    - **agreeing on the core** of the methodologies
    - **identify** (if any) **gaps and instructions** on how to fill them
    - **work plan** on remaining (editorial) work until end of January 2012
  - **Written comments** on the individual chapters .... !!!
- Continuation of experience exchange and networking (e.g. posters, presentations in the afternoon plenaries, discussions during coffee breaks, ...)

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Thank you for your attention and let's go!

Forth Annual Meeting of the IAEA FaSa Project

21 – 25 November 2011
International Atomic Energy Agency, Vienna

16. Summary –
The Status of the Overall FaSa Approach

J. Kaulard, Germany

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Motivation for DeSa Safety Assessment Methodology

- Dubai construction site flooding (07.02.2007)

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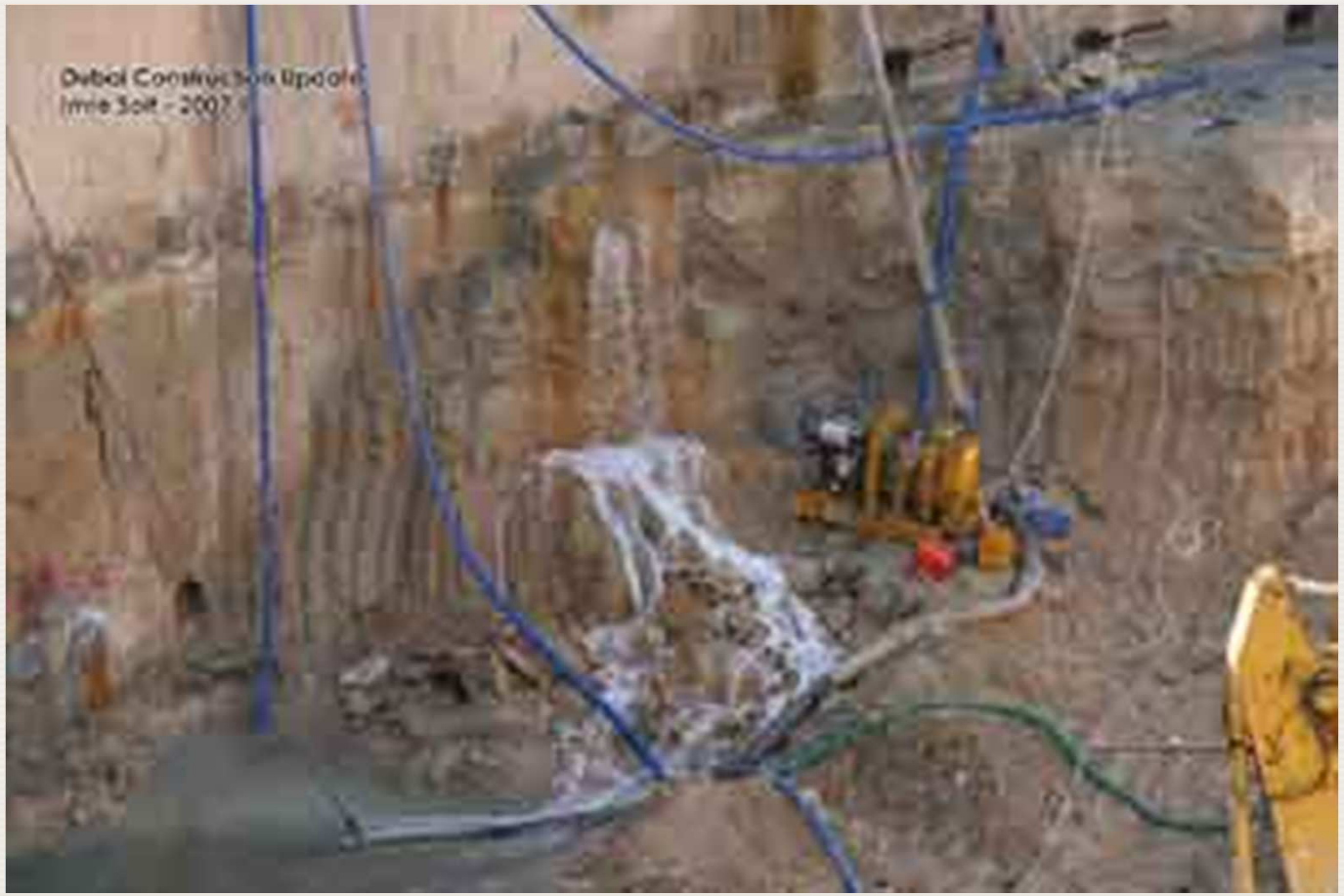
www.hoax-slayer.com/dubai-construction-flood.shtml

Motivation for DeSa Safety Assessment Methodology

- Dubai construction site flooding (07.02.2007)



