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Application of the Safety Assessment Methodologies for Near Surface Disposal Facilities (ASAM)

Disused Sealed Sources and Heterogeneous Waste Working Group

1st Research Coordinating Meeting,
11 to 15 November 2002, Vienna, Austria

December 2002

DSS-1RCM

CONTENTS

1. Introduction

The Disused Sealed Sources and Heterogeneous Waste Working Group (DSSHW) is one of the Application Working Groups of the ASAM project. The role of the group is to investigate application of the ISAM methodology with a view to studying the importance of considering the heterogeneity of waste in the safety assessment of near surface disposal facilities.

The scope, objectives, content and work programme of ASAM in general, and of the DSSHW Working Group in particular [1] were broadly discussed during the working group sessions at the 1st RCM, held in Vienna from 11 to 15 November 2002.

The proposed activities of the group presented in [2] were also reviewed and further elaborated during the meeting.

This document provides a summary of the activities, discussions and outcomes of the working group (WG) meetings during the first Research Coordination Meeting (RCM).

2. Outcomes

2.1. Plenary session – Monday 11 November

During the first plenary of the RCM the Working Group leader, Laurent Gagner from France, presented to all participants:

- the scope;
- the objectives;
- the proposed Working Group activities;
- the expected outcomes;
- the proposed WG programme for the RCM; and
- the expected participants input.

At the end of the plenary meeting 21 participants from 17 countries decided to join the Disused Sealed Sources and Heterogeneous Waste Working Group. The list of participant is presented in Table 1.

Following the plenary meeting three working group sessions were held, according to the agenda presented in Appendix A.

Table 1 Participants in the Disused Sealed Sources Working Group

Country	Participant
Argentina	G. Siraky
Belgium	A. Debauche

	D. Mallants V. Nys
Bostwana (Republic of)	S. Williams
China (People's republic of)	X. Fan
Cuba	R. Gil Castillo
France	L. Gagner (Leader)
Israel	D. Avraham
Japan	Y. Miyauchi
Korea (republic of)	C. Kim
Lithuania	P. Poskas
Portugal	R. Trindade
Russian Federation	A. Guskov (Deputy Leader)
Slovak Republic	V. Hanusik P. Salzer V. Stefula
Slovenia (republic of)	N. Zeleznik
South Africa	M. Edwin
Spain	I. Lopez Diez
United State of America	T. Sullivan (Technical Advisor)

2.2. Working Group Session 1 – Tuesday 12 November

The working group session 1 was dedicated to presentation, discussion, and prioritisation of issues related to the heterogeneity of waste to be addressed by the WG , i.e.:

- Definition of the proposed scope, objectives, and outcomes;
- Overview of the proposed approach to be adopted in the project and the planned activities; and
- Discussion on specific objectives and priorities concerning the test case.

2.2.1. Definition of the proposed scope, objectives, and outcomes

a. Scope

The scope of the WG presented in [1] was discussed by the participants and was generally agreed. At the same time it was agreed that it was necessary to define some

criteria for categorization of the main types of heterogeneous waste that will be considered by the group. These would have to address radioactivity, radionuclide half-life, physical characteristics, repartition of waste, release mechanisms, degradation of waste form in long-term.

A possibility was suggested to define different levels of heterogeneous waste: (i) hot spots such as sealed sources; (ii) large items inside a package such as a metal component; and (iii) very large items to be disposed directly in the disposal unit.

The need to define what a sealed source is was also recognised, in order to distinguish other heterogeneous waste, unsealed sources, and other hot spots.

It was proposed and accepted that the scope should cover such disposal facilities as vaults, trenches, and different boreholes. It was suggested that heterogeneities for all these disposal concepts need to be defined taking into consideration the depth, the footprint and, the level of containment.

Concerning the phases of repository life cycle to be covered by the scope, most of the participants suggested to focus on the post-closure phase. The operational phase is of second priority for the WG, but can be studied by the group if necessary.

b. Objectives

The proposed objectives were accepted by the WG participants, i.e.: to study the applicability of the ISAM methodology in evaluating the safety implications and acceptability of disposing heterogeneous waste in near surface facilities.

