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DOUNREAY 'INTERIM' INTEGRATED WASTE STRATEGY			
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Revision Record Sheet		
Issue	Date	Changes from Previous Issue
1	March 2005	Issued with Lifetime Plan 2005
2	February 2006	Issued with Lifetime Plan 2006. It should be noted that DSRS Volume 4 was never formally issued as an approved document.
3	February 2007	Amended to take account of the new NDA Specification for the Content and Format of a Site Integrated Waste Strategy (ENG01, Rev 2, August 2006). Issued to Site Programme Office for LTP07 following UKAEA Peer review
4	February 2008	Issued with Lifetime Plan 2008 following internal UKAEA Peer Review.

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1 EXECUTIVE SUMMARY

- 1) The Dounreay Integrated Waste Strategy (IWS) document describes the strategy for managing wastes on the Dounreay site. It provides the justification for the waste strategy in the Dounreay Lifetime Plan, (LTP). Issue 4 is being submitted to the NDA with the LTP08 and will continue to be revised and re-issued as part of the annual LTP process.
- 2) The Dounreay IWS addresses the management of all forms of waste, both radioactive and non-radioactive, and of material which may become waste in the future. It includes waste creation and its avoidance and minimisation, what requires storage and what is disposed of to the environment. There is also recognition that some wastes may require pre-treatment or conditioning to make them acceptable to a waste route. It is supported by the Dounreay Radioactive Waste Inventory (DRWI) which now also includes information on non-radioactive wastes.
- 3) An IWS can be considered to be optimised when it is the outcome of a systematic and consultative decision making process that has considered a range of options and their practicability. All relevant factors including safety, environmental and security should be seen to be appropriately balanced. This process is currently at various stages dependant on the waste, the project or the facility being considered. Therefore the overall strategy still has 'Interim' Status. This passed year has seen the development of strategies for Clean and Exempt waste as well as Contact Handleable ILW whilst Interim stage Letters of Compliance have further strengthened the strategies for solid Remote Handleable ILW and reactor wastes from PFR Decommissioning.
- 4) Historically, Dounreay produced a suite of documents, or volumes, that address the overall task of restoring the Dounreay called "The Dounreay Site Restoration Strategy (DSRS)". However, as these documents were initially produced to satisfy Regulatory needs, discussions are being held to ascertain if there is a need to continue to produce these documents.
- 5) Dounreay now believe that this IWS supersedes the original DSRS Volume 4 on waste management but DSRS Volume 6 on fuels management will remain at this time as it sets down the regulatory agreed fuel management strategy for the Site.
- 6) The key elements in developing of the Dounreay IWS are:
 - Characterisation to allow improved understanding of materials and the future waste treatment requirements.
 - Implementing the waste hierarchy, primarily for new arisings but where practical for existing material.
 - Radioactive wastes (LLW and ILW) from past operations and decommissioning are being progressively treated into a passively safe form suitable for long term storage or disposal as appropriate;
 - Provision of facilities to treat ILW into a passively safe form.
 - Defining the End State for the Dounreay Site to allow clear planning to reach that end point;
 - Provision of a new facility for the disposal of solid LLW at Dounreay.
 - Reviewing disposition strategies for other materials, such as fuels, to ascertain if they are appropriate to be consigned against current specifications for either an ILW or HLW/Spent Fuel facility.
 - Developing routes for the reuse or disposal of non-radioactive wastes and the provision of facilities to achieve that aim;

- Interacting with other SLCs to share information and experience on similar waste streams including participation in NDA or industry working groups and seminars.
 - Demonstrate BPM for all liquid and gaseous discharges from the Dounreay Site.
- 7) The Dounreay LTP08 contains a number of key and major milestones. These are detailed in section 2.2. These cover important points in the lifetime of the Site and relate to the completion of collective waste actions e.g. all ILW conditioned. The key phases identified in the Dounreay LTP08 are:
- 1st Phase – Decommissioning – Present day to 2025 (Interim End Point)
 - 2nd Phase – Interim Storage – 2025 to 2050
 - 3rd Phase – Off-Site Transfer and Final Demolition – 2050- 2078
 - 4th Phase – Care, Surveillance and Site Closure – 2078-2294 (Final End Point)
- 8) The main challenges to underpin the Dounreay IWS during LTP08 are:
- Dounreay have undertaken a considerable amount of work in the past year looking at improving waste data for the next 2 years, through the production of Project Specific Waste Plans. This has been aimed at improving the quality of the “near term” volume data in DRWI. Work identified in the LTP for the next 2 years will be focussed on the writing of Building Waste Plans. These will become the strategic document for a facility and will detail the expected waste to be generated during the full lifecycle of the facility. These will be supplemented with improved facility wiring diagrams.
 - Continued initiatives to improve facility and waste characterisation and hence better define treatment, packaging and disposal strategies.
 - Whilst every attempt has been made to put in place a reference strategy for a number of smaller waste streams these still require to be underpinned with specific strategy documents. This will be an important focus in the coming years to ensure the data generated from the production of the Building Waste Plans are formally assessed for their impact on the reference strategies, the identification of gaps and undertaking the work to address those gaps.
 - Ongoing tasks to characterise facilities to underpin the reference strategies and associated development work.
 - The consultation process on Site End Points has been completed and the outcome advised to the NDA, it will still require acceptance by the Government and therefore results in a potential challenge to the reference IWS position in future years.
 - Having produced a clean and exempt strategy in the past year, further work is still required in refining the non-radioactive waste strategy at Dounreay in order to maximise the opportunities for re-use and recycling of waste particularly on site as part of the site remediation. Work is also required to better understand the capacity of non-radioactive waste routes and facilities and demonstrate BPM.
 - Opportunities for the transfer of materials off-site will still be investigated as waste strategies are developed. However, Dounreay’s IWS currently plans to treat and package all its radioactive wastes on-site, with only the timing of the transfer of conditioned waste packages to national facilities requiring further work.

9) External Constraints and dependencies influencing the IWS include:

- a. NDA Funding: Whilst the strategies for treating the wastes on the Dounreay site can be defined, any changes on funding levels from the NDA will impact on the implementation timescales. This is particularly important as the Site will need capital funding to allow the construction of a number of waste packaging plants for the management of ILW.
- b. There will be requirements to produce individual Building Waste Plans, waste BPM or option studies. Possible constraints on the approval/implementation of such strategies may be through elongated Engineering reviews by the NDA or delays due to UK wide strategies not being available to implement on timescales required by Dounreay. Also if the options are deemed contentious in any way then there may be a requirement for stakeholder consultation.
- c. Regulatory constraints have the potential to impact either through the introduction of new legislation or requirements, unclear specification of those requirements, delays in consultation or approval of project documentation or by requests to undertake additional treatment of materials when Dounreay have already demonstrated BPM.
- d. Scottish Government policy statements have been issued but with no clear explanation of the impact. Dounreay are keen to work with the NDA and the Scottish Government to better understand these issues and also the impacts.
- e. Continued support for the Dounreay LLW strategy of a Disposal facility at Site.

10) Potential opportunities for improving waste management for consideration by the NDA include:

- NDA led Consultation where one or more SLCs are investigating waste management opportunities;
- Improved communication and information sharing between SLCs in areas such as:
 - Waste package design to offer potential savings;
 - Waste packaging plant design and equipment
 - Availability of historical development work
 - Sharing of letters of compliance
 - Sharing of Lessons learned
 - Early notification of Facility or Process Plant visits to allow other SLCs a chance to express and interest or influence specification of potential work.
 - Visibility of the full NDA portfolio of work/tasks to better understand where Dounreay's requirements can be addressed or where Dounreay may be best to lead.
 - Clarity on the capabilities of the National Laboratory
 - Decommissioning techniques.
 - Publishing list of key SLC contacts in areas of expertise.
 - NDA schedule of "national" waste management initiatives such as graphite etc.
 - Ensuring that Dounreay gets the best out of NDA-led groups such as the Nuclear Waste Research Forum, NWRF, which coordinates most of the above.

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Simon Middlemas, Site Director

2 INTRODUCTION

2.1 Purpose and Scope

- 11) In support of the delivery of NDA strategy, all NDA sites are required to produce and implement an optimised Integrated Waste Strategy (IWS). This is provided through a formal specification (1) and a companion document (2).
- 12) The overall objective of the IWS is to demonstrate how Dounreay will assess and manage all wastes, both radioactive and non-radioactive (including those in solid, liquid or gaseous form) arising from the site's past, present and future operations. This may also include any other waste transferred from other non-NDA sites for management of disposal.
- 13) The IWS demonstrates how all waste related activities on the site are integrated and includes a demonstration that the waste can be appropriately managed in accordance with 'Best Practicable Environmental Option' (BPEO) and 'Best Practicable Means' (BPM), at the time and rate at which it will arise. It is submitted to the NDA as part of the Lifetime Plan review process and will enable Dounreay to demonstrate to its regulators and stakeholders that it is complying with legislation and standards.

2.2 Background

- 14) The 140 acre Dounreay nuclear licensed site was developed on the site of an old military airfield, dating from the Second World War, and is situated on the north coast of Caithness in Scotland. Dounreay's mission from the 1950s onward was to develop the UK's fast reactor technology programme. This was achieved through the establishment of a materials test reactor (DMTR), two fast reactors (DFR and PFR), a Fuel Cycle Area (FCA) comprising plants for the manufacture, recovery and processing of fuel, and associated laboratories and support infrastructure. With the closure of PFR in 1994 and the subsequent government decision to discontinue investment in fuel reprocessing at Dounreay has led to the emphasis now being fully focused towards decommissioning and site restoration as an NDA designated site.
- 15) The facilities on the Dounreay site supported the full nuclear fuel cycle from the manufacturing of materials test reactor fuels through reprocessing and post irradiation examination of fuel. Waste generated from the operations and now the decommissioning of those facilities are the key inputs into defining the Integrated Waste Strategy for Dounreay.
- 16) Historically, Dounreay has stored a significant proportion of its intermediate level radioactive wastes (both solid and liquid) untreated on site. Only the conditioning of MTR raffinate through the Dounreay Cementation Plant is the only ILW to be conditioned to date. A number of ILW strategies have now been developed through to the conceptual design stage for the provision of new facilities such as the RHILW Immobilisation and Encapsulation Facility which will treat and package the most active liquor and solid ILW streams on the Dounreay site. A new Waste Treatment Plant is also planned for wastes retrieved from the Shaft and Silo.
- 17) Since operations started at Dounreay back in 1959, the Site had been authorised to dispose of its solid Low Level Waste on Site. When the existing facility was closed for further disposals, the Site undertook a consultation exercise on how best to manage future arisings. The outcome of that consultation was the requirement to build a new disposal facility to meet the future decommissioning needs of the site. That project has now progressed to the stage of a planning application. Meanwhile solid LLW continues

to be packaged and stored on the site until a new disposal facility becomes available in the middle of the next decade.

- 18) The site has a number of key facilities relevant to the delivery of its waste strategy. These facilities are a mixture of raw and conditioned waste stores, waste treatment and packaging facilities as well as waste discharge/disposal facilities for both radioactive and non-radioactive materials.
- 19) In terms of waste storage at Dounreay, the following facilities are integral in implementing the IWS. These are a combination of both existing and future facilities and include:
- Existing:
 - Unconditioned Solid RHILW 200 litre Drum Store
 - Unconditioned Solid CHILW 200 litre Drum Store
 - Combined Conditioned ILW 500 litre Drum Store and Raw Solid RHILW 200 litre Drum Store;
 - 3 Stores for Interim Storage of Containerised LLW
 - Liquid ILW Storage Facility
 - Solvents and Oil Storage Facility
 - Interim Spoil (clean & exempt) Storage Compound
 - Future:
 - Conditioned ILW 500 litre Drum Store
 - Conditioned ILW 3m³ Box Store
 - Conditioned ILW 4m Box Store
 - LLW Disposal Facility
- 20) In addition to the waste stores, a number of treatment, conditioning and packaging facilities are required to implement the waste strategy. These facilities include:
- Current
 - Dounreay Cementation Plant (DCP) for immobilisation of ILW (MTR) Liquors
 - Waste Posting Cell for the repackaging of solid ILW from small waste consignors into standard ILW drums for interim storage.
 - Low Level Liquid Effluent Treatment Plant (LLETP)
 - Low Level Waste Receipt Assay and Characterisation and Supercompaction facility (WRACS)
 - "In Facility" packaging of HHISOs for bulk LLW.
 - Various Stacks for filtration and monitoring of gaseous discharges.
 - Future
 - RHILW Immobilisation and Encapsulation Facility for liquid and solid ILW
 - Waste Treatment Plant for retrieved solid and sludge ILW from Shaft & Silo and also CHILW
 - Reactor Waste Packaging Plants for ILW and some LLW
 - Decommissioning Waste Packaging Plant for Liquid ILW Storage Facility
 - Solvent Incinerator for low level waste solvents and oils
 - Clean/Exempt Waste Facility
 - New gaseous discharge stacks to support decommissioning.
- 21) The 2008 Lifetime Plan has the following key and major milestones identified within it. Key milestones are steps leading to Major Milestones. These cover grouping of activities rather than specific waste treatment operations e.g. All ILW conditioned. The following tables provide a full listing of key and major milestones but split by Reactor

related, Site Decommissioning, Final End State and Site Closure and finally ILW and Waste Activities.

- *Key & Major Milestones: Reactor-Related*

PFR Reactor Hall Area - Auxillary			
D17.91	Stand Down Cat 1 Criticality, Fire Protection & Security Programmes	Key	Nov-22
D17.92	Stand Down Fuels & Nuclear Materials Analytical & Accountability Pro	Key	Nov-22
D21.3	PFR Structures Demolished	Key	Oct-24
PFR Irradiated Fuel Caves & Buffer Store Area			
D09.4	All PFR Liquid Metal Residues Removed	Key	Aug-19
PFR Irradiated Fuel Storage facility			
D15.4	Complete Transfer of Irradiated Fuels to Cask Store	Key	Mar-21
D15	All Fuels & Nuclear Material Offsite or in Onsite Safe Storage	Major	Nov-22
PFR Reactor Hall Area - Decontamination Area			
D19.2	PFR Decontamination Complete	Key	Sep-22
PFR Turbine Hall Area			
D09	All Alkali Metals passivated & Disposed	Major	Feb-22
D09.5	All Misc. Alkali Metal Removed	Key	Feb-22
D09.9	Stand Down Alkali Metals Analytical Capability	Key	Feb-22
DFR Sphere Area - Bulk NaK removal			
D09.1	DFR Bulk Liquid Metal Removed	Key	Oct-10
DFR Breeder Fuel Building - Element removal			
D15.10	DFR Breeder Fuel Removal Complete	Key	Feb-13
DFR Sphere Area - Vault			
D09.2	All DFR Liquid Metal residues Removed	Key	Feb-22
DFR Ancillary Buildings			
D17.2	DFR Cat 1 Facilities Decontaminated	Key	Feb-22
D19.1	DFR Decontamination Complete	Key	Feb-22
D21.1	DFR Structures Demolished	Key	Mar-25
DMTR Area			
D19.4	DMTR Decontamination Complete	Key	May-22
D21.4	DMTR Structures Demolished	Key	Jun-22

- *Key & Major Milestones: Site Decommissioning, Final End State and Site Closure*

Site Decommissioning - Active Facilities			
D17	All Cat 1 Buildings Decontaminated	Major	Oct-24
D17.90	Site Criticality Risk Removed	Key	Oct-24
FCA - Fuel Buildings			
D17.1	FCA Cat 1 Facilities Demolished	Key	Oct-24
D21.1	FCA Structures Demolished	Key	Oct-24
FCA Support Facilities			
D07.4	MTR Raffinate Immobilisation Complete	Key	Oct-13
D07.6	ILW Liquor Storage Facility Operations Complete	Key	Jun-22
D25.1	FCA Gaseous LLW Operations Complete	Key	Mar-24
Environmental Restoration management & Support			
D21E1	Regulatory Agreement on Soil Cleanup levels Received	Key	Mar-09
D27E1	Regulatory Agreement reached on Soil Cleanup levels	Key	Feb-25
D27.3	Complete Remediation of DSRP Zones	Key	Mar-25
D27	Landfill Closure, Misc Soils Remediation & ER Programme Complete	Major	Mar-25
ER Characterisation			
D27.2	Complete Particle BPEO	Key	May-08
Programme Management			
D30	Interim End State Achieved	Major	Mar-25
Final End State - Store Operations Storage Phase			
D40.2	Waste Storage/Disposal Operations Complete	Key	Sep-50
Site Management Closure Phase			
D50.1	Final Closure Activities Completed	Key	2294
D50.1	Final End State Achieved & Site Delicensed	Major	2294

- Key & Major Milestones: ILW and Waste Activities:

