Report on RWPG sponsored compatibility workshop

11th February 2004

Workshop facilitated by: Duncan Bury
Forth Road

DEFRA/RAS/04.007
Executive summary

This was the second of two companion workshops sponsored by the Radioactive Waste Policy Group (RWPG) to discuss current arrangements for the conditioning and packaging of intermediate and low level radioactive wastes unsuitable for Drigg (ILW and LLW).

The aim of the workshop was to raise awareness of the work of Nirex in looking at the extent to which wastes packaged to the Nirex standards and specifications were compatible with other waste management options.

A specific issue that came under consideration was whether the current arrangements, based on use of the Nirex Letter of Comfort (LoC) system was the best means of proceeding during the interregnum in which the Nuclear Decommissioning Authority (NDA) was being established to clean up the UK’s older, publicly-owned, civil nuclear sites but policy for the long-term management of the higher activity waste arising from this activity remained undecided until the Committee on Radioactive Waste Management (CoRWM) had delivered its recommendations to Government.

The overall conclusions were:

• A clear procedure for proceeding with the conditioning and packaging of ILW and LLW unsuitable for Drigg is required while the NDA is being formed and CoRWM is conducting its review.

• Current operational and regulatory arrangements involve the use of the Nirex LoC system, based on the Phased Disposal Concept. Work has been undertaken to check the compatibility of these arrangements with the range of options likely to be considered by CoRWM. A good level of compatibility had been noted.

• The workshop agreed that in light of the work that had been undertaken, and on the balance of probabilities, that waste should continue to be packaged under the LoC arrangements. The NII require mobile wastes to be immobilised as soon as possible and the EA need to ensure future disposability of conditioned wastes. It would not be acceptable to defer packaging during CoRWM’s review of options.

• That said, the arrangements needed to be kept under review. The new LoC process oversight arrangements that have been set in place by the regulators will help to serve this purpose. Greater certainty should also be added once CoRWM has narrowed down the range of options it wishes to consider, hopefully during the first year of its work.

* RWPG is the cross-government waste management policy group, which also includes the main regulatory bodies, the HSE and the environment agencies. Its terms of reference are “To review and make recommendations on issues which arise in relation to UK radioactive waste Management policy, radioactive discharges, and the corresponding regulatory processes and arrangements”
• There was agreement that the workshop had provided a useful forum for discussion of this issue.

• The conclusions of this workshop and also a related workshop provide confidence that all ILW can be packaged using the Nirex LoC process during CoRWM's deliberations.
Purpose of the workshop

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A specific issue that came under consideration was whether the current arrangements, based on use of the Nirex Letter of Comfort (LoC) system was the best means of proceeding during the interregnum in which the Nuclear Decommissioning Authority (NDA) was being established to clean up the UK’s older, publicly-owned, civil nuclear sites but policy for the long-term management of the higher activity waste arising from this activity remained undecided until the Committee on Radioactive Waste Management (CoRWM) had delivered its recommendations to Government.

The workshop provided the opportunity for senior representatives from industry, the regulatory bodies, UK Government, the devolved administrations, advisory bodies and Nirex themselves to discuss this issue, and to look to identify any better forms of approach that might be possible.

To support the discussion of these issues, Nirex were invited to supply and give their view of several relevant pieces of work that they had undertaken.

Work on which the workshop was based

Since 1998 Nirex has conducted work to explore the extent to which waste packaged to the Nirex standards and specifications would be compatible with other potential long term waste management options. This has included:

- Nirex report N/050 - Description of Long-term Management Options for Radioactive Waste Investigated Internationally. As a first step Nirex needed to identify the range of long-term management options suggested for radioactive wastes. Nirex asked its sister organisations around the world what reports and information was available on options. This work was initiated with a workshop attended by the sister organisations and then involved a literature review of all the reports sourced, some of which Nirex has had translated. The bibliography of reports uncovered is included with Nirex Report N/050 and was also passed to Wilkinson Environmental Consultants (WEC) Ltd back in 2001 for inclusion as part of their Information Needs Report which was commissioned by Defra and published in 2002. A poster summarising the options identified by Nirex

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under this exercise was displayed at the workshop and is included at the back of this report.

