

Packaging of Hunterston Sludge and Resin Waste (Interim stage)

Summary of Assessment Report

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Introduction

British Nuclear Group Magnox Electric Ltd (MEL) has sought Interim stage endorsement for the packaging of stored Sludge and Resin waste arising from operations at the Hunterston Decommissioning site. The proposed packaging process comprises retrieval and transfer of the Sludge and Resin into Nirex standard 3m³ Drums and immobilisation through addition of cement powders with in-drum mixing.

This document summarises the results of the assessment carried out by Nirex in response to the submitted proposals. The assessment has been carried-out as part of the Letter of Compliance process, whereby Nirex examines the disposability of the proposed waste packages by assessment against intermediate level waste (ILW) packaging standards and specifications and the underpinning Phased Geological Repository Concept (PGRC). Further information on the Letter of Compliance process is available elsewhere¹.

The process of obtaining a Letter of Compliance is embedded in the regulators' arrangements for the conditioning and packaging of ILW, as described in the guidance issued by the regulators^{2,3}.

Background to assessment

MEL has tendered an Interim stage submission relating to the packaging of the Cartridge Cooling Pond (CCP) sludge and ion exchange resin stored on site at Hunterston Decommissioning Site. The waste corresponds to waste streams 9J33 and 9J34 for sludge and 9J03 for ion exchange resin in the 2004 National Inventory. The submission has to be treated as an addendum to the previous Interim stage submission that dealt separately with the CCP sludge for which an Interim stage LoC has been issued, in January 2006.

The sludge comprises predominantly sand and silicate-based material. The sand has been produced by the back-washing of the CCP sand filter, with the other silicates arising from precipitation of some of the silicate additives used to limit corrosion of the aluminium CCP skips. The sludge also includes magnesium-based precipitates derived from the corrosion of Magnox fuel cladding, and aluminium and iron flocs used in early pond water treatment. Small quantities of hexacyanoferrate and organic materials are also present.

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

² *Improved Regulatory Arrangements for the Conditioning of Intermediate Level Radioactive Waste on Nuclear Licensed Sites: Provision of Advice to the Health and Safety Executive by the Environment Agency and the Scottish Environment Protection Agency, Regulators' Position Statement, December 2003.*

³ *Conditioning of Intermediate Level Radioactive Waste on Nuclear Licensed Sites: Provision of Advice by the Health and Safety Executive, the Environment Agency and the Scottish Environment Protection Agency, Guidance to Industry, March 2005.*

The ion exchange resin, which is known by the trade name Lewatit DN KR, was used for pond water treatment to remove dissolved activity and principally caesium ions. The resin is based on a phenol-formaldehyde structure and is present in a spherical bead form.

Packaging proposals

The proposed waste packaging process is based on addition of the ion exchange resin component of the waste with cartridge cooling pond sludge and conditioning to form a single waste product. The waste packaging process can be summarised as follows:

- The resins would be transferred to a 3m³ drum waste container, allowed to settle, and excess fluid discharged. The target volume would be 200 litres, with a maximum of 300 litres.
- Sludge would be added to achieve a total waste volume of 1.74m³.
- The sludge resin mixture would be pre-treated with lime, prior to immobilisation with cement powders.
- The cement powders would be added to the 3m³ drum and mixed with the waste using an in-drum paddle.
- The in-drum paddle would continue to rotate for a period after the addition of constituents, to ensure production of a homogeneous conditioned wasteform. The paddle would be stopped and the wasteform allowed to cure.
- The wasteform would be allowed to cure for approximately 16 hours, then capped with in-active cement grout.
- Finally, each drum package would be fitted with a lid and subject to quality checks before transfer to a new purpose built ILW storage facility.

The ILW solidification plant would also include a facility to return supernatant water from the drum to the sludge tank. This facility may be used when the more dilute heel of sludge is being retrieved. The final ILW packages will be transferred to an on-site store for storage, pending availability of a national disposal facility.

The proposed packaging process would lead to a predicted 59 off 3m³ Drums with an average package radionuclide inventory at 2040 of 10 A₂ multiples⁴ and a maximum package inventory of 67 A₂ multiples. When compared to a reference case conditioned volume of Unshielded ILW (UILW) for the 2001 National Inventory of 152,000 m³, the Hunterston Sludge and Resin wastes would constitute 0.001% of the volume of the UILW waste inventory considered in the 2003 Generic post-closure Performance Assessment.

Assessment of Disposability

The acceptability of the proposed packages has been assessed against criteria established within the Nirex PGRC and associated Generic Waste Package Specification (GWPS).

The Assessment of Disposability is based upon the inventory data supplied by MEL, and is derived from sampling and radiochemical analysis undertaken on the waste. This position has been accepted as consistent with expectations at the Interim LoC assessment stage.

The proposed 3m³ Drum waste packages examined herein are, at this Interim stage, judged to be generally consistent with Nirex standards and specifications for waste packages. Numerous analogues of the proposed wasteform are available and the associated development work assessed previously by Nirex provides confidence that an adequate wasteform could be produced for the Hunterston Sludge and Resin waste.

⁴ A₂ multiples provide a measure of the activity content of transport packages, where each radionuclide is weighted according to its damage potential.

The assessments of transport safety show that it should be possible for the 3m³ Drum packages containing Hunterston Sludge and Resin waste to comply with all relevant transport safety criteria when transported using the Nirex Standard Waste Transport Container (SWTC). It is noted that the ILW Store should provide access and compatibility for the interfaces of the SWTC, to enable transfer of the waste packages to any future disposal facility.

Similarly, the assessments of operational safety also show that it should be possible for 3m³ Drum packages containing Hunterston Sludge and Resin waste to be handled and stored safely within a repository design concept based on the PGRC.

The post-closure safety assessment revealed no significant areas of concern that should prejudice disposal of packages containing Hunterston Sludge and Resin waste. This is due to the relatively small number of packages containing the materials, and the relatively low and short-lived radionuclide inventory associated with them.

The waste stream includes fuel pond sludge and will contain some fuel related materials and therefore a simple Criticality Compliance Assurance Document will need to be developed for the proposed packages, to demonstrate that the waste would not present a criticality hazard.

In summary, the Assessment of Disposability has concluded that a Disposability Safety Case could ultimately be made for packages containing Hunterston Sludge and Resin waste.

Requirements for further development work

The submission document states that the following waste package data issues will be included in future submissions:

- Waste Product Specification
- Waste Package Data Records
- Criticality Compliance Assurance Document

Nirex welcomes MEL's intention to address these points in detail, and to include the findings in the future Final stage submission.

Conclusions

Consistency of the proposed Sludge and Resin waste package with the Phased Geological Repository Concept has been assessed and an Interim stage Disposability Assessment produced. In assessing the Interim stage proposal, Nirex has identified a number of issues that would need to be undertaken as part of a future development linked to plant design and results included at the Final stage for Nirex assessment.

On the basis of the submitted information, the assessment of the proposal has concluded that the proposed packages will be compliant with the requirements of the Nirex Phased Geological Repository Concept (PGRC), and can be endorsed at the Interim stage.