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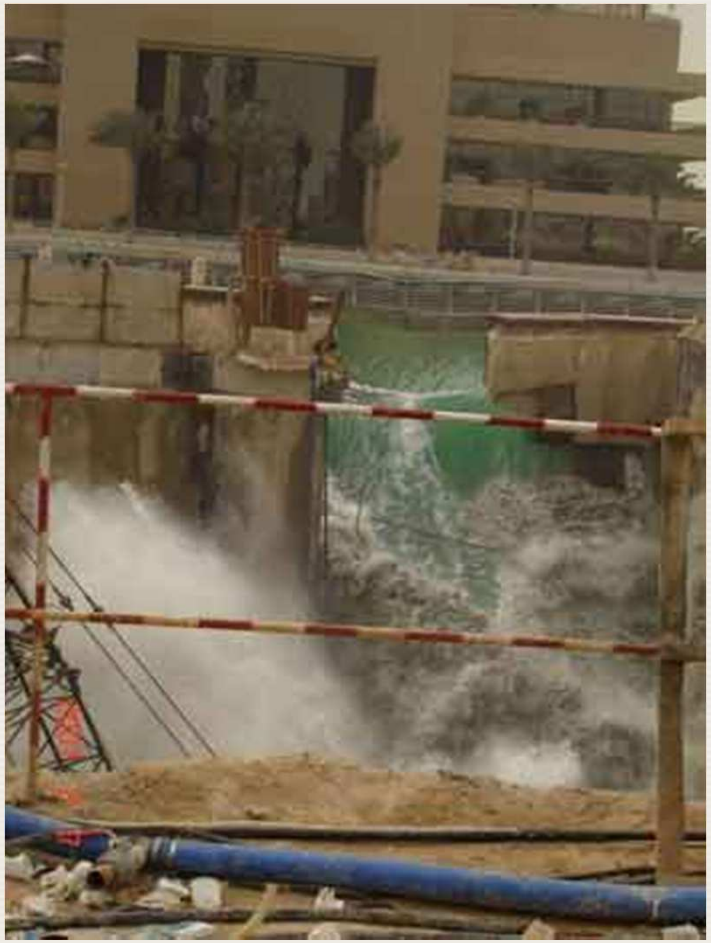

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Motivation for DeSa Safety Assessment Methodology

- Dubai construction site flooding (07.02.2007)

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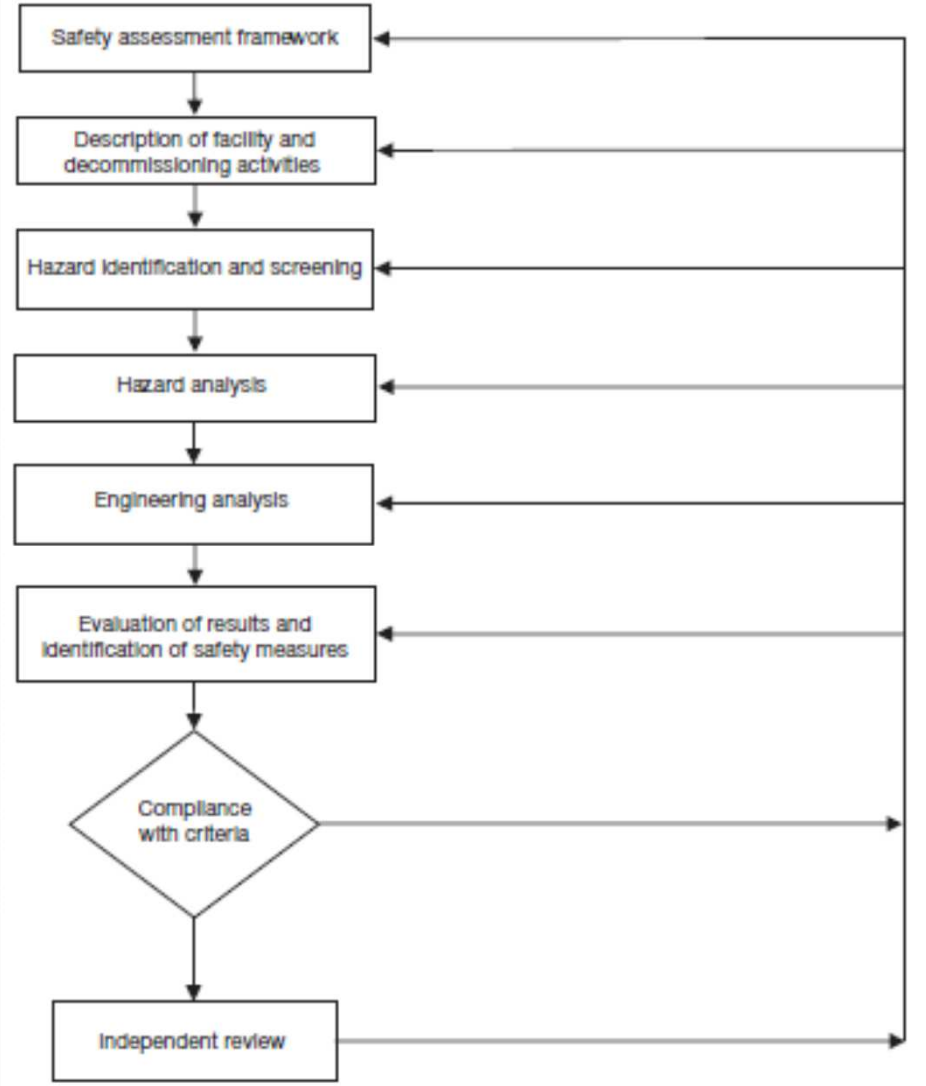
www.hoax-slayer.com/dubai-construction-flood.shtml

