



British Nuclear Group

Intelligent nuclear clean-up

Management Services

Integrated Sellafield Site Strategy

Framework document 3: Waste management

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Overview

British Nuclear Group is developing an integrated strategy to reduce hazard on the Sellafield site and restore the site in line with the national strategy of the Nuclear Decommissioning Authority (NDA). The Integrated Sellafield Site strategy is being developed up to a point where a preferred option will be identified by March 2006. This preferred option will then be developed on behalf of the NDA to guide the continued remediation of the site.

For the purposes of public consultation the Integrated Sellafield Site Strategy is considered in three areas:

- 1 the clean-up of the Sellafield site**
- 2 production operations (reprocessing and manufacture of mixed oxide fuel)**
- 3 waste management**

Framework documents giving an overview of each area and a description of key issues raised are available online at www.britishnucleargroup.com and on www.sellafield.com. Feedback from stakeholder workshops and from responses through the website will also be published online

This consultation is part of a broad and continuing engagement with those who wish to express their views on the Sellafield Integrated Site Strategy. British Nuclear Group will invite stakeholders to take part in the future development of strategies as they evolve. Stakeholder input and feedback will be considered as part of strategy development and their contributions will be recognised and communicated.

There will also be extensive engagement with stakeholders on other areas of the site's activities including the Integrated Waste Strategy and the selection of the Best Practicable Environmental Option.

Introduction

Waste management at Sellafield can be considered under the following categories:

- **high-level wastes**
- **intermediate-level wastes**
- **low-level wastes**
- **exempt materials**
- **aerial and liquid discharges**
- **waste storage**

High Level Waste

Overview

High-level liquors from reprocessing are intensely radioactive and represent a significant source of environmental risk at Sellafield. These liquors are stored in high integrity, purpose built tanks, a storage method which has been used for more than fifty years.

At Sellafield the high level waste operations:

- receive, concentrate and store the highly active liquors
- make the liquid stable by turning it into a solid glass (vitrification)
- store the vitrified UK high level waste in accordance with Government policy for a period of at least 50 years and until a national repository becomes available
- return vitrified waste to overseas customers

Strategic importance

Reducing stocks of highly active liquor will considerably reduce hazard and environmental risk at Sellafield.

Reduction of highly active liquor to regulatory agreed buffer storage levels will provide for storage of these liquors from future reprocessing operations

Vitrified high-level wastes will be returned to overseas customers as soon as is practicable. This is envisaged to start in 2007/8.

Key issues

The Health and Safety Executive have specified the maximum volumes of high-level liquors which can be stored at Sellafield. They require that volumes will be steadily decreased until the end of reprocessing in 2012. Reduction of stocks will then be more rapidly reduced to a 200 cubic metre buffer level by 2015.

It is assumed that vitrified high-level waste will start to be returned to overseas customers in 2007/8. Without return of overseas high-level waste it is predicted that the current vitrified product store would be full by 2013.

Intermediate Level Wastes

Overview

Intermediate-level wastes comprise a broad spectrum of radioactivity. The key feature is that this waste is not heat generating in the way that high-level waste is. Current arisings are made up of items including the cladding (casing) from fuel elements and equipment which has become contaminated with radioactivity.

The outer casing, or cladding, is removed from Magnox fuel before it is sent for reprocessing. Oxide fuel is sheared into small pieces which are dissolved, leaving sections of the casing (known as hulls). These, together with solids from the treatment of liquid effluents, are encapsulated (enclosed and isolated) in cement as they are produced and then placed in purpose-built stores at Sellafield.

Graphite and stainless steel is removed from British Energy advanced gas reactor (AGR) fuel to allow for more efficient storage. These materials are stored without being encapsulated in cement, as are some items of miscellaneous beta gamma wastes which are held in a separate purpose-built store.

In addition to the intermediate-level waste from current operations, British Nuclear Group is investigating options for the intermediate-level waste from past operations. The majority of this waste is associated with Sellafield's legacy ponds and legacy silos and the development of retrieval and treatment of these wastes is being undertaken under the Legacy Ponds and Legacy Silos Strategy.

Strategic importance

The volumes of intermediate-level waste to be recovered from clean-up of historic buildings at Sellafield will lead to greater demands on existing treatment and storage plants and may create the need for new facilities.

