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FOREWORD

The purpose of this report is to compile and disseminate information about the status of and trends in radioactive waste management in Agency Member States in a timely manner. The report is suitable for radioactive waste managers and regulators, decision making organizations in both governmental and private sectors, and for Agency Departments, in both the regular and Technical Co-operation programmes. Currently, the report is targeted at readers with a good knowledge of radioactive waste management. The plan is to have the document evolve to serve a broader audience using easy-to-understand graphical and tabular data.

For this, the third report in the series, contributions on a variety of topics in radioactive waste management were solicited from persons and organizations external to the Agency. Throughout the report, submissions received from external contributors are denoted.

The preparation of this annual report involves (a) a meeting with a team of consultants from a variety of government and industrial organizations to compile a first draft, (b) the optional issuance of special service contracts to polish and supplement the first draft, (c) review by Agency staff and external contributors to the report and (d) final review and approval by the Director of the Nuclear Energy and Waste Technology Division, Nuclear Energy Department, in the Agency.

Comments concerning the current report, suggestions for future reports, including suggestions for contributions to future reports, can be sent to the Agency as follows:

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e-mail: NEWMDB@iaea.org  
Subject: Status and Trends
1 DOCUMENT OVERVIEW

In its current format, this report is intended for persons directly involved in radioactive waste management and regulation as well as members of the general public who are relatively familiar with the nuclear industry and/or radioactive waste management. An annual review process has been established to enable the systematic presentation of information and the tracking of trends. As more quantitative data become available (see Section 11), the intent of the report is to provide information in both the format that appears in the current issue and, additionally, in tabular, statistical and graphical formats. As such, over time, this report should become more and more suitable as an information source for persons with a limited knowledge of the nuclear industry and/or radioactive waste management.

As stated in the first issue, the basic structure of the report was derived with the intent of developing a formal framework for the assembly of information in radioactive waste management. The objectives were:

1. to identify subject areas deemed to be of interest to Member States and the Agency,
2. to report the status of and trends in radioactive waste management according to these subject areas, and
3. to base this reporting, to the greatest extent practicable, on quantitative data.

Objectives 1 and 2 have been met. Quantitative data are not yet available at a sufficient level to achieve objective 3. However, as can be seen throughout the report, significant progress is being made in the collection of quantitative information, for example:

- Subsection 6.2.1, “Collection and Dissemination of Radwaste Processing Information at the International Level”
- Subsection 6.3.2, “Collection and Dissemination of Radwaste Storage Information at the International Level”
- Subsection 7.5 “Collection and Dissemination of Radwaste Disposal Information at the International Level”

With regards to objective 1, the reporting structure is general enough to minimize changes from issue to issue. In addition, “topical issues”, such as long term storage, are included to minimize changes in the main structure of the report. However, as developments or changes take place, the reporting structure of status and trends reports will evolve, as indicated in Table 1-1. The evolution of the structure from issue 1 to issue 3 reflects the input of subject matter experts. It is anticipated that the structure will change little, if all, for issue 4.
### Table 1-1: Evolution of the Structure of the S&T Report

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The various Sections in the report were developed within the context of the following questions:

- What are the end points to be achieved in the identified subject areas?
- What is the current global situation with respect to reaching those end points?
- What is the basis for understanding the current situation?
- What are the gaps between the current situation and what is to be achieved?
- Are there changing directions and/or trends to achieve the end points?
- What events have lead to any changes in directions and/or trends?

Under most Section headings there is a declared purpose for the Section. In addition, there may be some general remarks explaining the breakdown of the Section into specific topic areas. The beginning of a Section may also contain a brief summary of the information presented in the previous issue of the Status and Trends report, thereby minimizing the need to refer back to the previous report. This summary may include minor repetition or paraphrasing of text from the previous issue of the report.

Each Section of the report describes a subject area in radioactive waste management where work is ongoing. Part of the Section’s text will discuss the status of the subject area. In addition, questions will be addressed such as “Are there any unresolved or controversial issues?”, “What noteworthy events or activities took place since the last Status and Trends report?”, and “What trend(s) can be assessed?”.

In one or more subject areas, there may not yet be any emerging trends, only an ongoing work programme. As an example, security has recently emerged as a key topic area within Waste Management Systems and there is currently much activity. However, until that activity has matured to the point where a clear trend has emerged, for example in the design of new storage facilities, this Status and Trends report will only be able to inform the reader of the current status of ongoing work.

Each Section may contain one or more subsections. Subsections without “Topical Issue” included in their titles are meant to cover specific subject areas that are likely to be discussed over a number of issues of the Status and Trends report. These are subjects with anticipated “ongoing” interest. Subsections with “Topical Issue” included in their titles are meant to cover subject areas that are considered “timely”. These subjects may not be discussed in subsequent issues of the Status and Trends report (i.e., they are “newsworthy” or “sensitive” topics).

Subsections could include either “Topical Issue” or “Topical Issue – Update” in their titles. If “Update” is not included in the subsection title, the subsection introduces a new topical issue into the Status and Trends report. If “Update” is included in the subsection title, the subsection provides an update of a topical issue that was discussed in a previous issue (or issues) of the Status and Trends report. The relevant issue(s) is (are) cited within the body of the subsection.

Most Sections of this report include a list of reference documents. As additional issues are published over time, this Status and Trends report will serve as a valuable reference tool for understanding radioactive waste management in Agency Member States.
2 NATIONAL SYSTEMS FOR RADIOACTIVE WASTE MANAGEMENT

This Section looks at the development of systems necessary for the safe and effective management of radioactive waste, at the attempts to establish consistent approaches between Member States and the issues that currently impact upon these attempts. The subject area is covered by the following sub-headings:

- The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,
- Establishing National Systems for Radioactive Waste Management, and
- Ongoing Initiatives between Member States.

The following Topical Issues subsections are included to reflect current trends:

- Sustainable Development and Radioactive Waste (update),
- Institutional Framework for Long Term Management of High Level Waste and/or Spent Nuclear Fuel,
- Scorecard for the Implementation of National Systems for Radioactive Waste Management,
- International Co-operation - The Forum for Nuclear Co-operation in Asia, and
- Multinational Repositories.


