

Packaging of Hinkley Wet ILW

(Conceptual stage)

Summary of Assessment Report

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Background

Magnox Electric Ltd has sought Conceptual stage endorsement for waste packages proposed from the conditioning of sludges, sand and ion exchange materials that have arisen during the operation of Hinkley Point A Power Station. These wastes have been stored within existing ponds, tanks, vessels and facilities on Hinkley Decommissioning Site.

During the course of this assessment, the structure of Magnox Electric Ltd has been revised and this report is therefore directed to the new organisation having responsibility for Hinkley Point A, which is Magnox South.

This document summarises the results of the assessment carried out by NDA Radioactive Waste Management Directorate (RWMD) in response to the submitted proposals. The assessment has been carried-out as part of the Letter of Compliance process, whereby RWMD examines the disposability of the proposed waste packages by assessment against intermediate level waste (ILW) packaging standards and specifications and the Geological Disposal concept. Further information on the Letter of Compliance process is available elsewhere¹.

Scope of the Proposals

The sludges, sand and ion exchange materials addressed by this report are collectively known as 'Wet ILW' on account that they can be mobilised and transferred using wet processes. The wastes have arisen during operation of Hinkley Point A Power Station and are to be retrieved and conditioned for long-term management as part of the early decommissioning stages on site. Future arisings of Wet ILW are also included within the scope of this assessment.

Wastes covered by the Wet ILW descriptor will fall into one of four general categories:

- spent ion exchange resins,
- sludges from fuel cooling ponds and pond water treatment,
- contaminated sand from exhausted sand pressure filters,
- sludges from active effluent treatment plant and pond skip decontamination process.

The proposed packaging process is expected to result in the production of up to 73 off 500 litre Drums. When compared to a reference case conditioned volume of Unshielded ILW (UILW) of 152,000 m³, Hinkley Wet ILW would constitute 0.02% of the volume of the UILW waste considered for geological disposal in the UK.

Proposals for the packaging of these wastes were first put forward to Nirex in March 2004. These proposals were based on conditioning in a cementitious matrix and packaging in a standard 3m³ Drum.

¹ *Guide to the Nirex Letter of Compliance Process*, Nirex Document WPS/650, June 2006.

Since the original submission, proposals for retrieval, treatment, processing and packaging of these wastes have been reconsidered. Following review of available options, Magnox South has identified high temperature processing as the preferred process to deliver benefits from consideration of volume reduction and treatment of organic materials. The revised processing method involves pre-blending the wastes, addition of inactive glass forming materials as appropriate and treatment using a high temperature process, to provide a "glassy slag" wasteform.

Consequently a revised submission has been provided which is based on a high temperature melting process, and packaging the glassy slag residue into refractory lined 500 litre Drums for long term management and disposal. Each waste package would contain approximately 400 litres of glassy product.

This Assessment Report is a re-issue of a report which was first issued in October 2007. This version takes account of additional information provided and further reviews conducted by RWMD.

Packaging Proposals

Magnox South propose to retrieve the wastes from current storage locations, and transfer them into a series of four buffer tanks, one for each of the four adopted waste categories. Batches of waste from each of the four tanks, in predetermined relative proportions, would be transferred to a batching hopper, from where the mixture would be fed to the high temperature process, with addition of inactive glass forming materials as necessary.

The process is expected to destroy the organic content of the waste feed, and decompose and melt many inorganic constituents of the waste, resulting in the production of a glassy slag wasteform. Some of the radionuclides in the waste would be volatilised in the high temperature process, and collected in an off-gas treatment plant.

Magnox South has proposed two alternatives for waste packaging: treatment in a dedicated vessel, from which the still molten slag would be poured into 500 litre stainless steel drums fitted with refractory liner; or, the treatment process would take place in the 500 litre drum itself. In either case, once the slag had solidified and cooled to ambient temperature, inert filler would be added to fill voidage and a drum lid welded in position.

Assessment of Disposability

The acceptability of the proposed packages has been assessed against criteria established for the Geological Disposal concept and associated Generic Waste Package Specification.

The Assessment of Disposability is based upon a set of radionuclide inventories derived by RWMD using a series of assumptions of waste composition. Magnox South will be required to confirm that these derived inventories are suitably representative of the Hinkley Wet ILW, as packaged for disposal.

It is expected that a suitable wasteform could be produced from the high temperature treatment process and that the glass slag product within a 500 litre Drum, is likely to be compatible with geological disposal. However this will require Magnox South in future to demonstrate success against defined wasteform performance criteria.

