Radioactive Waste Management Directorate

Packaging of Berkeley Desiccant Waste (Conceptual stage)

Summary of Assessment Report

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Introduction

British Nuclear Group Magnox Electric Ltd (MEL) has sought Conceptual stage endorsement for the packaging of desiccant at the Berkeley Decommissioning site. The proposed packaging process comprises retrieval and transfer of the desiccant into Nirex standard 500 litre Drums and immobilisation through addition of cement powders, water and 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 elsewhere[1].

A Conceptual stage disposability assessment has been conducted and this Assessment Report produced.

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]. In line with regulatory guidance, Nirex carries out independent assessment of the specific waste packaging proposals in particular to assess disposability of the proposed waste packages by consideration of requirements for future storage, transport and disposal as embodied in the Nirex standards and specifications for waste packaging and underpinning PGRC.

Background to assessment

MEL tendered a submission seeking Conceptual stage endorsement for the waste packages that would arise from proposed packaging of desiccant waste at Berkeley. The proposals encompass those wastes that are expected to require conditioning and packaging as ILW.

In order to reduce corrosion rates of metal and graphite components in the reactor primary gas circuit of a drier system was used to remove excess water moisture from the carbon dioxide gas. The coolant gas was passed through a gas cooler and a water cooler to reduce the gas temperature to the optimum required for drying. The gas was then passed through a vessel that contained the desiccant material (predominantly aluminium oxide with smaller

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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.

amounts of sodium aluminium oxide). The desiccant absorbed moisture from the gas before it was returned to the reactor circuit via the gas heat exchanger.

Whilst in service the desiccant became contaminated with tritium which was associated with the tritiated water vapour removed from the gas. The desiccant remained contaminated with tritium even after regeneration to remove the water. Replacement of the reactor gas drier desiccant was periodically required as it gradually lost its capacity during service due to chemical contamination and physical changes caused by temperature cycling. The exhausted desiccant was stored in 200 litre drums with plastic liners.

At the end of its operational lifetime, a total volume of 10.6 m^3 of desiccant had accumulated and was held in on-site storage. The relevant National Inventory waste stream identifier for the spent desiccant is 9A18.

The waste represents only 0.01% of the total volume of ILW predicted to arise in the United Kingdom and contributes substantially less than 0.1% to the total radionuclide inventory of any of the significant longer-lived radionuclides. The only radionuclide present in significant quantity is tritium.

Packaging proposals

The proposed encapsulation plant would comprise a number of units:

- a desiccant retrieval and transfer system;
- a mixing unit;
- a cement powder discharge unit;
- a process control unit.

It is proposed that desiccant would be transferred into a 500 litre Drum with the required volume of demineralised water and pre-blended cement powder introduced into the drum. The 500 litre drum would include an in-drum paddle for immobilisation of the waste with cement grout.

The in-drum paddle would continue to rotate after the addition of constituents, for a period to ensure production of a homogeneous conditioned wasteform and then allowed to cure. The conditioned waste would then be capped with a cement grout and left to cure for a further period. Finally, each drum package will be fitted with a lid and subject to quality checks before transfer to an on-site ILW storage facility.

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 conservative assumptions regarding the degree of tritium contamination of the wastes. The submission has noted that information is preliminary and undertakes that further refinement would be completed prior to the Interim stage. This position has been accepted as consistent with expectations at the Conceptual stage.

The proposed 500 litre waste packages examined herein are, at this Conceptual 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 Berkeley Desiccant waste.

The assessments of transport safety show that it should be possible for the 500 litre Drum packages containing Berkeley Desiccant waste to comply with all relevant transport safety criteria when transported using the Nirex Standard Waste Transport Container (SWTC). It is noted that the containment system for the SWTC does imposes restrictive limits for the transport of tritiated wastes, however this does not prevent the transport of Berkeley Desiccant waste.

Similarly, the assessments of operational safety show that it should be possible for 500 litre Drum packages containing Berkeley Desiccant waste to be handled and stored safely within a repository based on the PGRC. A conservative treatment of the potential risk arising from the release of the tritium suggests that regulatory limits would not be breached.

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

The waste stream has only been in contact with the CO_2 primary reactor coolant in the reactor gas driers and should not contain any fuel related materials and therefore the proposed packages would not present a significant criticality hazard.

In summary, the Assessment of Disposability has concluded that a Disposability Safety Case ultimately could be made for packages containing Berkeley Desiccant waste, provided that tritium containment can be maintained.

Requirements for further development work

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

- Total activity content (TBq per waste package);
- Development of the container design.

Even though package data on each of the above points already exist, Nirex welcomes MEL's intention to address these points in detail, and to include the findings in future submissions.

The identification of these key characteristics provides a focus for development work.

Conclusions

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 Conceptual stage.

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