SAFETY ASSESSMENT METHODOLOGIES AND THEIR APPLICATION IN DEVELOPMENT OF NEAR SURFACE WASTE DISPOSAL FACILITIES – ASAM PROJECT

B. Batandjieva, P. Metcalf*(a)
International Atomic Energy Agency
Wagrammer Strasse 5, P.O.Box 100, 1400 Vienna, Austria

ABSTRACT

Safety of near surface disposal facilities is a primary focus and objective of stakeholders involved in radioactive waste management of low and intermediate level waste and safety assessment is an important tool contributing to the evaluation and demonstration of the overall safety of these facilities. It plays significant role in different stages of development of these facilities (site characterization, design, operation, closure) and especially for those facilities for which safety assessment has not been performed or safety has not been demonstrated yet and the future has not been decided. Safety assessments also create the basis for the safety arguments presented to nuclear regulators, public and other interested parties in respect of the safety of existing facilities, the measures to upgrade existing facilities and development of new facilities.

The International Atomic Energy Agency (IAEA) has initiated a number of research coordinated projects in the field of development and improvement of approaches to safety assessment and methodologies for safety assessment of near surface disposal facilities, such as NSARS (Near Surface Radioactive Waste Disposal Safety Assessment Reliability Study) and ISAM (Improvement of Safety Assessment Methodologies for Near Surface Disposal Facilities) projects. These projects were very successful and showed that there is a need to promote the consistent application of the safety assessment methodologies and to explore approaches to regulatory review of safety assessments and safety cases in order to make safety related decisions. These objectives have been the basis of the IAEA follow up co-ordinated research project – ASAM (Application of Safety Assessment Methodologies for Near Surface Disposal Facilities), which will commence in November 2002 and continue for a period of three years.

INTRODUCTION

The IAEA has the obligations to develop internationally agreed standards on nuclear, transport, radiation and waste safety; and to provide means for their application though appraisals, peer reviews, research and development, training and education and exchange of information. The IAEA places considerable emphasis on the development of safety standards, assessment and demonstration of operational and long-term safety of radioactive waste disposal facilities. During the past few years, particular attention has been given to near surface radioactive waste disposal facilities. These efforts have resulted in the development of two safety standards; safety requirements WS-R-1 “Near Surface Disposal
of Radioactive Waste” and a safety guide WS-G-1.1 “Safety Assessment for Near Surface Disposal of Radioactive Waste”.

During the last decade the IAEA has also initiated a number of research coordinated projects in the field of development and improvement of approaches to safety assessment and methodologies for safety assessment of near surface disposal facilities, such as NSARS (Near Surface Radioactive Waste Disposal Safety Assessment Reliability Study) and ISAM (Improvement of Safety Assessment Methodologies for Near Surface Disposal Facilities) projects. The ISAM project has been successfully completed in 2000 and has developed a consistent safety assessment methodology, which has found widespread acceptance. At the end of the ISAM project, it was recognised that there is a need to promote the consistent application of the safety assessment methodologies and to explore approaches to regulatory review of safety assessments and safety cases in order to make safety related decisions. Taking these recommendations into consideration the IAEA has prepared a new CRP “Application of Safety Assessment Methodologies for Near Surface Waste Disposal Facilities – ASAM” which has been prepared by the IAEA with the view to continue for a period of three years.

Scope and Objectives of the Project

The overall objective of the ASAM project is to investigate the application of the safety assessment methodologies for near surface radioactive waste disposal facilities, to develop agreed international approaches to their application and develop guidance, which will assist safety assessors, regulators and other specialists involved in the safety assessment for near surface disposal facilities in the application and review of the post-closure safety assessment methodologies.

The project focuses on practical application of the safety assessment methodology, developed under ISAM project, for different purposes, such as developing design concepts, licensing, upgrading of existing repositories, or reassessment of operating repositories. It also puts emphasis on application of the methodology in a traceable, transparent and consistent manner in order to enable development of a comprehensive safety assessment and safety case that can demonstrate compliance with regulatory requirements and criteria with the necessary level of confidence for the stakeholders involved.