All the specific objectives proposed in [1] and [2] were accepted. It was also decided to express the objectives for the disused sealed sources and for the other Heterogeneous Waste in the same words. These specifics objectives are:

- to advise in evaluating the safety of existing or proposed disposal facilities containing sealed sources and/or other heterogeneous waste, for different possible concepts such as vaults, trenches, and boreholes;
- to evaluate the extension of existing safety analysis in order to demonstrate the disposability of the new heterogeneous (waste including sealed sources) in existing near surface disposal facility;
- to evaluate and categorise the large variety of sealed sources, and other heterogeneous waste, in terms of relevant characteristics for safety analysis;
- to identify the specific risks associated with different levels of heterogeneity; and
- to illustrate the derivation of waste acceptance criteria (activity limits for sealed sources) for different concepts.

Discussion was held on the WG priorities. The two main aspects to be decided upon were evaluation of disposability of disused sealed sources or on other heterogeneous waste firstly. It was decided that the Working Group should try to deal with all the heterogeneous waste, but the priority was given to the sealed sources.

c. Outcomes

The expected outcomes presented in [1] and [2] were also discussed and accepted by the WG participants. These outcomes can be expressed in the same words for all the heterogeneous waste:

- Classification of identified sealed sources and other heterogeneous waste with regard to their radiological hazard level related to disposal in near surface facilities,
- Identification of the additional radiological risks associated with sealed sources by comparison to standard (homogeneous waste),
- Generation of a relevant set of scenarios and models associated with disposal of different heterogeneous waste (sealed sources and others) in near surface,
- Illustration of the determination of WAC (e.g. activity limits for sealed sources) associated with given dose objectives, for different level of heterogeneity and different disposal concepts.

2.2.2. Overview of proposed approach to be adopted in the project and the planned activities

a. Approach

An approach based on the following points was accepted:

- Definition of a test case based on an existing safety assessment of a volunteer site (this safety assessment is referred to as the reference case),
- Use of the ISAM methodology (see Figure 1) based on: definition of an assessment context, description of the system, development of scenarios, formulation and implementation of models, consequences analysis, study of the adequacy of the safety assessment, review and modification (iteration), considering the homogeneity of the waste; and
- Performance of further assessment identifying specificities of heterogeneous waste and associated risks for different types of heterogeneous waste.

It was recognised that there was a need to identify the reference case in order to consider its appropriateness and to determine if there was a need for additional specific issues for the development of the test case in a practical way. This is the purpose of the Working Group session 2. Nevertheless, some preliminary issues to be considered were identified for the test case.

b. Activities:

The four proposed activities [1] were accepted by the participants:

- Activity 1: Definition of WG priorities in consideration of heterogeneity in safety assessment;