- Nirex Report N/057 - Compatibility of Nirex Waste Package Specifications with Long-term Management Options. Within this report Nirex has examined the extent to which the waste packaged to the Nirex standards and specifications would preclude the waste packages being suitable for the options identified within Nirex Report N/050. The main conclusion of this report was that out of the 12 options identified 8 were not precluded. The options that were precluded were those that required the waste to be heat generating or in liquid form. It is the properties and characteristics of the UK’s ILW that meant that these options were precluded not the Nirex standards themselves.

- Comparison of the Nirex Waste Package Specifications (WPS) with Waste Acceptance Criteria (WACs) for Storage and Disposal Facilities in Other Countries. Nirex commissioned RM Consultants Ltd to perform a study to identify waste acceptance criteria available for existing or planned long term waste management facilities. In short WACs were identified for surface, shallow, near surface and deep facilities (5 facilities in total). The review involved a comprehensive and systematic comparison on a parameter by parameter basis between the requirements of the Nirex WPS and of the WAC that have been published for each of the five other facilities. Overall, parameters for other facilities were generally consistent with those in Nirex WPS.

All of the above reports were made available to participants prior to the meeting and are available from Nirex upon request. Scene-setting presentations at the beginning of the workshop were based on this material.

**Workshop proceedings**

**Views on the work presented**

Although there was opportunity to do so, the workshop did not explore the technical details of the Nirex work. However, there was more general discussion of it, from which the main points emerging were as follows. There was an agreed need to get on to condition and package the waste in question, to reduce its potential hazard and put it into a form suitable for passively safe storage. There were important, and unavoidable, uncertainties at the present time with long-term management policy undecided. But, in light of the work undertaken and on the balance of probabilities, the current LoC-based approach represented the best means of proceeding. It also had the benefit of providing a tried, tested and well-defined form of approach.

Delegates were challenged as to whether there was any better means of proceeding, or any alternative approaches. None were proposed.

However, it was agreed that the current system did need to be kept under review and, where necessary, improved. The proposed overview by the
environment agencies under the new regulatory arrangements that were set in place from 1 January 2004 would assist this process. Another key point made was that CoRWM would be eliminating from its consideration a number of options that had no realistic chances of implementation during the first year of its work. This could serve to ease the necessary compatibility requirement.

Several points were made in respect of the need for such ongoing review. It was pointed out that localised corrosion in stainless steel can happen rapidly under the wrong conditions. Temperature and environmental control can reduce the rate of corrosion, but this is not in line with concept of passively safe storage. Nirex believed that this issue had been addressed. There was also suggestion that there might be possibilities for relaxing constraints e.g. allowing the use of plasticisers. Here, Nirex pointed out that specifications in some other countries were even more constraining.

The extent to which the work had been subject to Peer Review was discussed.

It was noted that:

- Nirex Report N/050 had been reviewed by Nirex’s sister organisations, Rachel Western of Friends of the Earth and by a technical editor (for tone) prior to publication.

- Nirex Report N/057 had been Peer Reviewed by Quintessa prior to publication (the report of the peer review has been sent to Defra and is available on request from Nirex). Following publication this report was reviewed by RWMAC.

- RM Consultant’s report was a contractors report to Nirex and had been reviewed by Nirex prior to publication.

**Other presentational approaches**

There was some discussion at the workshop about the presentation of the work. Nirex have developed the option of Phased Disposal from which the Nirex waste package standards and specifications are derived. Using this as a starting point Nirex has then looked at the extent to which such packages would be compatible with other options. This has resulted in Nirex being able to state what additional requirements would be needed for the other options (e.g. for sea disposal a buoyancy/density criteria would be needed to ensure the packages sink). The CoRWM representatives asked if the work could be presented in a different way to take away any inference that the work was started from the assumption of a preferred option. This would be through identification of a central core set of requirements common to all options, with additional requirements for each of the individual long-term management options being identified and presented in add-on fashion. Nirex felt that they had presented the work true to the manner in which it had been undertaken, but agreed that such an approach might be the subject of further discussion.
between Nirex and CoRWM, including how CoRWM might use this work for their stakeholder engagement.

