

Retrieval, Sorting and Containerised Storage of Fuel Element Debris (FED) from Sizewell A (Conceptual stage)

Summary of Assessment Report

Issue date of Assessment Report: 24 May 2005

Introduction

This is a summary of an assessment carried out by Nirex in response to a proposal from British Nuclear Group for the retrieval, containerisation and storage of Fuel Element Debris (FED) waste at Sizewell A Power Station.

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.

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.

British Nuclear Group Proposals for Sizewell A FED

At Sizewell A, FED arises from the treatment of spent Magnox reactor fuel prior to transport to Sellafield for reprocessing. The FED comprises the items known as splitter blades and braces (splitters) and lugs that are removed from the outside of fuel elements to assist with packing for transport. The resulting waste is composed predominantly of Magnox metal (a magnesium-based alloy that corrodes relatively easily).

The current strategy for Sizewell A FED involves early retrieval and packaging to Nirex standards and specifications through a process of mechanical retrieval from storage vaults, sorting to remove any pieces of nuclear fuel and other non-FED material, placement in stainless steel Nirex standard 3m³ boxes and immobilisation using a cement grout. The waste packages would then be transferred to a purpose-built, shielded ILW store on the Sizewell A site to await the availability of a national long-term waste management facility.

The recent establishment of the Nuclear Decommissioning Authority (NDA) has prompted British Nuclear Group to examine whether the current strategies for decommissioning and waste management at Magnox reactor sites offer best value for money. Consequently, the 'Magnox Innovations Project' has been established, and has challenged current waste management practices for wastes produced by the operation of Magnox reactors.

British Nuclear Group has sought an early interaction with Nirex to progress those aspects of the Magnox Innovations Project relating to the packaging of ILW, and the management of FED from Sizewell A power station has been selected as the first proposal for assessment by Nirex.

The Magnox Innovations Project has identified an alternative strategy for Sizewell A FED that does not provide for early packaging to Nirex standards and specifications. Instead, the FED would be retrieved from its storage vaults, sorted to remove any fuel fragments and other high activity material, and then placed into 800 litre galvanised carbon steel containers for storage in the reactor building. The containerised waste would need to be recovered at some time in the future and reworked to produce waste packages compliant with Nirex standards and specifications. It is envisaged that rework would take place either during the care and maintenance period for the site or during final site clearance. The latter is commonly assumed to be about 100 years after the cessation of electricity generation.

Disposability Assessment for the Alternative Strategy

The carbon steel containers that have been proposed for the containerised storage of Sizewell A FED are not compliant with Nirex standards and specifications. The issues of non-compliance include:

- the initial condition and inventory of the waste and the extent of water carryover during retrieval is currently uncertain, affecting the credibility of any analysis of its future evolution and the resulting risks;
- the waste would not be immobilised in the containers, challenging containment under accident conditions and allowing the waste to evolve in a poorly controlled manner;
- continuing corrosion during containerised storage could cause the waste to agglomerate into a solid mass of uncertain properties and performance, or could form an increased and significant quantity of loose corrosion product that would not be immobilised;
- the carbon steel containers are a commercial product that has not been optimised to provide containment of radioactive waste over an extended period. The containers may be vulnerable to corrosion during storage and any resulting degeneration may make them difficult to handle or empty;
- the carbon steel containers would not be compatible with Nirex standards for transport and handling during disposal operations.

British Nuclear Group accepts that the proposed approach would produce non-compliant packages and that an essential future step would be to package the containerised FED into a disposable form compliant with Nirex standards and specifications. The future actions are denoted as 'exit strategies' in the submission from British Nuclear Group.

The justification provided by British Nuclear Group for not immediately packaging the waste to meet Nirex disposability requirements is based on short-term cost saving. The cost of implementing any exit strategy would be deferred and, according to British Nuclear Group, could be accommodated within the packaging facilities needed at the time of final stage dismantling of the reactor. However, should the exit strategy need to be implemented on a shorter timescale then there would be substantial, perhaps disproportionate, costs incurred in re-establishing the site infrastructure and provision of the necessary facilities for rework.