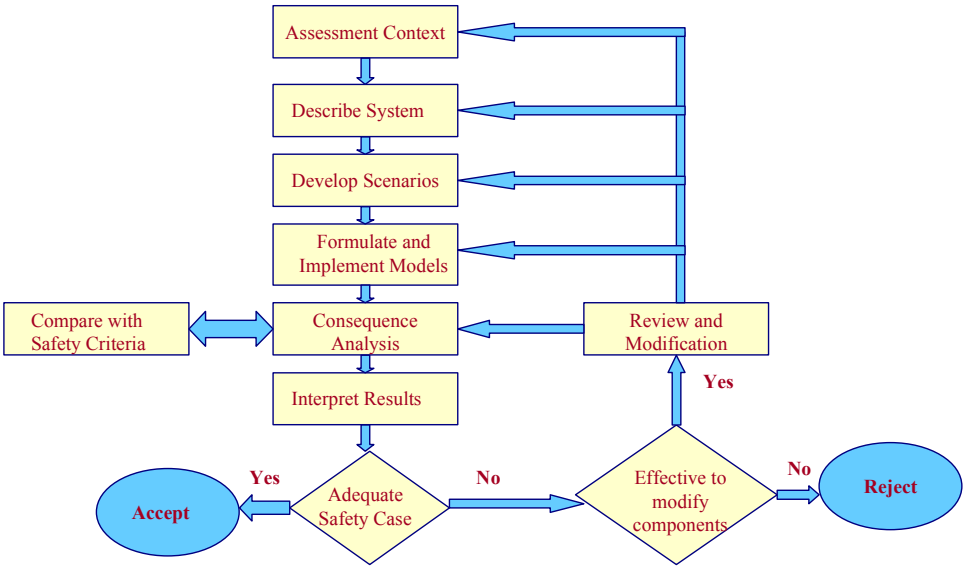

Figure 1: ISAM Methodology

- Activity 2: Definition of inventory of disused sealed sources and other waste;
- Activity 3: Safety assessment for disposal of disused sealed sources; and
- Activity 4: Safety assessment for disposal of other heterogeneous waste.

Activity 1:

As mentioned before, the agreed priority is evaluation of the long-term safety of disposal of disused sealed sources in near surface facilities, but there is a need for consideration of other heterogeneous waste.

Activity 2:

The need for a common definition of sealed sources to be considered in the study is coming from the fact that:

- This notion is variable according countries,
- This notion is variable depending on the involved stakeholders (manufacturers, suppliers, users, collecting entity, operator of waste disposal facilities, and administration),
- There are requirements from regulators which cannot be applied without a clear definition,

- Most of the definitions of sealed sources refer to "normal conditions of use" while the safety of a disposal of disused sealed sources refers to hot spot risks arising mainly from human intrusion.

Concerning the definition of the inventory (qualitative and quantitative) of sealed sources to be considered in the test case, it was recognized that:

- The qualitative and quantitative inventory will allow a classification of sealed sources according to their associated risks for the short and the long term safety of the near surface facility,

- The generation of a very broad inventory of existing sealed sources based on the IAEA data base and the participant inventories could be useful,

- The data on sealed sources to be collected will have to be determined, and based on main parameters relevant to safety, such as: radionuclide content, half-life amount, range of radioactivity, application, size, mechanical characteristics (envelop, tightness, deposition, matrix), possible potential use, etc.

Activity 3 and 4:

The ISAM methodology will be applied in evaluation of the acceptability of disposal of disused sealed sources in different types of near surface disposal facilities. Some important issues to be considered for each step of the ISAM methodology were discussed and identified by the participants. They are presented in Table 2 (last column) and are to be considered in the development of the test case.

2.2.3. Discussion on specific objectives and priorities concerning the test case

This discussion was delayed for the Working Group session 3, after the reference case presentation.

2.3. Working Group Session 2 – Wednesday 13 November

Several presentations were made during this session focusing on two main aspects; presentation of the volunteered reference site and experience gained from development of other safety assessments. The presentations were:

- Saratov reference safety case, by Andrey Gouskov from Russian Federation, the Deputy Leader of the Working Group;
- French safety assessment and WAC derivation for the acceptance of sealed sources in the Centre de l'Aube disposal Facility, by Laurent Gagner from ANDRA France, the Leader of the Working Group;

- Belgium proposal to deal with heterogeneity in the model for safety assessment, by Didier Mallant from SCK/CEN Belgium; and
- Influence of heterogeneity in the modelling, by Terry Sullivan from BNL USA, the Technical Advisor of the Working Group.

These presentations provided a basis for the discussion of those issues that are important in the consideration of heterogeneity of the waste in safety assessment, and which should be investigated in the test case. Specific issues were identified from the presentations for each step of the ISAM methodology (Figure 2).

