



THE NET ENABLED WASTE MANAGEMENT DATABASE IN THE CONTEXT OF RADIOACTIVE WASTE CLASSIFICATION

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Abstract

There is an emerging, international consensus that a common, comprehensive radioactive waste classification system is needed, which derives from the fact that the implementation of radioactive waste classification within countries is highly diverse. Within IAEA Member States, implementation ranges from none to complex systems that vary a great deal from one another. Both the IAEA and the European Commission have recommended common classification schemes but only for the purpose of facilitating communication with the public and national- and international-level organizations and to serve as the basis for developing comprehensive, national waste classification schemes.

In the context described above, the IAEA's newly developed Net Enabled Waste Management Database (NEWMDB) contains a feature, the Waste Class Matrix, that Member States use to describe the waste classification schemes they use and to compare them with the IAEA's proposed waste classification scheme. Member States then report waste inventories to the NEWMDB according to their own waste classification schemes, allowing traceability back to nationally based reports. The IAEA uses the information provided in the Waste Class Matrix to convert radioactive waste inventory data reported according to a wide variety of classifications into a single inventory according to the IAEA's proposed 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 while, at the same time, the IAEA can collect the information needed to compile a comprehensive, international radioactive waste inventory.

1. Introduction

In 1994, the IAEA published a Safety Guide entitled "Classification of Radioactive Waste" [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 conference paper focuses on the issues denoted by the bold italicized text (Section 2), it discusses progress made towards the implementation of a general system for waste classification (Section 3) and it discusses the waste class matrix feature of the Agency's Net Enabled Waste Management Database (NEWMDB) [2] to [5], which was implemented for IAEA Member States (a) to identify the waste classification schemes they use and (b) to compare these schemes with the IAEA's proposed general waste classification scheme (Section 4).

Table 1: Summary of the Assessment of the IAEA's Proposed General Waste Classification Scheme

Exempt Waste (EW)	<p>Typical Characteristics activity levels at or below clearance levels (see Note 1)</p> <p>Possible disposal Options no radiological restrictions</p>
Low and Intermediate Level Waste (LILW)	<p>Typical Characteristics activity levels above clearance levels thermal power below about 2kW/m³ (see Note 2)</p>
Short Lived (LILW-SL)	<p>Typical Characteristics restricted Long Lived radionuclide concentrations (see Note 3)</p> <p>Possible Disposal Options near surface or geological disposal facility</p>
Long Lived (LILW-LL)	<p>Typical Characteristics long lived radionuclide concentrations exceeding limitations for LILW-SL (see Note 3)</p> <p>Possible Disposal Options geological disposal facility</p>
High Level Waste (HLW)	<p>Typical Characteristics long lived radionuclide concentrations exceeding limitations for short lived waste thermal power above about 2kW/m³</p> <p>Possible Disposal Options geological disposal facility</p>
<p>Note 1: There is no internationally agreed definition for clearance levels</p> <p>Note 2: There is no international consensus on this thermal power level</p> <p>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</p> <p>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 "<i>The boundary between short lived and long lived waste cannot be specified in a universal manner</i>", 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 "<i>methods by which boundaries can be derived</i>" is inadequate or could not be understood. The Safety Guide objective to "<i>eliminate some of the ambiguity that now exists in classification schemes for radioactive wastes.</i>" may have been partially achieved, however it is clear that a great deal of ambiguity regarding the classification of radioactive waste still exists in IAEA Member States.</p>	

2. Assessment of the proposed general scheme for waste classification

A recent assessment of the IAEA's proposed general waste classification scheme indicated that the scheme is not rigorous and not completely defined [3]. This assessment was confirmed at a recent meeting of the Waste Safety Standards Committee (WASSC). The report for the 11th WASSC stated [6]:

“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 the matter in the framework of the Joint Convention and of the need for harmonisation of classification schemes in that context.”

Note: the “ongoing/planned collection of data from Member States” refers to the first data collection cycle of the NEWMDB, see Section 4 and Reference [2]. Table 1 summarises the recent assessment of the IAEA's proposed general waste classification scheme.

3. Progress towards the implementation of a general waste classification system

Since the IAEA Safety Guide on the classification of waste was issued in 1994, several assessments have been made of the multitude of waste classification schemes used world wide [7] to [10]. 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” [11]. 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 IAEA's 1994 Safety Guide but includes modifications to the IAEA's the 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 IAEA’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 IAEA Member States have recently adopted or are planning to adopt the IAEA’s proposed waste classification scheme in support of waste management programmes and activities. The adoption of the IAEA’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 IAEA’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 IAEA’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 IAEA’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 IAEA’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.

4. The waste class matrix tool in the NEWMDB

The recent assessment of the IAEA'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 IAEA Member States report their radioactive waste inventories to the NEWMDB in such a way that the IAEA 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 IAEA 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 IAEA'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 IAEA's proposed classification scheme, and/or (c) they had difficulty with the inherent ambiguities of the IAEA's proposed waste classification scheme.

- The 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 IAEA Member States.

Figure 1 and Figure 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 on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [12], which states that "For each Contracting Party the report shall also address its... ..criteria used to define and categorize radioactive waste".

Waste Class Matrix ▶ PNPP ▶ Status: Approved by Admin			
<small>Last modified by Admin on 2002-03-05 13:30:30</small>			
Matrix Name	PNPP		
PNPP Class	LILW-SL%	LILW-LL%	HLW%
LLW	100	0	0
MLW	0	100	0
HLW	0	80	20

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

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

Waste Class Matrix ▶ USNRC ▶ Status: Approved by Admin			
<small>Last modified by Admin on 2002-02-19 15:36:08</small>			
Matrix Name	USNRC		
USNRC Class	LILW-SL%	LILW-LL%	HLW%
Class A LLW	100	0	0
Class B LLW	100	0	0
Class C LLW	75	25	0
Greater than Class C LLW	0	100	0
HLW	0	0	100

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

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

5. The way forward

On 14 February 2002, the IAEA issued a Note Verbale to its Member States requesting that Member States that currently do not have a Country Co-ordinator to appoint one. The Note Verbale also requested that Member States that did not make a submission to the NEWMDB during the first data collection cycle (July 2001 to March 2002) do so during the second cycle (July 2002 to January 2003). The second data collection cycle is expected to result in additional Country Co-ordinators having problems with the identification of waste classification schemes in their countries and for comparing these schemes with the IAEA's proposed schemes. This will help identify additional countries that require international guidance on the issue of waste classification.

The results of the first data collection cycle indicate that the proposed WASSC review of the IAEA's proposed general waste classification scheme should be undertaken in a timely manner.

At time of writing, the Waste Technology Section 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.

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