Shaft Project			
D11.3	Shaft Isolation Complete	Key	Mar-09
Shaft & Silo Complex			
D03	Radwaste Store Construction Complete	Major	Jun-17
D11E1	Nirex Approvals Complete	Key	Sep-18
D11.4	Shaft Headworks Operational	Key	Sep-18
D11.5	Silo Headworks Operational	Key	Sep-18
D05.1	Waste Treatment Plant Operational	Key	Jul-19
D05.1	All Planned ILW Processing Plants Operational	Major	Jun-19
D11.6	Silo Waste Retrieval Complete	Key	Jul-22
D11.8	Silo Waste Treatment Complete	Key	Jul-22
D11.7	Shaft Waste Retrieval Complete	Key	Jul-23
D11.9	Shaft Waste Treatment Complete	Key	Jul-23
D11	Historic Waste Facilities Emptied with All wastes Encapsulated & Stored	Major	Jul-23
D19.5	Historic Waste Facilities Decontamination Complete	Key	Mar-25
D21.5	Historic Waste Facilities Structures Demolished	Key	Mar-25
D19.5	All Cat 2, 3 & 4 Buildings Decontaminated	Major	Mar-25
RHILW Immobilisation & Encapsulation Plant			
D05E2	Nirex LoC	Key	Jan-13
D05E3	NII Safety Case Approved	Key	May-13
D05E4	RHILW IEP SEPA Authorisation received	Key	Sep-13
D03.1	RHILW IEP Conditioned ILW Store Operational	Key	Oct-13
D07.3	PRF raffinate immobilisation complete	Key	Apr-15
D0.2	RHILW IEP operational	Key	Aug-15
D07.2	DFR Raffinate Immobilisation Complete	Key	Feb-17
D07.1	ADU Floc Immobilisation Complete	Key	Apr-18
D19.6	Balance of Site Decontamination Complete	Key	Dec-24
D07.7	RHILW IEP Operations Complete	Key	Mar-25
D21.5	All Buildings demolished & underbuilding	Major	Mar-25
D07	All ILW raffinates & Flocs immobilised and in Storage	Major	Mar-25
D21.6	Balance of Site Structures Demolished	Key	Mar-25
Waste Treatment			
D05.3	DCP Import/Export Facility Operational	Key	Apr-08
D07.5	DCP Operations Complete	Key	Dec-13
D25	All Authorised Effluent Discharges Complete	Key	Mar-25
Waste Storage			
D23.1	Solid ILW Operations Complete	Key	Mar-25
Waste Storage			
D15.2	Complete PCM Storage Operations	Key	Mar-22
LLW Pits			
D23.3	LLW Pits Retrieval & Disposal Complete	Key	Jun-22
New LLW Disposal Facility			
D01E2	SEPA RSA Disposal Authorisation Received	Key	Mar-10
D01E1	NII Site License received for LLW Disposal Facility	Key	Mar-11
D01E3	NII Authorisation for Operational Safety Case received	Key	Mar-14
D01.1	Procurement & Construction of LLW Disposal Facility	Key	Mar-14
D01	New LLW Disposal Facility Accepting Waste	Major	Apr-14
D01.2	Start LLW Disposal Facility Operations	Key	Apr-14
D23.4	LLW Disposal Facility Closed	Key	Mar-25
D23.2	Solid LLW Operations Complete	Key	Mar-25
D23	All Solid Waste Transported Offsite or in Onsite Storage	Major	Mar-25
Ancillary Buildings			
D27.1	Relinquish Landfill 42 Licence	Key	Aug-12
D27.4	Complete Landfill Closures	Key	Aug-17

- In addition to the key and major milestones, there are also a number of milestones in the programme which are NII regulated. This relates back to the original Dounreay Site Restoration Plan (DSRP). This lifetime plan has seen a number of new dates proposed but those are still subject to formal agreement by NII. The full listings are included in Annex 2.
- 22) As stated in the Executive Summary, the Lifetime Plan for the Dounreay site is split into 4 key phases. An overview of those phases is provided below:
 - 23) In terms of the Interim End Point, the Dounreay Lifetime Plan for 2008 is now estimating that this point will be achieved in 2025. This is a reduction of 7 years from LTP2007 which had estimated the IEP being achieved in 2032. At this point, 24% of the site will be delicensed.
 - 24) At the Interim End Point, end of Phase 1 for the Dounreay site, in 2025, the following facilities will remain:
 - 2 Conditioned ILW 500 litre Drum Stores and associated import/export facilities
 - Conditioned ILW 3m³ Box Store (sharing same import/export as one of the 500 litre drum stores)
 - Conditioned ILW 4m Box Store
 - Fuel Storage Facilities
 - DFR Sphere and ancillary administration building (under review)
 - Police Command and Control Building
 - Associated infrastructure and Utilities
 - 25) During the 2nd phase, the site, remaining stores and packages will be monitored and maintained, awaiting the availability of the off-site transfer routes, which are scheduled to be from 2050 onwards.
 - 26) During the 3rd phase, the conditioned ILW and nuclear material packages will be transported off-site in the 3rd phase. The current assumption is that an ILW repository will be available to receive Dounreay's waste from 2050, with all ILW removed from the Site by 2057. The nuclear material is scheduled to be transported from the Site between 2075 and 2076.
 - 27) In the 4th Phase, the site will be under care and surveillance until 2294, when the remainder of the Site will be de-licensed. During phases 2-4, it is anticipated that residual radioactivity and chemical contamination on the areas of site which remain licensed will be covered by an integrated Post Closure Safety Case, which will demonstrate the long-term safety of the entire site in its end state. Dounreay will seek authorisations to support its Final End Point strategy at appropriate times in the Lifetime plan, following regulatory consultation.

2.3 Site Vision, Mission and Objectives

- 28) In 2007, in preparation for becoming a Site Licence company, Dounreay prepared a vision and mission statement for "Dounreay Site Restoration Ltd" (3).
- 29) In terms of the vision:

"As a team, our aim is to be recognised as the best for safe, environmentally responsible and compliant decommissioning and environmental restoration."

The Dounreay Team will do this by:

- Decommissioning and restoring the Dounreay site as efficiently as possible whilst taking into account the socio-economic impacts of the work programme on the local economy.
- Developing a Dounreay Site Restoration Limited staff (DSRL employees, PBO secondees, and agency staff) that is a fully vertically integrated team, capable of self performing high hazard risk reduction activities and, as an intelligent customer, providing effective contract managements and safety and environmental oversight of the subcontractors on our team as they perform on the remainder of the decommissioning and restoration work.

30) This is supplemented by a new mission statement:

“The mission of the Dounreay Site Restoration team is to restore the Dounreay site to a condition specified by the results of consultation with the NDA, regulators and stakeholders. This must be done in a way that is safe and secure, friendly to the environment, compliant with law and regulation, responsive to the socio-economic needs of the area, and best value to the taxpayer.”

31) At Dounreay, the Site objectives are derived from the Policy on Decommissioning and Waste Management (4). These objectives are:

- To restore our sites using the best solution overall, taking account the needs of the environment, the safety of workers and the public and the potential future uses of the sites;
- To carry out initial decommissioning as soon as and as far as reasonably practicable;
- To schedule further decommissioning work to reduce the hazards progressively taking account of all the relevant factors including:
 - a. worker and public safety
 - b. site security and stewardship
 - c. effective, efficient and economic use of resources
 - d. minimisation of environmental impacts including reusing or recycling materials whenever practicable
 - e. any potential benefit or dis-benefit of radioactive decay
 - f. access to relevant skills and knowledge
 - g. use of best practice
 - h. development of necessary techniques which are not already available
 - i. consultation with public and stakeholder groups
 - j. prioritisation within funding constraints, taking account of relative hazard.
- To package radioactive wastes, including historic accumulations of waste, to render them passively safe in compliance with agreed national standards on timescales consistent with safety, the environment, dose uptake and value for money;
- To ensure that waste arisings are minimised and that those wastes which are unavoidable are characterised and segregated at source, so far as is reasonable practicable;
- To make prompt and proper use of available authorised waste disposal routes and to seek out additional disposal authorisations where necessary;
- To provide adequate storage capacity of an appropriate standard for existing and expected arisings of wastes for which there is currently no disposal route or other off-site management option;
- To keep a permanent record of redundant radioactive facilities and wastes;

- To use best practicable means to reduce radioactive discharges to the environment, and in particular to meet the requirements of the OSPAR agreement.
- 32) Additionally, Dounreay management introduced a Conduct & Expectations manual (5) in 2007 which was made available to all staff working on the site. Under section 7.6 Management of Waste and Radioactive Items, the following statement is included:
- “The Executive Team requires that all discharges and waste generated on the Dounreay Site complies with approved limits and conditions.”
- 33) These preceding statements encompass the requirement to demonstrate compliance with HSE Site Licence Conditions 31, 32 and 33 and RSA discharge authorisations for the discharge and disposal of wastes issued by SEPA.

2.4 Significant Changes from Previous Version of IWS

- 34) The main changes requiring recognition within this years IWS are;
- The Interim End Point has been brought forward from 2032 to 2025.
 - Although not a direct change, Dounreay has undertaken a major review of its ILW strategy during the past year (6). It has confirmed that the all the key facilities for the delivery of the ILW strategy have been identified but there has been a refocusing on the waste feeds to such facilities. These are explained in more detail below and in Section 6.
 - In LTP07, Dounreay stated it would use 2m boxes as its preferred waste package for reactor ILW. However, following the ILW strategy review, the 3m³ box was identified as the preferred container both from a risk management point of view and because it is more suitable for the ILW characteristics of the waste. The selection of the 3m³ box was subsequently underpinned following the assessment of a Conceptual Letter of Compliance submission by NDA RWMD (7) which confirmed that the 3m³ box was the most suitable.
 - The 500 litre drum store proposed to be as part of the Shaft & Silo Waste Treatment Plant has been removed from the LTP due to the success of development work undertaken by the project. This has seen their conditioned waste package numbers reduce by around 50%.
 - The RHILW Immobilisation and Encapsulation Facility will have an increased 500 litre drum store and a 3m³ box store.
 - The Clean and Exempt waste strategy for the Dounreay site has been approved (8).
 - Dounreay is introducing Building Waste Plans which are strategic documents and will define the key waste data and strategies for each facility to be operated and decommissioned. The production of such documents will help ensure that all waste is identified and strategic planning for their management improved. This supplements the process already in place requiring projects to produce Project Specific Waste Plans covering which carry in detail the waste they are likely to generate in the coming weeks and months.
 - For the first time, the projects are being asked to carry the cost of their waste packages in their scope of work. This is to ensure further “ownership” of the projects for their waste data and package requirements.

- Lifetime Plan 2007 stated that CHILW would be processed and packaged into a final wasteform through the modified Low Level Waste - Waste Receipt Assay Characterisation and Supercompaction facility. This had been a “quick fix” as the NDA requested full lifetime costs where no hand-off to other sites was possible. The CHILW strategy has been reviewed in the past year, as part of the overall ILW strategy and therefore the reference in LTP08 has been changed to show the CHILW being processed through the Shaft & Silo Waste Treatment Plant.
- The Interim spoil storage compound has been brought into use on the site. This allows mainly clean and exempt spoil to be retained on-site for future re-use.
- Consultation on the future programme of work related to the management of particles, mainly off-shore, has been completed. Dounreay has made provision in its baseline for offshore recovery operations over the next few years in an attempt to recover as many particles from the seabed.

3 WASTE MANAGEMENT POLICY, ORGANISATION & ARRANGEMENTS

- 35) This section outlines the regulatory and policy framework against which the Dounreay IWS has been developed. Further, it outlines the site organisation and arrangements for management of wastes and ensuring compliance with this framework.

3.1 Statement of Policy and Principles

3.1.1 Principles of Waste Management at Dounreay

- 36) An overview of the Government policy, legislation and regulatory requirements relevant to waste management and disposal is given in Section 4.3 and Annex 1 to this IWS. Further details are provided in the Companion Document to the Integrated Waste Strategy Specification (2). Dounreay has access to UKAEA’s legislation and obligations register which details applicable legislation to the Dounreay site.
- 37) In summary, the key principles of policy applicable to management of waste on the Dounreay site are:
- Protection of the public, workforce and environment (Cm2919 Para 50) through:
 - Keeping radiological doses and environmental impact ALARA (Cm5552)
 - Converting wastes into a passively safe state as soon as practicable
 - Minimising discharges through the use of BPM (Cm5552)
 - Strategic Planning
 - Application of the Waste Hierarchy (see glossary)
 - Consideration of BPEO/BPM in the selection of waste management options
 - Proximity principle (see glossary)
 - Sustainable development (see glossary)
 - Use of good practice guidance, such as the Industry Code of Practice on Clearance and Exemption.
 - Application of SEPA Waste Strategy for non-radioactive wastes.
- 38) These key principles are currently reflected in the Dounreay Decommissioning and Waste Management Policy (4). This policy is consistent with the Energy Act direction to the NDA regarding decommissioning and clean-up of its Sites. These objectives are repeated here for completeness:

- To restore our sites using the best solution overall, taking account the needs of the environment, the safety of workers and the public and the potential future uses of the sites;
- To carry out initial decommissioning as soon as and as far as reasonably practicable;
- To schedule further decommissioning work to reduce the hazards progressively taking account of all the relevant factors including:
 - a. worker and public safety
 - b. site security and stewardship
 - c. effective, efficient and economic use of resources
 - d. minimisation of environmental impacts including reusing or recycling materials whenever practicable
 - e. any potential benefit or dis-benefit of radioactive decay
 - f. access to relevant skills and knowledge
 - g. use of best practice
 - h. development of necessary techniques which are not already available
 - i. consultation with public and stakeholder groups
 - j. prioritisation within funding constraints, taking account of relative hazard.
- To package radioactive wastes, including historic accumulations of waste, to render them passively safe in compliance with agreed national standards on timescales consistent with safety, the environment, dose uptake and value for money;
- To ensure that waste arisings are minimised and that those wastes which are unavoidable are characterised and segregated at source, so far as is reasonable practicable;
- To make prompt and proper use of available authorised waste disposal routes and to seek out additional disposal authorisations where necessary;
- To provide adequate storage capacity of an appropriate standard for existing and expected arisings of wastes for which there is currently no disposal route or other off-site management option;
- To keep a permanent record of redundant radioactive facilities and wastes;
- To use best practicable means to reduce radioactive discharges to the environment, and in particular to meet the requirements of the OSPAR agreement.

3.1.2 Dounreay Approach to Waste Minimisation and the Waste Hierarchy

- 39) One of the key requirements of waste management at Dounreay is to ensure that the production and accumulation of new waste is minimised. This is encompassed within the site requirement for the application of the principles of the Waste Hierarchy to both radioactive and non-radioactive wastes. The waste hierarchy is intended to ensure that the amounts of waste requiring disposal is minimised and ensure that when planning projects, they fully address opportunities to avoid waste production minimise volumes and maximise reuse or recycling of materials. This is consistent with national policy and is reinforced in the Dounreay Waste Manual.



Figure 1: Waste Management Hierarchy

40) Examples of applying the waste management hierarchy are:

- a. Undertaking characterisation (both desk based and intrusive) work ahead of the main project task to define the waste categories and strategies (routes) before work commences.
- b. The production of waste is avoided by ensuring that cross-contamination during operations or decommissioning does not occur and that, where possible and Best Practicable Means, surface activity is removed and segregated from the bulk material.
- c. Much of the Low Level Waste (LLW) generated is compacted to minimise the volume requiring disposal. Segregation of waste at source also minimises the volume requiring disposal.
- d. During decommissioning activities non-radioactive material is recycled or reused wherever possible in preference to disposal. Metal may be recycled as scrap and crushed concrete or soil can be used for filling in holes or landscaping.
- e. Where possible, existing disposal routes are utilised so that waste is not accumulated which does not currently have a disposal route.

3.1.3 Dounreay Approach to Sustainable Development

41) Sustainable development principles require that there is no undue burden on future generations. This is part of the strategy for Dounreay in ensuring that radioactive wastes are in a passively safe state by the interim end point reducing burdens on future generations. Sustainability will also be achieved during decommissioning and remediation operations by the application of the waste management hierarchy to the management of all wastes at Dounreay. Support and information will be obtained from the SD:SPUR network as the IWS and decommissioning plans are developed.