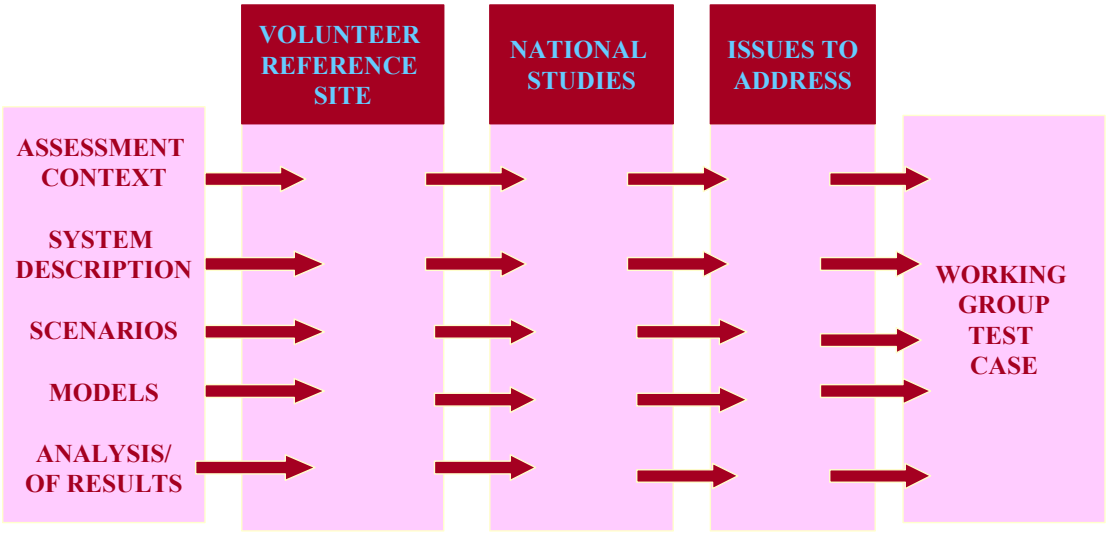

Figure 2 : Approach to identify the issues to be address

A summary of the outcomes of this discussions and the issues identified by the participants is presented in Table 2 in the Appendix. In this table:

- Column 2: presents what is already taken into account and missing in the reference safety case of the Saratov site (Radon Facility),
- Column 3: identifies what has been taken into account in the French safety assessment for sealed sources,
- Column 4: presents what is proposed from the Belgium proposal for heterogeneities in general,
- Column 5: defines the main issues to be considered in order to address heterogeneous waste in the test case. These issues come from; discussions of the Working Group session 1, from the Terry Sullivan technical presentation, and from the comparison between the existing reference case (Column 2) and the other assessments (Columns 3 and 4).

2.4 Working Group Session 3 – Thursday 14 November

Session 3 was dedicated to:

- Definition of the test case structure;
- Development of a short term work plan; and
- Development of a long-term work plan.

2.4.1 Test Case Structure

The discussions on the development of the test case were based on:

- The need for the case to be generic enough to cover existing situations in different countries (e.g. inventory, disposal options), and to illustrate derivation of generic WAC useful for different countries; and
- The necessity of the case to be specific enough in order to be able to provide realistic calculations and results; and
- The need for the case to provide practical guidance on treatment of heterogeneity in application of the ISAM methodology and in evaluating of the long-term safety of near surface facilities, where disused sealed sources have been disposed.

The approach for development of the test case structure is presented in Figure 3. This test case was defined based on the:

- the priorities agreed in session 1;

- the existing reference case presented during session 2 for the Saratov site; and

- issues identified during sessions 1 and 2.