As stated in the previous issue of this Status and Trends report, the first review meeting of the Contracting Parties to the Joint Convention will be held 3 to 14 November 2003. The associated organizational meeting was held at Agency headquarters from 7 to 9 April 2003. The meeting elected the President and two Vice-Presidents for the first Review Meeting, established Country Groups for the first review meeting, elected Country Group Co-ordinators, and selected the Chairperson, Vice-Chairperson and rapporteur for each Country Group. The report of the President of the organizational meeting is publicly available. For up to date information on the Joint Convention, including National reports, please see the following Internet page:

http://www-rasanet.iaea.org/conventions/waste-jointconvention.htm
Establishing National Systems for Radioactive Waste Management

“The Principles of Radioactive Waste Management” [2.2] cited in the Preamble of the Joint Convention states:

“The timely creation of an effective national legal and associated organizational structure provides the basis for appropriate management of radioactive waste”.

In this context, the Agency document[1] “Establishing a National System for Radioactive Waste Management” [2.3] sets forth the elements for establishing a national system that provides for the safe management of materials defined to be radioactive waste by appropriate national authorities. The document defines the end point to be achieved - the international implementation of safe and effective radioactive waste management that is based upon national legal and associated organizational infrastructures.

The previous issue of this Status and Trends report described the implementation of a mechanism to report on the progress for establishing national systems for radioactive waste management in accordance with Reference [2.3]. Progress with the implementation and use of this mechanism is described in Subsection 2.3, “Topical Issue: Scorecard for the Implementation of National Systems for Radioactive Waste Management”.

Ongoing Initiatives between Member States

The previous issue of this Status and Trends report described European Union (EU) programmes to assist non-EU countries. The current issue of this report describes additional, on-going initiatives between Agency Member States. Please refer to Subsection 2.4, “Topical Issue: International Cooperation: The Forum for Nuclear Co-operation in Asia” and Subsection 2.5, “Topical Issue: Multinational Repositories”.

2.1 Topical Issue - Update: Sustainable Development and Radioactive Waste

The previous issue of this Status and Trends report described the development and implementation of a single Indicator of Sustainable Development for Radioactive Waste Management (ISD-RW). In September 2002, additional testing was carried out and revised guidance for using the ISD-RW was prepared. The ISD-RW and the revised guidance were submitted to the United Nations Department of Economic and Social Affairs (DESA) in November 2002. The ISD-RW is now part of DESA’s list of core indicators – please refer to the web page that follows (it includes a link to the guidance document):


Please note: While the Agency was charged with the development of the ISD-RW, the monitoring of its usage is not an Agency responsibility. Use of any Indicator of Sustainable Development is the responsibility of individual countries.

1 The cited IAEA document has been superseded by IAEA Safety Standard GS-R-1, “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” (2000), however, it is referenced here because the guidance it provided was used as the basis for part of the IAEA’s Net-Enabled Waste Management Database (NEWMDB, see Section 11).
2.2 **Topical Issue: Institutional Framework for Long Term Management of High Level Waste and/or Spent Nuclear Fuel**

In December 2002, the Agency published a technical document entitled “Institutional framework for long term management of high level waste and/or spent nuclear fuel” [2.4], which was the culmination of a study funded by the Government of Japan. The document provides information on the institutional framework that has been, or is being, established for the long term management of high level waste (HLW) and/or spent nuclear fuel (SF) in selected Member States. The document contains information on the amounts of HLW and SF that are expected to be generated. It also describes the geological repositories that are being considered for disposal of this waste to help put the institutional framework into perspective (e.g. regarding the scale of the programmes).

For the purpose of the document, the institutional framework for the long term management of HLW and/or SF was defined to include the following elements:

- a consistent set of requirements for the technical and legal infrastructure including: funding, liability, institutional control, records management, and research activities,
- an organizational structure with clearly defined responsibilities, and
- provisions for participation by interested parties in decisions and outcomes.

The focus of the document is the geological disposal of HLW and/or SF from commercial nuclear power reactors. Nevertheless, in cases where national programmes include plans for geological disposal of HLW and/or SF from sources other than commercial nuclear power generation (e.g. research, defense, medicine, industry, agriculture), information pertaining to long term management of the waste from such activities is also included. The major topics addressed in the document are:

- organizational structure for HLW and/or SF long term management,
- legislative framework,
- waste streams and proposed repositories,
- siting of geological repositories,
- public involvement and transparency,
- waste management costs,
- financing systems, and
- other considerations.

The majority of the information presented in the report was collected in 2001. Nevertheless, to the extent possible, progress since 2001 has also been included.

The document also focuses on countries with a significant inventory of HLW and/or SF exists, where there is a potential for public concern regarding their long term management and where the is an associated need for careful attention to be paid by the authorities cognizant of such matters in those countries. As a result, Member States with more than two commercial nuclear power reactors in operation were invited to participate in the study.
At the start of the study, the Agency submitted a questionnaire to knowledgeable members of the nuclear community in Member States satisfying the criterion discussed above, and received and analyzed their responses. Where appropriate, existing documents were referenced and supplementary questions and responding answers were utilized, to complement the responses received from individual countries.

The document is divided into two main parts: a summary overview and comparison of the approaches selected by Member States for HLW and/or SF long term management in their countries and an Annex presenting more detailed information on the status of institutional development in the participating Member States. The summary overview was written under the guidance of, and was reviewed by, participants in consultants meetings. Descriptions of the individual institutional frameworks are based on information submitted by one or more representatives of the Member State concerned. The representatives of the Member States also reviewed their national frameworks to ensure their accuracy.

The Member States that responded to the questionnaire and whose programmes are addressed in the report are:

<table>
<thead>
<tr>
<th>Belgium</th>
<th>Hungary</th>
<th>South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>Japan</td>
<td>Spain</td>
</tr>
<tr>
<td>Canada</td>
<td>Republic of Korea</td>
<td>Sweden</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Lithuania</td>
<td>Switzerland</td>
</tr>
<tr>
<td>Finland</td>
<td>Netherlands</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>France</td>
<td>Russian Federation</td>
<td>United States of America</td>
</tr>
<tr>
<td>Germany</td>
<td>Slovakia</td>
<td></td>
</tr>
</tbody>
</table>

The report as a whole addresses several different aspects of the institutional framework for the long term management of HLW and/or SF, ranging from technical topics to administrative/legal provisions and financial arrangements. It is recommended that individuals who are interested in any particular subject should first review the summary observations in the main part of the report and then they should refer to the appropriate parts of the Annex for more details.

2.3 Topical Issue: Scorecard for the Implementation of National Systems for Radioactive Waste Management

In subsection 11.1 of the previous issue of this Status and Trends report, the methodology for a scorecard to measure progress towards the implementation of national systems for radioactive waste management in Agency Member States was described. In addition, the previous issue described the compilation of data in support of the scorecard. The compilation was based on data collected during the first data collection cycle of the newly implemented NEWMDB (see subsection 11.1 in the current issue).