3.1.4 Recent Developments in Policy and Regulation

42) Since the production of the 2007 IWS, there have been a number of developments in national policy as well as legislative and regulatory requirements. These key items include:

43) **LLW Policy:** In March 2007, Government issued its new policy for the long term management of solid low level radioactive waste. The policy updates Cm2919 in:

- Allowing greater flexibility in managing in the wide range of LLW that already exists and will arise in the future, proposing that a risk based approach is used in selecting disposal options;

- Giving NDA the remit for creating a UK-wide strategy for managing low level waste from the nuclear industry, including at what point in the future a replacement (or replacements) for the national disposal facility near Drigg in Cumbria might be required and planned;
 - Permitting export of LLW to other OECD and EU countries for the recovery of re-usable materials, or for the treatment that will make its subsequent storage and disposal more management where this has been demonstrated and authorised as the best practicable option.
- 44) The policy also gave new definitions for the lower activity end of the LLW, namely giving the two new categories of Low Volume and High Volume Very Low Level Waste (VLLW). The activity of High Volume VLLW can be up to 4 MBq/te except for tritium which is allowed up to 40 MBq/te.
- 45) Dounreay welcomes the new category of High Volume VLLW which makes VLLW management more applicable to the large volumes of waste arising from decommissioning and will consider this in future developments of the IWS. At this time, and in this IWS, Dounreay will continue to use the term HVLA.
- 46) **UK Government's Managing Radioactive Waste Safely Programme (MRWS):** Under their MRWS programme, in October 2006 the Government accepted the Committee on Radioactive Waste Management, CoRWM's recommendation that geological disposal coupled with safe and secure interim storage is the way forward for the long term management of the UK's higher activity waste. The Government through a reconstituted CoRWM is to prepare an implementation framework and NDA was given responsibility for developing and ensuring delivery and implementation of programmes for interim storage and implementing geological disposal.
- 47) Based on NDA guidance that a national facility will not be available until 2040 at earliest, Dounreay has made provision for the interim storage of conditioned ILW on the Site until that time. Additionally, working with the NDA and NDA RWMD, Dounreay has participated in a repository scheduling workshop and therefore waste will start to be consigned from Dounreay to a national facility from 2050.
- 48) In June 2007, the Scottish Government also announced that it did not endorse the findings of the UK Government consultation on Managing Radioactive Waste Safely. Instead it stated: *"Our policy for waste in Scotland is to support long term "near surface near site" storage facilities so that the waste is monitorable and retrievable and the need for transporting it over long distances is minimal. We will be progressing this in conjunction with the Regulators and the Nuclear Decommissioning Authority."*
- 49) To date, Dounreay has received no guidance from the NDA to alter its baseline. Therefore this IWS and the Lifetime Plan still make provision for the transfer of conditioned ILW offsite to a UK national facility in the middle of this century. As Dounreay's conditioned ILW will be in a passively safe state and in stores which are above ground and allow monitoring of the packages, the policy does not have any immediate impact.
- 50) **RSA Authorisation Requirements:** As part of the changes due to the formation of Dounreay Site Restoration Ltd, work has been ongoing with respect to demonstrating that the current authorisation, granted to UKAEA, can be transferred to DSRL
- 51) **Exemption Orders:** The Exemption Orders under the Radioactive Substances Act 1993 are currently under review. These are statutory instruments made under the Act and specify classes and descriptions of radioactive material which do not need to be registered or further authorised. This is a key part of the Dounreay IWS as it allows

further flexibility in the management of wastes on the site, especially where the history is unclear.

- 52) **Scottish Government National Waste Strategy**: This sets out a framework within which Scotland can reduce the amount of waste it produces and deal with the waste that is produced in a more sustainable way. It covers all household, commercial and industrial waste. Dounreay recognises its obligations under this requirement, hence the focus on applying the waste hierarchy to non-radioactive as well as radioactive wastes. Again this is captured in the Project Specific Waste Plans which cover both categories of waste. The Scottish Government also aspires to a “zero waste Scotland”.
- 53) **National Planning Framework for Scotland - 2**: In January 2008, the Scottish Government issued this discussion document. This document includes statements on the possibility of applying the “proximity principle” with respect to radioactive waste management. This means the requirement to build facilities to manage the waste near the site of origin. Whilst Dounreay’s strategy already applies this principle for LLW, there is a potential impact on higher activity wastes. Dounreay has yet to respond on the discussion document.

3.1.5 Local Waste Management Plans:

- 54) Dounreay’s strategic planning for the management of its wastes takes account of local and regional waste management plans. The main objectives are:
- That effective waste minimisation measures will be adopted and, following these, that waste, including radioactive waste, will be managed at the highest achievable level within the waste hierarchy;
 - That waste will be managed as near as possible to where it is produced;
 - That the environmental impacts of waste management developments, including traffic, will be kept to a minimum;
 - That there will be increased community and stakeholder involvement and ownership for initiatives and planning for sustainable waste developments.

As well as these objectives, the main draft policies relevant to Dounreay are Core Strategy Policy 14 on ILW storage, 15 on ILW geological disposal and 16 relating to provision of disposal capacity for LLW. The objectives are compatible with the Dounreay site plan and policy and these will continue to be considered in optimising the IWS.

3.1.6 Good Practice Guidance Used by the Site

- 55) Guidance on good practice and general advice on waste management is taken from a variety of sources by the Dounreay site and include the following:
- Nuclear Industry Code of Practice for Clearance and Exemption – provides guidance on how to measure and assess waste in order to dispose of waste as exempt or non-radioactive;
 - SAFEGROUNDS – Good practice guidance for the management of contaminated land and defence sites;
 - SD:SPUR – Site Decommissioning: Sustainable Practices in the Use of Resources;
 - HSE/EA and SEPA – Joint Guidance on Radioactive Waste Management – Part 1: The management of higher activity radioactive waste on nuclear licensed sites (published in December 2007 - the first stage in updating the Joint Guidance on the Conditioning of ILW);

- EA and SEPA: Guidance for the Environment Agencies Assessment of BPEO Studies at Nuclear Sites;
- EA Pollution Prevention Guidance (PPG) notes;
- EA Requirements Working Group, EARWG, which was established as a Best Practice Forum for radioactive waste and manages the production of a best practice website including a waste minimisation database. Dounreay recognised early in the development of its decommissioning plans for the Site that the future management of waste was a key building block in achieving success.

3.2 Waste Management Organisation

- 56) Dounreay recognised early in the development of its decommissioning plans for the Site that the future management of waste was a key building block in achieving success.
- 57) Therefore in 2006, Dounreay recognised that to deliver its Lifetime plan, the reorganisation of the site management structure had to be undertaken to establish a Waste Services Unit whose primary focus was the delivery of:
- Further development, and refinement, of waste and fuels strategies at Site and project levels. The communication of the strategies to the projects.
 - Establishment of a Waste Compliance Section to improve quality management of waste consignments and associated records.
 - Management of Waste Stores and treatment facilities
 - Provision of a waste transport & collection system
 - Provision of Qualified Experts on radioactive waste management.
 - Provision of a Non Destructive Assay (NDA) service for both WSU and Site Projects.
 - Overseeing the management of the New Low Level Waste Disposal project.
- 58) The vision for Waste Services Unit is responsibility for the provision of an effective 'one-stop shop' for waste management activities and provide the interface with the regulators, decommissioning projects and off-site waste management operators. The main benefits of this approach will be:
- Clarity and accountability for all waste matters and more business efficient
 - Development and optimisation of the Integrated waste strategy
 - Optimisation of waste and fuels strategy implementation
 - Management of all waste storage and transport which allows for clearer and more focussed waste management provision.
- 59) The Waste Services Unit (WSU) organisation structure is shown in Figure 2 and comprises:
- **WSU Manager is responsible:**
 - To the Site Project Manager for overseeing all of the waste services required to support decommissioning of the Dounreay site. The WSU Manager is the owner of the IWS.
 - For the Waste Management Process and associated procedures and standards.
 - **Waste & Fuels Strategy and Compliance Project Manager is responsible:**
 - For the development of radioactive and non radioactive waste strategy through to a point where implementation can be managed by others. This includes consideration of the waste hierarchy at the strategic level.

- For the development of fuels strategy through to a point where implementation can be managed by others.
 - To ensure that appropriate technical work, option studies and BPEO or BPM studies are undertaken to support the strategy.
 - To produce the IWS on behalf of the WSU Manager and the Site.
 - For maintaining the Waste Quality Management System, including Building and Project Specific Waste Plans, for the Dounreay site, both in terms of defining the specifications through to ensuring that consignment paperwork is correct.
 - For the co-ordination of an embedded team of Waste Tactics Officers. These officers work as part of the projects and have responsibility for ensuring that the Site Waste strategies are appropriately implemented at a project level but also to provide guidance on waste issues to projects.
 - For working with the Site Programme Office in ensuring the waste strategies are correctly addressed in the LTP and ongoing Change Controls.
- **Waste Operations Manager is responsible:**
 - For operating key radioactive and non-radioactive waste treatment facilities on the Dounreay site.
 - For operating a waste transport collection service for waste generated by projects.
 - For provision of waste containers to projects.
 - **Facilities Management Project Manager is responsible:**
 - For supporting the Authority to Operate manager for the waste treatment facilities.
 - For the maintenance and safety of all the waste treatment facilities as part of the Works Control process.

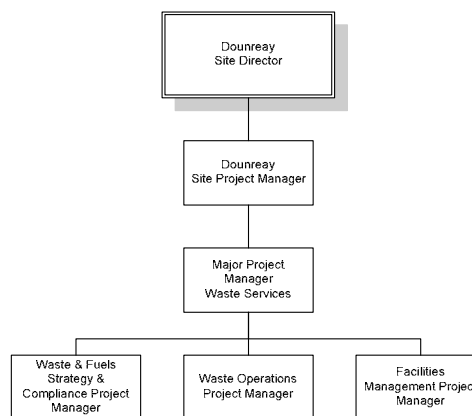


Figure 2: Dounreay Waste Services Unit Organisational Structure

- 60) Project Managers and Authority to Operate (ATO) Holders have direct responsibility for waste management within their project or area of responsibility including ensuring application of the waste hierarchy and minimisation of waste. They have the responsibility for the production of Project Specific Waste Plans to allow WSU to approve their waste routes. This is where consideration and implementation of the waste hierarchy is considered at the working level.

- 61) Additionally, as stated above, each Major Project Area on the Site has the help of embedded Waste Tactics Officers whose responsibilities are to cascade site strategies to the projects and also assist in the preparation of project documentation to allow consignment of waste.
- 62) Each project or facility also has dedicated Area Waste Officers appointed to deal with day to day waste issues, mainly waste consignment.
- 63) This approach of utilising embedded Waste Tactics Officers to assist projects helps to ensure the integration and development of project strategies and allow consignment of wastes to Waste Services Unit.

3.2.1 Key Formal Meetings:

- 64) The Dounreay site waste management organisation and development of the IWS is supported by a number of formal meetings where waste strategy and issues are discussed. They include:
 - Dounreay Accountability Meeting (DAM) is the Dounreay Executive Meeting. This meeting takes the form of individual reviews of each Major Work Group with each Group Manager with respect to project performance.
 - Dounreay Investment and Change Control Meeting (ICCM) are responsible for the review and approval of all the changes with the potential to affect the delivery of the Dounreay Programme. The ICCM ensures that proposed changes are assessed in the context of the whole Lifetime Plan.
 - The Dounreay Environment Committee (DEC) ensures that all key environmental documents go through UKAEA “due process” as defined in UKAEA arrangements. It also provides a forum at which Senior Managers can review environmental performance, environmental strategy, compliance with environmental legislation, and cultural and behavioural issues relevant to the environment. There is a focus on improving performance, management arrangements and culture. The meeting has executive authority but any significant issues are referred to the DAM for endorsement.
 - The Dounreay Site Safety Working Party also meets to discuss project safety documentation and facility safety cases. As the management of waste is a key part of most projects and safety cases, the proposals for waste management are also scrutinised here.
 - Discussions are ongoing about whether a specific waste management strategy meeting, or technical meeting, similar to the DEC, is required or whether WM strategy can be approved through existing due process between Waste Services Unit, Programmes Office and the Projects.
 - In the interim period and following on from the ILW strategy review in the summer of 2007, an ILW Strategy Group has been established. This meeting allows strategic or technical issues related to ILW management to be formally reviewed. This meeting currently meets on a monthly basis with representatives from all key project areas on the Site.
 - The Site Plan of the Day & Week meetings at which short term waste logistic issues are one of the topics discussed.

- All these are in addition to the feedback of information from attendance at NDA or Industry working groups or meetings.

3.3 Waste Management Arrangements

3.3.1 Accreditation

- 65) To ensure that the requirements of relevant legislation are achieved, Dounreay operates an integrated management system, independently certificated to ISO14001, ISO9001 and BS OHSAS 18001. This covers the overall health, safety and environmental arrangements required of the site. These certifications are currently valid and subject to formal reassessment on a routine basis. Additionally Dounreay has achieved UKAS accreditation for its Laboratory facilities which support the decommissioning and waste management process.

3.3.2 Overview of Dounreay's Integrated Management System

- 66) Dounreay's management system is designed around the various processes required to support the delivery of the Lifetime Plan. One key process is that of management of waste. All of the following processes and guidance are available to all staff through the Dounreay Intranet.
- 67) Dounreay's Waste Management Process, is summarised in Figure 2 aims to ensure:
- the consistent preparation and endorsement of waste management strategies at Site level;
 - consistent standards are applied in implementing these strategies;
 - Compliance with legislative requirements and Conditions for Acceptance.

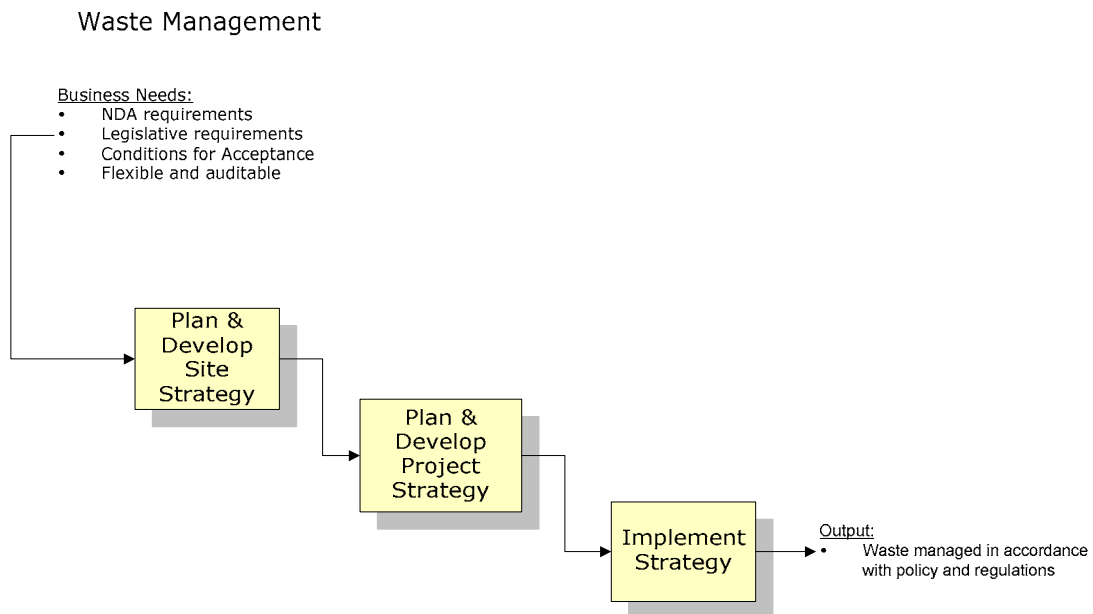


Figure 2: Dounreay Waste Management Process

- 68) This top level process is then supported by lower level processes, which provide further definition and guidance for Site Strategy development:

Waste Management - Plan and Develop Site Strategy

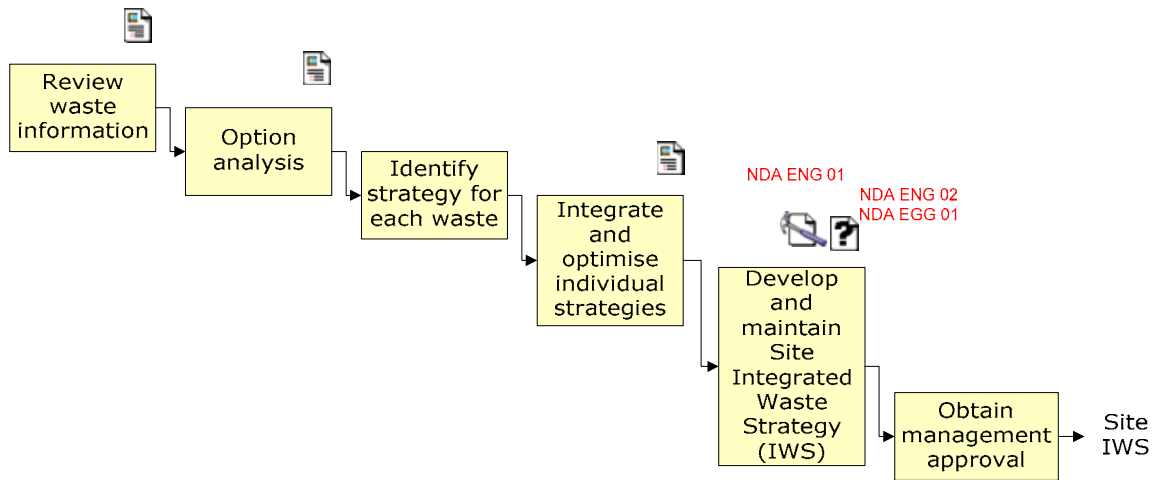


Figure 3: Site Strategy Development Process

69) With the overall Site strategies in place and also those for key waste streams, the responsibility then falls to individual projects to develop their own waste strategies for review and approval. Projects prepare their strategies in accordance to the process set out in Figure 4.

