

Containerised Storage of Hunterston A FED Graphite and other non-Magnox FED (Final stage)

Summary of Assessment Report

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Background

Magnox has sought a Final stage assessment from the NDA Radioactive Waste Management Directorate (hereafter RWMD) of the proposed containerised storage of the Fuel Element Debris (FED) graphite and other non-Magnox FED currently stored in the Solid Active Waste Building (SAWB) at Hunterston A decommissioning site. The proposed temporary storage represents an initial step in the production of disposal packages to be based on immobilising the wastes within a cemented wasteform in stainless steel 3m³ boxes and drums in the proposed Solid ILW Encapsulation (SILWE) plant at Hunterston.

The proposal for containerisation has been justified by the need to fulfil regulatory requirements for early access to, and treatment of, the Magnox FED stored in Bunker 1. Magnox has also re-affirmed that the baseline for the management of the FED graphite and other non-Magnox FED continues to be the production of disposable packages.

The packaging of solid ILW from Hunterston A has been the subject of numerous interactions between Magnox and both RWMD and its predecessor Nirex. The most recent proposals for final packaging of the wastes were endorsed at the Interim stage through the provision of an Interim stage Letter of Compliance (LoC). The strategy of containerised storage represents a variation in the previously endorsed approach to packaging.

In keeping with expectations at the Final stage, Magnox has sought assessment of the suitability of the arrangements for implementing containerised storage, in particular the controls on the retrieval of waste and the associated records, and on the subsequent temporary storage. Recognising that the necessary suite of documents is not yet complete, and to progress their efficient completion, Magnox has sought initial commentary from RWMD on a limited number of documents, as reported herein.

The subsequent encapsulation of the waste to produce disposal packages would be the subject of a further submission and assessment specific to the operation of the SILWE plant. At that time, a new version of the existing Assessment of Disposability covering the final disposal packages would be issued, taking account of the temporary containerised storage.

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 elsewhere¹.

Where appropriate, RWMD may assess and endorse proposals that do not immediately or directly result in the production of a disposable product. In such cases, the intermediate product should be clearly demonstrated to represent a step in the production of a disposable product. The use of an intermediate product is required not to compromise the ability subsequently to produce a disposable product.

The general requirements placed on ILW packages for disposal in a GDF are embodied in the RWMD Packaging Specifications.

Scope of the Assessment

The assessment has considered the proposed packages containing Hunterston FED graphite and other non-Magnox FED (hereafter solid ILW), which covers waste streams 9J18-9J22, 9J24-9J30, 9J40-9J42 and 9J44 in the 2010 Radioactive Waste Inventory.

The current assessment has focused on supporting dialogue on the submitted Management System documents, and other equivalent documents, relating to containerised storage together with the responses from Magnox on relevant existing Final stage Action Points. In addition to a submission outlining the general response to outstanding issues and RWMD expectations, the following documents have been considered at this stage:

- relevant Magnox company standards and other controlling documentation;
- *ILW Waste Package Management Arrangements* for Hunterston;
- Data Recording Methodology and associated radionuclide fingerprints;
- other elements of the proposed package records;
- Waste Product Specifications (WPrS) for the solid ILW packages;
- Criticality Compliance Assurance Documents (CCAD) for the solid ILW packages;
- justification for the removal of the existing exclusion of filters.

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.

Packaging Proposals

Nature of the waste

Each of the five bunkers in the SAWB has a volume of approximately 700m³, with Bunkers 1-4 being full and Bunker 5 approximately one third full. Bunker 1 contains mainly the Magnox splitter components of the FED, with the remaining bunkers containing mainly graphite. Other components of the waste were distributed across all bunkers and include the following.

- fuel channel components, comprising cast iron Fuel Support Members (FSM) (200 mm long by 150 mm diameter) and zirconium D-bars;

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

- Miscellaneous Activated Components (MAC), comprising mainly thermocouple reeling drums (principally stainless steel) and thermocouple wire;
- Miscellaneous Contaminated Items (MCI), comprising redundant contaminated equipment and materials from irradiated fuel handling, pond operations, reactor gas circuits and decontamination activities. The includes filter dust bags, with smaller quantities of sludge, incinerator ash, pond skips and general waste;
- filters, comprising High Efficiency Particulate Air (HEPA) filters and Burst Cartridge Detection (BCD) filters.

The total volume of waste to be packaged is 1700m³.

Waste processing and packaging

The submission presents proposals for the retrieval and temporary storage of the relevant wastes in an un-encapsulated form in 3m³ stainless steel boxes. This process is presented as an intermediate step in the production of disposable packages. The containerised waste would be stored in the Hunterston ILW store.

In all cases, the retrieved solid ILW would be stored in stainless steel 3m³ boxes, the design of which is based on the original Berkeley box design, modified with additional basal reinforcement to prevent distortion. It is planned that the storage boxes would be used for the subsequent encapsulation of the solid waste in the Solid ILW Encapsulation (SILWE) plant. In the case of boxes of particulate material, the waste would be transferred to a 3m³ drum for final immobilisation. The proposed final disposal products for both solid ILW and particulate material are intended to be consistent with those described in the previous Interim stage submission for Hunterston solid ILW.