The first data collection cycle for the NEWMDB was extended because of low participation by Member States (only 22 submissions). The extended cycle was conducted July 1, 2002 to February 14, 2003 – see subsection 11.1 for details. The following discusses the scorecard in the context of the combined first and second data collection cycles.

The NEWMDB provides a simple, easy-to-use method for Member States to indicate the status of the development and implementation of their national systems for radioactive waste management. The General Information section of the NEWMDB contains a “policy
questionnaire”. Instead of free-form text, Member State representatives simply point-and-click to select the appropriate answers to policy questions. Figure 2-1 shows some of the policy questions.

The intent of the questions is to assess the status of and the trends for various aspects of national systems for managing radioactive waste. With the low response rate for the first two data collection cycles, too few data have been collected to date to draw broad conclusions. In addition, the results obtained were not rigorously assessed because a “lessons learned” process was underway to clarify some of the questions and responses.

The results were published April 2003 as a sub-report entitled “Scorecard for National Systems for Radioactive Waste Management” within the Agency report “Radioactive Waste Management Profiles – Compilation of Data from the Net Enabled Waste Management Database, Number 5”. The “Profiles” report can be ordered on CD ROM or downloaded via the NEWMDB’s online reports page (see subsection 11.1).

![Figure 2-1: Example Policy Questions in the NEWMDB](image)

<table>
<thead>
<tr>
<th>National Systems</th>
<th>Disposal</th>
<th>Facilities</th>
<th>Processing</th>
<th>Storage</th>
<th>Spent SRS</th>
<th>Import-Export</th>
<th>Liquid HLW</th>
<th>UMS</th>
<th>Decommission</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Help</td>
<td>Policy</td>
<td>Strategies</td>
<td>Requirements</td>
<td>Responsibilities</td>
<td>Activities</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Insert each of the following phrases into the question: “Has your country... according to IAEA Safety Series No. 111-S-1”. For example, “Has your country identified the parties involved in the different steps of radioactive waste management according to IAEA Safety Series No. 111-S-1?"
2.4 **Topical Issue: International Cooperation: The Forum for Nuclear Co-operation in Asia**

based on input provided by Professor T. Kosako,
The University of Tokyo, RCNST

The first International Conference for Nuclear Cooperation in Asia (ICNCA) was held by the Japan Atomic Energy Commission (JAEC) in March 1990 to promote cooperation in the field of nuclear energy with neighbouring Asian countries more efficiently. Since then, the JAEC has held many ICNCAs where the ministers in charge of development and utilization of nuclear energy exchanged frank views on how to proceed with regional cooperation. Practical cooperation on specified subjects has been carried out as well. At the 10th ICNCA held March 1999, it was agreed to move to a new framework, the Forum for Nuclear Cooperation in Asia (FNCA). The FNCA includes a Coordinator and Project Leader System and a shift to more effective and organized cooperation activities. Under this framework, views and information exchanges are made in the following fields: (1) utilization of research reactors, (2) utilization of radioisotopes and radiation to agriculture, (3) application of radioisotopes and radiation for medical use, (4) public information of nuclear energy, (5) radioactive waste management, (6) the safety culture of nuclear energy, and (7) human resources development and new projects.

The countries and organizations participating in the FNCA at the time this Status and Trends report was written included Australia, China, Indonesia, Korea, Malaysia, The Philippines, Thailand, Japan, Vietnam and the Agency as an observer. The basic framework of cooperation consists of the following:

- **Forum meeting:** Discussion on cooperation measures and nuclear energy policies. A forum meeting is comprised of a ministerial level meeting and a senior official level meeting,
- **Co-ordinators meeting:** Discussion on the introduction, revision and abolishment, adjustment, and evaluation of cooperation projects by an appointed coordinator from each country, and
- **Co-operation activities for each project** (see Figure 2-2 for current projects)

**Progress:**

The first FNCA meeting was held in Bangkok, Thailand November 2000. It was co-sponsored by the Ministry of Science, Technology and Environment of Thailand and the JAEC. Workshops for the Radioactive Waste Management Project have been held in Sydney, Australia (December 2000), in Dalat, Vietnam (December 2001), and Daejon, Republic of Korea (November 2002). Minutes of the workshops can be accessed on the FNCA website (http://www.fnca.jp/english/fnca/5_hosyasei/index.html). Of note is the FNCA’s recently launched “Task Group on Spent Radiation Sources”, which is discussed in subsection 9.2 of this Status and Trends report.
2.5 **Topical Issue: Multinational Repositories**

There are various examples of international co-operation in the field of radioactive waste management. In the past, some countries accepted responsibility and custody of waste generated in other countries. This form of co-operation typically resulted from the implementation of reprocessing contracts, which in the early years did not contain clauses on returning the waste to the country where the power was generated. A specific example of international co-operation is the return of spent enriched research reactor fuel (of USA origin) to the USA, a practice that was discontinued in 1988 but has been resumed and will continue until 2006 (or 2009 if additional fuel cooling is needed). Another example would be the shipment of former USSR originating spent fuel for management in the Russian Federation.

Despite these examples of transferring radioactive materials between countries, to date multinational co-operation on radioactive waste disposal has been largely limited to the area of research and development. Repository development is currently being carried out on a strictly national basis. This nationally based approach reflects the fact that radioactive waste is a sensitive political issue, making co-operation among countries difficult. It is also consistent with the generally accepted principle that a country that enjoys the benefit of nuclear energy or the utilization of nuclear technology, should also take full responsibility for managing the associated radioactive waste. This principle, however, does not necessarily imply that each country should exclusively develop its own national repositories regardless of the technical, economic, financial and institutional implications. Each country needs to fully accept its national responsibility and to manage it to the best of its ability in the most appropriate manner, which could include international collaboration. The possibility of adopting a multinational approach to radioactive waste disposal is being examined with a view to determine the parameters involved in creating such a co-operative system.
An important development in the international arena that had a bearing, albeit indirectly, on the concept of multinational repositories was the Joint Convention [2.1]. This convention, while encouraging Contracting Parties to take responsibility for the management of their radioactive waste, also recognizes in its Preamble “that, in certain circumstances, safe and efficient management of spent fuel and radioactive waste might be fostered through agreements among Contracting Parties to use facilities in one of them for the benefit of the other Parties”. Because of its international significance, adherence to the Joint Convention is considered necessary for future participants in a multinational repository project, just as it is for all countries pursuing a purely national approach to repository development. In this regard, recognition of the principles embodied in the Joint Convention is important.