Waste Management - Plan and Develop Project Strategy

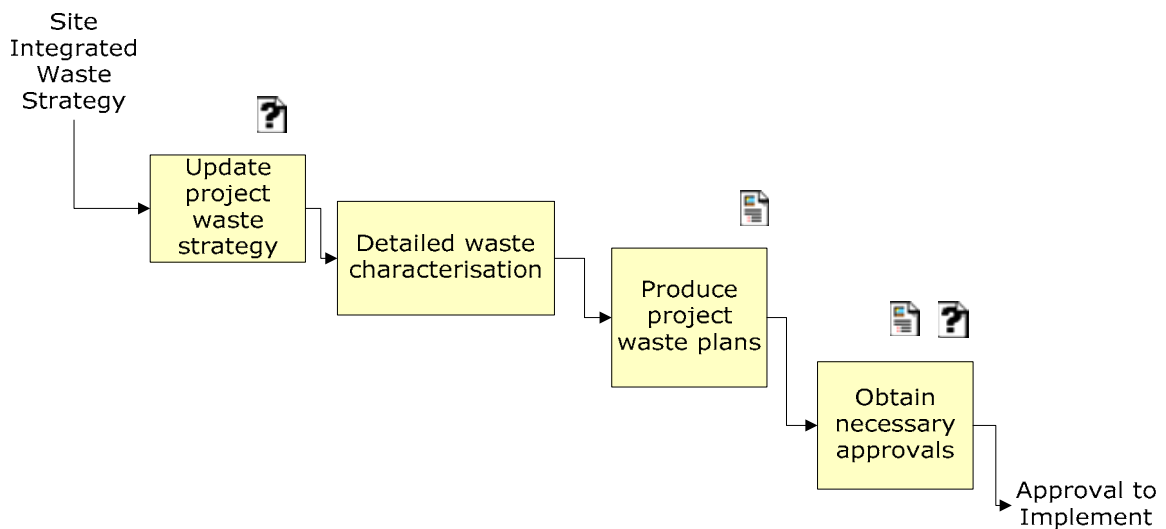


Figure 4 – Plan and Develop Project Waste Strategy

70) Following approval of the project strategies these are then moved to the implementation phase. Again, the following process map, Figure 5, defines the key steps to be undertaken by the project.

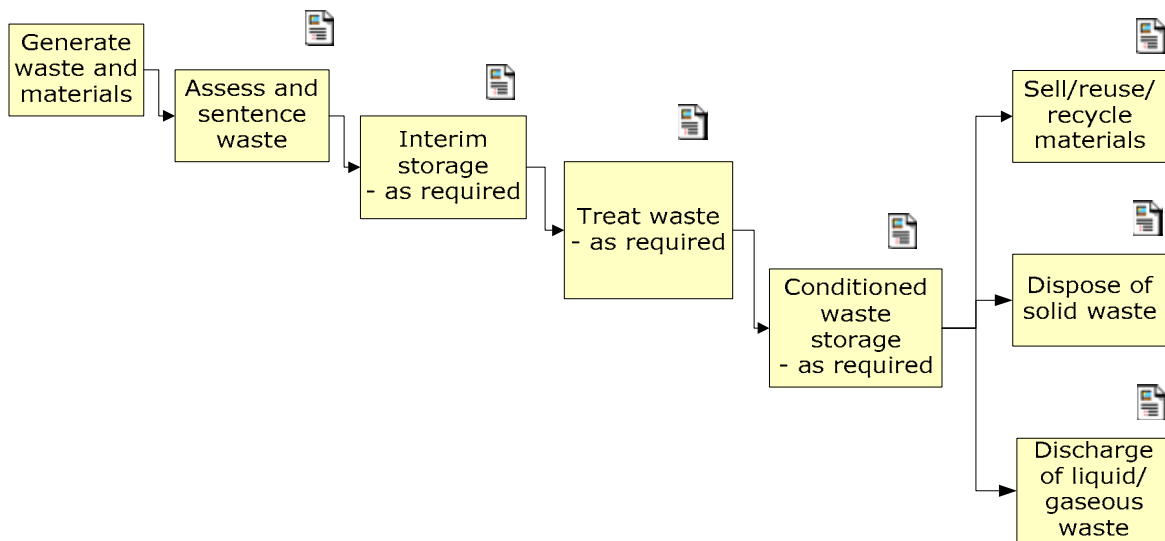
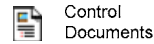
Waste Management -
Implement Strategy

Figure 5: Waste Management – Implementation Strategy

- 71) Dounreay ensures continual improvement in its Safety, Health, Environmental and Quality Management by establishing and monitoring annual objectives and targets. The overall site performance in implementing management systems is measured through a programme of integrated monitoring activities.

3.3.3 Waste Management Requirements

- 72) Dounreay's waste management requirements are covered in the Dounreay Waste Manual which details the roles, responsibilities and requirements to allow consignment of solid wastes and some liquid wastes and aids demonstration of compliance against the Site Authorisations.
- 73) This move to a Dounreay Waste Manual has also allowed the incorporation of former UKAEA corporate standards on waste into the document. The combination of the Dounreay Waste Manual and associated Guidance notes set down the requirement to implement the waste hierarchy both at a Strategic level in Building Waste Plans and the again at the Project Specific Waste Plan level. This is supplemented with BPM studies.
- 74) The following diagram details the relationship between the documents now in use.

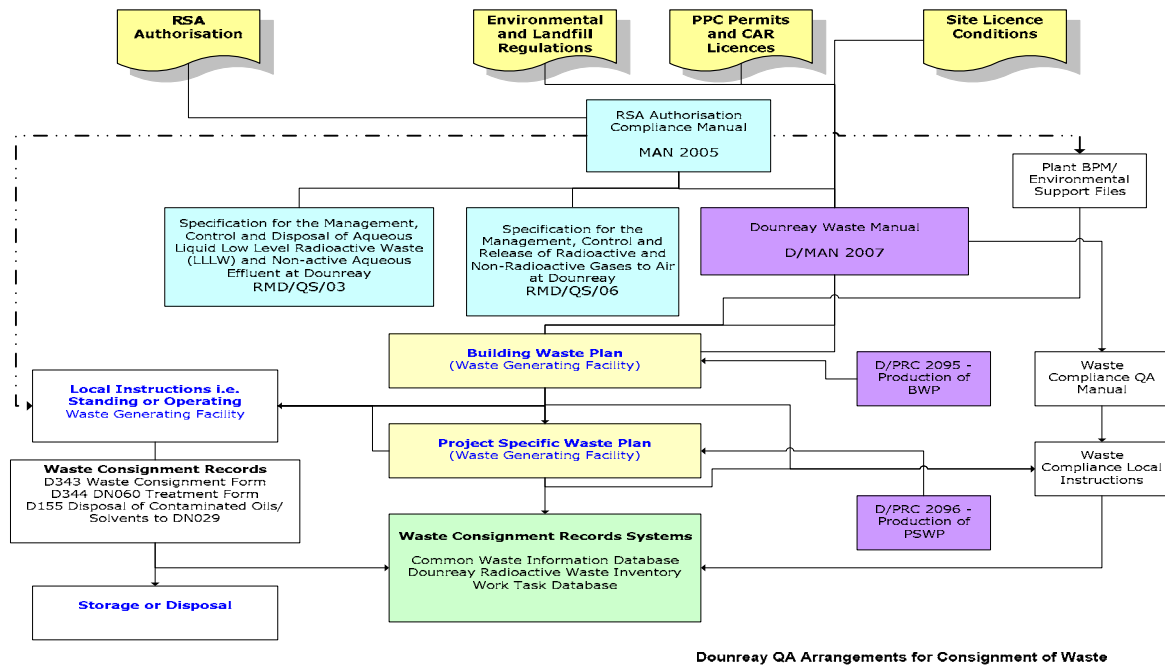


Figure 6: Dounreay Waste Management Documentation Hierarchy

- 75) The Waste Manual requires Project Managers/ATO holders to:
- Ensure that a waste management plan consistent with the Integrated Waste Strategy is developed and maintained for the facility or project within his responsibility.
 - Make arrangements to prevent or otherwise minimise the creation of all wastes where possible in accordance with the waste hierarchy, and to avoid the unnecessary accumulation of waste.
 - Categorise waste appropriately, segregating wastes as necessary.
 - Ensure that the approach taken to manage current and future waste arisings represents the BPEO in accordance with the site Integrated Waste Strategy.
 - Check and maintain the effectiveness of arrangements and equipment required to manage waste by ensuring that the quantities of waste are minimised via robust and transparent options studies e.g. BPM or BAT (Best Available Technique) as appropriate, and that re-use and recycling opportunities are maximised where practicable.
 - Maintain documented arrangements for the management and disposal of all wastes across the Site and for each facility or project, ensuring recording of relevant facility and waste information. The documented arrangements include the arrangements and responsibilities for:
 - Receipt, transport, processing, storage, consignment, disposal of wastes and monitoring of transfers/consignments
 - Maintenance of waste-service agreements
 - Sampling, monitoring and measurement
 - Management and retention of information, records etc
 - Management of interfaces with other facilities and projects and other Sites
- 76) The PSWPs also detail the methodology and equipment being used by a project to characterise and consign wastes where appropriate. These PSWPs are independently checked and verified by a number of Suitably Qualified Experts in the areas of radiological protection and waste compliance. Only once all parties have agreed the

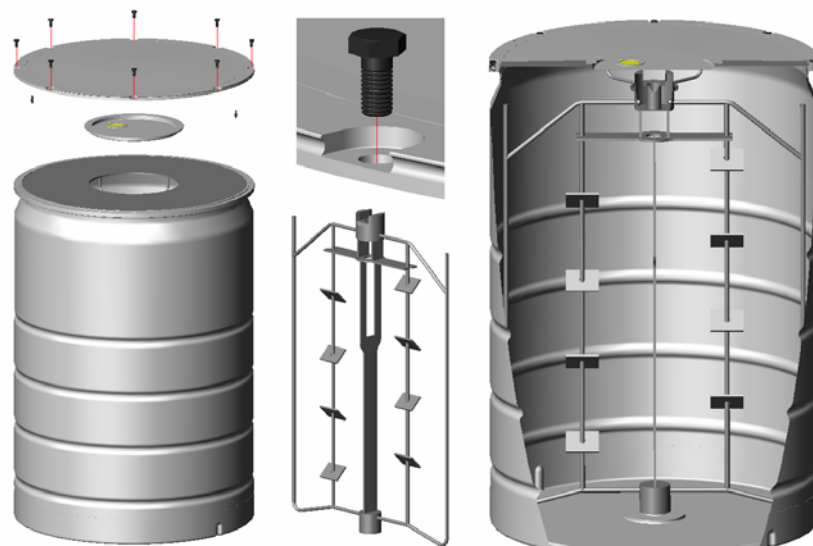
methodology and waste quantities that can then be consigned. The emphasis is on “at source” monitoring and categorisation with subsequent assay operations focussed on compliance.

3.3.4 Good Practice and R&D

77) Dounreay promotes the sharing and use of good practice across waste streams and projects on the site through the formal meetings listed under Section 3.2. With the formation of Dounreay Site Restoration Ltd, meetings previously attended by UKAEA’s corporate teams have been allocated back to individual Site representatives. The Site will therefore attend a wide range of NDA, Regulatory and inter-industry workshops, meetings and good practice sharing activities. Dounreay believes these forums are important to information exchange with other SLCs and also influencing future initiatives. Examples include:

- Attendance at national working groups such as the Clearance and Exemption Working Group (CEWG), the Nuclear Waste Research Forum (NWRP), the Inter-Industry Group on Contaminated Land (IIGCL), the Soil and Groundwater Technology Association (SAGTA), NDA, RWMD Technical Sub-Groups and NDA working groups such as package longevity.
- Participation in the collaborative development of a cross-industry web-based database on waste minimisation.
- Attendance at conferences and workshops
- Specific industry collaborations on particular issues. For example, Dounreay is represented by Windscale on the Encapsulated Metallic Uranium Steering Group (EMUS) and at the Hydrogen Forum..

78) Dounreay has demonstrated good practice through the development and manufacture of a new design 500 litre drum for both solids and liquids waste. The slight changes to the drum design result in more waste being able to be packaged whilst still meeting the NDA RWMD requirements on package design. An example of the liquid drum is shown below:



UKAEA D3900 LIQUID WASTE DRUM

Figure 7: RHILW-IEP 500 Litre Liquid Drum

79) Dounreay also maintains a Lessons Learned database of safety, waste and environmental issues as well as project management.

3.3.5 Research & Development

- 80) Dounreay's R&D requirements are set out in the Technical Baseline and Underpinning Research Document (TBUrd) document which accompanies the lifetime plan. The R&D work can focus on many areas with the key ones related to decommissioning and waste management.
- 81) Dounreay is now represented as an SLC on the Nuclear Waste Research Forum and the Radioactive Waste & Decommissioning Technology Group (RWDTG).
- 82) With respect to ILW issues, Dounreay follows the Letter of Compliance process as a framework to demonstrate in a robust manner that wastes can be suitably treated and package to make them passively safe. This framework then provides a structured approach to development work from a requirement to take samples:



Figure 8: Actual Ammonium DiUranate (ADU) Floc

- 83) Through to undertaking both inactive and active encapsulation trials:



Figure 9:
Sectioned Solid RHILW 500l Drum

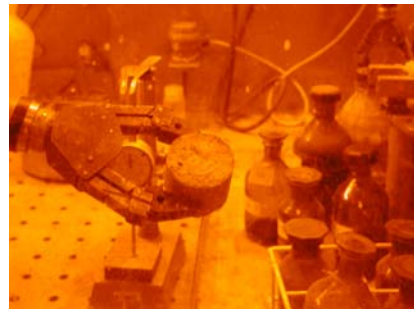


Figure 10:
Cemented Active PFR Raffinate

- 84) It must also be recognised that decommissioning practices also require changing from those used in historical projects. Therefore the use or design of new equipment may be required to assist in the decommissioning facilities where decommissioning was not a primary concern during construction. With decommissioning, a key area for learning is associated with the success or failure of decontamination agents, strippable coatings or fixative solutions.
- 85) Good examples of decommissioning ingenuity are associated with the decommissioning of PFR where they have had to construct "unique" tooling such as a pipe piercing machine to assist in the removal of sodium coolant from the reactor. This was required to allow sodium pools to be drained and treated as part of the bulk and secondly to reduce the burden to be removed during the residues removal phase.
- 86) Another innovation has been remote sampling tooling which has allowed samples of the PFR reactor vessel and diagrid to be taken and analysed. This allows both the

provision of real information on the materials and also provides a means of validating previous theoretical models.

3.3.6 Skills, Records & Interfaces

3.3.6.1 Skills

87) Dounreay also produces a "Workforce Transition and Skills Plan" (10) for submission to NDA which, as a minimum, covers: key skills required in the short, medium, and long term; identification of skills gaps and links to the migration of the existing workforce; sensitivities relating to demographic change; recruitment and training strategies; links with training providers; succession planning; and supply chain strategies for long-term availability of skills. Each skills strategy also includes a technical competency framework which incorporates key technical areas including waste management. The sites' skills strategies are analysed and developed by the NDA to ensure the appropriate supporting infrastructure is in place, and that any key issues or skills gaps are identified.

3.3.6.2 Records

88) The management of waste records and information is the responsibility of the Waste Services Unit in accordance with the current quality management arrangements. This applies to both waste retained on-site and despatched off-site. The exception to this is the recording and reporting (internally and externally) of site environmental discharges which is managed by the Environmental Team from the Assurance Unit. The external reporting requirements are laid down in the Site Authorisation.

89) Dounreay also has to retain records for all wastes consigned off-site as part of its "Duty of Care".

90) Dounreay also utilises a Record Retention Schedule which defines the type of records requiring to be archived and for how long. Dounreay has its own on site archive and at set review periods, records are either retained, destroyed or transferred to the national archive at Kew.

3.3.6.3 Interfaces

91) The interfaces with other sites relating to waste are managed in a variety of ways:

- At present, Dounreay has no reference strategies in place requiring handshakes to dispatch waste to other NDA sites. Dounreay is investigating a number of opportunities for the transfer of materials to other sites. These are documented in the "Waste Disposal & Authorised Transfer Routes" and show the current status of the transfer, see Section 6.3 and Annex 3.
- Interface management is required to ensure that wastes can be returned to overseas customers as part of Dounreay meeting its contractual and regulatory obligations. These requirements are also enshrined in the Site Authorisation.
- An important waste strategy interface is that with the neighbouring Ministry of Defence establishment, Vulcan. Regular meetings are held with Vulcan management to update them on decommissioning timescales for Dounreay to allow them to assess any potential impact on their programme and also for the MoD to provide information on their plans for future operations and decommissioning.
- Individual agreements are in place with a variety of waste brokers, waste carriers and waste management contractors for the purposes of reuse, recycling or disposal

of a variety of non-radioactive waste types from the Dounreay sites. These include metal scrap yards, inert landfill and non-hazardous landfill.