DeSa Safety Assessment Methodology

1. Safety Assessment Framework
2. Description of facility and decommissioning activities
3. Hazard identification and screening
4. Hazard analysis
5. Engineering analysis
6. Evaluation of results and identification of safety measures
7. Compliance with criteria
8. Independent review

Graded Approach



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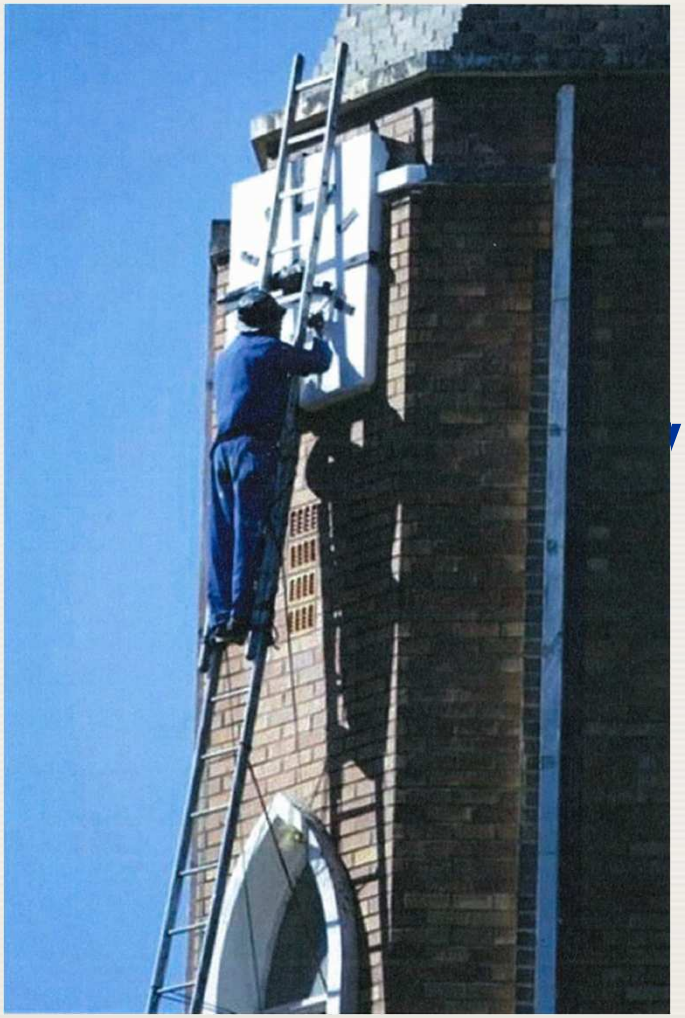
Motivation for FaSa Methodology



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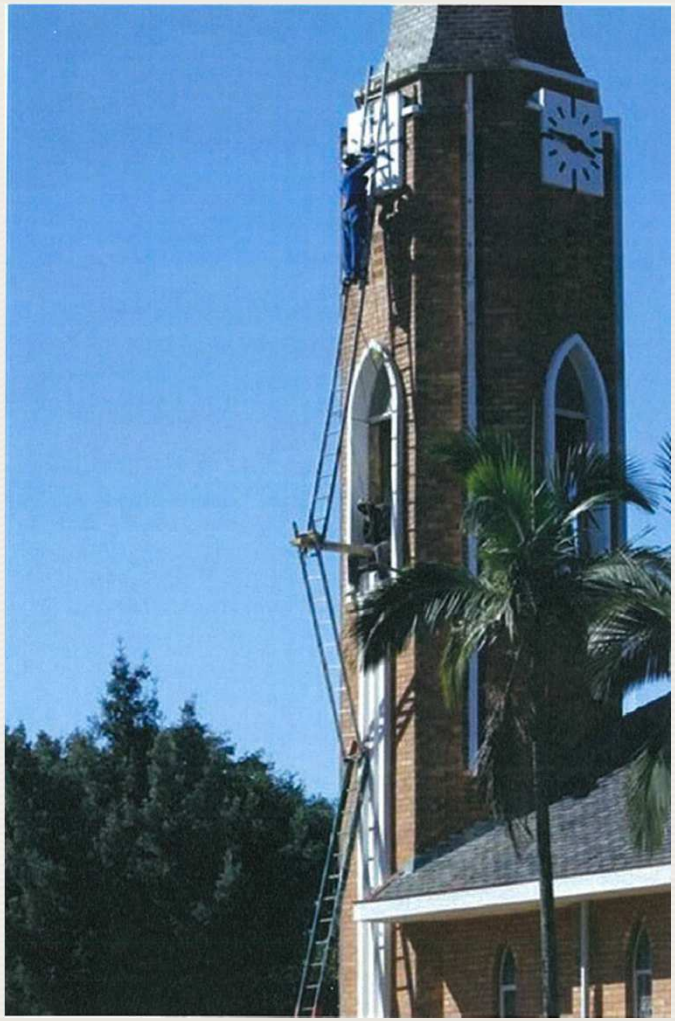
Motivation for FaSa Methodology