The development and implementation of national and multinational repositories should be regarded as complementary activities. At present, there are countries that do not have the necessary resources to undertake the development of a repository project entirely on their own. This is the case for all internationally recognized disposal options. In such cases, it may be appropriate for these countries to engage in a multinational, collaborative effort to establish a repository that would otherwise be very difficult to realize.

In response to requests from several Member States expressing an interest in multinational disposal options, in 1998 the Agency produced a technical document [2.5] outlining the important factors to be taken into account in the process of realizing such options. These factors include for example, technical (safety), institutional (legal, safeguards), economic (financial), socio-political (public acceptance) and ethical considerations. After examination of many rational arguments, potential benefits and challenges for the development and implementation of multinational repositories, the report concluded that:

- the multinational repository concept does not contradict ethical considerations,
- the high ratio of fixed to variable costs for a repository ensures that considerable economies of scale will apply, and
- transport of nuclear material is so safe that the distances resulting from a multinational repository will not have a significant impact on public health.

As part of its current tasks, the Agency reviewed the work done in the previous study, taking into account developments since its publication in 1998 as well as current activities in the field of multinational repositories. The review included a more detailed assessment of possible implementation scenarios, resulting in more detailed specification of implementation requirements. The intent of the review was to work towards the development of a reference document for Member States that might be interested in multinational repository concepts, either as hosting, partner or third party countries.

References for Section 2


3 THE CLASSIFICATION OF RADIOACTIVE WASTE

As discussed in the previous two issues of this Status and Trends report, historically, Agency Member States have developed and currently use a variety of waste classification schemes for their radioactive waste. These classifications are based on both qualitative and quantitative criteria in which wastes are commonly grouped according to their origin, radioactivity content, radiotoxicity and thermal power. There is often a substantial overlap between the various waste classes. Waste classification schemes have been developed for practices and usually they do not address naturally occurring radioactive material (NORM) or technologically enhanced NORM (TE-NORM) where concentrations of naturally occurring radionuclides have been increased.

The purpose of this Section is to raise international awareness of a number of issues related to the classification of radioactive waste. These issues are discussed in the following subsections:

- Exclusion, Exemption and Clearance, and
- Radioactive Waste Classification at the International and National Levels

3.1 Exclusion, Exemption and Clearance

In September 2000, in resolution GC(44)/RES/15, the IAEA’s General Conference requested the Secretariat “to develop, using the Agency’s radiation protection advisory mechanisms and in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, during the next two years and within available resources, radiological criteria for long-lived radionuclides in commodities, particularly foodstuffs and wood, and to submit them to the Board of Governors for its approval” and requested the Director General to report to it at its forty-fifth (2001) regular session on the implementation of the resolution.

Since that time several draft texts for a Safety Guide within the Agency’s Safety standards programme have been developed. In March 2002, the Waste Safety Standards Committee (WASSC) and the Radiation Safety Series Committee (RASSC) agreed that the draft document should be sent to Member States to elicit views and comment and requested the associated Safety Report, which provides the basis for the activity concentrations presented in the Safety Guide, also be presented as background information.

The General Conference resolution specifically mentioned that the Agency should develop radiological criteria for commodities, including foodstuffs “in collaboration with the competent organs of the United Nations and with the specialized Agencies concerned”. Responsibility for defining acceptable activity concentrations of radionuclides in foodstuffs and drinking water has been taken by the Codex Alimentarius Commission (CAC) and the World Health Organization (WHO) respectively. A Technical Meeting in February 2002 and the WASSC/RASSC meetings in March 2002 expressed the view that any modification of the Codex Alimentarius values should be the responsibility of the CAC. The Secretariat has consequently transmitted the results of its work on appropriate levels for foodstuffs to the CAC and recommended that they proceed with the development of new standards as soon as possible. The WHO is already in the process of reviewing its drinking water standards.

A new draft text of the Safety Guide was presented to WASSC/RASSC meetings at Agency headquarters in December 2002. The draft has taken into account many of the comments
made by Member States. However, other significant changes, affecting both the title and the conceptual basis of the document (such as extending the scope of the term exclusion as compared with the Basic Safety Standards), were introduced. This eventually led to a strong request for another round of Member States’ comments. In WASSC/RASSC meetings in March 2003, it was agreed that a new version of the draft Safety Guide should be circulated to Member States for comments in the course of 2003.

3.2 Radioactive Waste Classification at the International and National Levels

In 1994, the Agency published a Safety Guide entitled “Classification of Radioactive Waste” [3.1]. This guide stated:

“To simplify their [radioactive wastes] management, a number of schemes have evolved for classifying radioactive wastes according to their physical, chemical and radiological properties of significance to the facilities managing this waste. These schemes have led to a variety of terminologies, differing from country to country and even between facilities in the same country. This situation makes it difficult for those concerned to communicate with one another regarding waste management practices, causing problems in comparing data published in the scientific literature, and causes confusion among members of the public trying to understand waste management programmes and practices of their countries and of other Member States...

...The objective of this Safety Guide is to recommend a method for deriving a classification system and to suggest a general system for classifying radioactive waste that will facilitate communication and information exchange among Member States, and eliminate some of the ambiguity that now exists in classification schemes for radioactive wastes.

Furthermore, this Safety Guide is to specify boundaries in a general system for classifying radioactive waste, especially in the assignment of boundaries to radioactive waste classes. It describes how to deal with a classification system, points out approaches for further quantification and discusses methods by which boundaries can be derived.”

This subsection of the Status and Trends report focuses on the issues denoted by the bold italicized text, it discusses progress made towards the implementation of a general system for waste classification and it discusses the waste class matrix feature of the Agency’s Net Enabled Waste Management Database (NEWMDB) [3.2] and [3.3], which was implemented for Agency Member States (a) to identify the waste classification schemes they use and (b) to compare these schemes with the Agency’s proposed general waste classification scheme.

Assessment of the proposed general scheme for radioactive waste classification

A recent assessment of the Agency’s proposed general waste classification scheme indicated that the scheme is not rigorous and not completely defined [3.4]. This assessment was confirmed at a recent meeting of the Waste Safety Standards Committee (WASSC). The report for the 11th WASSC stated [3.5]:

“WASSC recognises the need for a review of the current safety guide, in order to:

• take more account of predisposal waste management considerations
• address the inclusion of other waste types
• introduce an international definition of radioactive waste

However, it is felt that the review should not start before the ongoing/planned collection of data from Member States. Further consideration should then be given to
Note: the “ongoing/planned collection of data from Member States” refers to the first data collection cycle of the NEWMDB, see subsection 11.1.