4 FORMULATION OF INTEGRATED WASTE MANAGEMENT STRATEGY

- 92) Dounreay led the way in the UK when it published the Dounreay Site Restoration Plan in 2000. It was the first time a UK nuclear facility operator had attempted to produce an integrated decommissioning and waste management strategy and programme to take the site through to closure.
- 93) That experience and the evolution of strategies and technology advancements are now being built upon in the continuous improvement of those strategies which underpin the Lifetime Plan for the Dounreay site. This section describes how Dounreay undertakes a range of options studies as necessary to develop and implement its waste management strategy.

4.1 Methodology for Strategic Option Studies

- 94) Dounreay undertakes a variety of strategic option studies as necessary to develop and implement the waste management strategy. These may comprise BPEO studies used for the management of wastes, strategic option studies used for decommissioning projects and the use of best practicable means (BPM) methodology to minimise the production of waste when implementing a preferred option.
- 95) Sometimes rather than formal BPEO studies, there is a requirement for technical options workshops, which is essentially the next level down. These meetings are conducted using BPEO type methodology to determine the best technical solution.

4.1.1 BPEO Studies

- 96) The Best Practicable Environmental Option (BPEO) is the option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long term as well as in the short term. This option is usually identified using a systematic and consultative decision-making procedure in which options are assessed against various criteria including environmental impact, socio-economic impact, health and safety, technical viability and financial cost.
- 97) Dounreay has a procedure for performing BPEO studies (11) which involves the assessment of waste management options against a range of attributes and encourages the use of options assessment workshops.
- 98) One of the key stages of a BPEO Study is the information gathering stage. Information needs to be gathered to ensure that the Study identifies realistic options for each of the wastes. Information should cover current best practice, techniques which have been applied elsewhere, any new or novel techniques which might have been developed and any 'blue-skies' research issues that may be relevant. Information gathering is carried out early to avoid reassessing options where information already exists and remains valid.
- 99) The Dounreay guidance for BPEO Studies provides a list of assessment attributes which should be considered as a minimum. This ensures that, regardless of site and waste stream, all Studies undertaken deliver consistency in the consideration of relevant attributes. However each study is unique so this list is often modified to exclude attributes which are not relevant to the study and/or to include any extra attributes thought relevant to the particular study.

- 100) Where a study covers more than one waste stream, waste streams are grouped to which the same strategic options can be applied to all the wastes within each group. This promotes consistent management strategies for equivalent wastes. It is essential to the BPEO Study that the waste streams are well defined prior to commencing any options identification.
- 101) In carrying out a BPEO study, cognisance is taken of other such studies which are being carried out on the site in order to manage interrelationships between different wastes streams. The study also recognises opportunities for cooperation with other sites and organisations. For example, there may also be interfaces with other sites where strategy options involve utilising waste management facilities on another site.
- 102) Three types of BPEO studies have been typically carried out: Site-wide studies, facility specific studies and waste stream specific studies. BPM studies are generally carried out for individual facilities or waste streams. This LTP has no BPEOs currently identified for external consultation.
- 103) Dounreay, as part of its RSA authorisation, will be undertaking an "All Wastes BPEO" over the next 2 years. No decision has been made as yet on whether there will be external consultation on this BPEO as due process for a new Authorisation will result in consultation once submitted to SEPA.

4.1.2 Decommissioning Studies

- 104) At Dounreay strategic options studies for decommissioning are undertaken at a facility or project, rather than at a site programme level. The original Dounreay Site Restoration Strategy was underpinned by a suite of these strategic options studies, or Level 2 decommissioning studies as they were titled at that time.
- 105) A key part of these option studies is consideration of all plausible options, which may relate to differences in timing or technical approach. In selecting and justifying an option, relevant factors are taken into account. These may include the scope for further hazard reduction, radiation doses, availability of skills and experience and interaction with facilities such as waste management facilities, in addition to financial appraisal. These studies generally carry the constraints set down in the IWS, with the key ones being the currently available Site Waste strategies and routes.
- 106) These studies provide an estimate of the project timescales, resources, costs and volumes of waste arising for the preferred decommissioning strategy. These studies will in future provide underpinning data for Building Waste Plans and highlight any gaps or requirements to amend the Site strategies.

4.2 Site Prioritisation Logic

- 107) Projects are prioritised using the principles of the Dounreay Project Prioritisation Procedure (12) which meets NDA guidelines. These were applied to site decommissioning work. Minimum operating level activities were not considered since such work has to be carried out as part of the essential work needed to keep the site in a safe condition and to meet regulatory requirements.
- 108) The projects are ranked by the Project Benefit Measure which scores their contribution to:
- Rate of reduction in Radiological and Chemical Hazard Potential
 - Safety Factors
 - Environmental Factors

- Value for Money

109) The top 10 projects that have already or are planned in LTP to be started in the next 5 years are:

RANK	PROJECT	Score
1	Removal of Bulk NaK (80% of Bulk)	184
2	NaK removal – stored items	159
3	Processing of MTR Raffinate	152
4	Processing of PFR Raffinate	140
5	Decommissioning & Demolition of MTR Reprocessing Plant	140
6	Sodium residues removal – PFR stored items	134
7	Processing DFR breeder – Out of reactor	133
8	Sodium residues removal – PFR reactor	122
9	LLW pits cover buildings – decommissioning & demolition	120
10	Sodium residues removal – PFR Irradiated Fuel Caves	117

Table 1: Top 10 Projects based on Project Benefit Measure

110) This list is used to inform the development of the schedule but other factors, know as modifiers, are also taken into account. Modifiers can be applied to allow for the measure of concern about a facility (the Safety and Environmental Detriment) and unquantifiable factors such as socioeconomic aspects. The Safety and Environmental Detriment (SED) is calculated from:

- The potential for the facilities inventory to cause safety and environmental damage
- The ongoing environmental damage caused by the care and maintenance of the facility.

111) The top 10 scoring facilities are:

Descriptions	SED Score
Ion Exchange Plant – DFR	3.28E+24
Shaft	5.75E+19
PFR Turbine Hall (bulk sodium)	5.76E+18
ILW Liquor Store	1.38E+17
Castle Gate Seep	1.25E+16
Nuclear Material Store	9.19E+15
DFR Sphere	2.80E+15
Silo	4.57E+14
Marshall Laboratory	2.42E+14
PFR Buffer Store	5.56E+12

Table 2: Top 10 SED Scoring Facilities

112) The metrics described above cannot be produced until close to the submission of the LTP so they are used to inform the development of the following year's schedule, i.e. the LTP08 figures will be used in the subsequent development of the next schedule.

4.3 Waste Management Constraints and Dependencies

113) The external policy drivers and constraints that affect the radioactive waste management and which have influenced the development of the integrated waste strategy are considered in this section.

4.3.1 Regulatory Constraints and Dependencies

114) The external policy and regulatory framework is complex with regulations/legislation covering radioactive waste, liabilities management, nuclear facility decommissioning, radioactive discharges, general waste strategies, sustainable development, health and safety, and security being of relevance. The Regulatory principles and related drivers and constraints which affect Dounreay's waste management strategy are given in Annex 1 under:

- Legislative Framework
- RSA Authorisations
- Site License Conditions
- EURATOM Treaty Requirements
- Requirements of the Office of Civil Nuclear Security (OCNS)
- OSPAR Convention

4.3.2 Financial Constraints and Dependencies

115) Although acceleration of Dounreay's baseline is an objective, current planning activities lead to an Integrated Programme which is reasonable, achievable, defensible and agreeable to Stakeholders within the Annual Site Funding Limit (ASFL).

116) Whilst the funding levels may fluctuate as mentioned earlier, the underpinning waste strategies will still remain applicable although implementation times have the potential to change. Again, Dounreay will use the prioritisation process to assist in assessing any financial impacts.

117) One key area is the provision of capital funding required for the design, construction and commissioning of the main ILW treatment facilities namely, the RHILW Immobilisation & Encapsulation Plant and stores along with the Shaft & Silo Waste Treatment Plant. Dounreay will continue to work with the NDA to ascertain if alternative funding routes can be identified to assist in the construction of these facilities.

118) Dounreay also receives a small amount of income associated with the storage of cemented product from historical reprocessing contracts, the storage of fuels and the management of solid and liquid low level wastes from the MoD facility at Vulcan.

4.3.3 Timing Constraints and Dependencies

119) The high level strategies for each major waste stream are now fully integrated in the logic of the Dounreay Lifetime Plan (LTP) schedule and therefore the waste strategy drives the programme. This ensures that any changes to the timing of projects will also highlight any impact on waste facilities or strategies.

120) During the development of IWS, due consideration has been given to what waste is scheduled to be produced and when on the Dounreay site. This has assisted in determining the required timing and availability of waste treatment and storage facilities/routes to deliver the integrated waste strategy.

121) The LTP schedule recognises that there are timing constraints associated with minimum times for design and construction of new facilities, standard regulatory periods or technical issues such as the availability of sample or inventory information to allow the development of encapsulation formulations and to then specify plant requirements.

122) Although the Site Interim End Point is shown as a specific date in each LTP, it is a target derived from planning estimates and therefore subject to change dependant on other programme constraints, funding etc. It should not be viewed as a deadline.

4.3.4 Technical Constraints and Dependencies

123) Decommissioning at Dounreay will require a considerable amount of technical knowledge and development to facilitate both the decommissioning and waste treatment and packaging operations.

124) Dounreay now sends its own SLC representatives to participate in NDA initiatives as well as technical and stakeholder forums. This is viewed as a significant benefit and offers the opportunity to share knowledge with other SLCs and perhaps influence work packages and save the NDA money by doing so.

125) The TBuRD for Dounreay details, at the project level, the main R&D requirements but the collective themes are listed below.

- Waste retrieval and size reduction systems
- Robotics and remote handling/cutting technology
- Fuel extraction, conditioning and repackaging
- Waste encapsulation (cementation/grouting)
- Waste characterisation
- Particles monitoring/retrieval and contaminated ground
- Alkali metal removal
- Tank washout and chemical decontamination
- Radioactivity abatement by ion exchange
- Mercury decontamination
- Gas and liquid filtration and monitoring
- Waste containment/packaging

126) One key area of technical development where Dounreay is not leading but still participating is the encapsulation of metallic uranium materials. Work is being undertaken by both BNG and Windscale on this subject and Dounreay has commented on the specifications for the work and also reviewed documentation. This will assist in Dounreay leading to making an informed decision on its management of the material.

4.3.5 Transport Constraints and Dependencies

127) There are no plans to transport radioactive waste from the Dounreay site until conditioned ILW is transported to a national repository.

128) Clean or exempt waste is collected for recycling, re-use or disposal mainly by approved contractors. They then transport the materials to other locations in Scotland and the UK. Whilst transport of materials over long distances may not seem BPM it is sometimes the only location the material can be taken to. Overall, this is managed to be efficient and least disturbance to the local community.

129) On-site waste transport is a key function within Waste Services Unit at Dounreay. WSU is tasked with ensuring that the correct transport provision is available for the movement of wastes on the Dounreay site. WSU also collect LLW HHISO containers from the manufacturer often tying in the collection with the transfer of other materials to other UK locations.

- 130) It is recognised that better project waste estimates leads to better integration in waste transportation. Therefore the introduction of project specific waste plans has improved near term planning of waste collections on-site.
- 131) A significant component in the delivery of the LTP is the management of ILW. However, to move ILW between facilities involves flask and transporter movements on the Dounreay site right up until the interim end point.
- 132) Currently the LTP has not adequately reviewed flask provision as a “potential bottleneck” in the programme. Provision has been made for additional flasks to cover this gap but this will be subject of future studies in 2008/09.
- 133) However work on the ILW strategy during 2007 identified a strategy to reduce the risk from the flasking of unconditioned ILW around the Dounreay Site. Existing ILW flasks will be used to transfer waste from an older store to a new store in the period 2008-10. This will reduce the reliance on some older flasks beyond that date.
- 134) When these unconditioned wastes then require to be moved for treatment, Dounreay has made provision for 3 Waste Product Encapsulation Plant (WPEP), 4 drum flasks, to move multiple drums around the site in this LTP. Work is also identified in the LTP to assess site infrastructure for the movement of these flasks on site roads.
- 135) These WPEP flasks will also double up to allow the transfer of conditioned 500 litre drums and 3m³ boxes around the site to the RHILW IEP drum and box stores.
- 136) Within the Final End State (Phase 3), the assumption is that NDA, or the repository operator, will provide transport flasks to take waste to a national repository. Dounreay will load these flasks on site and then transfer them to a nearby railhead.
- 137) There are 2 constraints associated with this transfer:
- the suitability of the public roads;
 - Clarification of transport regulations regarding indivisible loads. This topic has been the subject of a recent Department of Transport seminar.

4.3.6 Key Site Specific Constraints and Dependencies

- 138) The key dependencies are covered in the sections above. The constraints on the overall management and prioritisation of the Dounreay LTP will have the biggest impact on the waste management tasks undertaken on the site. Waste management strategy is fully integrated in the current schedule and processes will be undertaken to ensure that any changes in LTP are fully assessed.
- 139) A waste strategy is only as good as the data on which it is based. A number of the underpinning studies are now several years old, but still relevant. The introduction of Building Waste Plans will allow updated volume and characterisation information to be made available, waste routes and gaps to be identified and lead to further iterations of the IWS in due course.

4.4 Site End Points and Contaminated Land

4.4.1 Site End Points

- 140) In 2006/07, a public stakeholder consultation was undertaken with the aim of recommending to the NDA, the preferred end state for the Dounreay site. The results of

this consultation are described in the publicly available document “Defining the Dounreay Site End State – Results of Consultation”.

- 141) The recommended end state has been incorporated into Dounreay’s Lifetime Plan 2008 and will be published in the next draft NDA strategy for consultation. The details of the end state for Dounreay are outlined below and are also described in draft document 14312/TR/0041 “Summary of End States Descriptions in Support of the NDA End States Strategy”, produced by AMEC on behalf of the NDA (13).
- 142) The decommissioning and restoration programme, Lifetime Plan for the Dounreay site is split into 4 key phases:
- 1st Phase – Decommissioning – Present day to 2025 (Interim End Point)
 - 2nd Phase – Interim Storage – 2025 to 2050
 - 3rd Phase – Off-Site Transfer and Final Demolition – 2050- 2078
 - 4th Phase – Care, Surveillance and Site Closure – 2078-2294 (Final End Point)

Phases 2 to 4 are currently referred to as the Final End State.

- 143) By the IEP, at the end of the 1st Phase.

- Decommissioning of all redundant facilities will have been completed
- All waste streams will have been appropriately treated, conditioned and disposed of.
- ILW will have been conditioned and packaged and will remain stored on-site within 3 stores, awaiting the availability of the national repository.
- Nuclear material will have been packaged and will remain stored on-site within 2 stores, awaiting the availability of an off-site route.
- The LLW disposal facility will be partially closed off;
- The DFR sphere will remain as a historical monument
- Redundant infrastructure will have been removed or isolated
- Infrastructure associated with the remaining stores, including security infrastructure and the Police Command and Control Building (PCCB), will remain in place;
- Some areas of site (approx 24%) will have been remediated to a level which permits those areas to be delicensed.



Figure 11: Dounreay at Interim End Point 2025

- 144) During the 2nd phase, the site, remaining stores and packages will be monitored and maintained, awaiting the availability of the off-site transfer routes, which are scheduled to be from 2050 onwards.
- 145) During the 3rd phase, the conditioned ILW and nuclear material packages will be transported off-site. The current assumption is that an ILW repository will be available to receive Dounreay's waste from 2050, with all ILW removed from the Site by 2057. The nuclear material is scheduled to be transported from the Site between 2075 and 2076. As each building is emptied, it will be demolished along with associated infrastructure. The final activity of this phase will be to demolish the PCCB, once the nuclear material has been completely removed, and undertake any final remediation tasks, with potential delicensing of further areas.
- 146) From 2078 onwards (the 4th phase) the site will be under care and surveillance until 2294, when the remainder of the site will be delicensed.



Figure 12: Dounreay at Final End Point

- 147) During phases 2-4, it is anticipated that residual radioactivity and chemical contamination on the areas of site which remain licensed will be covered by a Post Closure Safety Case, which will demonstrate the long-term safety of the site in its end state. In the period up to the IEP, an Integrated Performance Assessment tool, will be used to aid decision making for remediation activities and will act as a source of much of the information required for the Safety Case.
- 148) Dounreay will seek authorisations to support its Final End Point strategy at appropriate times in the Lifetime plan, following regulatory consultation.