The current treatment and storage protocols for intermediate-level waste were designed in line with the requirements of past UK Nirex advice. Since that time the disposal considerations, along with regulatory and other stakeholder guidance on intermediate-level waste treatment, has changed substantially, notably:

- The final disposal route for intermediate-level waste is uncertain and is currently awaiting the outcome of the Committee on Radioactive Waste Management (CoRWM) deliberations, expected in mid-2006.
- Waste packages were designed for fifty years in store followed by fifty years of the operational phase of a repository. As a repository is unlikely to be available within the original timescale and new concepts such as phased disposal have been developed, packages may need to be stored for longer than fifty years. The Health and Safety Executive, Environment Agency and Nirex have all issued guidance that wastes should be prepared for a storage period substantially exceeding that previously envisaged.
- It is probable that existing wastes will need to be re-assessed and some may need to be reconditioned to meet future disposal requirements. Until there is some clarity on this they will continue to be stored in their current form unless remedial treatment is required. Treatment options for future wastes will have to be developed in accordance with advancing criteria.

Key issues

- The bulk of future intermediate-level waste covered by this strategy arises from decommissioning. Decontamination of materials to produce lower category wastes or exempt materials is not necessarily a sound option from an environmental perspective due to the volumes of effluent it generates.
- The available funding must be used in a balanced way to deal with decommissioning and waste treatment. In arriving at this balance the timing of investment in new treatment facilities may need to influence when some plants are decommissioned.

Low Level Waste

Overview

Solid low-level waste includes a variety of equipment, debris and protective clothing which has originated from, or been used in, areas where radioactive materials are used. This waste originates from the vast majority of active operations at Sellafield and significant work is carried out to minimise the volume of this waste.

The bulk of low-level wastes are disposed of at the Low Level Waste Repository a few miles south of the Sellafield site. This has been the principal UK disposal facility for low-level waste since 1959. It receives waste from defence establishments, hospitals and industry generally, as well as from the nuclear power industry.

Strategic importance

The current disposal area at the Low Level Waste Repository in West Cumbria will be full by 2008. A project is ongoing to develop a successor. On the basis of current predictions the total consented area of the repository will be full by volume by 2050.

In addition to limits on volume there are limits that apply to specific radionuclides. Current disposals are generally well within the annual limits on radioactivity set by the Nuclear Installation Inspectorate.

Considerable volumes of low-level waste will be generated by the restoration of the Sellafield site. It is anticipated that these will exceed the capacity of the Low-Level Waste Repository.

Key issue

The estimated quantity of low-level waste generated from clean-up across the UK significantly exceeds the total capacity of the National Low Level Waste Repository. A major component will come from Sellafield. This is despite the decontamination and reclassification of significant amounts of waste.

A more immediate issue is the timely availability of new capacity to provide continuity of LLW disposal in the near-term.

Exempt Materials

Overview

Materials classified as exempt may have been exposed to radioactive contamination but are at such low levels that the Government allows them to be exempt from the radioactive materials regulations. Clean materials have never been exposed to radioactive contamination. Exempt materials and clean materials are to be reused, recycled or disposed of off-site.

Strategic importance

Future decommissioning at Sellafield is anticipated to generate one million cubic metres of low-level waste. Up to 80% of this is potentially exempt or clean waste. However, effective techniques and management controls will be essential to separate this material from the low-level waste, for instance mechanical removal of contaminated layers of concrete.

Key issues

Failure to decontaminate material to exempt levels will result in much greater quantities of low-level waste. This will lead to constraints on disposal and poorer use of resources. The potential for recycling much of the material would also be lost.

Aerial and Liquid Discharges

Overview

An overall effluent strategy covers all aerial and liquid effluents from the Sellafield site during the clean-up programme up to the point when all the waste is safely stored ready for final disposal. Approximately 200 facilities which handle radioactive materials are considered as part of this work as well as the aerial and liquid effluents from other buildings and facilities at Sellafield.

Strategic importance

A waste management hierarchy is applied to minimise wastes and discharges. Despite this some aerial and liquid effluent discharges will occur. These are subject to stringent regulation through the Discharge Authorisation process and through routine environmental monitoring.

Key issues

The Sellafield Discharge Authorisation sets limits for specific radionuclides over various time periods. New arisings of effluents will be produced under the extensive future clean-up programme. Variations to particular authorised local limits may be appropriate in order to progress some aspects of the clean-up programme.