There are circumstances where Nirex would consider endorsement of proposals that required interim packing of waste. This would be where real technical challenges prevent the production of a fully disposable package immediately and the existing conditions under which the waste was being stored required immediate improvement. In such cases, it is an essential prerequisite for Nirex endorsement that credible plans are in place for the future conversion of the wastes into a fully disposable form compliant with Nirex standards and specifications.

In the case of Sizewell A FED, British Nuclear Group has not identified any technical challenges that would prevent the early production of disposable packages and that would necessitate an alternative strategy such as containerised storage. In fact, Nirex has previously endorsed the production of fully disposable packages for similar wastes at Trawsfynydd, and equivalent plans at other sites are being actively pursued. Furthermore, even if there was a technical justification for containerised storage, it would be necessary to produce credible plans for future conversion of the stored waste into a disposable form. As currently proposed, all of the suggested exit strategies are subject to significant uncertainty and, for the reasons discussed below, none can be described as a credible plan for the production of disposable packages.

A key aspect of the disposability assessment has been the consideration of the likely evolution of the containerised waste during storage and how this may impact on proposals to rework the containerised waste to produce Nirex compliant disposal packages. In addition, the practicality of some of the proposed exit strategies also can be challenged. The following issues are noted:

- as noted above, the initial condition and inventory of the waste and the extent of water carryover during retrieval is currently uncertain. The presence of water would result in continued corrosion, although the extent and rate of corrosion would be uncertain;
- the proposal not to actively control the environmental conditions during storage increases the likelihood and extent of waste and storage container corrosion that would occur during storage;
- corrosion of the FED during storage could form an agglomerated mass, hindering removal of the waste from the containers and adversely affecting the infiltration of the waste with an encapsulant;
- significant quantities of particulate material could be difficult to immobilise, possibly requiring the segregation and separate treatment of the remaining bulk solids from any particulate material;
- as noted above, the galvanised carbon steel containers could be vulnerable to corrosion during storage. Any resulting loss of integrity would hinder future handling and emptying of the storage containers;

- rework could potentially involve the over-packing and encapsulation of the storage containers, and the waste in them, within Nirex standard containers. However, the design of the storage containers has not been optimised to be compatible with Nirex standard containers;
- proposals for the acquisition during retrieval operations of data relevant to records for the disposal packages have not been set out in sufficient detail, and the implications may not have been factored into the costs and timescales associated with the retrieval process.

The processes discussed above introduce significant uncertainty in the final condition of the waste after containerised storage, preventing the definition of credible plans for reworking the waste to produce disposable packages at that time. It should be noted, however, that even if these issues were addressed and credible plans developed, there would still need to be a justification for deferring the production of fully disposable packages immediately.

Conclusions and Suggested Way Forward

The proposals submitted by British Nuclear Group for the containerised storage of Sizewell A FED are not compliant with the requirements of Nirex standards and specifications.

There is no technical justification within the proposal for deferring production of disposable packages, and the early production of disposable packages is current practice at other Magnox sites. There are significant concerns regarding the deterioration of the condition of the waste and carbon steel containers during the proposed storage period of up to 100 years. Consequently, none of the 'exit strategies' proposed in the submission represents a credible plan for future conversion of the containerised FED to a disposable form.

Although the current proposal for containerised storage is specific to Sizewell A FED, endorsement of the strategy would inevitably be cited as a precedent in the development of similar strategies for other waste streams and sites. Therefore, instead of future proposals being built around a limited range of Nirex standard containers for waste management, there is a risk that proposals could be built around an increasing range of intermediate storage containers with attendant inefficiencies and quality concerns. This could result in the creation of a substantial new legacy of wastes requiring packaging for disposal at a future time at additional cost.

Unless proper justification can be provided for deferring the production of disposable packages, it is the view of Nirex that Sizewell A FED should be packaged directly in a disposable form in line with the existing strategy. Nirex would be pleased to work with British Nuclear Group to determine a way forward that addresses the need to achieve passively safe wasteforms whilst also meeting long-term disposability requirements. Nirex recognises that British Nuclear Group has identified examples of how the processes for production of disposal packages could perhaps be improved, and we would be pleased to explore these further.

In assessing the present submission, Nirex has identified a number of issues that would be required to be followed-up in the implementation of the current strategy for early packaging and production disposable waste packages. These issues are listed in an Appendix to this report.