Assessment Inventories and Number of Packages

The assessment inventory has been developed by Magnox, based on a combination of modelling of the activation of the various components of the solid ILW and confirmatory sampling and analysis. Compared to the Interim stage, this inventory has been modified by the omission of the Magnox FED and the confirmation that fuel fragments would not be present in the packages. This has been accepted as being suitably comprehensive and an appropriate basis for assessment, and two representative inventories have been developed, covering packages from Bunker 1 and from Bunkers 2-5 respectively.

A statistical analysis of the required number of 3m³ box packages for the wastes from Bunkers 2-5 has concluded that 1008 packages would be required. The necessary number of boxes for the non-Magnox FED from Bunker 1 is less certain, but is expected to be of the order of 10. The quantity of particulate material, and hence the number of storage boxes and 3m³ drum disposal packages, is not known in advance of retrieval but is expected to be a small fraction of the total.

Assessment of the Submitted Documentation

The submitted documents represent a well-developed structure that ultimately will fulfil RWMD expectations. Nevertheless, detailed review has identified a number of shortcomings in the current drafts and some approved documents. The required actions to fulfil RWMD expectations have been captured as a limited number of additional Final stage Action Points intended to summarise the areas for further development. These points 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 omissions from the current suite of documents. These areas also have been captured as Final stage Action Points.

Wasteform Properties

A review of the properties of the wasteforms to be produced by the packaging of solid ILW has confirmed that the existing evidence relating to the expected performance of the final disposal packages is sufficient. Furthermore, the potential effects of a period of temporary storage of the solid ILW before final encapsulation have been considered and, based on the nature of the waste, it is concluded that the waste would not be expected to evolve in a manner that would preclude satisfactory encapsulation at a later date.

The proposed destruction of HEPA filters, combined with experimental evidence of infiltration and the estimated very low inventory of material associated with the filters, is sufficient to justify the inclusion of these items of waste. However, further information is required to confirm the gas generating potential due to the corrosion of the aluminium associated with the proposed loading of filters from Bunker 1 before the full proposals could be endorsed. Furthermore, the potential effects of the much higher, acute rates of gas generation during waste encapsulation on product quality should be better substantiated.

Container Design

A brief review of the understanding of the container design for the 3m³ boxes to be used for temporary storage has shown that a suitably comprehensive set of design drawings and specifications was assessed at the Interim stage. Confirmation is required that the relevant container design documents already held by RWMD are the current versions.

Management System

The *ILW Waste Package Management Arrangements* provide clear evidence of the intent to implement suitable arrangements and demonstrate that an appropriate structure for the controlling documents will be put in place. However, this high level document does not yet provide a complete picture of the necessary detailed arrangements and this Action Point will not be closed until further information has been supplied. To this end, additional documents have been sought for review. In addition, a finalised version of the draft Lifetime Quality Record (LTQR) Checklist is required.

Although the two draft Waste Product Specifications (WPrS) submitted for assessment superficially address many of the requirements expressed in guidance, more generally they exhibit numerous shortcomings. Most importantly, it is not clear that the WPrS provide controlling specifications that are integrated into the Management System and there are several inconsistencies between the WPrS and other documents in the system.

Based on these conclusions, further interaction on the Management System arrangements and development of the WPrS is required before endorsement at the Final stage could be provided.

Data Recording

The presentation of a clear overview of the Data Recording arrangements in the *ILW Waste Package Management Arrangements* is welcomed. However, significant concerns have been raised regarding the integration of the various individual elements (documents) with one another and with the Management System. It is particularly noted that the Data Recording Methodology does not recognise, and is

not recognised by, the *ILW Waste Package Management Arrangements* and the LTQR Checklist.

The presentation of the radionuclide fingerprints is clear and definitive. Nevertheless, for completeness, confirmation of the influence of the change to the treatment of the inventory associated with FSM is required. An Action Point to this effect has been placed.

It is recognised that the anticipated development by Magnox of company strategies for certain key aspects of Data Recording has prevented the presentation of finalised arrangements for Hunterston solid ILW. The timely completion of this development and the consequent translation into local arrangements is required before Final stage endorsement can be offered and further details on the following areas are required:

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

Magnox also should recognise that a suitably extensive set of underpinning evidence, supporting references and records of development work should be identified and incorporated into records. This should include more general enabling information relating to the operation of Hunterston A.

Criticality Safety

Magnox has identified the basis for the safe fissile mass (SFM) that should be applied to the proposed packages containing Hunterston solid ILW; namely the generic CSA for natural uranium. Magnox has also supplied approved issues of the Criticality Compliance Assurance Documents (CCAD) for packages containing non-Magnox wastes from Bunker 1 and FED graphite and other non-Magnox FED from Bunkers 2-5. The position recorded therein has been found to be acceptable.

Conclusions

An initial Final stage assessment has been undertaken for the proposed containerised storage of Hunterston solid ILW, based on the temporary storage of the waste in an un-immobilised form in 3m³ boxes. 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, nine Final stage Action Points remain open.