Other Issues

It was noted that the Nirex standards and specifications are for intermediate level waste ILW and LLW unsuitable for Drigg. There were also waste acceptance criteria for Drigg. A question was asked about the extent to which the Nirex Phased Disposal Concept could address HLW. Nirex replied that it was working with its sister organisations to develop a reference HLW and spent fuel concept and that this should be available by end March 2004.

Defra explained to the participants that work is planned through RWPG to establish waste acceptance criteria (WAC) for materials that could be considered as wastes over the next 100 years or so. The group agreed that the UK should have a robust basis for waste acceptance criteria for the broad range of waste and materials.

However, as had been shown by the work discussed at the workshop waste package standards, including specification and WACs, cannot be derived in isolation from the form of long-term management system proposed, but rather needed to be derived as an integral part of the operational concept upon which the system was based.

Overall conclusions

- A clear procedure for proceeding with the conditioning and packaging of ILW and LLW unsuitable for Drigg is required while the NDA is being formed and CoRWM is conducting its review.

- Current operational and regulatory arrangements involve the use of the Nirex LoC system, based on the Phased Disposal Concept. Work has been undertaken to check the compatibility of these arrangements with the range of options likely to be considered by CoRWM. A good level of compatibility had been noted.

- The workshop agreed that in light of the work that had been undertaken, and on the balance of probabilities, continuation with current LoC-based arrangements was both sensible and the best form of approach. Despite specific consideration, no workshop members felt there was a better form of overall approach available for use during the CoRWM programme interregnum period.

- That said, the arrangements needed to be kept under review. The new LoC process oversight arrangements that have been set in place by the regulators will help to serve this purpose. Greater certainty should also be added once CoRWM has narrowed down the range of options it wishes to consider, hopefully during the first year of its work.
• There was agreement that the workshop had provided a useful forum for discussion of this issue.

• The conclusions of this workshop and also a related workshop provide confidence that all ILW can be packaged using the Nirex LoC process during CoRWM’s deliberations.
Appendices

Appendix A list of attendees

Appendix B agenda

Appendix C presentations
Appendix A list of attendees
RWPG-Sponsored workshop in Compatibility
11 February 2004

Ray Parkinson
Stuart Newstead
Ann McCall
Bruce McKirdy
Steve Barlow
David Bennett
Paul Abraitis
Terry Selby
Mark Hannan
Tony Goddard
Michelle Wise
Doug Graham
Maurice Phillips
Charles Curtis
Mick Bacon
Dave Glazbrook
Joyce Rutherford
Ian Hall
Jim Cochrane
Robert Jackson
Malcolm Wakerley
Jeff Hoare
Mark Dutton
Lynda Warren
James Fitzpatrick
Kevin Newland
Duncan Bury (Facilitator)
Appendix B agenda

Agenda for Workshop on the Nirex Work on Compatibility of Nirex Waste Package Specifications to Other Options

Date: 11 February 2004

Location: Defra
Eland House
Bressenden Place
London SW1E 5DU

9.30 Introduction

9.45 Workshop Context Setting  Robert Jackson

10.15 Update on Nirex  Ann McCall

10.45 Coffee

11.15 Context of Nirex Compatibility Work on Options  Sam King

11.45 Discussion

12.30 Lunch

1.00 Status of Work and Future Work Planned  Sam King

2.00 Discussion

3.00 Closing Remarks

3.30 Close
Appendix C presentations
Copies of presentations by Ann McCall (Nirex) and Samantha King (Nirex)

Long term management of Intermediate Level Waste

Nirex

Presentation to Compatibility Workshop

(11 February 2004)
Context

• LoC process is being applied and waste being packaged now
• CoRWM established and review options
• What if some wastes cannot go through the LoC Process?
• What if not Phased Disposal?

What if not Phased Disposal?