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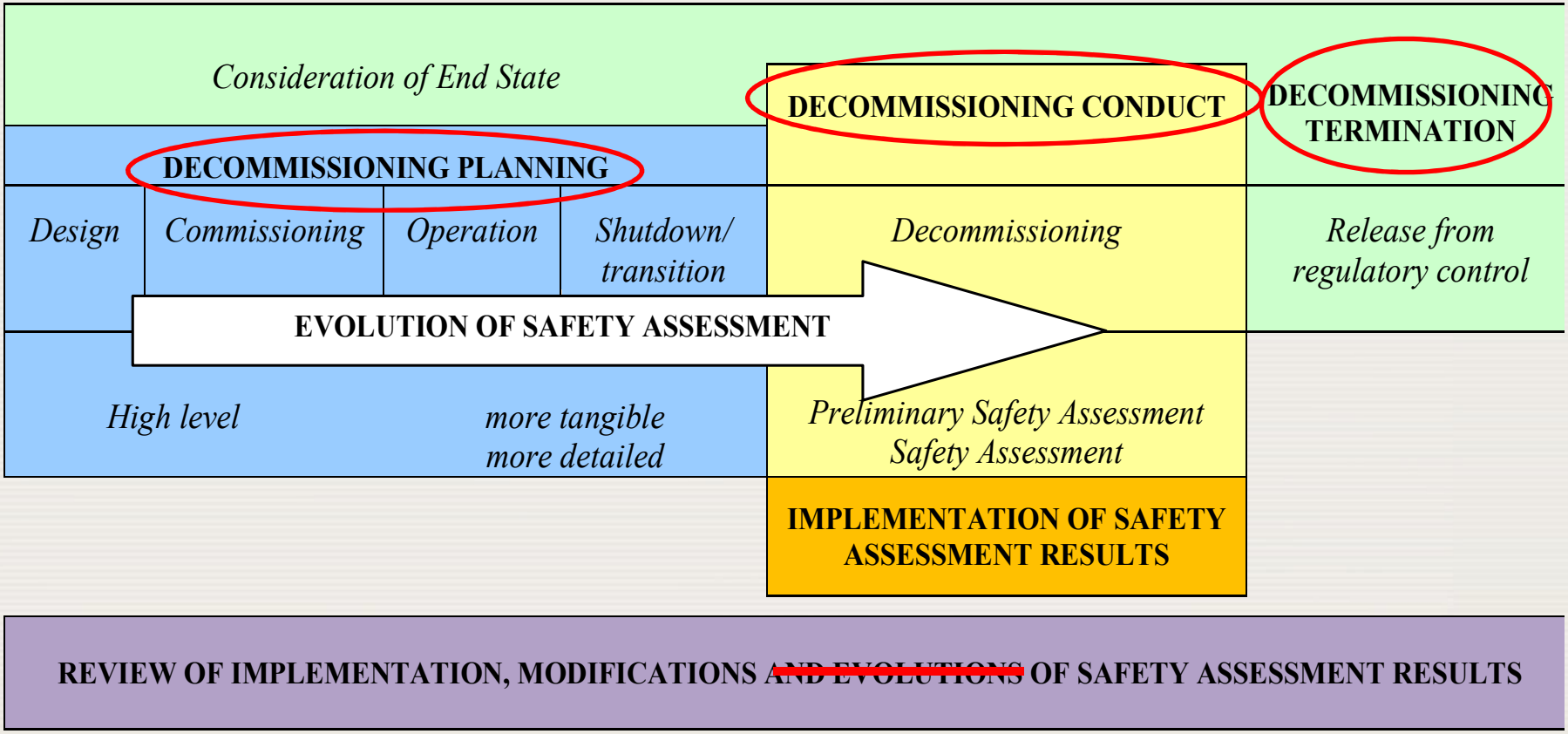
FaSa Methodology