4.4.2 Contaminated Land

- 149) Dounreay has produced a strategy for contaminated land management and remediation (14) that has been submitted to NII, SEPA and Highland Council. The Dounreay site also has a Contaminated Land Safety Case (15) in place which details the known contamination hazards and assesses them against industry standard safety case assessment criteria. This safety case will be reviewed in the next financial year. The safety case refers to a supporting assessment of radiological risks from contaminated land in its current state. Current understanding of contaminated land is documented in a Land Characteristics Report (16) and Contaminated Land Annual Reports (17), updated as appropriate.

- 150) In terms of contaminated land management through to the interim end point, Dounreay is characterising land around facilities and under facilities when this becomes possible as decommissioning progresses. Characterisation comprises measurement of possible contamination and assessment of associated risks to human health and the environment. Where it is not possible to demonstrate that the risk-based end-state criteria can be met by leaving contamination *in situ*, remedial work will be undertaken.
- 151) The intention is to produce the least waste possible whilst still demonstrating compliance with the “no danger” criterion for radioactively contaminated land and no “significant possibility of significant harm” in respect of non-radioactive contamination. Dounreay will continue to monitor its areas of contaminated land and characterise areas in support of projects as and when necessary. The scope and schedule of work to achieve this is contained in the current lifetime plan and is revised annually. An inventory of estimated lifecycle waste arisings is maintained in DRWI and updated annually. This inventory includes radioactive and chemical contamination.
- 152) The land and associated groundwater on the Dounreay site have been surveyed over a number of years in order to determine the extent and concentration of contaminated land and groundwater. Results of these surveys are documented and processed using a Geographical Information System (GIS) based records management system developed to enable the systematic collection, interpretation and assessment of associated data. The system is known as IMAGES - Information Management and Geographical Evaluation System.
- 153) There are plans to delicense 24% of the current Dounreay Site.
- 154) It has been assumed that a cap will be placed over parts of the Site that require it to make the safety case. This might be up to 2m thick and be composed of clean and exempt material from decommissioning and construction works. The volume may need to be supplemented with some new rubble and soil, as there may not be sufficient material available from the decommissioning operations. The hope is that material used for this and any other backfilling operations will be material which has been retained in the Onsite clean/exempt storage compound for recycle/reuse, subject to regulatory consent.
- 155) The main uncertainty over the site end state is whether it can be fully implemented through the current regulatory regime. The Dounreay Integrated Waste Strategy is consistent with the end state but there may be events beyond Dounreay’s control which make it impossible to achieve this e.g. the transfer of ILW to national repository. Should the end state evolve leading to a different end state then the impact on the IWS will be re-assessed.

4.4.3 Groundwater

- 156) Dounreay has a series of boreholes across its site to allow both an understanding of groundwater flows and also to monitor the possible presence of radioactive and chemical contamination in groundwater. Monitoring results are reported annually.
- 157) Groundwater contamination is known to be present on the site and characterisation is ongoing through both monitoring of seepages but also of borehole water. Once information is available assessment of the possible need for remedial action is undertaken.
- 158) At this time the highest priority, and regulatory requirement, is the management of seepage of radioactively contaminated water offsite at the Castle Gate Drain. These

liquors are collected and then taken to LLETP for discharge through the authorised disposal route.

- 159) A package of work to understand groundwater flows through the site has recently been started and the results will be available in the next financial year. The output of this work will be an action plan to address any issues which arise.

4.5 Assumptions, Exclusions and Risks

- 160) The Dounreay LTP is underpinned by assumptions and exclusions as well as identifying risks. Assumptions and exclusions are addressed in accordance with NDA requirements in PCP-09 for cost estimating and the management of risk is carried out in accordance with NDA requirements in PCP-10 for risk management.
- 161) These are normally covered in the Detailed Volumes (DVs) which are submitted as part of the main Lifetime Plan deliverables. All DV's generally include some reference to waste and this section only attempts to provide some **examples** of the types of assumptions, exclusions, risks and opportunities in the Dounreay LTP. Dounreay has an ongoing process of review to ensure that the assumptions and exclusions are relevant and underpinned.

Assumption Description	Basis for Assumption
Levels of contamination in and around floor slabs, utilities and structures will be commensurate with held historical data	Historical information held by the Contaminated Land Team and surveys held in the Buildings database
Reasonable information as to the type, condition and amount of asbestos present in facilities and utilities is known	Based on information from Type 2 surveys, periodic reports and information held in the Buildings database
A disposal route for LLW produced during investigation and remediation of contaminated land at Dounreay will exist	Preliminary work on provision of a disposal facility is underway
Estimates of current extent of potentially contaminated ground requiring investigation are correct	Working assumption pending completion of study in progress.
Conditioned ILW and spent fuel will eventually be transferred offsite	NDA Strategy
Sufficient progress is made in the remediation of the source of contamination to allow the castle gate drain seep to be decommissioned by 2020	Manhole 5 project currently in progress
No significant change in volume or activity of water pumped from Silo	Silo activity level have remained constant for >10 years
30 batches of primary NaK have been processed and there are no major issues arising that have programme or cost implications	Any issues or problems with the plant will have been discovered early in commissioning allowing time to resolve them. Plants have been subject to robust design and substantiation exercise
Bulk NaK removed from the Reactor Vessel to below bottom plate before starting removal of elements	Level of residual NaK cannot be confirmed until end of Bulk NaK disposal.
10% of the breeder elements and core fuel assembly are stuck	Number of stuck elements cannot be ascertained until removal operations commence.
There will be no requirement to construct a new active laundry	Use of disposable suits being reviewed.

Infrastructural upgrades to roads etc such that the flask/transporter can be moved will be carried out by Site Support Unit	Site Support Unit are responsible for the roads infrastructure
Miscellaneous waste streams (POCO washouts, solids decommissioning, etc) fall within the bounds (envelope) of the main RHILW-IEP waste stream Letters of Compliance	Identified waste streams are in RHILW-IEP Statement of requirements issue 5.
Security requirements/arrangements do not change facility categorisation such that the RHILW-IEP requires additional ring fenced arrangements	Based on current security and legislative requirements.
The volume of waste soil and spoil generated and needed for re-use will require a further storage area	Scoping studies not yet complete. Information to date suggests extra capacity required.
Up to 175,000m ³ of packaged Dounreay LLW will require managing.	This is the maximum volume estimated from the Dounreay BPEO study.

Table 3: Assumptions from LTP08 Detailed Volumes

EXCLUSIONS	
Any changes to the chosen end state arising from the Scottish Governments new policy on ILW Management and therefore the Dounreay end state	NDA has yet to publicise the impact of the policy changes upon Dounreay
Strategy for Vulcan	This is the responsibility of a different government department and not part of the Dounreay baseline
No costs for a Public Planning Inquiry have been included	The decision on an Inquiry lies with the Scottish Government and cannot be predicted.
The consideration of LLW from anywhere else other than Dounreay Site and the neighbouring Vulcan site	Original terms of reference for project and basis of technical work and stakeholder dialogue programme.
The import of waste and nuclear material liabilities, apart from those already identified within the scope which are Dounreay Liabilities (agreed with NDA and Regulators)	Dounreay has no plans to import wastes and nuclear materials that are not identified in the existing scope.
Production of Radioactive Waste Management Safety Cases for conditioned ILW	Excluded at present as the Guidance is immature. Dounreay will produce a trial document in 2008/09 before committing to full implementation.
The scope, schedule and cost for the long term management of contaminated land at Dounreay beyond 2078 are excluded from the Dounreay LTP	Derived from NDA instruction

Table 4: Exclusions from LTP08 Detailed Volumes

4.5.1 Risks

- 162) Risks are identified by means of a top down (strategic) review and bottom up (project) review to capture events which may impact positively or negatively on the outcome of objectives. Risks are reviewed on a monthly basis but no formal timescales are in place for addressing or closing out of risks.
- 163) All risks to the Dounreay programme, including those relating to waste, are captured on the site risk register which records a description of the risk, its probability, consequence, mitigating actions and magnitude in terms of time and cost.
- 164) The Dounreay Lifetime Plan Detailed Volume states that the key programme risks are primarily associated with the availability of waste transfer and disposal routes.
- 165) Some **examples** of top level risks to the Dounreay LTP08, together with the possible impact and mitigating actions, are summarised below.

Description of Risk	Possible Impact	Mitigation Plan
Contamination levels greater than anticipated during decommissioning	Project delay and increased cost	Sample and surveys prior to decommissioning
Re-routing of Labs ventilation requires a variation to the gaseous discharge authorisation following further regulatory review of the environmental documentation	Potential delay to the ventilation upgrade activities that could miss SEPA imposed timescales. Also potential delay to analytical support activities.	Early assessment against the RSA and regular discussion with the regulator.
Radioactive debris other than known loss of irradiated fuel arrives on beaches and has to be managed by Dounreay	Cost and resources to satisfy regulator requirements	None
Estimates of extent of contaminated ground requiring investigation/remediation may prove incorrect including unexpected finds of contamination	Possible increased (decreased) cost	Prioritise investigations
WTP Concept design – final package for solids and sludge – existing drum and internals – design is more difficult to agree with NDA RWMD than programmed	Additional costs and delay to concept design or scheme design due to redesigning container, redesigning plant around new container	1) Liaise with RHILW_IEP project 2) Some further development work 3) Further work to design paddle and pucks 4) Four further solids and sludge trials
Active commissioning of NDP/IXP is delayed by either an unanticipated major breakdown or by commissioning tests which reveal deficiencies in the plant design/construction.	Major plant failure or deficiency would require 6-8 months to recover from post active commissioning start. This would cause a delay to breeder element removal and the DFR critical path	Spares, procedures and training in place prior to inactive commissioning. Implementation of maintenance strategy to minimise possibility of outage. Comprehensive testing of system/process during inactive commissioning.

If higher than anticipated levels of contamination have been absorbed into the pond concrete, the existing strategy may prove incorrect. Calculations on contamination absorbed may not reflect actual levels	Delay to programme, increased costs and increased waste quantities	Additional trials required.
LLW Disposal Facility: Water assurance monitoring identifies facility failure	Extensive reworking of facility, perhaps the removal of waste. Inadequate design or construction	Facility and packages designed to minimise leachate.
LLW Disposal Facility: Public Inquiry called	Additional funding required when scope of Inquiry is known. Inquiry could be wide due to political/local government concerns. Cost could be up to £4m	Try to avoid Public Inquiry by discussion with Project Board and development of stakeholder dialogue strategy.
Excavation arisings may require waste licensing	600,000m ³ material may be classified as waste and have to pay landfill tax etc. Case not accepted by SEPA that it is stored material to be used in landscaping site at closure and therefore classify as waste.	Refining design to define quantities involved from storage options will be considered and discussed with stakeholders. Reuse maximised. There is a requirement for materials at site closure.
Particulate build up in MTR raffinate tanks and transfer pipework preventing further transfer of liquor for cementation	Unable to immobilise remainder of tank inventory	Monitoring of particulate build up during transfer to cementation facility. Feasibility study planned to look at alternative transfer methods.
The location of Dounreay and nature of uncertainty associated with the nuclear industry may inhibit the recruitment of the required levels of staff for decommissioning.	Decommissioning is delayed since the resources are not available	Additional contract staff may subsequently be brought in which would increase decommissioning costs.

Table 5: Risks from LTP08 Detailed Volumes

166) Dounreay continually strives to look at opportunities to either improve the site programme through management of technology, changes in assumptions etc. At this time, there are no off-site opportunities identified for waste management treatment.

4.6 Stakeholder Engagement

167) Dounreay is committed to open and honest two-way communication and active engagement with all its stakeholders as part of Dounreay's open and honest policy (18).

168) The strategy for stakeholder engagement is justified by the achievement of a good working relationship with many internal and external stakeholders. It is easier to make good progress developing and implementing waste strategy when stakeholders understand the objectives and constraints of the site.

169) Dounreay has many Stakeholders ranging from its customer (the NDA) through national regulatory bodies like the Scottish Environment Protection Agency (SEPA) to groups from the local community and individuals like MPs, MSPs and MEPs and members of the press and public. Dounreay also engages with relevant safety, security, transport and planning regulators. These groups and individuals have a variety of needs and interests and require information to be provided in different

formats and different levels. Dounreay therefore uses a range of communication activities to inform stakeholders of developments at Dounreay and to respond to enquiries from members of the press and public. Local stakeholder groups e.g. Dounreay Stakeholder Group (DSG) and its associated sub-committees are involved in decision making wherever practicable.

- 170) Stakeholder engagement activities are managed on behalf of the Dounreay Director by Dounreay's communications team, with support as required from project staff.
- 171) Dounreay's communication team is responsible for communicating all site activities including generic waste information and issues internally with staff and externally with the wider community. The team produces a fortnightly bulletin for stakeholders that covers all decommissioning activities, including waste-related developments on the site and provides regular updates on decommissioning progress. It also keeps stakeholders informed of any news and developments in the wider nuclear industry. Dounreay also attend the NDA Stakeholder meetings.
- 172) The communications team supports both formal and informal consultation with stakeholders. Formal consultation encourages participation in decision making (see next Section) whilst informal consultation takes the form of comments or suggestions received during site visits, meetings and briefings with site staff and the wider community.
- 173) Dounreay produces material such as information sheets about projects taking place at Dounreay on behalf of the NDA. Press and public relations is also essential part of stakeholder engagement and regular meetings, site visits and similar media-related activities are expected to continue indefinitely.
- 174) At the beginning of 2008, Dounreay has launched a new venture on behalf of the NDA, which is a website "Dounreay.Com" which is complemented by a new community office in Thurso of the same name. Latest publications are available along with details on Site activities including waste topics.

4.6.1 Stakeholder Engagement on IWS and Specific Waste Management Issues

- 175) There is no formal stakeholder engagement on the Integrated Waste Strategy planned for Dounreay. Dependant on the specific waste management issues which arise in the future, consultation will be achieved via the public participation process. This is planned within the overall site stakeholder communication strategy and ensures that stakeholder engagement is effective, targeted and proportionate; it is important that stakeholders are not flooded with information and requests for involvement and reaction to waste management issues.
- 176) When required, a newsletter is published to alert all registered stakeholders to the consultation and provides background information, list of options, the criteria with which the options will be assessed and the proposed timeline for consultation. Stakeholders are invited to attend the BPEO workshops, ensuring that they have the opportunity to participate in the BPEO during, rather than after the study and that the study report subsequently reflects their input in the identification of options and the attributes and weightings against which the options are assessed.
- 177) Involvement in these Studies ensures that stakeholders are given the opportunity to question and challenge the site's prioritisation logic in regards to waste matters. Attendees can include employees on the site, members of the Site Stakeholder Group and representatives from the Nuclear Decommissioning Authority and Non-Governmental Organisations.

- 178) Following the BPEO workshops, a summary document is produced which records the issue, the panel discussions and invites further comment from a wider distribution. From the date of issue there is a further 12-week period to allow interested parties to respond either to the questions posted in the summary paper or fuller if so required.
- 179) Once the 12-week period of consultation comes to a close, the responses are reviewed with a view to addressing them in the BPEO document. The BPEO will be revised if appropriate and put through Dounreay's due process before a Recommendation paper on Dounreay's preferred way forward is published and issued to the registered stakeholder distribution.
- 180) To date, Dounreay has consulted with the public on the following:
- How to Deal with the Management of PFR Raffinate;
 - The End State for Decommissioning the Dounreay Waste Shaft;
 - Developing the Long Term Strategy for Managing Dounreay's Solid Low Level Radioactive Waste
 - Dealing with Radioactive Solvents and Oils stored at Dounreay
 - Determining a strategy for managing radioactive Particles in the environment.
 - Defining the Dounreay Site End State
- 181) There are no further external BPEO consultation exercises identified in LTP08. There is work identified to produce an "All Wastes BPEO" but no stakeholder communication strategy is in place as yet.

4.6.2 Linking of Site Engagement Plans with External Engagement on Waste Issues

- 182) The strategy for stakeholder engagement relating to waste at Dounreay takes account of external stakeholder engagement, such as the government output relating to waste from the CoRWM consultation and the recent LLW Policy consultation. Stakeholder engagement plans relating to waste transfers to or from another site are managed in discussion with the recipient or donor.

5 IWS OVERVIEW

- 183) Dounreay has developed a decommissioning strategy to enable it to reach an Interim End Point by **2025**. This is the point at which:
- Conditioned ILW will be stored on-site awaiting the availability of a national strategy for its long-term management.
 - Nuclear materials will be in storage on-site awaiting a decision on its long term disposition.
 - The LLW facility disposal facility phase 3 will wait capping.
 - Radioactive liquid discharges will have ceased.
 - There will be ongoing radioactive gaseous discharges.
- 184) The Dounreay Integrated Waste Strategy is made up of a number of individual strategies and also supported by BPM and decommissioning studies.