Table 3-1 summarizes the recent assessment of the Agency’s proposed general waste classification scheme.

Table 3-1: Summary of the Assessment of the Agency’s Proposed General Waste Classification Scheme

<table>
<thead>
<tr>
<th>Waste Class</th>
<th>Typical Characteristics</th>
<th>Possible disposal Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exempt Waste (EW)</td>
<td>activity levels at or below clearance levels (see Note 1)</td>
<td>no radiological restrictions</td>
</tr>
<tr>
<td>Low and Intermediate Level Waste (LILW)</td>
<td>activity levels above clearance levels thermal power below about 2kW/m³ (see Note 2)</td>
<td></td>
</tr>
<tr>
<td>Short Lived (LILW-SL)</td>
<td>restricted Long Lived radionuclide concentrations (see Note 3)</td>
<td>near surface or geological disposal facility</td>
</tr>
<tr>
<td>Long Lived (LILW-LL)</td>
<td>long lived radionuclide concentrations exceeding limitations for LILW-SL (see Note 3)</td>
<td>geological disposal facility</td>
</tr>
<tr>
<td>High Level Waste (HLW)</td>
<td>long lived radionuclide concentrations exceeding limitations for short lived waste</td>
<td>geological disposal facility</td>
</tr>
</tbody>
</table>

Note 1: There is no internationally agreed definition for clearance levels

Note 2: There is no international consensus on this thermal power level

Note 3: Safety Guide 111-G-1.1 only provides guidance for restricting the concentrations of alpha emitting radionuclides - no explicit guidance is provided for other long lived radionuclides

The proposed scheme defines the LILW class by exclusion - it is neither clearance nor HLW. However, currently there are no internationally agreed definitions of either clearance or HLW, as such these boundary conditions are ambiguous. Additionally, the proposed scheme divides LILW into the LILW-SL and LILW-LL classes but only provides general guidance on the level of alpha emitting nuclides. The Safety Guide states “The boundary between short lived and long lived waste cannot be specified in a universal manner”, indicating that the boundary between the LILW-SL and LILW-LL classes is also ambiguous. Furthermore, recent discussions between the NEWMDB’s Programme Officer and official contact points in Member States has indicated that the Safety Guide’s discussion of “methods by which boundaries can be derived” is inadequate or could not be understood. The Safety Guide objective to “eliminate some of the ambiguity that now exists in classification schemes for radioactive wastes.” may have been partially achieved, however it is clear that a great deal of ambiguity regarding the classification of radioactive waste still exists in Agency Member States.

Progress towards the implementation of a general waste classification system

Since the Agency Safety Guide on the classification of waste was issued in 1994, several assessments have been made of the multitude of waste classification schemes used worldwide [3.6] to [3.9]. All of these assessments indicated that some form of harmonization of waste classification is needed. In 1999, the European Commission issued a recommendation that stated “the [EU] Member States and their nuclear industry adopt a common classification system for national and international communication purposes as well as to
facilitate information management in this field’ [3.10]. The EC recommendation further states:

“... that this classification system should be used for providing information concerning solid radioactive waste to the public, the national and international institutions and the non-governmental organisations. It would not replace technical criteria where required for specific safety considerations such as licensing of facilities or other operations;

that this classification system could be used by Member States. During the period to 1 January 2002 it could be used in parallel with existing national systems;...

... The use by all countries of the international IAEA classification of radioactive waste packages is a suitable base to develop a common classification system for the Member States of the European Union. Definition of a reference classification system may provide useful guidance for specific countries in developing their own management strategies, whilst at the same time facilitating general and commercial communications. Concerning safety, however, while such a reference classification system may be useful for generic and basic considerations, it cannot replace specific safety assessments performed for specific management purposes, including the selection of disposal routes....”

The EC recommendation is based on the Agency’s 1994 Safety Guide but includes modifications to the Agency’s proposed general classification scheme. For example the EC recommendation states, “For instance the IAEA recommended limit of heat generation in LILW radioactive waste (2 kW/m³) was not retained. The experts could not find any foundation for such a value and commonly accepted that this value is only related to site-specific safety analysis.”

One key point is that the recommended common EC classification system should “be used for providing information concerning solid radioactive waste to the public, the national and international institutions and the non-governmental organisations” but it would not replace existing waste classification schemes that support waste management operations and activities, notably disposal assessments. Another key point is that the recommended EC classification system only serves as a “suitable base to develop a common classification system for the Member States of the European Union”. However, this EC statement must be viewed in the context that the Agency’s proposed general classification scheme is not rigorous and not complete. The same is true for the EC’s recommended common classification system since its waste classes are also defined by either ambiguous boundary conditions or boundary conditions for which there is no international consensus.

A major question arises. How could EU Member States “convert” waste management information based upon nationally-based waste classification schemes into information reported according to the EC’s common classification system if the boundary conditions for the EC’s waste classes are ambiguous and in the context of the EC statement that “In addition the borderlines between the [national] categories are not always easily quantifiable and hence can vary widely from one country to another.”?

Recent discussions between the NEWMDB’s Programme Officer and official contact points in Member States indicated that some Agency Member States have recently adopted or are planning to adopt the Agency’s proposed waste classification scheme in support of waste management programmes and activities. The adoption of the Agency’s proposed general classification scheme may not only be premature, it may be inappropriate if it is to serve as the fundamental basis for radioactive waste management. The EC statement that its recommended common classification system “would not replace technical criteria where
required for specific safety considerations such as licensing of facilities or other operations” is a clear recognition of the limitations of the Agency’s proposed general classification scheme as the basis for supporting radioactive waste management operations. The EC has clearly indicated that until an effective common classification system is developed, its recommendations should be limited to providing information “to the public, the national and international institutions and the non-governmental organisations”.

An additional point to consider is that the Agency’s proposed scheme, upon which the EC recommendation is based, is principally a disposal based waste classification scheme. As such, it does not adequately address pre-disposal radioactive waste management (handling, processing, storage) that can require quite complex classifications such as fissile/non-fissile waste, waste requiring/not requiring safeguards, package stackability, compressibility, durability in storage, etc. In other words, the Agency’s proposed waste classification scheme does not fully address “technical criteria where required for specific safety considerations such as licensing of facilities or other operations”.

Obviously there is an international dilemma. While organizations like the EC want to see radioactive waste reported according to a common classification system, how could this be implemented given the fact that both its recommended common system and the Agency’s proposed general scheme are not rigorous and not completely defined and, nationally, there is a great deal of uncertainty about waste classification in general? A possible solution is described next.