- Decommissioning related safety aspects



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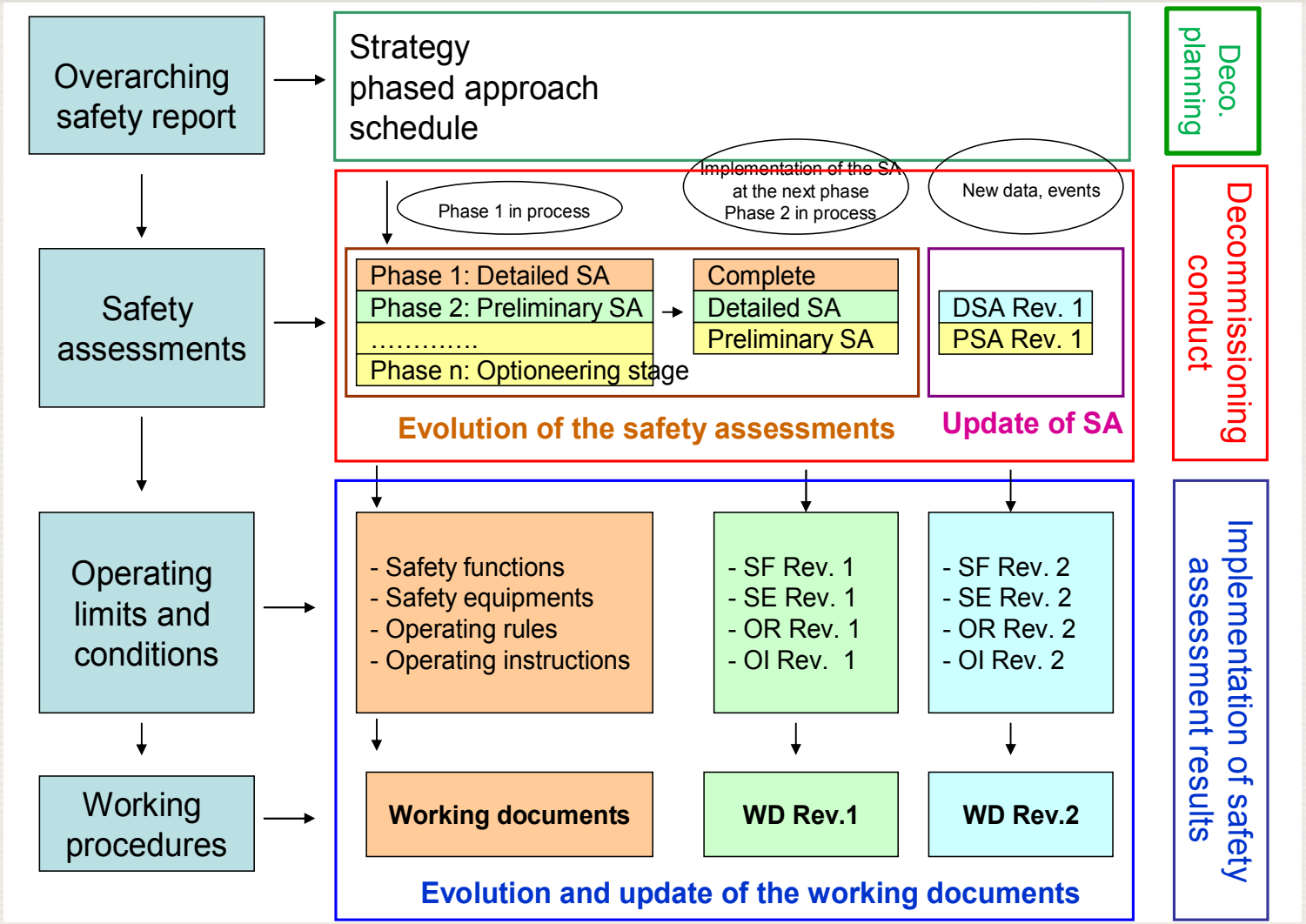
FaSa Methodology – Safety Assessment Aspects



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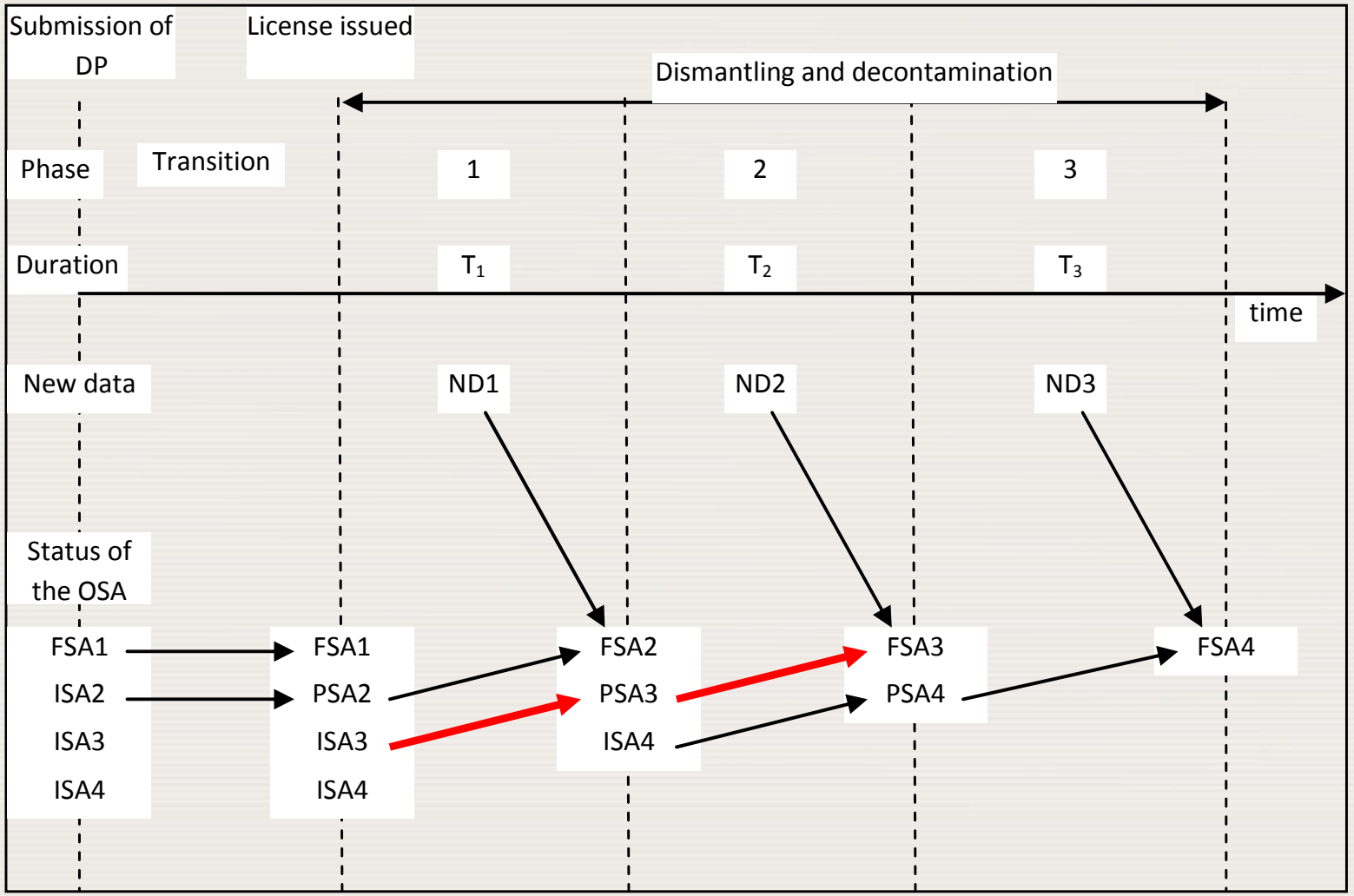
FaSa Methodology – Safety Assessment Evolution