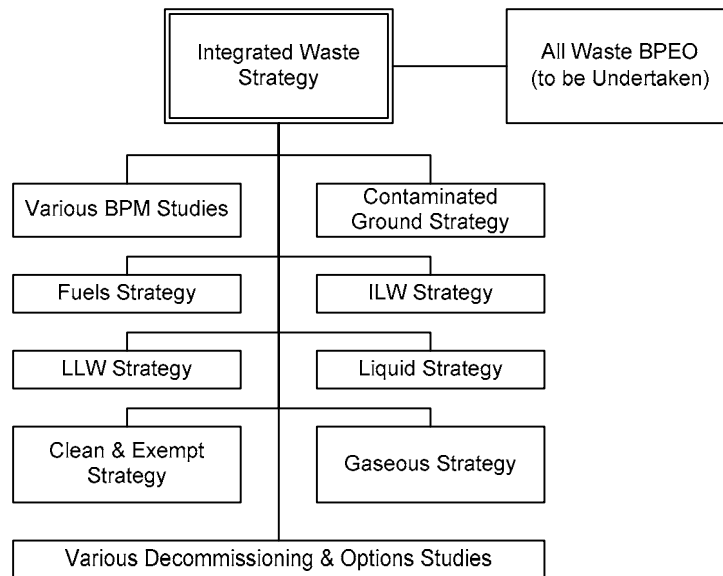


Figure 13: IWS Support Documents

185) In order to assist in the communication of the waste strategies to the Dounreay site and stakeholders, a number of high level strategy wiring diagrams have been prepared. These cover the waste category and define the facilities they pass through for treatment, conditioning or packaging and then disposal. These cover the following waste categories, with the wiring diagrams included in Annex 4.

- Solid RHILW
- Solid & Liquid CHILW
- ILW Liquors & Sludge
- LLW (including HVLA)
- Low Level Liquid Effluent
- Exempt – Inert
- Exempt – Non-Hazardous
- Exempt – Hazardous
- Clean – Inert
- Clean – Non-hazardous
- Clean - Hazardous

186) These wiring diagrams set out the waste category and the current reference strategies to permit storage and disposal of both radioactive and non-radioactive wastes. These are all explained in more detail in the following sections.

187) Table 6 summarises the raw solid radioactive waste volumes currently anticipated to arise over the lifetime of the Dounreay site. A comparison with the figures contained in last years LTP is provided.

Waste Type	LTP 2007 (m ³)	LTP 2008 (m ³)
HLW	0	0
RHILW	8,835	2,735
CHILW	392	429
LLW	70,744	48,790
HVLA	18,283	18,280
HVLA (left in-situ)	30,009	30,056

Table 6: Summary of Future Raw Radioactive Waste Arisings

- 188) Dounreay also maintains estimates for its non-radioactive, exempt and clean, raw solid wastes predicted to arise over the Lifetime plan.

Waste Category	LTP 2007 (m ³)	LTP 2008 (m ³)
EW Inert	165,138	64,515
EW Non-Hazardous	44,830	60,687
EW Hazardous	368	308
EW (in situ)	168,261	167,443
Clean Inert	156,968	118,394
Clean Non-Hazardous	26,689	23,833
Clean Hazardous	211	271

**Table 7:
Future Raw Waste Arisings for Non-radioactive
And RSA93 Exempt Wastes and Contaminated Soil**

- 189) The main changes in volume in Tables 6 and 7 are directly related to a review of the waste arisings associated with PFR decommissioning (19). These were originally quoted as “envelope” volumes of a facility or tanks etc rather than the actual waste volume.
- 190) The key and major waste management milestones identified for the LTP08 were presented in Section 2 and have not been repeated here. Those milestones along with **proposed** new NII Milestones are included in Annex 2.

6 INTEGRATED WASTE STRATEGY (IWS)

- 191) This section summarises the strategy for specific groups of waste and their inter-relationships where appropriate. The inventory of existing and future expected/or estimated solid decommissioning waste arising for the Dounreay site is listed in Annex 5.
- 192) The overall strategy for radioactive wastes is treatment as necessary to allow removal from the site. This will largely be achieved by disposal via authorised disposal routes or conversion to a passively safe state for long term storage on-site prior to disposal to the national repository. Based on NDA guidance that a national repository will not be available until 2040 at the earliest, Dounreay has made provision for the interim storage of conditioned ILW on the Site until that time. Additionally, working with the NDA and NDA RWMD, Dounreay has participated in a repository scheduling workshop and therefore waste will start to be consigned from Dounreay to a national facility from 2050.
- 193) The Clearance and Exemption Code of Practice (20) has been produced with technical support from Dounreay to identify and facilitate good practice within the nuclear industry regarding the clearance and sentencing of articles, substances and wastes which may or may not require disposal as radioactive waste under the Radioactive Substances Act 1993. The Code of Practice has been developed and agreed by representatives from the nuclear industry and the Dounreay site has established and maintains arrangements to comply with the code.
- 194) Issues identified as a result of stakeholder engagement which have an effect on waste strategy include:
- The health and safety of workers and public and protection of the environment are top priorities

- The impact of transport, particularly of radioactive waste, concerns local residents
- Discharges from processes
- Location of new facilities
- Importation of waste from other areas or sites.

195) The Dounreay IWS is taking account of the waste management policy, principles and constraints discussed in Sections 3 and 4 by:

- Undertaking waste minimisation initiatives;
- Sampling and characterising wastes in order to improve understanding, assist in the development of strategies and reduce uncertainty;
- Undertaking BPEO/BPM studies to determine optimum waste management strategies where appropriate;
- Decommissioning and removing buildings and facilities as early as is practicable, commensurate with any hazard and so as to minimise “hotel” costs;
- Packing and conditioning ILW wastes into drums and boxes to make passively safe;
- Obtaining NDA RWMD Letters of Compliance to ensure that conditioned ILW packages meet the requirements for final disposal;
- Storage of ILW and LLW under controlled conditions until a disposal route becomes available;
- Segregating, size-reducing and compacting LLW waste to minimise volumes sent for interim storage and subsequent disposal;
- Transferring filtered radioactive liquid effluents to the LLETP (Low Level Liquid Effluent Treatment Plant) where they are treated prior to discharge;
- Discharging gaseous wastes through HEPA filters in order to reduce discharges to the environment.

196) Dounreay recognises the NDA guidance to try and sub categorise its waste streams into a number of categories e.g.:

- Metals
- Graphite
- Organics
- Sludge, Floc etc

197) Where possible these have been addressed in the detailed descriptions in the following sections. However, the inventory data for a number of historical waste streams do not allow such a breakdown to be derived.

198) For future iterations of the IWS, Dounreay are to consider providing additional coding within DRWI to allow analysis by such sub-categories to be undertaken although it may not directly impact on the management of the waste streams.

6.1 Radioactive Wastes

6.1.1 Radioactive Waste – Inventory & Categories

199) Dounreay currently operates the “Dounreay Radioactive Waste Inventory (DRWI)” which provides a formal record of the quantities of radioactive and non-radioactive wastes held on the Dounreay Site, together with best estimates of the future waste arisings. This is linked into the LTP P3e site programme via activity coding and routinely updated. It doesn’t however contain information on Low Level Liquid Effluent, non-active liquors nor gaseous wastes.



Figure 14: DRWI Screenshot

200) Currently, DRWI contains the following detailed information:

- A description of the waste (including the state of the waste and storage conditions)
- Activity of the waste
- Waste quantities, including a statement of confidence in these values
- Waste characteristics (e.g. hazardous properties) including a comment on confidence in this data
- When it will arise or whether it is a legacy waste
- When and where it will be processed (including major new facilities and their planned operational dates)
- How the waste will be transported on site
- When and where it will be stored
- When and where it will be transferred off-site.

201) A summary of the main radioactive wastes expected to be generated from the Dounreay facilities, operational and decommissioning, is given in the Table 1 in Section 5. The data in the tables is based on current waste stream information in DRWI [DRWI Dataset 2008 (21)]. Dounreay recognise that the quality of the volume data and some of the radionuclide and physical/chemical data, is variable and studies are continuing to refine and improve the information.

202) Detailed information on the waste is included in Annex 5. This includes:

- Waste stream number (id)
- Waste stream description
- Waste Category (RHILW etc)
- Stock Date
- Raw Stocks (m³)
- Raw Stock Activity (TBq)

- Future Arisings (m³)
- Future Arisings Activity (TBq)
- Conditioning Plant
- Conditioning Container
- Total Conditioned Packages
- Total Conditioned Packages Activity (m³)

6.1.2 Strategy Definition & Status

- 203) The following sections give details of the radioactive waste generated on the Dounreay site. The titles also include the status of the strategy. The status can be "**Operational**", "**Approved**", and "**Reference**" or "**Draft**" and these terms are defined below.
- 204) It should be noted that the Dounreay Site Waste BPEO or specific facility or waste BPM studies will underpin some of the strategies and a direct correlation to the strategy status is possible. The Dounreay site radioactive waste BPEO has not undergone external consultation.

Operational

The strategy is being implemented. Waste is being transformed to a form suitable for long-term storage awaiting disposal or for disposal itself. For ILW, it will have a final LoC.

Approved

An "Approved" strategy is one that has been approved by the Dounreay management or by subordinate bodies to whom the authority to approve has been delegated in accordance with company procedure. For ILW, an approved strategy is one that has also gained an Interim LoC.

Reference

A "Reference" strategy is one which is selected as the preferred (or best) strategy at the time but it is not necessarily the one that will be approved. It is the strategy against which other strategies can be compared. For ILW, a reference strategy is one that is working towards gaining an Interim LoC. It may or may not have a Conceptual LoC.

Draft

A "Draft" strategy is one that is being considered and developed as part of the optioneering process. For ILW, a draft strategy is unlikely to have a LoC although some interaction may have taken place with NDA RWMD to help define technical options.

- 205) In addition, a further strategy status of "Fallback" is used to describe the management arrangements should the Reference, Approved or Operational strategy fail. The definition of a "Fallback" strategy is:

Fallback

A "Fallback" strategy is one that is selected as a back up to the preferred (or best) strategy at the time. It is the strategy that would become the preferred management route should the Reference, Approved or Operational strategy fail.

6.1.3 High Level Waste (HLW)

- 206) There is no High Level Waste (HLW) on the Dounreay site.

6.1.4 Intermediate Level Waste

- 207) Dounreay follows the national definition of ILW. Additionally, it splits this category by physical type into Solid, Liquid and Sludge. The Solids category is further broken down into Remote Handleable, where individual packages for consignment have a dose rate exceeding 7.5mSv/hr beta/gamma and Contact Handleable which is below this 7.5mSv/hr figure.
- 208) The high level objective for ILW management on the Dounreay site is treatment of the wastes into a conditioned, passively safe form using a cement matrix. This is assisted through the use of the Letter of Compliance process. This then allows long term conditioned waste storage on site pending the availability of a deep geological disposal facility. All ILW will be in a passively conditioned state by the Interim End Point of 2025.
- 209) At the Site Level, there are a number of wiring diagrams that help describe the overarching strategy for the management of ILW. Those are included in Annex 4 and cover:
- Solid RHILW
 - CHILW
 - ILW Liquors & Sludge
- 210) As stated earlier, these state the current strategy and set down where wastes will be placed in unconditioned storage, conditioned and packaged and then finally undergo conditioned waste storage ahead of disposal.
- 211) During 2007/08, Dounreay staff undertook a review of the robustness of the ILW strategy. Based on a detailed flowchart, provided in Annex 6, this review presented a number of key findings:
- ILW strategy is robust but needs some improvements;
 - RHILW Immobilisation and Encapsulation facility is still required but the waste streams and associated volumes have been better defined resulting in a shorter operational period (10 years);
 - Waste Treatment Plant for packaging shaft & silo wastes should also treat and package CHILW and THTR Graphite, thus optimising its capabilities;
 - The Site will standardise on 500 litre drums, fixed design, and 3m³ boxes for most RHILW and CHILW.
 - 4m box use will be restricted to the packaging of DFR Graphite, LSA Scale and DMTR unless the LoC process identified alternative packages.
 - No conditioned waste store at Waste Treatment Plant, all drums from WTP will be flaked to RHILW IEP drum store.
 - RHILW IEP will also have a 3m³ box store
 - PFR, DFR and ILW Liquor Storage Facility all to have local waste packaging plants that will grout their waste. This offers the opportunity to standardise designs.
 - DMTR to have its own small waste packaging plant.
 - Waste characterisation initiatives must continue to refine estimates and identify any orphan wastes.
- 212) The status of the strategies for ILW is further amplified by describing how far Dounreay has reached in obtaining approval from NDA RWMD for the proposed packaging route against the requirements for safe disposal against the phased disposal concept. The definitions of the stages of 'Letter of Compliance' (LoC) are given first below.

- **Conceptual LoC:** presents the known information regarding the waste, the proposed conditioning method and process, and the expected average and maximum package properties. This stage should take place before any resources are committed to a waste management strategy. Although a conceptual LoC may be received, their will be Action Points, requirements, identified to be completed at the Interim or Final stage submission.
- **Interim LoC:** presents further information on the waste (and may include the results of mathematical modelling to determine radionuclide inventory), method of conditioning (e.g. grout formulation envelope), results of wastefrom trials, and describes the facility and conditioning process in detail. This stage typically occurs when design(s) and processes for the treatment/conditioning facility have been finalised but no capital has yet been committed. Action points from the Conceptual stage will have been addressed, generally leaving only QA related activities.
- **Final LoC:** presents information on commissioning of the waste packaging plant along with documentation to demonstrate that Action points from the Interim stage submission have been closed out.

213) Dounreay makes use of the Letter of Compliance process to assist in the definition and underpinning of strategies and plant designs. The current list of LoC's achieved by Dounreay are listed in the Table 3 below:

Dounreay Letter of Comfort/Compliance As at 01/02/08

Waste Stream	Stage	Date
MTR Liquors in Dounreay Cementation Plant	Conceptual	11/06/90
500 Litre "Liquor" drum for DCP	Drum Only	04/01/91
Cemented DFR Raffinate	Conceptual	22/06/92
Tank 1 MTR Raffinate Liquors in DCP	Final	25/11/93
Dounreay Supercompacted PCM	Conceptual	01/12/94
MTR Raffinate Tanks 1,3 & 7	Final	23/08/96
TRIGA (Never Implemented)	Conceptual	30/05/97
Dounreay Shaft	Conceptual	23/09/97
Dounreay Silo	Conceptual	16/02/98
DFR Raffinate	Conceptual	19/04/99
Dounreay PFR Boron Carbide Absorber Pins	Conceptual	14/01/00
Dounreay Solid RHILW	Conceptual	06/06/01
PFR Ion Exchange column Waste	Conceptual	14/06/01
DFR Pond Ion Exchange Columns	Conceptual	21/03/03
MTR Raffinate High Solids	Final	14/05/03
Dounreay Thorium Nitrate	Conceptual	22/05/03
DFR NDP IX Columns	Conceptual	23/12/03
MTR Raffinate Overarching	Final	14/05/04
PFR Pond Ion Exchange Columns	Conceptual	26/11/04
PFR Raffinate	Conceptual	18/08/05
PFR ETP IX Columns	Conceptual	03/03/06
DFR Breeder Fuel Removal Wastes	Conceptual	31/03/06
PFR Raffinate	Interim	14/08/06
ADU Floc	Conceptual	05/02/07

Cemented Irradiated Dissolver Liquor (D2670)	Conceptual	06/02/07
D3900 RHILW	Interim	05/04/07
PFR Decommissioning ILW	Conceptual	28/09/07
PFR Mixer Breeder Sections	Conceptual	08/01/08

No Letter of Compliance (at Present)		
DFR Breeder Waste (Out of Reactor)		
Irradiated Thorium Fuel Pins		

Table 8: Letter of Compliance Status

214) The following sections provide further detailed information on both the key facilities required for the future treatment and management of ILW wastes at Dounreay along with waste stream data.

6.1.5 Intermediate Level Waste – Dounreay Cementation Plant

215) There is currently only one ILW immobilisation plant on the Dounreay site. That facility is the Dounreay Cementation Plant. It receives MTR raffinate liquor from the adjacent ILW liquor storage facility, immobilises the waste in a 500 litre drum before transferring the drums into the adjacent Interim Drum Store.

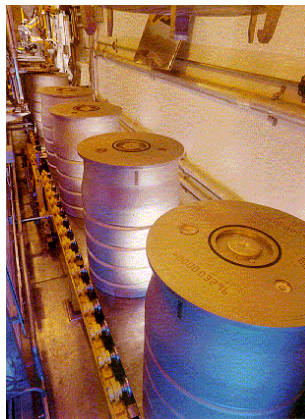


Figure 15: Cemented MTR raffinate in DCP

216) The DCP has not cemented any MTR raffinate for approximately 2 years following an incident in the plant. Recovery operations are nearing completion and the facility is currently scheduled to restart routine immobilisation operations in spring 2008.

6.1.5.1 MTR Raffinate (Operational)

217) Dounreay reprocessed irradiated materials test reactor fuel. The liquid waste is an anion-deficient aluminium nitrate solution containing fission products and some actinides. The liquor is currently stored in 12 tanks in the ILW Liquor storage Facility.