The waste classification tool in the NEWMDB

The recent assessment of the Agency’s proposed general waste classification scheme indicated that the scheme “could serve as a good foundation” for developing a rigorous and complete scheme. This fact was also recognized by the EC. However, the development of a rigorous and complete common waste classification scheme could be well into the future. How, then, could Agency Member States report their radioactive waste inventories to the Agency’s NEWMDB in such a way that the Agency could compile a comprehensive, radioactive waste inventory according to a common classification scheme?

The NEWMDB’s waste class matrix tool was implemented to address this issue. Using the waste class matrix, an Agency Member State’s single point of contact, known as a Country Co-ordinator, is responsible for identifying the various waste classification schemes used in his/her country and for comparing these schemes with the Agency’s proposed general classification scheme. Country Co-ordinators were requested to provide supporting documentation to indicate whether or not a waste classification scheme is required by law or regulation and to describe how the comparison between their schemes and the Agency’s proposed scheme was performed.

Once the identification and comparison of waste classification schemes was completed, Member States reported their radioactive waste inventories to the NEWMDB according to their own, nationally-based waste classes. The advantages of this approach are:

- The reporting of wastes according to nationally-based waste classes avoids the requirement for Country Co-ordinators to first “convert” nationally-based information into a common classification scheme. The intention was to have Member States report information that could be traced back to nationally-based reports. Converted information reported at the international level is not readily traceable back to unconverted information reported at the national level,
This factor is very important to the successful reporting of nationally-based information at the international level. Without traceability, confidence cannot be established for the international information. In addition, use of the waste class matrix was a major stumbling block for many Country Co-ordinators. A number of Country Co-ordinators indicated that they had difficulty using the matrix because (a) they did not have any formally recognized waste classification scheme(s) in their country, (b) the schemes they did have were not quantitatively based or were based upon parameters such as the origin of waste and radiation field strength measurements, which could not be readily compared with the Agency’s proposed classification scheme, and/or (c) they had difficulty with the inherent ambiguities of the Agency’s proposed waste classification scheme, and

- Waste class matrix information is used after Member States report their wastes according to their own waste classes to convert the national waste inventories into a first order approximation of an international waste inventory according to a common scheme.

This approach allows the international community time to develop a comprehensive, common classification scheme and allows Member States time to develop and implement effective, operational waste classification schemes. Until these are implemented, Member States can report traceable waste inventory data to the NEWMDB. Over time, the first order approximation of an international waste inventory according to a common classification scheme can progress to a reasonably accurate representation of the inventory of radioactive waste in Agency Member States.

Figure 3-1 and Figure 3-2 illustrate waste class matrices prepared by the Country Co-ordinators for Hungary and for the USA during the NEWMDB’s first data collection cycle. In both cases, supporting documentation indicated that the comparison of waste classification schemes was based upon detailed waste characterization data that had been compiled by the countries. The provision of supporting documentation by Country Co-ordinators is in conformance with a requirement of the Joint Convention [2.1], which states that “For each Contracting Party the report shall also address its... ...criteria used to define and categorize radioactive waste”.

The way forward

The results of the NEWMDB’s first (July 2001 – March 2002) and second (July 2002 – February 2003) data collection cycles indicate that the proposed WASSC review of the Agency’s proposed general waste classification scheme should be undertaken in a timely manner. The results also indicated a need for capacity building to assist some Agency Member States with the classification of their radioactive wastes. This classification is required to support the effective management of radioactive wastes and to support the Indicator of Sustainable Development for Radioactive Waste Management (see subsection 2.1).

At time of writing, the Agency’s Waste Technology Section within the Department of Nuclear Energy had plans to introduce the development of a new technical document to address “operational waste classification” starting in fiscal year 2004. The intention is to undertake a comprehensive examination of waste segregation practices in Member States and to assess why these practices were implemented. From this assessment, an operational waste classification scheme can be prepared for the life cycle management of radioactive waste. An
operational waste classification scheme would provide valuable input for the development of a higher level, common waste classification scheme.

### Figure 3-1: One of the Waste Class Matrices Defined by the Country Co-ordinator for Hungary

<table>
<thead>
<tr>
<th>Matrix Name</th>
<th>PNPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNPP Class</td>
<td>LILW-SL%</td>
</tr>
<tr>
<td>LLW</td>
<td>100</td>
</tr>
<tr>
<td>MLW</td>
<td>0</td>
</tr>
<tr>
<td>HLW</td>
<td>0</td>
</tr>
</tbody>
</table>

**Description**: LLW: low level waste \( (A < 5 \times 10^5 \text{ Bq/g}) \) MLW: medium level waste, \( (5 \times 10^5 \text{ Bq/g} < A < 5 \times 10^8 \text{ Bq/g}) \) HLW: high level waste \( (5 \times 10^8 \text{ Bq/g} < A) \)

### Figure 3-2: One of the Waste Class Matrices Defined by the Country Co-ordinator for the USA

<table>
<thead>
<tr>
<th>Matrix Name</th>
<th>USNRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>USNRC Class</td>
<td>LILW-SL%</td>
</tr>
<tr>
<td>Class A LLW</td>
<td>100</td>
</tr>
<tr>
<td>Class B LLW</td>
<td>100</td>
</tr>
<tr>
<td>Class C LLW</td>
<td>75</td>
</tr>
<tr>
<td>Greater than Class C LLW</td>
<td>0</td>
</tr>
<tr>
<td>HLW</td>
<td>0</td>
</tr>
</tbody>
</table>

**Description**: NRC waste classes defined in Title 10, Code of Federal Regulations, Part 61, Subpart 55. Class C split based on analysis of actual data

References for Section 3.


3.5 Report of the 11th Waste Safety Standards Committee (WASSC) meeting, April 4-6, 2001.


4 SOURCES OF RADIOACTIVE WASTE

In the first two issues of this Status and Trends report, this Section was used to provide an overview of the sources (origins) of radioactive waste. The previous issues provided a brief summary of radioactive waste from current practices from two main areas - nuclear applications (NA) and the nuclear fuel cycle (NFC).

Two types of large volume, low activity waste containing long lived (more than 30 year half life) radionuclides are uranium mine and mill tailing (UMMT) waste and naturally occurring radioactive materials (NORM) waste. These two types of waste may require special attention within a country’s overall radioactive waste management framework and, therefore, they are given special attention in the Status and Trends report series – see subsection 4.1 and subsection 4.2.

Wastes arising from facility decommissioning are discussed in Section 5, “Decommissioning of Nuclear Facilities”.