The test case will make use of the existing safety assessment for the volunteer site (the reference case), where the waste had been considered as a homogeneous matrix. If necessary the reference case could be updated in order to incorporate particular topics and issues suggested and of interest to the participants. Focus will then be given to revising the reference safety assessment taking into consideration the heterogeneity of different types of waste (disused sealed sources, large metal components, etc.). A comparison of the approaches and results of the two assessments will be made. This approach is presented in Figure 3:

- Line 2 (the results of the reference safety assessment) takes into account the existing reference safety assessment (e.g. reference case of Saratov for homogeneous waste) and the theoretical safety assessment carried out in the ISAM project based on the reference site for the three disposal type facilities on the site i.e. trench, vault and borehole (for homogeneous waste),
- Line 3 (the WAC derived in the reference safety assessment) takes into account the existing reference WAC (reference case of Saratov for homogeneous waste) and the illustrative WAC developed as part of a separate IAEA project;
- Line 4 (considering the waste in a heterogeneous state) presents the studies on the question of the influence of heterogeneity in the likelihood and consequences of human intrusion scenarios by comparison to homogeneous assessment are shown

on line 4. This generic study will be applied in a second step to the reference assessment for the volunteer site;

	Vault	Trench	Borehole
Results of the reference safety assessment	Volunteer safety assessment and ISAM safety assessment	Volunteer safety assessment and ISAM safety assessment	Volunteer safety assessment and ISAM safety assessment
WAC derived in the reference safety assessment	Volunteer WAC and Generic (IAEA) WAC	Volunteer WAC and Generic (IAEA) WAC	Volunteer WAC and Generic (IAEA) WAC
Consideration of the waste in a heterogeneous state (intrusion)	ΔSA and ΔWAC	ΔSA and ΔWAC	ΔSA and ΔWAC
Consideration of the waste in a heterogeneous state (water)	ΔSA and ΔWAC	ΔSA and ΔWAC	ΔSA and ΔWAC
Inventories			

Figure 3: Test Case Matrix based on the Saratov Volunteer Site

- Line 5 (considering the waste in a heterogeneous state) presents studies on the question of the influence of heterogeneity in the water pathways sources term modelling scenarios by comparison to the assessment for homogenous waste. This generic study will be applied in a second step on the volunteer site.

The proposed test case will provide a good compromise between the generic and the specific approach since it:

- Considers all the identified disposal options in different countries (vault, trench, borehole), and the volunteer site contains all these options itself. In this respect the test case is both specific and generic,
- Is specific because it considers the reference safety assessment (line 2) and the existing WAC (line 3) of the volunteer site,
- Is generic because it considers in general the question of heterogeneity with regard to intrusion scenarios (line 4) and water pathway modelling (line 5),
- Covers the needs of the WG participants in terms of inventory because a broad inventory of sealed sources and other heterogeneous waste in the disposal facility.

The way this will be achieved will be debated further during the DSSHW WG meetings.

2.4.2. Cross Cutting Issues

Some cross-cutting issues were identified in the DSSHW Working Group that were considered important to the scope of its activities and the ASAM project in general. It was and suggested by the participants that these should be considered by the WG and the two cross-cutting WGs (Common Application Issues and Regulatory Review WG):

a. Regulatory

- Specific safety criteria and calculational endpoints required for consideration of the disposal of heterogeneous waste (e.g. dose to skin from sealed sources, specific limits for sealed sources or heterogeneous wastes);
- Additional safety indicators for use in evaluating impact and determining the acceptability of disposal of disused sealed sources and other heterogeneous waste (e.g. flux);
- Acceptability of near surface disposal of long-lived radionuclides and high activity sources (impacts disposal of spent sources) taking into account security options;
- Regulatory guidance for development of waste acceptance criteria for different types of heterogeneous waste; and
- Regulatory guidance for definition the nature of institutional control and cut-off times.

b. Common Aspects

- Consideration of non-radiological risks (e.g. chemical toxicity) as at present it is of secondary importance for the DSSHW WG. If considered further in the ASAM project there is a need to develop an inventory of chemicals disposed with sealed sources; and
- Coordination of the Disused Sealed Sources WG and Common Application aspect WG in developing specific intrusion scenarios, which are particularly influenced by the hetrogoneity of the waste.

3. Organisation and work plan

The Working Group will be organised in four Sub-Working Group, corresponding to the activities identified and agreed by the participants and presented in Table 2:

- Sub-Group 1: Inventory Activities,

- Sub-Group 2: Site Specific,
- Sub-Group 3: Intruders Analysis,
- Sub-Group 4: Source Term Heterogeneity Analysis.