draft Nov. 2011

Review Results

- General comments from the working groups
  - harmonization with respect to the terms used
    ➔ use IAEA glossary as much as possible
- Overview chapter 2 was confirmed
  - editorial comments to improve clarity
- Planning chapter 3 was confirmed
  - mainly editorial modifications, including figure 3.1
  - possibility to send additional example figures on the evolution of the decommissioning plan (esp. on deferred dismantling)
    ➔ volunteers to send figures latest end of December 2011

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Review Results

- Conduct chapter 4 was confirmed
  - consists of three parts
    - part 1: methodology – reviewed during this week & confirmed
    - part 2 and 3: Member State examples on different level of detail, as such content not necessary to review
    - part 2 and 3 might become appendices
- Implementation chapter 5 was confirmed
  - review performed
  - two additional examples expected
  - two gaps identified – will be closed soon by WG chair
    - work permit system
    - engineering feedback

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Else

- No comments submitted or made on
  - Decommissioning termination
  - Review of Implementation results
  - If there are any comments related:
    send them until end of 2011 to
    - Working Group Chairperson, FaSa Chairperson and IAEA
- Workplan for chapters 1 – 9 (chairpersons, IAEA)
  - processing of review comments until end of January 2012
  - drafting of missing chapters (executive summary, lessons learned , summary) until end of February 2012
  - conduct of editorial meeting of CWG until end of April 2012

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Thank you for your attention!

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International Atomic Energy Agency

FaSa NPP Test Case WG - Results

A. Bassanelli

4th Joint Working Group Meeting
FaSa Project, November 2011

Work performed

- Review of the whole report (except for Appendices that have not been changed respect to Rome meeting),
- Minor changes, mostly editorial, that require some minor homework to be fixed,
- The current status is that of “Final Draft”,

Next activities

- Need to include the minor comments arisen during the meeting,
- Need to add references to the Planning and Conduct WG reports
- The updating will be done as homework,
- The report could be finalised by February 2012

International Atomic Energy Agency

Fuel Fabrication Facility Test Case

Feedback 2011

Audrey Halle

Fourth Annual Meeting of the IAEA FaSa Project

21 November – 25 November 2011

IAEA, Vienna,

List of participants

• Mark Pennington	Sellafield Sites, UK
• Patrice Francois	IRSN, France
• Stephen Dhlomo	NESCA, South Africa
• Philipe Auffrey	EDF, France
• Geraldine Palcoux	CEA, France
• Roger Tremblay	AECL, Canada
• Erik Strub	GRS, Germany
• Vladan Ljubenov	IAEA
• Audrey Halle	DSRL, UK
• Vik Winspear Roberts	ONR, UK
• Christian Kennes	AVN Belgium

Outline Work Plan for the Working Group

Objectives:

- Review of current Test Case Report
- Detailed review and update of Part 2 – Illustration of FaSa.
- Detailed review and update of Part 3 – Illustration of DeSa.
- Harmonisation with other FaSa test cases and confirmation that objectives of Test Case have been delivered

Working Group Achievements

- Review of current Test Case Report - Completed
- Detailed review and update of Part 2 – Illustration of FaSa – Completed and restructured. Contains the elements of FaSa; planning, conduct, implementation, regulatory review and termination.
- Detailed review and update of Part 3 – Illustration of DeSa – WG decided to remove Part 3 given that this is covered elsewhere and would therefore be a repeat of the DeSa methodology.
- Overall conclusion was that the test case matched well with FaSa methodology.


Dec 2+C

To Conclude....

All objectives for this week have been completed, the WG has developed a ‘gap analysis’ table to summarise the test case against FaSa methodology and utilised this as the final conclusion.

Chairman's Coordinating Working Group February 2012 –Harmonisation of all the chapters.

Questions and Answers from the meeting participants.

