

Evaluation and Demonstration of Safety of Decommissioning of Research Reactors



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Research Reactor Decommissioning Demonstration Project (R2D2P)

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Background

- **Safety of research reactors – Code of Conduct (2004)**
- **Increase in decommissioning activities worldwide with differing complexity and hazard potential**
- **Need for evaluation and demonstration of safety**
 - Safety standards
 - Integral with decommissioning plan
 - Graded approach – commensurate with hazard and complexity
 - Regulatory review and approval

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Background

- **Limited experience available**
- **Differing approaches used worldwide**
- **Increasing requests to IAEA for assistance with safety assessment for decommissioning**
 - Research reactors – Romania, Serbia and Montenegro, Bulgaria
 - NPP– Lithuania



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Action Plan

- **Action 3 - Safety Assessment**

Establish a forum for the sharing and exchange of national information and experience on the application of safety assessment in the context of decommissioning and provide a means to convey this information to other interested parties, also drawing on the work of other international organizations in this area

Challenges

- **Both radiological and industrial hazards**
- **Dynamic change of conditions and hazard potential**
- **Transition from operational / decommissioning safety assessment**
- **Graded approach**
- **Availability of trained personnel**
- **Regulatory review and approval**

The DeSa Project

**Evaluation and Demonstration of Safety
during Decommissioning (2004-2007)**

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DeSa Project Objectives

- **Investigate approaches to evaluate and demonstrate safety with a view to harmonization**
- **Develop guidance on application of methodology to specific cases**
- **Investigate approaches for review of safety assessments**
- **Provide forum for exchange of information, experience, lessons learned**



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Scope

- **All types of nuclear facilities**
 - Nuclear power plants
 - **Research reactors**
 - Nuclear fuel cycle facilities
 - Research, medical facilities, etc.

- **Decommissioning options**
 - Immediate dismantling
 - Deferred dismantling
 - Entombment

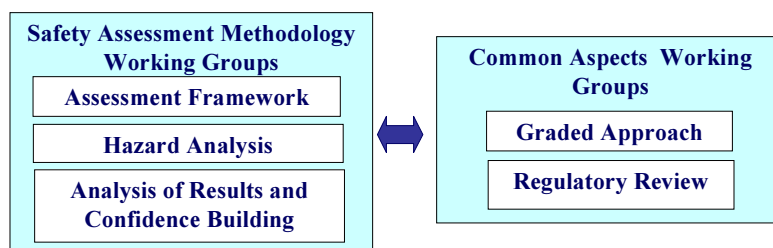
- **Radiological impacts**
 - Workers and public
 - Normal and accidental situations