• LoC process does not foreclose other options
• Some options foreclosed by the nature of the waste (e.g. heat, liquid)
• Purpose of the day is to raise awareness of this work
Long-term management of ILW

- Safety standards for storage, transport & long-term environmental protection
  - Set by society through Government and the regulators

- Nirex phased geological long-term management concept
  - Designed to meet all safety standards and ensure long-term environmental protection

- Nirex waste packaging specifications and advice process
  - Provides practical guidance to waste producers to ensure wastes are packaged consistently with the concept
Nirex letter of comfort process

- Retrievable Geological Disposal Concept
- Standards and Specifications
- 600 Waste Streams
- Package Proposal for each Waste Stream
- Letter of Comfort (LoC)
- Waste Conditioned and Packaged

Do not preclude other key Waste Management Options
Progress with ILW Packaging by volume - April 2003

- 5% Packaged with final LoC
- 15% Issued with final LoC but not yet packaged
- 20% Currently within LoC assessment process
- 60% Still to be addressed
Regulatory arrangements for ILW Packaging
Phased Geological Long-term Management Concept
ILW Vault Emplacement/Retrieval Systems
Able to address

- Historic ILW legacy
- Current and future ILW risings
- OSPAR implications, Tc-99

Other materials

- HLW and spent nuclear fuel
- Plutonium
- Uranium
- Other radioactive materials
Phased Disposal is a viable option

- Worldwide
- Generic assessments for UK
- Lessons learned from past experience

Dialogue

- Local Communities and Local Government
- Our own staff
- Friends of the Earth and Greenpeace
- International ‘sisters’
- Politicians and Media
- Regulators
- Nuclear Free Local Authorities
- RWMAC
- Defra/DA - MOD - DTI - No 10 (UK Government)
- Nuclear Industry
Lessons learned

- Structure
- Process
- Behaviour

Structure- 16 July 2003
Government announcement

- Nirex to be independent of industry, and
- to be seen to be independent of industry
- greater Government control
- Autumn 2003 announcement
Process

- Openness and Transparency of process
- Clear roles and inputs
- Clear up front setting out of interactions

Behaviour

- Structure and process will influence behaviour
- Involvement and engagement
- Proactive and responsive
Context

- CoRWM will review all options and make recommendations to ministers
- Nirex will operate the LoC process and assess against the PDC
- These 2 processes are not inconsistent

Context

- LoC process is being applied and waste being packaged now
- CoRWM established and review options
- What if not Phased Disposal?
What if not Phased Disposal?

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Compatibility workshop presentation

February 2004

Presentation outline

- Presentation 1
  Why are Nirex investigating compatibility of Nirex WPS with other options
  Preliminary analysis results

- Presentation 2
  Further analysis
Context of Nirex Compatibility Work on Options

Phases of waste management
Relationship between, regulations, concept and specifications

- Safety standards for storage, transport & long-term environmental protection
  - Set by society through Government and the regulators

- Nirex phased geological long-term management concept
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- Nirex waste packaging specifications and advice process
  - Provides practical guidance to waste producers to ensure wastes are packaged consistently with the concept
Nirex Standard Packages

Stillage carrying frame with four 500-litre drums

4m box for ILW

Other standard Nirex packages - 3-m³ box, 3 m³ drum, 4m LLW box, 2m LLW box
Nirex key objective

- Ensure that all ILW and LLW being packaged now are suitable for long-term management
- Hence, Nirex work on compatibility

Nirex work since 1998

- In response to
  - Regulators;
  - RWMAC/NuSAC; and
  - Defra, in the context of CoRWM
Approach

- Preliminary analysis
  - Would option be foreclosed for waste packaged in accordance with Nirex WPS?

- Further analysis
  - What would the packaging requirements be for other options?