4.1 Uranium Mine and Mill Tailings Management

The Agency is currently undertaking a co-ordinated research project (CRP) on the long term management of UMMT [4.1]. Large volumes of low activity milling residues, such as mill tailings, are produced - sometimes exceeding millions of tonnes at a single uranium mining/milling facility, in particular, when uranium is only a by-product from the mining for other metals/minerals. The common mode of disposal is in near-surface impoundments in the vicinity of the mine or mill. Historically, such impoundments were often arranged in a haphazard fashion, either utilizing geomorphological depressions or by filling in valleys. As a result, little or no action was taken to isolate tailings from the environment. More recent uranium mining developments have improved residue management considerably [4.2].

Typical environmental problems arising from UMMT are radon emanation, windblown dust dispersal, acid generation due to sulphide oxidation, and the leaching of contaminants, including radionuclides, heavy metals and arsenic, into surface and ground waters.

Engineering solutions need to consider long term care and maintenance as an integral part of planning and design. In turn, this may require active institutional control and stewardship over very long periods of time. Engineering solutions, long term care and maintenance and institutional control should, together, strive for an optimization of economic, technical, risk reduction and societal factors.

The emphasis of the CRP is on technical solutions that can be applied in a restoration/remediation context. Costs are of crucial importance, as these frequently have to be borne by the taxpayer instead of by revenue generated as a component of product price. Any proposed expenditure has to be carefully balanced against the expected benefit from restoration/remediation measures. This implies that a comparison of forecasted environmental and radiological impacts with and without the implemented measures is undertaken beforehand. However, legal requirements, environmental targets and standards, economic resources available, and thus the actual management and remediation/restoration practices, may vary considerably from Member State to Member State.
The CRP is proposed as one step towards both raising the awareness of potential problems and assisting Member States in the development of efficient procedures and processes for the sustainable long term management and, if deemed appropriate, remediation of uranium mining/milling waste sites, and to encourage a harmonized and systematic approach where feasible.

The overall objective of the stabilization and isolation of mill tailings and other uranium mining residues is to minimize the exposure of target groups from radiation and contaminants in the various environmental media. This can be achieved by creating conditions resulting in low source terms for solid, aqueous, and gaseous releases and by designing disposal facilities resistant to failure. Long term stabilization and isolation of mill tailings is an active R&D area, covering among other things, the development of new techniques for tailings deposition, the geomechanical and geochemical stabilization of waste materials, and the design of advanced barriers, both at the bottom and as cappings.

It is expected that the CRP will contribute to the transfer of technologies and know how within the international (uranium) mining/milling, waste disposal and contaminated land communities. The specific problems arising from the properties of relevant radionuclides and the properties of tailing materials is being addressed. Special emphasis has been given to the development of innovative methods and techniques for stabilization.

The expected outputs of the CRP are listed in Table 4-1.

<table>
<thead>
<tr>
<th>Expected</th>
<th>Present Status</th>
</tr>
</thead>
</table>
| 1. Protocols for relevant procedures | a) a method for integrated performance assessment is being developed  
  b) a holistic project planning method is being developed  
  c) a method for assessing the performance of relocating tailings underground was developed. |
| 2. Relevant methods | a) methods to stabilize tailings material by precipitation of e.g. BaSO₄ were developed and are being tested in the field  
  b) a method to improve erosion resistance of loose material by organic polymers was developed and optimum application parameters are derived from laboratory test. Field tests are under way.  
  c) a procedure to improve the geochemical behaviour of impounded tailings by inter-layering them with reactive compounds was developed. |
| 3. Publications in refereed journals | |
| 4. TECDOC | a) A project Web site was created as a means for communication with the project participants. On this Web site progress reports etc. are being posted.  
  b) A draft final report to be developed as TECDOC is being developed with the help of additional consultants. Draft 3.1 is currently available. |

The objective of the CRP is to encourage the sharing of practical experience (adaptive research) and (applied) R&D work by Member States on topics relevant to the long term stabilization/isolation of mill tailings. While the individual projects are rather diverse, the final report will bring together the results and put the work of the individual participants into an appropriate context. It is expected the final report, to be published as an Agency technical document, will give a comprehensive overview over the current situation with respect to the long term management of historical uranium mining and milling residues.
4.2 Naturally Occurring Radioactive Material (NORM) Waste

The Agency attaches great importance to the dissemination of information that can assist Member States with the development, implementation, maintenance and continuous improvement of systems, programmes and activities that support the nuclear fuel cycle and nuclear applications, including the legacy of past practices and accidents. In response to this, the Agency has initiated a comprehensive programme of work covering all aspects of environmental remediation:

- factors important for formulating strategies and selecting technologies for environmental remediation,
- site characterization techniques and strategies,
- assessment of remediation technologies,
- assessment of technical options for clean-up of contaminated media,
- post-restoration compliance monitoring, and
- remediation of low level dispersed radioactive contamination in the environment.

Radioactive residues are found not only in fuel cycle activities, but also in a range of other industrial activities, namely:

- mining and milling of metallo-ferrous and non-metallic ores,
- production of non-nuclear fuels, including coal, oil and gas,
- extraction and purification of water for the generation of geothermal energy, as drinking and industrial process water, and paper and pulp manufacture as examples,
- production of industrial minerals, including phosphate, clay and building materials, and
- use of radionuclides, such as thorium, for properties other than their radioactivity.

The Extent of Environmental Contamination by NORM

The Agency plans to issue a Technical Report (TR) on environmental contamination by NORM in 2003 [4.3]. The main objective of the TR is to provide the first step in an effort to develop a global knowledge base on the occurrence and characteristics of NORM in a wide variety of industrial and domestic activities and to identify and assess potential technologies that have been or could be used to help reduce the potential for or magnitude of potential exposures. Such technologies could be applied at source to limit the amount of radioactivity extracted with the raw material, during processes using recycling/reuse or treatment, at the back end of the process through special disposal practices, or in the form of remediation approaches in cases where some form of remediation is needed.

The TR is intended to help Member States gain perspective regarding the industrial processes that may lead to NORM generation and where, within those processes, NORM can accumulate and eventually may lead to increased potential for exposure of the general public to radioactivity. To this end, the TR includes a summary of a variety of processes that may involve NORM and some examples of the amounts and characteristics of NORM containing feed stocks, residues, by-products and products associated with these processes.
The TR attempts to give an international overview over the relevant processes, the types of residues and waste generated, the pertinent management strategies and technologies with a view to identify shortcomings that may lead to the need of remediation. An overview of applicable abatement and remediation technologies and strategies is given, together with a brief discussion of the possible socio-economic impact. The intention is to help Member States gain perspective regarding the industrial processes that may lead to NORM generation and where, within those processes, NORM can accumulate and eventually may lead to increased potential for exposure of the general public to radioactivity. It is also hoped to make decision makers in radiation protection aware of the industrial and socio-economic implications of their decisions. Further, it is hoped that the document will help to identify those process steps that are amenable to improved radiation protection and to identify the type of residue and waste and the associated disposal sites that may be of concern and in need of remediation.