International Atomic Energy Agency

FaSa Test case

Complex research reactor

Summary of the Meeting

RR test case working group

Fourth Annual Meeting of the IAEA FaSa Project

21 – 25 November 2011
IAEA, Vienna

The RR test case working group

Planned work for this meeting

- Review of comments received and not yet incorporated in the draft report
- General review of the draft report and identification of editing still to be done
- Finalization of chapter 11, “Summary and Lessons Learned”
- Finalization of the report?

Outcomes

- **Review of comments received and not yet incorporated in the draft report**
  - ✓ **Done**
- **General review of the draft report and identification of editing still to be done**
  - ✓ **Done**
- **Finalization of chapter 11, "Summary and Lessons Learned"**
  - ❖ **Almost done**
- **Finalization of the report?**
  - ➢ **Not quite**

Work plan

Tasks	Deadline
A few figures to be revised	2011
Some new text to be elaborated	2011 – January 2012
Rewriting of one section	2011
Glossary to be checked	2011
Final editing	January 2012
Final round of comments	February 2012

That’s all ☺

International Atomic Energy Agency

Mining and Mineral Processing Case Study

Alistair Cadden

Third Annual Meeting of the IAEA FaSa Project

21-25 November 2011,
IAEA Vienna,

Goals for 2011

- Complete chapter
  - Not quite (but there are still 6 weeks to go!)
- Collect examples from Member States in defined format
  - 7 examples written in the past 2 days

What are the criteria for a test case?

- Completed safety assessment (or elements thereof) and a decommissioning plan available
- Information must be publicly available, or at least agreement that information can be made public
- Process has a number of the steps of the DeSa methodology
- Preferably the test case will be supported by an operator
- Reasonable chance of achieving outcomes expected from FaSa project

Findings from Member State Examples

DeSa Flowchart (Figure 3 'Main Steps of SA')

- ✓ **Safety assessment framework**
- ✓ **Description of facility and activities**
- ✓ **Hazard identification and screening**

- **Hazard analysis - some**
- **Engineering analysis – some**
- **Evaluation of results and identification of controls - some**
- **Compliance with requirements - some**
- **Limits conditions and controls specifications - some**

Findings from Member State Examples

- Decommissioning not normally addressed; but lots of information on remediation and disposal
- Safety assessments could not be found
- Therefore no information on use of safety assessment
- No information on radiation protection measures during decommissioning

STOP PRESS

At 7pm yesterday evening we received an example of actual decommissioning at a mine site!

- Remediation of a Calciner Room which had once operated as the final stage of a uranium processing circuit.
- Contaminated steel from within the Calciner Room was recycled.
- Concentrated uranium within the process equipment required stringent radiation protection measures beyond those normally employed for such remediation.
- Completed successfully with worker radiation exposures well below the regulatory dose limits and with the effective protection of the environment.

Conclusions

- DeSa type methodology has not normally been applied to decommissioning of mines and milling facilities
- Decommissioning activities at MMFs are likely to be very similar to routine operational activities
- Radiological risks at MMFs during decommissioning are likely to very similar to those during operations

Remaining Work for this WG

- Clean up text of chapter as currently written
- Edit case histories already received
- Assemble final document
- Feedback to IAEA

Forth Annual Meeting of the IAEA FaSa Project

21 – 25 November 2011
International Atomic Energy Agency, Vienna

18. Overall Chairman's Remark

J. Kaulard, Germany

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International Atomic Energy Agency

Achievements – Statistics ...

- **2011 Annual Meeting performed with**
  - **43 participants from 24 Member State and IAEA**
  - 6 working group activities to
    - review and finalize chapters & report
  - 2 presentations for the afternoon plenary sessions
  - 9 posters from 7 countries
    - the second ***FaSa Poster Award*** with 9 awardees
  - an ongoing experience exchange and formation of a living expert network
    - still remarkable and improving (!) team spirit within the FaSa Project much beyond a normal project spirit

