

## Packaging of Hunterston A Sludge and Resin (Review of Final stage)

### Summary of Assessment Report

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#### ***Background***

Magnox has sought Final stage endorsement from the NDA Radioactive Waste Management Directorate (hereafter RWMD) for the proposed packages containing the sludge and ion exchange (IEX) resin currently stored at Hunterston A decommissioning site. The proposed packages are based on immobilising the wastes within a cemented wasteform in stainless steel 3m<sup>3</sup> drums in the Hunterston Wet ILW Retrieval and Encapsulation Plant (WILWREP).

The packaging of sludge and resin from Hunterston A has been the subject of numerous interactions between Magnox and both RWMD and its predecessor Nirex. The most recent proposals for packaging of the wastes were endorsed at the Interim stage through the provision of an Interim stage Letter of Compliance (LoC). At that time, an Assessment of Disposability for the packages was recorded.

In keeping with expectations at the Final stage, Magnox has sought assessment of the suitability of the arrangements for implementing the agreed packaging process, in particular the controls on the production of the packages and the associated records, and the subsequent storage of the completed packages. Recognising that the necessary suite of documentation is not yet complete, and to progress the efficient completion of all relevant documents, Magnox has sought initial commentary from RWMD on a limited number of documents, as reported herein.

#### ***RWMD Reference Basis for Assessment and Endorsement***

Disposability assessment considers the compatibility of the proposed packages with the requirements for safe long-term management, including storage, transport, emplacement and potentially extended storage underground, and disposal. The current reference basis for this assessment of disposability is the conceptual designs for a Geological Disposal Facility (GDF) derived from the recently-published generic Disposal System Safety Case (DSSC). Further information on the Disposability Assessment process is available elsewhere<sup>1</sup>.

The general requirements placed on ILW packages for disposal in a GDF are embodied in the Generic Waste Package Specification (GWPS)<sup>2</sup>.

#### ***Scope of the Assessment***

The assessment has considered the proposed packages containing Hunterston sludge and resin, which correspond to waste streams 9J03, 9J33, 9J34 and 9J951 in the 2010 Radioactive Waste Inventory.

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<sup>1</sup> NDA, *Guide to the Letter of Compliance Process*, NDA Document WPS/650, March 2008.

<sup>2</sup> NDA, *Generic Waste Package Specification*, NDA Report NDA/RWMD/067, March 2012.

A detailed Assessment of Disposability has been reported previously. The current assessment has focused on supporting dialogue on the submitted Management System documents, and other equivalent documents, together with the responses from Magnox on the Final stage Action Points placed previously. In addition to a brief submission outlining the general response to outstanding issues and RWMD expectations, the following documents have been considered at this stage:

- WILWREP Quality Plan;
- Data Recording Overview for WILWREP and associated radionuclide fingerprints;
- Waste Product Specification (WPrS) for WILWREP packages;
- Criticality Compliance Assurance Document (CCAD) for WILWREP packages;
- revised container design justification and drawings;
- response to challenges to the justification of the wasteform formulation.

It is anticipated that a further assessment would be required to confirm that all issues raised have been addressed and that the full suite of necessary documentation is in place. At this time, a new version of the existing Assessment of Disposability would be issued.

### ***Packaging Proposals***

#### ***Nature of the waste***

The wastes to be packaged are described as follows:

- sludges arising from the treatment of Cartridge Cooling Pond (CCP) water, currently stored in Sludge Retention Tanks (SRT) 1 to 3;
- 'miscellaneous sludges' added to SRT1, comprising:
  - CCP sludge remaining on the floor of the pond;
  - the contents of the Pond Purge Sump;
  - the contents of the Miscellaneous Sump;
  - sludge in the SRT overflow.
- Lewatit DN organic (IEX) resin used in the Pond Water Treatment Plant to remove soluble activity (principally caesium), currently stored in Active Resin Storage Vessel 1 (ARSV1).

The total volume of waste to be packaged is 193m<sup>3</sup>.

#### ***Waste processing and packaging***

The proposed process to be implemented in WILWREP is based on conventional in-drum mixing with 3:1 BFS/OPC powders in stainless steel 3m<sup>3</sup> drums. In recognition of the potentially detrimental effects of some organic IEX resins on the stability of cemented-wasteforms, it is proposed that the resins would be packaged as a minor component of a mixture with the larger volume of sludge (typically <15% of the mixture by volume). Furthermore, pre-treatment of the waste using hydrated lime (calcium hydroxide) powder is also employed to enhance the stability of the product.

Subsequent to the immobilisation of the waste, the wasteform would then be capped with additional cement grout, lidded and placed in an interim store until the currently assumed date of transport to a GDF, namely 2040.

### ***Assessment Inventories and Number of Packages***

To assess the disposability of the proposed packages, and to provide general background to the consideration of the submitted documents, it is necessary to define waste package inventories that capture the range and variability of the package contents.

The basis of the assessment inventory is the characterisation of the sludge and resin stocks as sampled in 2008, supplemented by the results of previous sampling campaigns. The inventory associated with the waste is moderate, but is significantly influenced by the addition of CCP pond sludge, which potentially includes quantities of actinides released from fuel during storage in the pond.