The assessments of Transport Safety show that it would be possible for packages containing Hinkley Wet ILW to comply with all relevant criteria if transported in 285 mm thick walled Type B transport containers such as the Standard Waste Transport Container (SWTC). The current assessments indicate that the bounding inventory could include significant fissile material content, but that this is within the limits proposed for safe transport within the SWTC.

The assessments of operational safety show that it should be possible for 500 litre Drums containing Hinkley Wet ILW to be handled and stored safely within a geological repository. The current assessments indicate that assessed doses could potentially represent significant fractions of the limits applied by RWMD. This is primarily due to the use of a bounding inventory and pessimistic performance assumptions within the fault analysis. Provision of improved data for inventory and fault performance can be expected to reduce the assessed doses considerably in the future.

The waste under consideration currently includes a high proportion of organic materials that will be essentially destroyed through high temperature processing. This will be of benefit to the post-closure safety case and will reduce the volume of waste for disposal. The efficiency and effectiveness of destruction remains as a residual issue where further information is required.

Assessment of this proposal has concluded that the proposed wasteform is unlikely to have a negative impact on pH buffering, however unlike cementitious wasteforms, it is neither expected to make a positive contribution to pH buffering.

The principal barrier to the release of radionuclides from such a wasteform is the low leach rate of the radionuclides from the glassy slag matrix. Therefore, the potential for degradation of the wasteform itself due to attack by alkaline porewater, and the effect on leach rate, is relevant to wasteform performance and safety evaluation. Magnox South has provided a case to demonstrate radionuclide retention based on a literature review of vitreous products in high pH environments. Furthermore Magnox South has committed to support this with a dedicated research and development programme.

In summary, the Assessment of Disposability has concluded that the proposed packages for Hinkley Wet ILW are likely to be suitable for long-term management and consistent with geological disposal. RWMD has concluded that the proposed waste packages can be endorsed by the issue of a Conceptual stage Letter of Compliance.

RWMD notes that the assessment has been restricted to consideration of the wastes defined in the submission. In the event that Magnox South wishes to apply the high temperature process to other wastes or materials then additional disposability issues might be raised.

Requirements for further development work

The following will need to be provided as part of any Interim stage packaging proposal for the Hinkley Wet ILW waste streams:

- Confirmation of the preferred high temperature processing technology;
- Provision of an improved and justified waste package inventory, with particular emphasis on the disposition of volatile species and radionuclides of significance following high temperature processing;
- Development of wasteform performance criteria and demonstration that the proposed process is robust to potential variations in the waste characteristics;
- Demonstration of radionuclide retention and wasteform performance under conditions representative of the repository near-field;
- Development of appropriate data measurement and recording proposals;
- Confirmation of details of the refractory liner and waste container design;
- Development of the draft Waste Product Specification.

The above points have been raised as a series of Action Points within the Assessment Report.

Conclusions

The Conceptual stage proposals from Magnox South for the retrieval and packaging of Hinkley Wet ILW comprising sludges, sand and ion exchange materials have been assessed.

The assessment has considered two potential processing options for the packaging of the Wet ILW: high temperature treatment with direct transfer into the drum incorporating a refractory liner and high temperature treatment directly within an annular drum. The assessment concluded that in principle both processing options could be developed to be consistent with geological disposal.

An Assessment Report setting out the Conceptual stage Assessment of Disposability when judged against the GWPS and disposal concept has been produced. This identifies the extent of compatibility with criteria determined from future management concepts and areas where further information or development is required. A number of Action Points have been raised which will require to be addressed as part of any Interim stage proposals for the waste.

The proposal to employ a high temperature process will lead to a new wasteform for the ILW repository. Performance of the wasteform is a key factor within the safety cases being developed for transport and for the disposal facility. The proposal has been categorised as Category 1 under RWMD procedures and consequently has been considered by the NDA RWMD Waste Management Advisory Committee.

RWMD has determined that high temperature treatment processing if applied to Hinkley Wet ILW is likely to lead to disposable waste packages and that a Final stage case for disposability could ultimately be made. RWMD has concluded that the proposed waste packages can be endorsed by the issue of a Conceptual stage letter of Compliance.

RWMD notes that the assessment has been restricted to consideration of Hinkley Point A sludges, sand and ion exchanges resins. In the event that Magnox South wish to apply the technology to other wastes or materials then additional disposability issues might be raised. Magnox South should seek further advice from RWMD in the event that the technology is proposed for wider application.