Aim of the study

- Review Compatibility of Nirex Waste Package Specification with Other Options
  - Identify the options;
  - Identify non-foreclosed options; and
  - Identify additional requirements
Scope of work


- Compare WPS with WACs (RM report to Nirex)
- Further define Outline Reference Concepts
- Identify additional requirements
11 Options identified + P&T

- Placing wastes in deep boreholes in the rock
- Surface storage
- Near-surface disposal
- Direct injection of liquid wastes
- Melting wastes into rock
- Shooting into space
- Sea disposal
- Placing in ice sheets
- Disposal in subduction zones
- Disposal under the seabed
- Burial deep underground - "deep disposal"
Compatibility of Nirex waste packages with other options

• Preliminary review performed (N/057) Nirex WPS do not preclude the following options
  – Long-term Storage  Near-surface Disposal
  – Deep Geological Disposal  Deep Boreholes
  – Sea Disposal  Sub-seabed Disposal
  – Disposal in Subduction Zones  Disposal in Outer Space

Compatibility of Nirex waste packages with other options

• 4 Options precluded due to waste characteristics
  - Rock-melting and disposal in ice sheets
  • Non-heat generating
  - Direct injection and P&T
  • Not liquid waste
Further work

- Described in Nirex report N/057 published July 2002
  - Review WAC in other countries;
  - Review management of returned ILW with sister organisations; and
  - Define outline reference concepts in order to identify packaging criteria for other options

RWMAC/NuSAC Review

- Comments received December 2002
- Suggested to focus on smaller set of options, e.g. those that do not
  - contravene international agreements;
  - involve transport overseas; and/or
  - require the use of speculative or experimental technology.
- Highlighted may become important to know any additional packaging requirements
Status of Work

Further work

• Review WAC in other countries;
• Review management of returned ILW with sister organisations; and
• Define outline reference concepts in order to identify packaging criteria for other options
Review of WAC

- Review of literature;
- Collate parameters specified in WAC’s into a framework for comparison; and
- Compare parameters.

Framework for comparison

- **General parameters**
  - activity content, thermal output, surface contamination, gas release, integrity, impact performance and fire performance

- **Container parameters**
  - size, mass, materials and lifting features

- **Wasteform parameters**
  - immobilisation, mechanical properties, chemical properties, hazardous materials, degradation, gas generation and nuclear properties
Framework for comparison

- Range of facilities
- Range of wastes
- Different countries
- Parameters generally consistent with those in Nirex WPS
- Values differ

Outline Reference Concepts

- **Outline reference concepts for 8 non-foreclosed options**
  - describes activities for each phase of concept
  - draws on published literature and technical precedence (where possible)
  - did not assess technical feasibility of implementing the option
Assessment Approach

- Systematic evaluation of whether additional requirements required for each option
  - If yes - what are they?
  - If no - what would be needed to optimise the WPS specifically for this option?
  - Cannot optimise for more than one option
Long-term storage

• Additional requirements
  • Leachability (flooding)
Near-surface disposal

- Additional requirements
  - Leachability
  - Specified voidage limit
Deep geological disposal

- No additional requirements
Deep Boreholes

- Additional requirements
  - Lifting features not optimum for larger packages
  - Package integrity and criticality would require assessment
Sea Disposal

- Additional Requirements
  - minimum density - greater than 1.2kg/dm³;
  - buoyancy - no materials which might float; and
  - container durability - package integrity under hydraulic stress
Sub-Seabed Disposal (offshore)

- Additional requirements for offshore concepts
  - package dimensions - diameter less than 50cm;
  - minimum density - greater than 1.2kg/dm³;
  - buoyancy - no materials which might float; and
  - container durability - ability to withstand pressures at depths of up to 7km.
Disposal in Subduction Zones

• Additional requirements
  • package dimensions - diameter less than 50cm;
  • minimum density - greater than 1.2kg/dm³;
  • buoyancy - no materials which might float; and
  • container durability - ability to withstand pressures at depths of 7km.
Disposal in Outer Space

- Additional requirements
  - impact and fire performance under accident conditions
**Overall conclusions**

- The question of which option will be taken forward is open at this point
- Nirex is giving advice against the Phased Disposal Concept
- That advice is not foreclosing other options that CoRWM might consider
- Also gained understanding of the packaging requirements for other options