A picture of the worldwide scale of potential problems with NORM in a variety of industries has been developed based on literature surveys and the contributions by experts from various Member States. A comprehensive survey had been undertaken for Europe and also for Northern America. The knowledge base for most less developed countries remains scarce.

For several reasons, the circumstances in the less developed countries are of particular concern:

- a large proportion of the world mining operations and, to a lesser degree, also milling operations are located in these countries,
- environmental and radiation protection standards may be less stringent or their enforcement may be less strict,
- artisanal mining and milling and other artisanal industries are widespread with less stringent occupational health and safety precautions. As opposed to developed countries, such activities are still more integrated with the private and family life, potentially leading to exposure of the public (e.g. residential/garden plots on or adjacent to ‘industrial’ sites, re-use of contaminated materials to optimize resources use),
- limited or no resources to deal with legacy wastes and for upgrading plants and waste management infrastructure, and
- unclear responsibilities for legacy wastes and contamination.

Regardless of the socio-economic circumstances, NORM containing materials, residues and wastes pose particular technological challenges owing to:

- their often large volumes,
- the long half lives of the radionuclides concerned,
- their widespread occurrence in many industrial and societal areas, and
- the vast number of legacy sites.

Changing processes to avoid NORM containing raw materials, to generate better waste forms, or to reduce workplace exposure typically is not so much a technological challenge, rather an economic one. Sometimes it can also be a societal or socio-psychological one as it may, for instance, involve replacing manual labour by machinery. Several studies and conferences,
therefore, have concluded that by proper workplace protection measures and good industrial practice, the majority of exposure scenarios can be eliminated.

For geochemical reasons, NORM related problems are mainly associated with the abstraction and processing of raw materials, including water, and in particular with the early stages of their processing. The processing of ores and other geologic materials aims at arriving at the pure product, which typically means that most radionuclides end up in slag, fly ash, scale, slurries and other residues. As a result, the oil and gas industry, coal mining and burning, many metal ore and industrial mineral industries, as well as water use were identified as major “producers” of NORM containing residues and wastes. Technologies to condition and dispose of NORM residues and wastes do exist in principle, but their (economical) applicability largely depends on the volumes of material arising. The TR provides a broad overview of suitable technologies and strategies. While such technologies, in principle, do exist and their application to legacy wastes and NORM contaminated sites is possible, in regions where there is a major need the necessary resources are often not available. The document also briefly describes low tech and low maintenance solutions.

More details on such technical solutions will be provided in a forthcoming technical document focusing on the remediation of sites with dispersed contamination [4.4]. Given the long half lives of the relevant radionuclides (mainly U-series) and the limited resources and technical options to deal with legacy wastes, the question of long term stewardship and monitoring arises. Hence, the concept of monitored natural attenuation and its implications is increasingly being discussed.

No simple solution can be found for funding the remediation of legacy sites. In some developed countries a decisive effort was made over the last couple of decades or so. Constraints on the gross national product in many other Member States prevented similar activities. The multinational character of many mining operators made it often difficult to hold them liable for clean up of historical wastes. The situation is slowly changing, however, as these operators try to promote a ‘green’ image of themselves. On the other hand, the contamination legacy from small scale artisanal mining and other artisanal industrial activities remains difficult to solve.

Regulatory Aspects of NORM Management

The following describes the current situation and the state of the debate concerning regulating NORM containing materials highlights some of the problems encountered.

Differences in national and international NORM regulations and standards appear to be the result of differences in risk management policy rather than differences in underlying scientific information. Radiation originating from NORM containing materials has the same effect as radiation from other sources. There exists, however, the problem of distinguishing and accounting for background radiation from the same radionuclides present in NORM material and in the surrounding environment.

Waste management methods and approved disposal sites appear to vary widely for specific industries, waste forms (sludge, scales, liquids, dusts) and Member States. Statutory and regulatory controls in Member States also vary widely with some countries having complete schemes of NORM radiation protection and waste management while other countries have no separate regulatory arrangements whatsoever. One underlying problem is the different national approaches to what constitutes NORM, and consequently which industries, wastes,
and products are covered by relevant guides and regulations. In other words, there is presently no international consensus on the scope of regulations.

The generic principles and criteria for exclusion, exemption, and clearance have been detailed in the Basic Safety Standards (BSS) [4.5] (see subsection 3.1 for impending changes).

There is a general concern and uncertainty over potential impacts of regulations on the international trade and industry. While some believe that “clearance” of materials would open up the markets for these materials, others fear that the explicit statement that a material contains radioactivity, if only below a specified level, would brand them by implication as ‘radioactive’. It is also feared that specifying one or the other numerical value could be used as political and economic instrument to influence market positions. On the other hand, there is a variety of national and international regulations concerning toxic and hazardous substances, such as heavy metals and certain organic compounds, in commodities and other materials.

Notwithstanding the applicability of general radiation protection principles, due to the variety in occurrence and possible exposure scenarios for members of the public, deriving allowable doses from natural radionuclide concentrations appears to be a difficult task. Related to this problem is the question of multiple exposures of members of the public to different sources that in themselves may not pose a concern.

Concerning workplaces, the situation is much clearer. The general principles as laid out in the BSS are applicable and often national regulations do exist. In addition international guidelines on radiation protection in certain industries, such as oil and gas and uranium and thorium mining, are currently being developed.

The issue of NORM waste was discussed in Session 6 of the International Conference on Issues and Trends in Radioactive Waste Management (see subsection 12.1). In his summary, the Conference President noted “There is a lack of clear guidance on how to handle NORM wastes, site remediation and related areas. Recommendations on the part of the IAEA would be welcome, but these should be flexible enough to accommodate case-by-case management where appropriate.” [4.6]. This sentiment was echoed in the conference report that was submitted to the Agency Board of Governors.

Recently the Agency issued a Safety Guide related to NORM waste management [4.7].

References for Section 4

4.1 Project Web site, “Co-ordinated Research Project (CRP) on Technologies and Methods for Long Term Stabilisation and Isol ation of Uranium Mill Tailings” [note, this site will only be active for the duration of the CRP] http://www.iaea.org/programmes/ne/nefw/crp1/login.htm