The activities of Sub-Group 1 are expected to be completed in the short term, the others will be carried out throughout the three year project.

3.1 Short-term work plan

The short-term work plan for the DSSHW Working Group is focussed on definition and agreement of inventory of disused sealed sources and the other heterogeneous waste. This will be used in the development of the WG test case. This activity is scheduled to be completed by 1st May.

The intermediate tasks for this activity, the associated due date, the deliverables, the responsible member(s) of the working group, and the involved team are presented in Table 3.

Task	Due Date	Deliverable	Responsible	Team
Develop form for SSRS	1 Dec	Form	L,T,A	Laurent (L), Terry (T), Andrey (A)
Complete data from for SSRS	1 Apr	National data	L,T,A	All WG participants
Develop SSRS Inventory for test case	1 May	Inventory/waste characteristics for test case. Text describing assumptions	L,T,A	
Definition of heterogeneity for the test case	February2003	Text defining heterogeneity. Form for data collection	P. Salzer	Vincent Nys P. Salzer G. Siraky D. Avraham R. Trindade M. Edwin
Complete data on waste heterogeneity	1 Apr	National data	P.Salzer	All WG participants
Develop heterogeneous source term for test case	1 May	Text defining source term and assumptions. Inventory/waste characteristics and spatial distribution.	L, T, A, Salzer	

Table 3: Short term work plan for activity 1

3.2 Long-term work plan

The long-term work plan for the DSSHW WG is divided in three main actions corresponding to the other three Working Group activities 2, 3, and 4. The long-term work plan is presented for each Sub-Group on Tables 4, 5, and 6.

At this stage it was decided that the three sub-groups will identify available information and key issues to be addressed and will propose a work plan. The due date for these tasks is the 1st May. A longer work plan will be decided after the next Working Group meeting in 2-6 June 2003.

Tasks	Due Date	Deliverable	Responsible	Team
1. Identify available information, key issues and propose work plan	May 1	Work plan and identification of issues.	A. Guskov	A. Guskov P. Poskas
2. Borehole Assessment	To be agreed in June meeting, 2-6, 2003			
4. Trench Assessment				
5. Vault Assessment				

Table 4 : Long term Work plan for Activity 2 - Site-Specific Analysis

Tasks	Due Date	Deliverable	Responsible	Team
1. Identify available information, key issues and propose work plan	May 1,2003	Work plan and identification of issues.	L. Gagner	L. Gagner C. Kim I. Lopez-Diaz X. Fan V. Nys V. Hanusik G. Castillo S. Williams M. Edwin
2. Intruder Assessment for Vault.	To be agreed in June meeting, 2-6, 2003			
3. Intruder Assessment for Trench				

4. Intruder Assessment for Borehole	

Table 5: Long term work plan for Activity 3 - Intruder Analysis

Tasks	Due Date	Deliverable	Responsible	Team
1. Identify available information, key issues and propose work plan	May 1	Work plan and identification of issues.	T. Sullivan	T. Sullivan C. Kim D. Mallants V. Stefula D. Avraham V. Hanusik
2. Vault Analysis	To be agreed in June meeting, 2-6, 2003			
3. Trench Analysis				
4. Borehole Analysis				

Table 6: Long term work plan for activity 4 – Water Analysis

4. Plenary Session – Friday 15 November

A report from the working roup was presented to all the RCM participants during the final plenary meeting of the RCM summarising the discussions, and main outcomes of the WG sessions.