There may be tensions between this and the 1998 Oslo and Paris (OSPAR) Commission which sets targets for reduction of radioactive marine discharges so that they add close to zero to historic levels by 2020.

The latest guidance on this issue is reproduced from the Environment Agency 'Sector Plan for the Nuclear Industry', November 2005:

"At the 1998 Ministerial meeting of the Oslo and Paris (OSPAR) Commission, contracting parties to the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic agreed a strategy with regard to radioactive substances. The strategy was endorsed in a Ministerial Declaration, signed by the UK and all other OSPAR contracting parties. This strategy sets challenging targets for the reduction of radioactive discharges by 2020.

"The UK Strategy for Radioactive Discharges 2001 – 2020 provides a strategic framework for achieving these targets. Its aims are:

- progressive and substantial reduction to radioactive discharges and discharge limits, to achieve the strategy targets
- progressive reduction of human exposure to ionising radiation arising from radioactive discharges, as a consequence of reductions in discharges, such that a representative member of a critical group of the general public will be exposed to an estimated mean dose of no more than 0.02 millisieverts a year from liquid radioactive discharges to the marine environment made from 2020 onwards
- progressive reduction of concentrations of radionuclides in the marine environment resulting from radioactive discharges, such that by 2020 they add close to zero to historic levels

“As well as providing a long-term framework, that strategy also includes a number of annual discharges. The Government has said that is not its intention that the UK strategy be an immutable blueprint for radioactive discharges for the whole of the period to 2020. It will though, continue to apply its policy of progressive reduction of such discharges.

“Achieving these targets by 2020 is one of the major challenges facing the industry”

Strategies for the Sellafield site must align with the above.

Waste Storage

Overview

Intermediate-level waste is strategically the most important waste category in terms of storage because of the volumes which will be generated from clean-up. High-level waste is unlikely to prove problematic provided that vitrified waste is returned to the overseas customers as envisaged. This will guarantee storage capacity for UK owned vitrified waste. Low-level waste is disposed of at the National Low Level Waste Repository.

Current plants, with the addition of an additional encapsulated product store, will provide storage for all the intermediate-level waste from commercial operations up to the end of reprocessing oxide and Magnox fuels.

Strategic importance

There is currently sufficient capacity for the storage of waste from production operations but not for the storage of waste from retrievals from Legacy Ponds and Silos and decommissioning.

Key issues

Intermediate-level wastes from current operations continues to be conditioned and stored in bespoke facilities. These support the remainder of the reprocessing operations.

- The design of the majority of the intermediate waste stores envisaged to manage wastes retrieved from legacy ponds and legacy silos, as well as the requirements for monitoring and inspecting waste packages, will be challenged by some of the legacy ponds and legacy silos waste product forms.
- There will be a large inventory of packages of intermediate level wastes. One part of this inventory will require significantly higher environmental controls and inspection regimes. Segregating this waste and storing it separately will simplify the task of control and monitoring for both the regulators and the site operators.
- An initial study has indicated that several Sellafield buildings have some potential for reuse as stores until a repository or provisions for long term storage become available. This may particularly apply to the interim storage of lower order intermediate-level wastes.
- It is possible that existing wastes will need to be re-assessed and some may need to be reconditioned or re-packaged to meet future disposal requirements. The longer term storage regime will need to accommodate this.
- Future storage options for intermediate-level waste are primarily driven by the date when a repository will become available.
- The current national approach to planning at NDA sites assumes that a waste repository is not expected to become available until 2040. Until that time wastes from decommissioning could be stored by changing existing store designs, extending the lifetime of existing stores, converting redundant buildings to be used as stores or alternative approaches to current storage concepts. These include:
 - Continued use of the existing encapsulated product store design with an extended design life of 100-150 years. These could be built at intervals if there was a long-term delay to the availability of a repository.

- Design and construction of 'fit for purpose' stores for lower order intermediate-level wastes.
- An interim store design for buffer storage of wastes prior to treatment. This may be particularly suitable for some decommissioning wastes.
- A near-surface store design with an extended design life. This could be an option if there is a delay to, or no decision on, the availability of a repository.
- Many of the current waste treatment plants will be old by the time they finish their planned work on current operations. It is likely that new plants will be necessary to treat wastes from clean-up.



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