The ASAM project considers both proposed and existing near surface waste disposal facilities, i.e. disposal facilities at or close to the Earth’s surface (e.g. mine and mill tailings facilities, vault facilities) and disposal facilities at depth of up to several tens of meters (e.g. boreholes facilities). The emphasis of the ASAM project is on post-closure safety assessment, although, where appropriate, operational safety will also be assessed. The inventories to be considered include a range of low and intermediate level waste arising from: the extraction and processing of naturally occurring radioactive materials; the generation of nuclear power; the use of radionuclides in research, industry, medicine and education; and the decommissioning of nuclear facilities. The primary focus is on the radioactive contaminants in the associated waste streams, however, where considered appropriate (e.g. safety assessment of disposal of mining and mineral processing waste) non-radioactive contaminants will also be assessed.
The project aims to investigate and treat specific problems associated with the development and review of safety assessment and safety case for near surface facilities based on the use of reference volunteer sites existing or in operation in the participating Member States. This will be achieved through development of group test cases applying the ISAM Safety Assessment Methodology with the aim of producing credible safety assessments for realistic situations. This approach will ensure that the focus of the project remains on credible solutions to safety assessment issues that can be used in practical assessments.

In order to fulfil these objectives, the associated work plan focuses on the application of the ISAM safety assessment methodology (Fig. 1) to:

- reassessment of existing facilities;
- disposal of disused radioactive sources and other heterogeneous waste;
- disposal of mining and mineral processing waste, and other wastes with enhanced content of naturally occurring radionuclides; as well as
- review of safety assessment and associated regulatory aspects.

![ISAM Safety Assessment Methodology](attachment:image)

**Fig. 1 ISAM Safety Assessment Methodology**

**Project Activities**

The ASAM project scope, objectives and activities has been described in detail in reference [1, 2] and were discussed and agreed at the first ASAM research coordination meeting.
(RCM) held from 11 to 15 November 2002 at the IAEA. This meeting provided a good opportunity to discuss and create good understanding of the focus of the project and direction. The agreed work project is being implemented through five of working groups (Fig. 2) and a Coordinating Working Group that were established at the November meeting:

![Organizational Structure of the ASAM Project](image)

*Fig. 2 Organizational Structure of the ASAM Project*

**Reassessment of the Safety of Existing Disposal Facilities**

This working group activities aim to demonstrate the application of the ISAM safety assessment methodology to operating waste disposal facilities, where the safety of the facility has not been proven yet; no safety assessment has been performed; safety has been questioned because revisions to the operating conditions have been proposed; or a periodic review and update of the safety assessment is required by the regulator. Comparison of different options of corrective actions (see Fig. 3) will be made with the aim of assisting decisions for future development of these types of facilities. The test case to be developed will consider the Hungarian repository and recent safety assessment performed on evaluation of its long-term safety.
Disposal of Disused Sealed Sources and Other Heterogeneous Wastes

The working group focuses its activities on investigating the role and applicability of the ISAM safety assessment methodology in evaluation of disposability of heterogeneous wastes such as disused sealed sources, decommissioning waste in near surface disposal facilities. It is expected that the work will lead to classification of identified heterogeneous wastes with regard to their radiological impact; identification of the additional radiological risks associated with such heterogeneous wastes to be taken in comparison to other wastes; generation of relevant scenarios (and conceptual and mathematical models) associated with such heterogeneous wastes; and derivation of reference activity levels for the disposal of such heterogeneous wastes in near surface waste disposal facilities. The Test Case to be developed will also consider real site, which will be agreed at the forthcoming Joint ASAM working group meeting from 2 to 6 June 2003 in Vienna.

Disposal of Mining and Mineral Processing Wastes and Other Wastes with Enhanced Content of Naturally Occurring Radionuclides

The main objective of this working group is to investigate the application of the ISAM methodology to disposal of mining and mineral processing radioactive waste and other wastes with enhanced content of naturally occurring radionuclides in near-surface disposal facilities with the purpose of exploring the issues affecting their long-term safety. It will focus on identifying the main differences and specifics in development of the safety assessment at each stage of the ISAM methodology and provide guidance on considering those issues for long-term safety assessment of these facilities. The group will also identify FEPs specific to these facilities; and assess the applicability/suitability of the regulatory review procedure, developed by the Review and Regulatory Aspects Working Group (see below) to the assessment of the facilities. Consideration has been given to the use of the
volunteer reference site in South Africa (Fig. 4) for the development of the working group’s Test Case.