References:

[1] ASAM - The International Project on Application of Safety Assessment Methodologies for Near Surface Waste Disposal Facilities - Scope, Objectives, Content and Work Programme IAEA Document (June, 2002)

[2] ASAM - The International Project on Application of Safety Assessment Methodologies for Near Surface Waste Disposal Facilities – Proposed Working Group Activities (version 0.1, October 2002)

Appendix A

1st Research Coordination Meeting

Application of Safety Assessment Methodologies for Near Surface Waste Disposal Facilities (ASAM)

11 – 15 November 2002
IAEA Headquarters, Room C07VI, Vienna, Austria

TENTATIVE AGENDA
OF
DISUSED SEALED SOURCES AND HETEROGENEOUS WASTE WORKING GROUP

Tuesday, 12 November
Morning

Working session 1:

1. Detailed presentation and discussion of proposed activities and prioritisation

1.1.Overview of the proposed scope, objectives, and outcomes (L. Gagner, ANDRA)

1.2.Detailed presentation of proposed approach to be adopted in the project and the planned activities (L. Gagner, ANDRA)

2. Discussion on specific objectives and priorities: generic study/specific study on the volunteered site; sealed sources/other heterogeneous waste; approach in three steps/one step

Wednesday, 13 November
Morning

Working session 2:

3. Presentation on national experiences and needs, and decision on priorities

3.1. Presentation of the volunteered reference site (A. Guskov, MosRadon)

3.2. Presentation on national experiences (sealed sources inventory and classification; waste forms; existing disposal concepts; approaches to setting limits. Controls and conditions for disposal of sealed sources; regulatory framework; associated needs) in the context of applying the ISAM methodology (L. Gagner (ANDRA), T. Sullivan (BNL), Belgium (to be confirmed)

3.3. Decision of issues identified in the reference and national presentations aimed at defining issues to be addressed in the project

Thursday, 14 November

Morning

Working session 3:

4. Development of work plan

4.1. Test Case Structure

4.2. Defining a work plan

a. Development of a long-term work plan (2002-2005): tasks and participants involvement

b. Development of a short-term work plan (up to the following RCM): task and participants involvement (inventory activities, etc.)

Appendix B

ISAM Methodology	Radon Facility	National Case 1	National Case 2	Issues
1	2	3	4	5
Assessment Context Purpose	Preliminary Guide Research and development	Sealed Sources Develop activity limit based on dose limit Reassessment for extension of capacity	Preliminary safety assessment. Pre project phase. Examine the potential to go from temporary storage to final disposal.	How to assess impacts of heterogeneities Multiple purposes : Develop WAC, Re-assess existing facilities (interaction with reassessment group), new facilities.
Scope	Post closure, radiological impacts	Operational and post-closure. Conditioned solid sealed	Post closure. Radiological and chemical	Post closure top priority. Consider

		sources Mixed with homogeneous waste	toxicity. Large metallic pieces from D&D.	operational. Radionuclides top priority (long-lived radionuclides is regulatory issue) Chemical toxicity secondary (Cross-cutting) Mixture of wastes (spatial distribution within the facility).
Radiological Protection Criteria (exposure group)	Followed IAEA and ICRP guidance effective annual dose < 0.1 mSv/yr. Environmental concentrations.	Specific dose target 1 mSv/yr due to abnormal occurrences due to sources (intruders) Total dose target sum of sealed sources and normal wastes (10 mSv/yr)	Not well developed but follow 1 mSv/yr dose limit for radiological. Groundwater standards for inorganic chemical components.	Depending on the purpose, may need specific criteria (total dose and organ specific dose) for sealed sources or heterogeneous wastes.

		Sealed source has stricter limit because it is a non forecast waste and perhaps an additional dose. Equivalent dose target to skin 500 mSv/yr.	::	(Regulatory) Additional safety indicators (flux)
Calculational End Points	Same as protection criteria	Total Activity for each radionuclide and source properties.	As above.	Depending on the purpose. (Regulatory group)
Time Frames	No end in computational time Institutional Control 400 years	Intruder at 300 years	No fixed time limit. Guidance at later times >10000 years is needed.	IAEA guidance on interpretation of predictions at large times. Intruders at end of institutional control. Regulatory group.
System Description Waste	Sealed sources. Institutional wastes . Vaults Cs ; Co ; H3 ; Pu Sources Cs ;Co ;Ra Large variety of	Physical and radiological description of sealed sources. Many types of sources and radionuclides.	Institutional and D&D Wastes (NPP) Separate problem. Sealed	Questionnaire on sealed sources and heterogeneous wastes.