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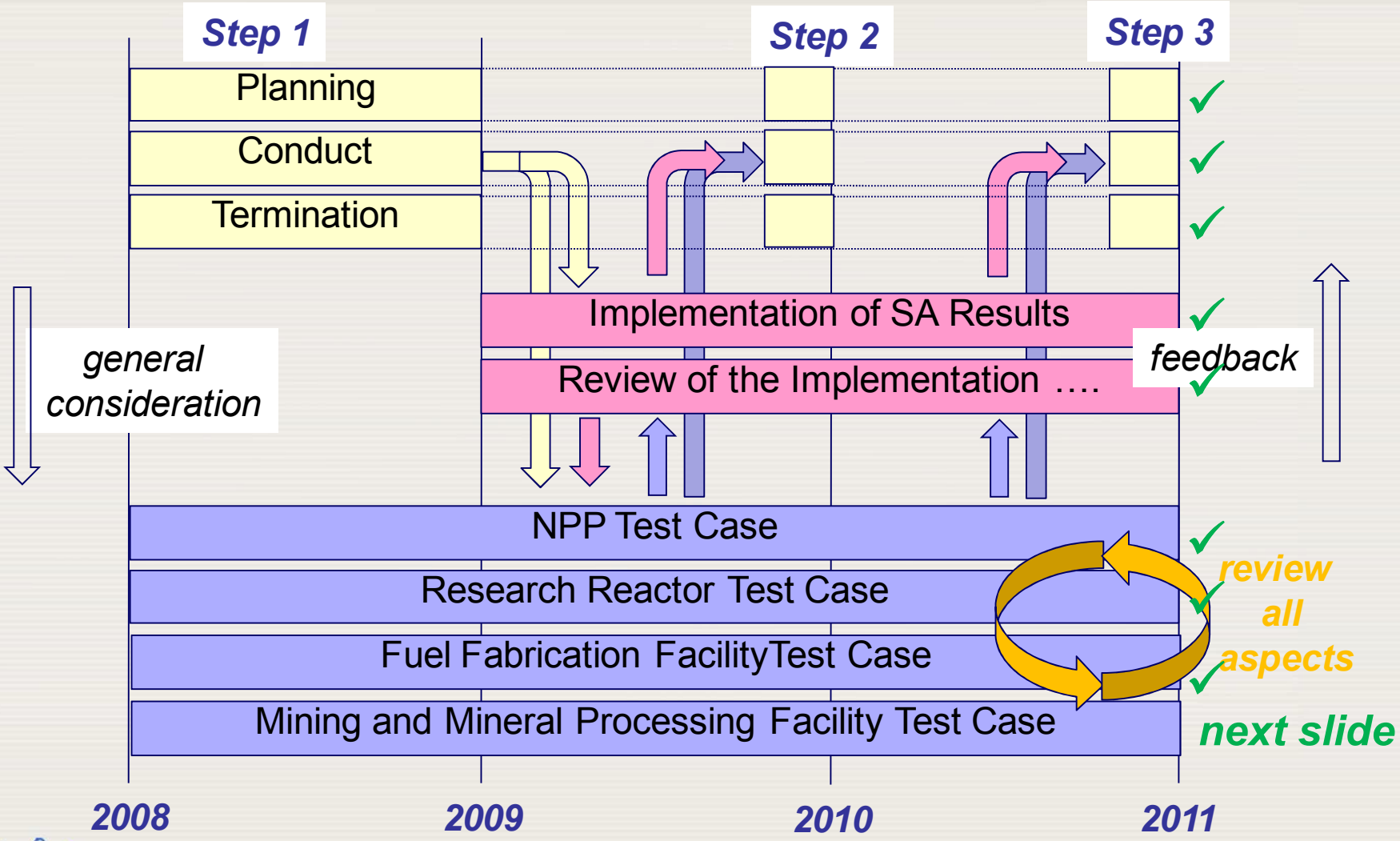
Achievements – View on Working Groups ...



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Achievements – View on Working Groups ...

- Concluded the basic content of all the chapters and the test cases
  - mostly these now need a tidy up ready for submission to the IAEA for review, approval and publication
  - it's the task for the CWG
- New chapter 2 was presented
  - sets the FaSa project into context
  - acts as a good pointer to what is to come in the other chapters and the test cases
- Planning chapter 3 redrafted
  - following CWG meeting of Rom
  - has met with robust comment

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Achievements – View on Working Groups ...

- Conduct chapter 4 received some comment but in a good state.
- Implementation chapter 5 also robustly challenged
  - minor post-processing needed
- Not reviewed: chapters on termination or regulatory review
  - remember: opportunity to send comments by end of 2011
- Test Cases on NPP, RR and FFF
  - reviewed and in a good shape now
- “New land activity”: Status report on Safety Assessment for decommissioning in MMPF
  - learned a lot and will provide valuable feedback to IAEA

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Lessons Learned from FaSa

- A complex project is manageable, but careful consideration of interdependencies is needed
- Still a high interest on further joint activities
  - participation in the two proposed projects on “Risk Management” and “Source Term and Dose Assessment”
  - elaboration of details on further details on how
    - to prepare a decommissioning plans
    - to perform a safety assessment (“blue prints”)
- Remarkable interest on a future Expert Meeting on Decommissioning
  - Note: remember the opportunity to send comments to IAEA (V.Ljubenov@iaea.org)

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Lessons Learned from FaSa

- Factors for success of the FaSa project are
  - having a clear goal
    (even if it's not to solve all
    problems of the world...),
  - being engaged and interested,
  - trying to understand each other,
  - fighting for a position,
    but acting as friends,
  - working together since years
    (and enjoying that!!)

➔ *"FaSa Way of Life"*

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Outline on the Final Steps

- Submission of missing figures and comments — 15.01.2012
- Completion of post-processing on chapters — 29.02.2012
- Drafting of missing chapters of the FaSa Safety Report — 29.02.2012
- Final editorial of CWG — latest 30.04.2012
- Final FaSa Newsletter — latest 30.06.2012

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Closing from the Chairman's Point of View ...

- Special thanks to
  - the IAEA, esp. to Magnus Vesterlind, John Rowat, Vladan Ljubenov and Maria Rieder
  - the working group chairs and vice chairs
  - the volunteering facilities
  - the afternoon lecturers
  - the "Glorious Three" and FaSa awardees
  - and finally to ...

all of your for a productive meeting and acting as friends!

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All the Best

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Let’s keep in touch and look for further opportunities to meet and work together!

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