

Packaging of Ammonium DiUranate (ADU) Floc (Conceptual stage)

Summary of Assessment Report

Issue date of Assessment Report: 2 February 2007

Introduction

This is a summary of an assessment of disposability carried out by Nirex in response to a Conceptual stage proposal from UKAEA for the packaging of Ammonium DiUranate (ADU) Floc, which arose from the treatment of ILW liquors, produced during PFR fuel reprocessing at Dounreay.

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

Background

The Nirex mission is, in support of Government policy, to develop and advise on safe, environmentally sound and publicly acceptable options for the long-term management of radioactive materials in the UK. This includes all intermediate-level radioactive waste and some low-level radioactive waste (ILW and LLW).

As part of this role, Nirex sets specifications and standards for the packaging of ILW and some LLW, based on its Phased Geological Repository Concept (PGRC)¹. Nirex issues Letters of Compliance when the proposed packaging methods are judged to be capable of producing waste packages that would be consistent with Nirex requirements for long-term management and protection of the environment. This process is intended to minimise the risk of inappropriate treatment, the need for future repackaging and the creation of a new legacy of wastes to be dealt with by future generations, with all the attendant safety, environmental and cost implications. 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 PGRC.

UKAEA's proposals for packaging ADU Floc

UKAEA propose to dissolve the ADU Floc in nitric acid, re-neutralise the liquor and precipitate sodium diuranate. The wastes would be conditioned by cement grouting into

¹ *The Nirex Phased Disposal Concept*, Nirex Report N/074, July 2003.

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.

Nirex standard 500 litre Drums and completed packages would be transferred to on-site storage to await transfer to a disposal facility.

The proposed packaging process would yield an estimated 403 off 500 litre Drums containing treated, encapsulated ADU Floc with an average package inventory at 2040 of 387 A₂ multiples and a maximum package inventory of 727 A₂ multiples. When compared to a reference case conditioned volume of Unshielded ILW (UILW) for the 2001 National Inventory of 152,000m³, the ADU Floc would constitute 0.13% of the volume of the UILW waste inventory considered in the 2003 Generic post-closure Performance Assessment.

Assessment of Disposability

The disposability assessment conducted by Nirex considers the proposed waste packages for compliance with the Phased Geological Repository Concept (PGRC). This is achieved by assessing the proposed waste packages against published generic safety assessments that address transport of waste packages to the facility and safety of operations at the facility. The wastes and packages are also assessed against the generic post-closure performance assessment.

The assessment of transport safety shows that it would be possible for drums of ADU Floc to comply with all relevant criteria if transported in Type B transport containers with 70mm steel shielding such as the Nirex Standard Waste Transport Container (SWTC-70). In particular, the modelling of impact and fire behaviour for groups of four packages in an SWTC-70 shows that the criterion of activity released in a week following a transport accident would be met.

Similarly, the assessments of Operational Safety show that it should be possible for 500 litre Drums containing ADU Floc to be handled and stored safely within a repository based on the PGRC.

The post-closure assessment has revealed no significant areas of concern that would prejudice disposal of packages containing ADU Floc.

The generic methodologies for demonstrating criticality safety, including those to cover packages of waste containing irradiated natural uranium, are currently undergoing development following dialogue with regulators. The levels of fissile materials in the proposed packages of ADU Floc are judged likely to fall within the bounds being developed for the updated methodologies.

In summary, the Assessment of Disposability has concluded that a Disposability Safety Case ultimately could be made for packages containing ADU Floc, and that the proposals for the packaging of these wastes can be endorsed at the Interim stage. During the course of the assessment, areas requiring additional work to progress the proposals beyond the Conceptual stage were identified, and these are summarised below.

Requirements for further work

The Conceptual stage submission, and the resulting assessment by Nirex, has been based upon a number of assumptions regarding the performance of the waste packages that would eventually be produced. At the Interim stage, it is required that the details of the proposals be substantiated through the provision of evidence associated with the physical, chemical and radiochemical composition of the ADU Floc. The development and substantiation of the wasteform formulation envelope will also be required at the Interim stage.

Conclusions

The assessment of the proposals has concluded that packages containing ADU Floc are potentially consistent with disposal under the PGRC and can be endorsed at the Conceptual stage. The consistency of the proposed waste packages with the PGRC has been demonstrated through the provision of an Assessment of Disposability.