	radionuclides		sources. 1000 Ci radium Sealed sources 200 Curies other sealed sources Heavy metals	
Waste Package	Solid wastes some solidified in cement Not considered in analysis.	Concrete waste package.	Solidified in cementitious matrix. Small amount of bitumen waste forms.	
Disposal Concept	Vault (near surface. 3.5 m deep, 16m width). Concrete with bitumen lining Borehole Disposal (4 m depth) Trench (3.5 m deep)	Concrete Vault (4 meter cover, 12 meters deep).	Concrete Vaults 7- 8 meter multi-layer cap, waste zone 9 m deep, 1000 m^2, above ground Case 2 : Sealed sources : 16 m^2, height 2.5 m, cover 4-5 m. Sources in	Vaults, Trenches, Boreholes. Categorize on size and depth. Consider impacts of intruder resistant barriers.

			Sources in concrete bunkers Concrete bunkers high activity wastes Copper foil around concrete bunkers : Caps over low activity wastes Low-activity wastes have only multi-layer cover.	
Geosphere	Complex Hydrogeology Sandy/Clay host rock 70 m unsaturated zone perched water at times	Not relevant for intruders scenario.	Olen : Simple hydrogeology, flow to nearby river. Groundwater at 1-2 m depth. Sand aquifer with few meter thick clay layer at 5 meters. Mol : Sandy aquifer, 30 m	

			thickness. Clay layer underneath the sand (5 m thick). Deep sand aquifer under clay..	
Biosphere	Climate – 350 mm/yr	Not relevant for intruders scenario	Climate -	
Receptor	Nearest villages for normal evolution scenario Near field well scenario. Intruders	Intruder Residence with contaminated soil.	Sustainable farmer at edge of the facility	Intruder pathways Residential Pathways
Scenario Method	Screened ISAM FEP list Developed site-specific design scenario I Homogeneous Wastes	Followed risk assessment approach to identify scenarios. Different scenarios for sealed sources. Sealed sources not treated differently for the water pathway.	Intruders Canal adjacent Residential scenario Groundwater ; river ; direct exposure pathway :	Distance to receptor Screening of FEP list. .Develop intrusion scenarios. (Common application group)

List of Scenarios	Drilling/Intruder Erosion Enhanced degradation of engineered barrier Flooding (extreme precipitation). Surface run-off. Surface Construction with and without intrusion.	Operational – drop and crash. Direct exposure. (Take sealed source home)	Several alternative scenarios assessed May need special scenarios for intruders due to value of disposed metals (lead).	Additional scenarios due to heterogeneities
Models	Homogeneous release. Depends on scenario.	Different source term for sealed sources.	Screening models solubility ; etc : Geochemical models Detailed	Depends on scenario. May need new models for new (D&D wastes, sealed sources).

			assessment for those above screening limits : May need different approach to handle non-homogeneous source term. Including distribution of wastes within the vault. May need corrosion models for large metallic pieces.	Provide approaches to help in selecting modelling approach
Interpretation Uncertainties Multiple lines of reasoning	Multiple analyses (different rainfall rates, Kd's, etc)		Parameter uncertainty : Monte Carlo approach for key parameters. Scenario uncertainty : Multiple scenarios with degraded performance.	How to address uncertainty due to spatial variability. Archaeological analogues (landfills with heavy metal release)..

			Comparison between different models and codes. Confidence building.	
WAC	Not addressed, existing facility.	Qualitative and quantitative criteria developed for sealed sources :		Derive WAC. Based on relevant scenarios Compare and contrast WAC's derived from homogeneous and heterogeneous distribution with the same total activity.

Table 2 Main issues proposed for consideration in the test case based on the national presentations