

# Packaging of Magnox Fuel Element Debris at Sizewell A Decommissioning Site (Conceptual stage)

## Summary of Assessment Report

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### **Introduction**

This is a summary of an assessment carried out by Nirex in response to a proposal from British Nuclear Group Magnox Electric Ltd for the retrieval, containerisation, storage and eventual grouting of Magnox 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)<sup>1</sup>. 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<sup>2,3</sup>.

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.

### **Magnox Electric Ltd Proposals for Sizewell Magnox FED**

At Sizewell A, Magnox FED was generated from the treatment of spent Magnox reactor fuel prior to transport to Sellafield for reprocessing. The Sizewell Magnox 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

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

<sup>2</sup> *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.

<sup>3</sup> *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.

composed predominantly of Magnox metal (a magnesium-based alloy that corrodes relatively easily).

The published strategy for Sizewell Magnox 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 500 litre drums 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 Magnox Electric Ltd to examine whether the current strategies for decommissioning and waste management at Magnox reactor sites can be improved and whether they 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.

The Magnox Innovations Project has identified an alternative "innovative" strategy for Sizewell Magnox FED that does not provide for early packaging to Nirex standards and specifications. Instead, the Magnox FED would be retrieved from its storage vaults, sorted to remove any fuel fragments and other high activity material, washed, drained of free water and then transferred into stainless steel 500 litre Drum containers for storage in an Intermediate Level Waste Store, which is to be a development within an existing facility in the reactor building. The containerised waste would need to be recovered at some time in the future and an immobilisation matrix added to produce waste packages compliant with Nirex standards and specifications. It is envisaged that this immobilisation step will involve the adding of cement grout and would be deferred for an initial period of up to 15 years, or longer if justified by periodic safety review.

### ***Disposability Assessment for the Alternative Strategy***

Magnox Electric Ltd accepts that the proposed approach would initially produce non-compliant packages when judged against Nirex waste packaging standards and that an essential future step would be to convert the containerised Magnox FED into a disposable form fully compliant with Nirex standards and specifications.

There are circumstances where Nirex can provide endorsement of proposals for interim packing of waste. This would be where technical challenges prevent the production of a fully disposable package immediately and the existing conditions under which the waste is 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 Magnox FED, Magnox Electric Ltd 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 decommissioning site and equivalent plans at other sites are being actively pursued. Furthermore, it would be necessary to ensure appropriate storage conditions are maintained and monitoring checks undertaken on the containerised waste, to support the future conversion of the stored waste into a disposable form.

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 this context, based on current knowledge of cement immobilisation, it is important to ensure that the wastes are washed to remove adhering sludge and dried to prevent further accelerated corrosion during storage. In particular Magnox Electric Ltd should adopt a similar rigorous

approach as used at the Magnox Debris Handling and Sorting Facility, operated at Trawsfynydd for the containerised storage of similar materials.

Deferral of the conditioning step introduces some uncertainty in the final condition of the waste after containerised storage, and this will require regular specific monitoring and inspection checks to be undertaken on the wastes and container. In particular these checks would need to provide the necessary evidence that continued storage is safe and acceptable, that the wastes and container are performing as predicted and that final grouting of the waste remains feasible and consistent with expectations. It is important that the safety case for continued storage is subject to periodic review, and it is understood that this will be undertaken on a 10 to 15 yearly basis. Notwithstanding this there remains the need for the proposed innovation strategy to be demonstrated as representing the Best Practicable Environmental Option (BPEO) and for this to be taken forward with the involvement of stakeholders.

The proposals considered by this assessment are a development of proposals that were first submitted to Nirex in 2004. At that time, the innovation strategy involved retrieval, containerisation and storage of the Magnox FED for up to 100 years. The proposal was not endorsed by Nirex as the assessment, at that time, identified three key concerns.

- Technical justification for deferral of production of waste packages that would be compliant with Nirex disposability criteria was not given. This was seen as an important omission given that fully compliant packages had been planned previously and were being produced on other decommissioning sites.
- The assessment identified many potential issues relating to degradation of the containerised raw waste and the proposed carbon steel container during the 100 year period that the waste could be expected to be in store.
- The assessment concluded that plans for creation of Nirex compliant packages at the end of the 100 year interim storage period could not be considered credible given the uncertainties surrounding the evolution of waste and its condition at the end of storage.

Magnox Electric Ltd has subsequently modified the strategy to address feedback from Nirex and other stakeholders and propose now to use a Nirex standard stainless steel waste container for these wastes rather than the carbon steel box proposed previously. Importantly Magnox Electric Ltd has provided better information on the state of the Magnox FED and its expected evolution in the containerised form and committed to a monitoring and checking programme during the storage period. Furthermore, Magnox Electric Ltd has given further consideration to the period of deferral and has now committed to a formal safety review after a maximum period of 15 years into Care and Maintenance, at which time the waste would be converted into a Nirex compliant form, or a case made for continued containerised storage based on the outcome of the monitoring and checking programme. Magnox Electric Ltd has recognised the importance of controlling the storage environment to maintain humidity and chloride levels within appropriate bounds and will apply controls defined within their code of practice for care and management of intermediate level waste packages. It has also been agreed with regulators that Magnox Electric Ltd will justify any proposals by production of a Best Practicable Environmental Option (BPEO) study and take forward such proposals by a process of engagement with stakeholders.

Assessment of these revised proposals has concluded that production of Nirex compliant waste packages should not be compromised by a deferral period of 15 years, subject to waste drying, waste and container monitoring and checking and application of appropriate storage environmental controls.

## **Conclusions**

The Conceptual stage submission from Magnox Electric Ltd for the packaging of the waste that would arise from the Magnox FED project at Sizewell A Decommissioning Site has been assessed.

The Assessment has concluded:

- The current published strategy to provide an early packaging plant and to produce conditioned waste packages for on-site storage, would meet Nirex waste packaging standards and facilitate early transport and management at other facilities including the Phased Geological Repository Concept.
- The alternative strategy of containerised storage and deferred grouting will initially lead to non-compliant waste packages when judged against the Nirex packaging standards and specifications.
- A deferral period of 15 years for grouting has been assessed and subject to washing and drying of Magnox FED, appropriate monitoring and inspection of the container and waste and controls on the storage environment to meet technical criteria defined by Magnox Electric Ltd, the production of Nirex compliant waste packages should not be jeopardised.
- Justification for the revised strategy must be demonstrated through production of a Best Practicable Environmental Option (BPEO) study and the strategy taken forward through a process of engagement with all stakeholders.

Consistency of the proposed conditioned waste packages with the Phased Geological Repository Concept has been assessed and a Conceptual stage Disposability Assessment produced. In assessing the alternative proposals, Nirex has identified a number of issues that would need to be followed-up as the strategy is taken forward.

Nirex has further in-house reviews to complete in order to determine whether the proposal can be endorsed by the issue of a Conceptual stage Letter of Compliance.