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COMPACTION OF SOLID WASTES IN COUNTRIES WITHOUT DISPOSAL FACILITY: *a prelude of future troubles.*

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Abstract.

This paper is intended to launch a technical debate, which will lead up to simple recommendations on what to do with compactable solid wastes in countries without disposal facilities. The paper discusses the problems caused by some practical uncertainties in the long-term management of the radioactive solid wastes produced outside the nuclear fuel cycle, in countries belonging to Groups A, B and C. Compaction is the preferred volume reduction method. But the compacted solid wastes are very probably not in a suitable form for future disposal and would need to be processed again in the near future.

1. Introduction

Radioactive materials are extensively used in industrial and research activities mainly related to medical, agricultural, environmental and other studies and applications. During these applications significant amount of radioactive wastes inevitably arises, which must be managed with particular care.

Since practices in different Member States range across a very large scale, to facilitate an internal understanding of issues, progress, and problems with more that 120 Member States, the IAEA has grouped their nuclear programmes into five classes [1]. The grouping is in accordance with the extent of the use of radioactive materials. Class "A" countries include Member States in which practices are represented by applications of few sealed radioactive sources and limited quantities of other radioactive materials in medicine. Class "B" countries use radioactive materials in a greater variety of applications, including the wide use of sealed and unsealed sources for medical, industrial, agricultural and research purposes. Class "C' countries practice all the activities of B-countries, and in addition, have nuclear research reactors in operation. This paper discusses the situation in countries belonging to these three groups, and having no disposal facility in operation.

The volume of radioactive wastes produced by individual users of radioactive materials in Groups A, B and C Member States is not likely to be large. It includes solid radioactive wastes with beta and gamma emitters and an insignificant amount of alpha emitters whose radiation dose on the surface is not higher than 2 mSv/h. From practical experience the 75% of solid wastes generated in these countries would require treatment, such as volume reduction.

2. Compaction

The waste arising in A, B, C countries are rather small and almost exclusively consisting of compactable, combustible waste such as paper, cardboard, plastics, rubber, gloves, fabrics

(protective clothes), filters, etc. Although incineration would be the most efficient volume reduction procedure for the combustible wastes, it is not recommended in this particular case. The amount of combustible waste is in fact too small to warrant the application of such a rather sophisticated and expensive technology [2].

The selection of the most effective waste management strategy for compactable wastes may differ for different countries. Criteria that might be applied in the selection of treatment processes for compactable wastes could include the economics of the processes, the desirability of volume reduction, the complexity of the technology and equipment, the regulatory requirements [3] and the future options for interim storage or disposal.

Compaction is a volume reduction process in which solid materials are mechanically compressed to achieve smaller volumes. It is an economical technique due to moderate capital cost and low operation and maintenance cost. Operations being room temperature ones are simple and the fire risk is relatively negligible. There is no multiple handling of the waste. Generation of air-borne activity is also minimal, hence radiation exposure during operation is very low. Commercially available presses and compacting devices are frequently used in radioactive waste treatment after appropriate adaptation to the specific task.

Because of these advantages, the IAEA, through several technical documents [4-7] and Regional Training Courses [8-10] is recommending the use of volume reduction by compaction for the treatment of solid radioactive waste.

2.1. Future troubles by compaction just for interim storage

As previously mentioned, compaction needs low funding and it is a well demonstrated and proven volume reduction method that ideally fits the needs of the wastes dealt with in our countries. But the question is *what to do with the wastes already compacted?*. In case a waste repository is available and the external dose rate of the drum allows it, the drums could be disposed of directly. Therefore, this is not any trouble for countries with operating disposal facilities. But it will be a problem in our countries, because compacted wastes are probably not in suitable from for future disposal. Future reworking (reconditioning) of packages containing compacted wastes can be extremely difficult, risky and expensive [11]. Any reason why the compacted waste may be not suitable for long term storage must be carefully considered now.

2.2. Future troubles by current cementation of compacted solid wastes

The primary aim in the waste management is to immobilize harmful wastes, this is the containment concept. Even when absolute containment may not be possible, dispersion of radionuclides to the environment may be minimized by the immobilization approach. Therefore by packaging the compacted solids in a container will retard the ingress of water and the radionuclide mobility [12].

According to [2] the drums with compacted wastes (as well as compacts) can be packed into "disposal containers" into which they can be embedded by concrete. But "disposal containers" do not exist in countries without disposal facility and additionally, the special requirements (waste acceptance criteria for disposal) that waste packages should meet have unfortunately not been developed yet.

In the absence of a final management policy, wastes are stored until a solution is adopted. However, storage could also be utilized as a longer-term solution. This would allow future

generations some flexibility in deciding what to do with the radioactive waste legacy, and allow them to take advantage of any future scientific or technical advance – although once wastes have been conditioned they are less amenable to alteration.

The selection process requires a systematic and balanced analysis of whether it is better to process the wastes for interim storage or for "theoretical disposal route". Something is clear, it is not know what treatment steps are most suitable for the waste disposal. We do not know whether future disposal will be favored by cement immobilization since now.

Should the compacted solid wastes be immobilized by cementation?. Or should they be stored until better ways for dealing with them are available?.

3. Underling principles

The recommended compaction process for solid wastes just for interim storage reduces the volume of wastes to be stored but does not reduce the potential hazards during interim storage. Such action provides only very short-term benefits. The recommended immobilization of compacted wastes by cement grouting reduces the potential hazards during interim storage. But the implications of such actions for the eventual end point should also be addressed. Reconditioning of such packages can be extremely difficult and risky. "Permanent" surface storage places a radiological burden on future generations. In anticipation of early disposal, current stores and waste packages are designed to last for only several decades. Storage for a considerably longer period (over 50 years) will place demands on both structures and packaging. Human intervention, involving risks to workers, would be necessary to relocate the wastes to an alternative site, or to prepare the wastes for repackaging or reconditioning.

Internationally agreed principles for radioactive waste management have been set out by IAEA [13]. Principle 8 of the "safety fundamentals" sets out the need to take into account interdependencies in the main waste management steps. In particular there is a need to be aware that decisions made at any one step may foreclose alternatives or otherwise affect subsequent steps, particularly disposal. This should be taken into account when any treatment and conditioning activity is being considered. There is a great risk that the wastes treated and immobilized at present in our countries will be incompatible with future disposal requirements.

The interim storage of compacted wastes without over-packaging does not protect future generations (the fourth principle) and at the same time undue burdens are imposing on future generations (the fifth principle) [13], because of the need of reworking (reconditioning) these treated wastes in the future.

4. The way forward

Radioactive wastes have been accumulating for decades. We have to get on and decide what to do with them in the long term. We recognize that we should not rush the process, but take the time required to get it right. Safe and effective management of radioactive waste shall consider the main steps as part of an overall system, from generation through disposal. Because decisions made in one step may foreclose certain alternatives in another step, it is important to take into consideration interdependencies among all steps during management of the current radioactive wastes. Implementing the decision on how to manage radioactive wastes in the long term will take decades. So now is the time to start planning for the future.

The aim is to recommend and implement, a solid waste conditioning process, which inspires long-term support and confidence.

A comparison of long term performance of the interim storage with and without waste compaction across different strategies to reduce risk and cost should be investigated. The investigation should include the potential impacts of compaction versus non-compaction will have on the long term storage and possible future operating and disposal strategies. This is a classic case of implementing a short term fix to a long term problem.

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