It is assumed that the containers would have a total waste loading of 1.47m<sup>3</sup> of sludge, or combined sludge and resin, per package. Based on the assumed waste loading and the volume of waste, it is expected that 111 packages would be produced.

### ***Assessment of the Submitted Documentation***

The detailed review of the submitted information has identified a number of shortcomings in the documents. The required actions have been captured as a limited number of additional Final stage Action Points intended to summarise the areas for further development and are supported and supplemented by additional, detailed commentary as summarised below.

In addition to the reviews of the submitted documents, RWMD has also identified a number of significant omissions from the current suite of documents. These areas also have been captured as Final stage Action Points.

### ***Management System***

RWMD is aware that Magnox continues to develop the Management System arrangements and that some elements would not be complete at the time of reporting. The submitted Quality Plan is generally consistent with what would be expected, both in form and general content, although a number of general observations and suggestions for improvement have been made. It is strongly recommended that a revised version of this document is produced and re-submitted.

The Quality Plan apparently controls the manufacture of the packages, but does not cover the subsequent storage and associated monitoring and inspection requirements or the arrangements for the management of (potentially) non-conforming packages. Further documentation governing these activities is sought from Magnox.

The current version of the *Quality record proforma* provides an appropriate means of generating the necessary records for the manufacture of the packages. Nevertheless, a number of detailed issues with the proforma have been identified and should be considered by Magnox.

The WPrS continues to exhibit some apparent deficiencies. Most importantly, it is not clear that the WPrS provides the necessary control of the wasteform formulation. More generally, considering both the WPrS and the WILWREP Quality Plan, it is not clear that the WPrS is fully integrated into the wider Management System arrangements or that it would be used to control the processing of the wastes to produce satisfactory products.

### ***Data Recording***

The presentation of a clear overview of the Data Recording arrangements and the obvious consideration of the requirements of RWMD Specification for Data Recording (WPS/400) are welcomed. The presentation of the radionuclide fingerprints is clear and definitive. No further development of this aspect of the Data Recording system is required.

RWMD is aware that Magnox continues to develop all Management System arrangements, including those for Data Recording, and that some elements would not be complete at the time of reporting. Nevertheless, further development of the Data Recording Overview document is required to provide the definitive and enduring record of the methodology sought at Final stage. In particular, it is noted that the Overview document does not provide a description of how Data Recording activities would be implemented and controlled under the Management System and it exhibits internal inconsistencies and a lack of clarity in some areas.

It is recognised that the anticipated development by Magnox of general strategies for certain key aspects of Data Recording has prevented the presentation of finalised arrangements for Hunterston sludge and resin. The timely completion of this development and the consequent translation into local arrangements is required before Final stage endorsement can be offered. Currently the following areas are identified as being covered by this expectation:

- storage, monitoring and inspection of completed packages;
- management of non-conforming packages;
- management of completed package records.

Based on these conclusions, further interaction on the Data Recording arrangements and development of the records will be required before endorsement at the Final stage.

### ***Criticality Safety***

Magnox has identified the basis for the safe fissile mass (SFM) that should be applied to the proposed packages containing Hunterston sludge and resin; namely the generic Criticality Safety Assessment (CSA) for natural uranium. Magnox has also supplied an approved issue of a CCAD. Both the arguments relating to the SFM and the CCAD itself have been reviewed and the adoption of the generic CSA for natural uranium as the basis for deriving the SFM is supported. Magnox has proposed the adoption of the most restrictive SFM as the basis for compliance. Although this SFM is accepted, it is noted to be a conservative position and, potentially, a less restrictive SFM could be justified.

The current CCAD does not provide sufficient clarity as to the approach to ensuring criticality safety and the requirements of WPS/625 have not yet been fulfilled. Further interactions are recommended to develop the CCAD into an acceptable position for approval at the Final stage.

### ***Other Issues and Documentation***

The review of the submission has identified a number of important areas where the necessary documentation is still awaited, as follows:

- arrangements for inactive and active commissioning, including the outcome of inactive commissioning;
- arrangements for managing non-conforming packages;
- arrangements for the storage, monitoring and inspection of completed packages.

## ***Conclusions***

An initial Final stage assessment has been undertaken for the proposed packages containing Hunterston sludge and resin, based on the immobilisation of the waste in cement wasteform in 3m<sup>3</sup> drums. This assessment has provided preliminary commentary on the submitted documentation intended to support the implementation of the process, together with consideration of the responses from Magnox on a number of outstanding issues. A full Assessment of Disposability has not been reported at this time, although it has been concluded that the Assessment of Disposability presented at the Interim stage remains valid.

The recognition by Magnox of the breadth of matters to be controlled in the operation of the process, and the early and sustained engagement with RWMD to generate the required range of documentation, is welcomed. As anticipated, further development of the submitted documents, and the provision of a number of further documents, is required to fulfil RWMD expectations at the Final stage.

A number of additional Final stage Action Points have been identified, supplementing those placed previously. At this time, 10 Final stage Action Points remain open.