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Activities

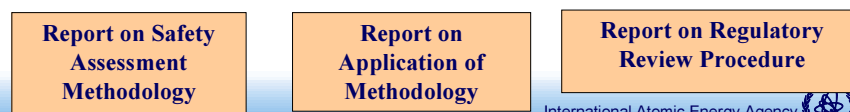
Phase 1 – Methodology



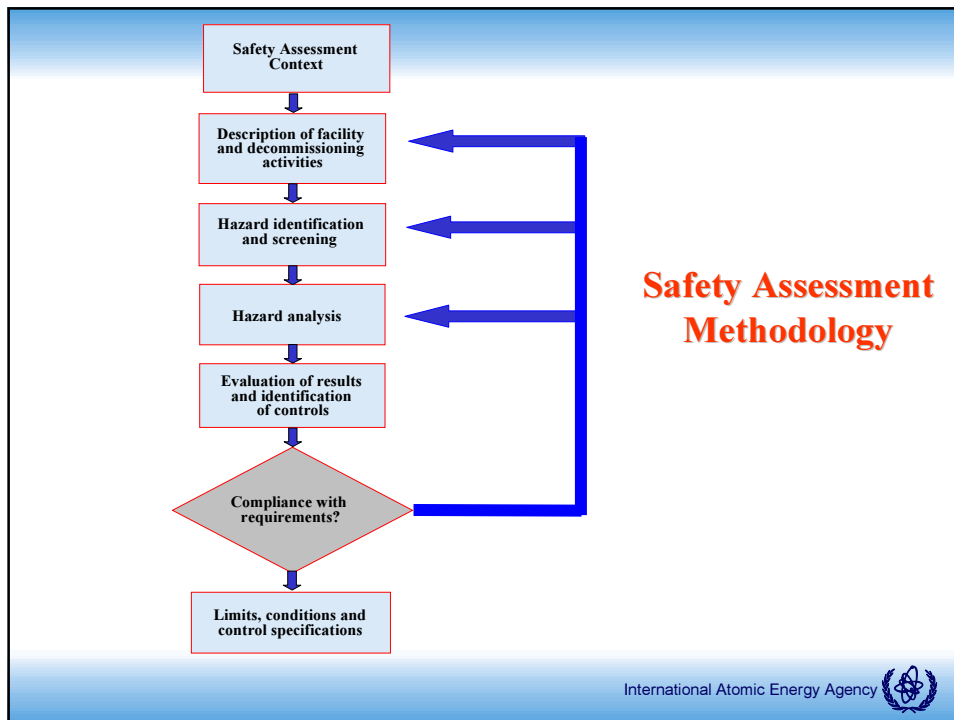
Phase 2 - Application

Test Cases/Safety Assessments for Specific Facilities

Phase 3 Summaries of the Project Outcomes



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- **Assessment framework**
 - **Context and relation to decommissioning plan**
 - **Scope**
 - **Objectives**
 - **Requirements and criteria**
 - **Timeframes**
 - **End states of decommissioning phases**
 - **Assessment outputs**
 - **SA approach**
 - **Existing SA**

- **Description of facility and decommissioning activities**

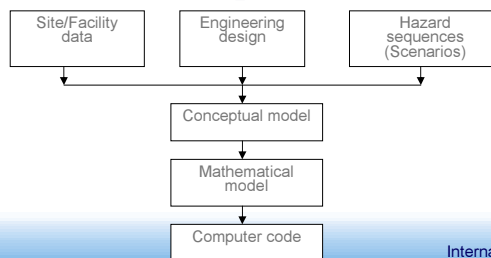
- Site description and local infrastructure
- Structures, systems and components
- Radioactive inventory
- Operational history
- Decommissioning activities and techniques
- Supporting facilities

- **Hazard Identification and Screening**

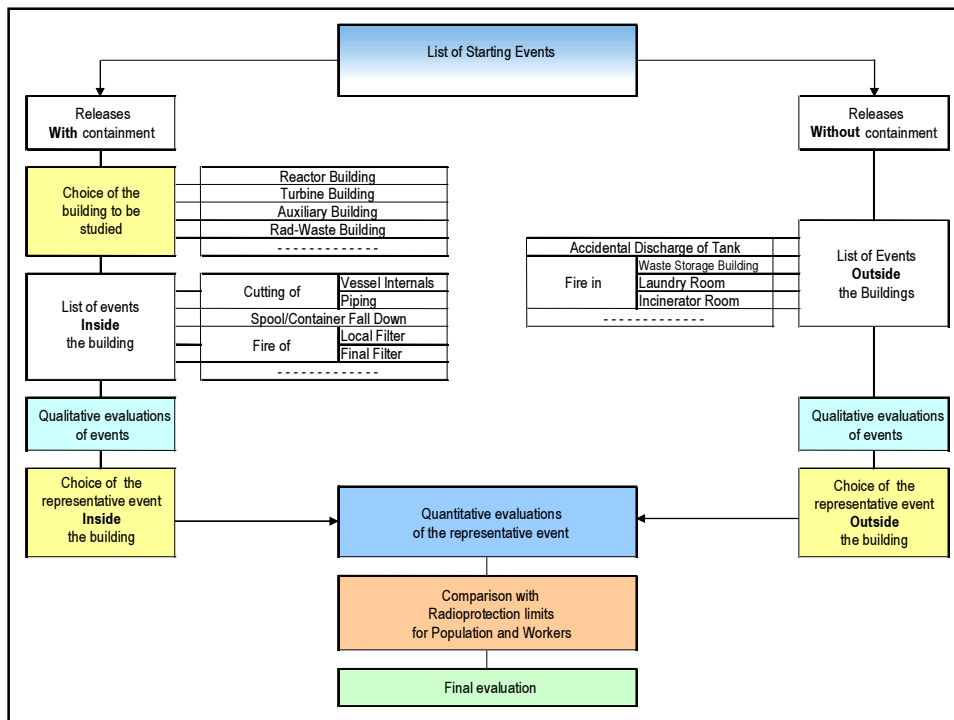
- **Identification of hazards**
 - To workers, public and environment
 - Radiological hazards
 - External
 - Internal
 - Human induced
 - Non-radiological hazards
- **Screening of hazards**
 - Check lists
 - Screening analysis
 - Expert judgement