![Mining and Mineral Processing Waste Disposal Facility in South Africa](image)

**Fig. 4. Mining and Mineral Processing Waste Disposal Facility in South Africa**

The two additional working groups (Cross-cutting Working Groups) were established that are associated with treatment of issues common for the development and review of post-closure safety assessment and cut across the three Application Working Groups, namely:

### Review and Associated Regulatory Aspects

The group addresses aspects that have not been elaborate during the ISAM project and are important to the development of a robust safety assessment that could contribute to the development of a defendable safety case to be presented to different stakeholder, such as regulators, independent reviewer, etc. as part of a licensing process. The working group plan includes development of a procedure for the regulatory review of a post-closure safety assessment of a near surface disposal facility; the integration of the post-closure safety assessment in safety case; regulatory review of the safety. The group also considers studying strategies to build confidence in different stakeholders (e.g. safety assessors, regulators, public) the post-closure safety assessment and the safety case of near surface waste disposal facility. The experience of UK, USA, Spain, Belgium and other countries has been considered as a staring point of these activities at the first RCM.

### Common Aspects of Application of Safety Assessment Methodologies

Issues of common concern to the application of long-term safety assessment methodologies, such as evaluation of disruptive events (e.g. human intrusion), role of engineered barriers, etc. together with the topics identified by the three Application Working Groups are the main tasks of the Common Applications Aspects working group with the aim of providing practical guidance on the treatment of these issues, based on detailed review of the existing international recommendations and good practice in the Member States. Active debate took place during the working group sessions at the 1st RCM last year to define the main priorities and topics in this area of the ASAM project. Based on the discussions five main activities have been agreed to be investigated further – assessment of disruptive events; assessment of engineered barriers performance; prioritisation of safety assessment activities; treatment of insufficient data; and conservatism vs. realism.
First Project’s Research Coordination Meeting

The first RCM organized in November was very successful and this was demonstrated by the attendance of 68 experts from 31 countries with the main objective to discuss and agree upon the purpose, scope and activities of the ASAM project for the three year period. Five working groups – three Application groups and two Cross-cutting groups were established as initially proposed and the main achievements of the 1st RCM were the broad acceptance of the proposed ASAM objectives, scope and activities; the development of a detailed work plan for each working group and discussion and agreement on the use of reference volunteer sites in the structuring of the ASAM Test Cases.

It was also important that a coordination group was established with the main purpose to ensure consistency and coordination of the ASAM working group activities according to the agreed scope, objectives and work plan. It consists of the ASAM Chairman (John Cooper, NRPB, UK), the working group leaders (Peter Ormai - PURAM, Hungary; Laurent Gagner - ANDRA, France; Jaccubus van Blerk - Aquisim, South Africa; Len Watts - BNFL, UK and Carlos Torres-Vidal - CSN, Spain) and the IAEA Scientific Secretary (Borislava Batandjieva, Waste Safety Section).

Two research coordination meetings bringing together all ASAM working groups will be organised by the end of the project in 2005, and the second RCM is scheduled for February 2004. Before that each ASAM working group will hold a meeting where the working group’s progress and documents developed will be discussed, reviewed and agreed and also all ASAM groups will meet in a Joint Working Group meeting to be held from 2 to 6 June 2003 at the IAEA headquarters in Vienna. More information about this project and its ongoing and planned activities can be found on the Rasanet web site (http://www.iaea.org/ns/hasanet/projects/index.htm); in the first ASAM newsletter and 1st RCM Proceedings (CD-ROM) to be issued in January 2003 or can be obtained directly from the Scientific Secretary.

CONCLUSIONS

The ASAM project is expected to contribute to development of improved mechanisms for application of post-closure safety assessment methodologies and for systematic review of safety cases for near surface waste disposal facilities, reflecting current international recommendations and good practice in Member States. The project will provide operators, safety assessors, regulators and independent reviewers with recommendations and guidance on development of safety assessment and a safety case for near surface waste disposal facilities, guidance on the review of safety assessment and safety case and on demonstration of quality and depth of safety assessment and safety case. It will also lead to improvement in the level of knowledge of participants in the application of post-closure safety assessment methodology for different purposes (e.g. licensing) and increased confidence in the development and review of safety assessment and safety cases for specific site in their own countries.

It is important to emphasise that the project is still open to professionals from Member State who undertake technical activities related to safety assessment of radioactive waste
disposal facilities. Participants can be from regulatory bodies, facility operators or developers, technical support organizations or research organisation and have the possibility to attend both Application Working Group and a Cross-cutting group.

REFERENCES


FOOTNOTES

(a) The authors would like to acknowledge the contribution of the ASAM Coordinating Working Group and all RCM participants for the preparation of the article.