Hazard Analysis

- **Scenarios for**
 - **Normal (as planned)**
 - **Accidental situations**
- **Modeling**
 - **Conceptual modelling**
 - **Mathematical modelling**
- **Calculation of consequences (doses and risk)**



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- **Evaluation of Results and Controls**
 - Comparison of results with safety criteria
 - Treatment of uncertainties
 - Considering/evaluation adequacy of safety controls (administrative, technical, etc.)
 - Dealing with shortfalls
- **Confidence Building**
 - **Means**
 - Quality management – procedures
 - Trained staff,
 - Independent review,
 - Involvement of stakeholders,
 - Dialogue with regulators, etc.

Graded Approach

- **Application:**
 - Development of safety assessment
 - Review of safety assessment
- **Depends on:**
 - Inventory
 - Associated hazards
 - Type and size of facility
 - Physical state of the facility
 - Quality of data
 - Resources, etc.
- **Expert judgement**



Review of Safety Assessment

- **Review adequacy of safety assessment:**
 - Internal (licensee)
 - External (RB or independent organization)
- **Systematic approach**
 - Phases of decommissioning
 - Guidance and recommendations (procedures)
 - What should be included in the safety assessment
 - How to judge the sufficiency, accuracy and completeness
- As part of the review of a decommissioning plan (decommissioning activities, endpoints, criteria, facility description)

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Application to Test Cases

- **Objectives:**
 - Demonstration and test of the methodology
 - Illustration of the graded approach
 - Test of the review procedure
- **Type of facilities:**
 - Small facility – Pu laboratory (UK)
 - Research reactor – D1 (Denmark)
 - Nuclear power plant – Barseback (Sweden)
- 3rd DeSa meeting – 13-17 November 2006, IAEA Vienna



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Test Cases A

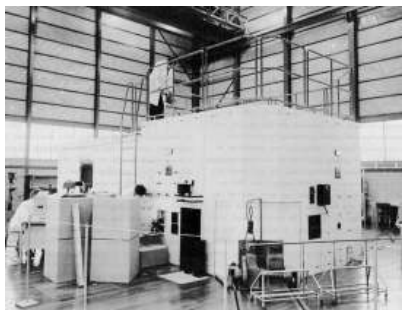
- **NPP**
 - Based on Barseback unit 1 (Sweden)



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Test Cases B

- **Research Reactor**
 - Based on DR -1 (Denmark)



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Test Case C

- **Laboratory**
 - Based on Pu-laboratory, Dounreay NPP



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Interfaces with International Activities

- **Draft Safety Guide on Safety Assessment for Decommissioning (DS 376)**
- **Safety Reports**
- **Demonstration Project on Decommissioning of a Research Reactor**
- **Technical advice on safety assessment**
 - RER/9/058 (RRs) – Romania, Bulgaria, Serbia
 - RER/3/003 (NPPs) - Ukraine
- **Coordination with NEA/OECD and WENRA**



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Summary

- More focus on safety during decommissioning
- DeSa project aims to collect MSs experience and knowledge with a view to harmonisation of approaches
- Basis for the new IAEA Safety Guide and supporting documents
- Focus of DeSa moving to application of methodology
- Useful guidance for the R2D2P project

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Further Information

- DeSa web site



<http://www-ns.iaea.org/tech-areas/waste-safety/desa/>

- DeSa Newsletters



- Scientific Secretary:
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