218) There are no future arisings of MTR Raffinate. The DCP started immobilising MTR raffinate in 1996 and processed 1879 drums until it shutdown in 2005 following an incident.

219) Cementation operations are expected to resume in 2008 with the remaining liquors being immobilised by the end of 2013. It is estimated that a total of 4400 drums of cemented MTR raffinate will be produced. Figure 16 shows the proposed throughput of MTR raffinate to be immobilised.

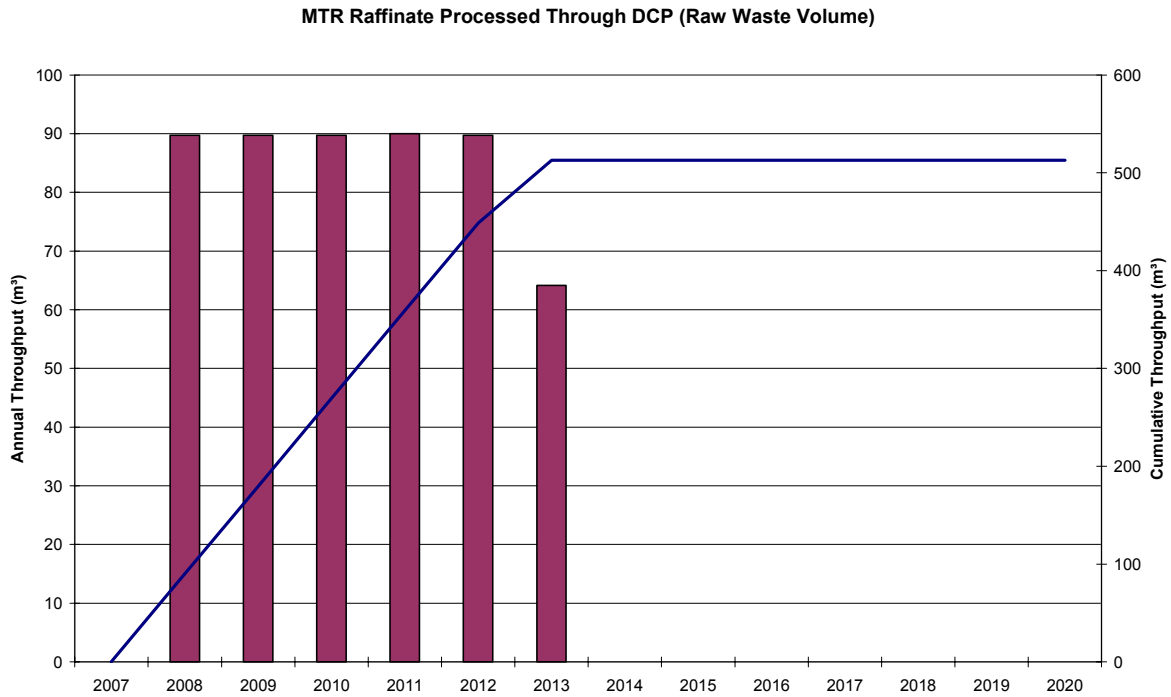


Figure 16: MTR Raffinate (raw waste Volume) processed through DCP

220) A Final LoC has been received from NDA RWMD endorsing the immobilised product from twelve of thirteen tanks. Only Tank 12 remains without a LoC although once the tank is sampled, a further submission will be made.

6.1.6 Intermediate Level Waste – RHILW Immobilisation & Encapsulation Plant (RHILW-IEP)

221) The highest hazard material on the Dounreay site is the PFR raffinate currently held in 4 tanks in the ILW liquor storage facility. The material is unsuitable to be immobilised in the current DCP, although modification has been looked at. Therefore a new facility was required to package this material into 500 litre drums. This led to the establishment of a project to build the RHILW Immobilisation and Encapsulation Plant.

222) This facility was also assessed for suitability to immobilise other ILW liquors and therefore as part of the ILW strategy it will also immobilise DFR raffinate, Ammonium DiUranate (ADU) Floc and subsequent tank washout liquors. These are explained in more detail later in this section.

223) The Dounreay site also had no facilities available to encapsulate its historic arisings of solid RHILW currently held in interim storage in 200 litre drums. Therefore work was completed to justify an encapsulation capability in the RHILW-IEP. Again the wastes will be treated and packaged into 500 litre drums.



Figure 17: RHILW Immobilisation & Encapsulation Plant (RHILW-IEP)

224) With respect to the immobilisation capability, the facility is anticipated to receive PFR raffinate as part of active commissioning from the autumn of 2013. The immobilisation process will be designed with a throughput of 150m³ of raffinate liquors per year. The schedule for processing the liquors is given below:

Year	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20	21	21	21	21	22	22		
Wastestream	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	
PFR Raffinate																																				
DFR Raffinate																																				
ADU Floc																																				
Washouts																																				

Figure 18: Liquid Waste Process Timetable in RHILW-IEP

225) The figure below shows graphically the throughput of liquors anticipated through the RHILW Immobilisation and Encapsulation Plant.

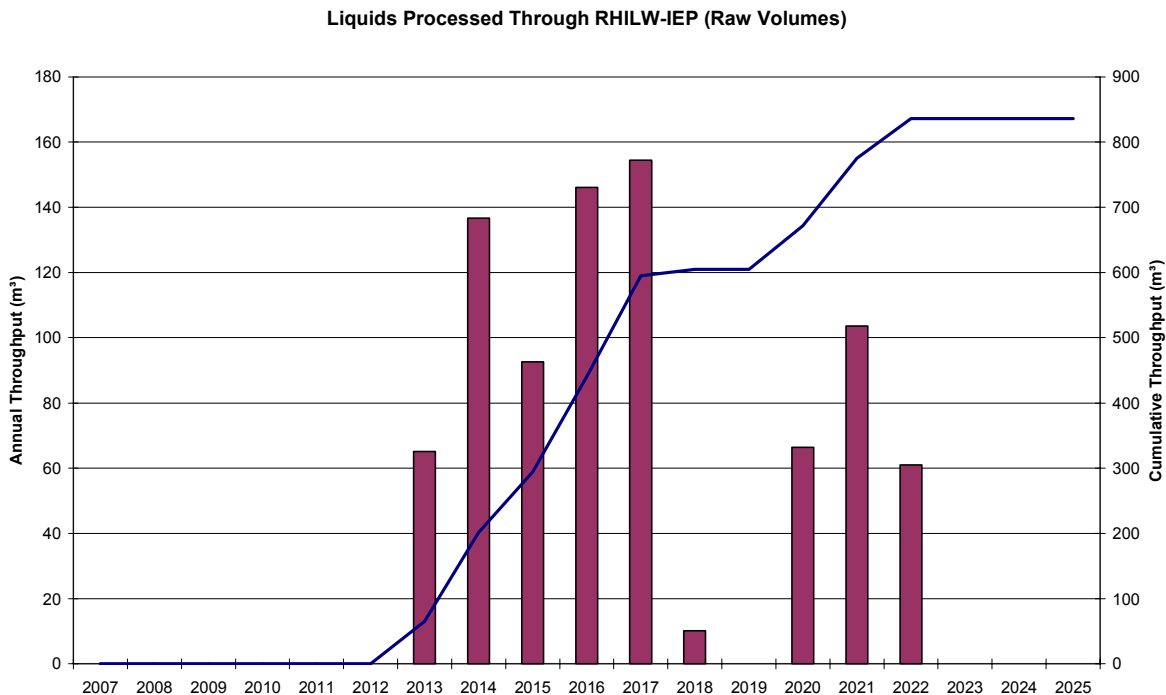


Figure 19: Liquid ILW Processing through RHILW-IEP

6.1.6.1 PFR Raffinate (Operational)

- 226) PFR raffinate is the liquor produced from the reprocessing of irradiated PFR Fuel. The liquor is a nitric acid solution containing fission products and trace quantities of uranium and plutonium. This is the highest hazard waste stream on the Dounreay site. The material is stored in 4 stainless steel tanks, 13 to 16, in the ILW Liquor Storage Facility.
- 227) This ILW raffinate will continue to be stored safely in ILW Liquor Storage Facility. There will be no further arisings apart from the addition of the plutonium nitrate liquors transferred from another FCA facility that will be added to Tank 15. The LTP states that PFR raffinate will be immobilised between 2013 and 2015.
- 228) The waste stream is estimated to produce 743 x 500 litre drums. It should be noted that the design of this drum has been value engineered to maximise the amount of raffinate liquors that can be added whilst producing an acceptable product.
- 229) Dounreay has received an Interim Stage LoC from NDA RWMD for the packaging of this waste stream.
- 230) This stream also underwent full stakeholder consultation before agreement was reached on the strategy being implemented.

6.1.6.2 DFR Raffinate (Operational)

- 231) DFR raffinate has been produced from the reprocessing of spent DFR fuel elements. The waste consists of a ferric/aluminium nitrate solution containing fission products and actinides and is stored in 3 tanks in the ILW Liquor Storage Facility.
- 232) There are no future arisings of this ILW liquor. The raffinate will be immobilised after PFR Raffinate between 2015 and 2017.
- 233) This waste will utilise the same 500 litre drum design as for the PFR raffinate. It is anticipated that 928 drums will be produced.
- 234) A Conceptual LoC for this proposed wasteform has been received from NDA RWMD and an Interim stage submission has recently been submitted for 2 of the tanks whilst sampling of the third one is awaited to allow development work to take place.

6.1.6.3 Ammonium DiUranate (ADU) Floc (Reference)

- 235) Ammonium DiUranate (ADU) floc was produced in the flocculation plant of ILW Liquor Storage Facility which uses a chemical precipitation process to remove the majority of the plutonium and uranium activity from the ILW liquors discharged from the Plant Washings Tank (PWT) thus allowing the supernate to be discharged as a low active effluent. However, this process has not been in operation for a period of time and therefore the supernate is currently stored as well.
- 236) The ADU floc is held in 3 tanks in ILW Liquor Storage Facility. The current reference strategy is to continue to store the floc until it can be retrieved, dissolved into a form ready for transfer to the RHILW-IEP.
- 237) The ADU floc will be processed after the PFR and DFR raffinate, starting in 2017 and running through to 2018. It will produce up to 729 x 500 litre drums. This is the subject of ongoing review.
- 238) A Conceptual LoC has been received for the conditioning of just the ADU floc. Future submissions will consider both treatment and packaging of the ADU floc and the associated supernate.

6.1.6.4 ILW Liquor Storage Tank Washout Liquors (Reference)

239) The previous liquors are all already contained within various tanks within the ILW Liquor Storage Facility. Once the bulk of the liquors are removed, due to the tank construction a heel of liquor will remain.

240) Therefore it is proposed to undertake a series of “dilutions” to reduce the activity in the tanks. These dilute liquors will be transferred to the RHILW-IEP for immobilisation. The IEP will also have an evaporator that will concentrate up the liquors, to a similar “characteristic” as the earlier feeds and hence minimise the number of drums being produced.

241) The current estimate is that around 250m³ of liquors, of a mixed inventory will be produced which will generate around 250 x 500 litre drums of conditioned product for storage.

6.1.6.5 Solid remote Handled ILW (Reference)

242) As stated in the introduction to this section, the RHILW-IEP will have 2 functions: immobilisation of liquors and the encapsulation of solid RHILW. This next section now addresses the solid waste streams.

243) Solid RHILW has historically arisen from the reprocessing and post irradiation examination of irradiated fuels from the DMTR, DFR and PFR. Those wastes, which were low in alpha activity, were originally consigned to the Shaft & Silo. From 1980, when PFR fuel started to be reprocessed, higher alpha/beta/gamma activity, RHILW, wastes were placed into interim storage either directly in 200 litre drums or via a dedicated Waste Posting Cell. The wastes are mainly metallic with some plastics.

244) The Waste Posting Cell receives waste from small waste consigners in the FCA in a range of containers from 5 to 50 litre capacity. The waste is then assayed and placed into the larger 200 litre drums before being sent to interim storage.

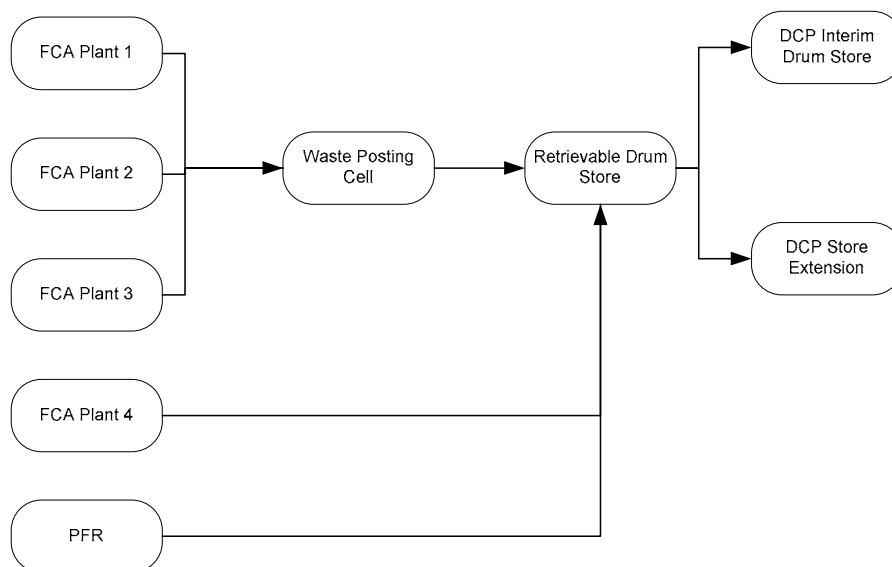


Figure 20: Role of Waste Posting Cell

245) These drums are then transferred into a retrievable drum store. The figure below shows the number of 200 litre drums exported from the Waste Posting Cell during the Lifetime Plan.

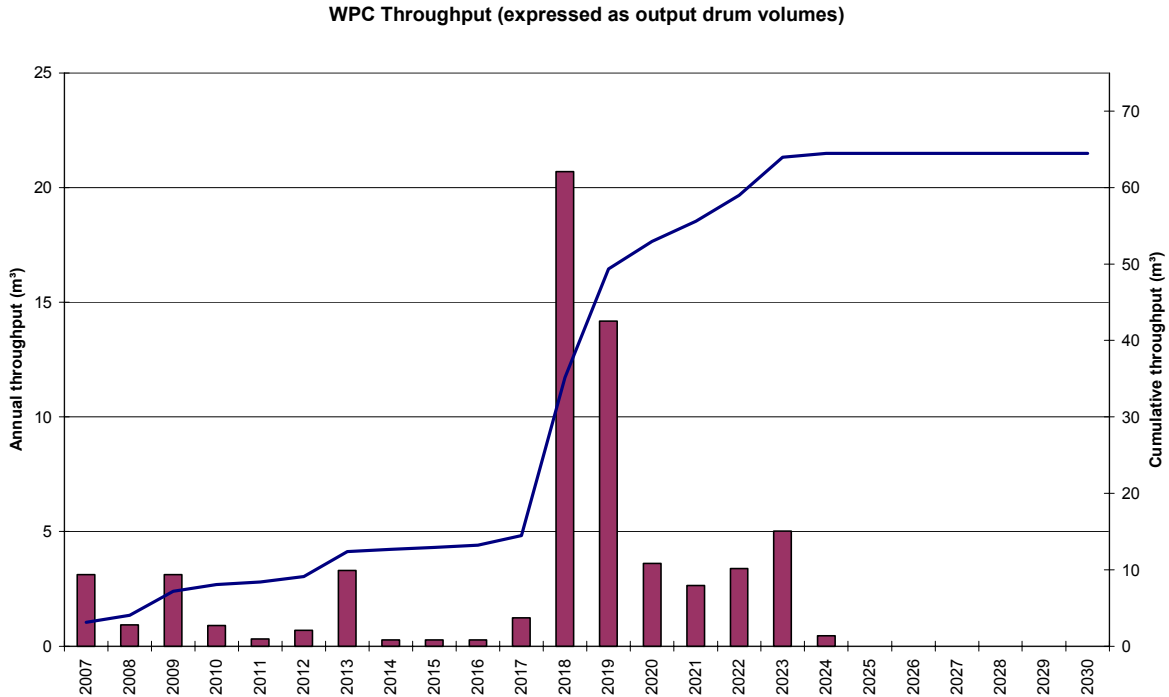


Figure 21: Waste Posting Cell Throughput (Output 200 litre drums)

- 246) As the drum store came close to capacity in the early 1990's, over 400 drums were flaked into the DCP Interim Drum Store. Filling of the original drum store then recommenced. The store is once again approaching capacity and it will be emptied again to the DCP, this time to the Store Extension over the next 2 years. All the 200 litre drums that are consigned to the DCP store are placed into a 350 litre overpack to assist in handling and stacking within the store.
- 247) This transfer will allow the old store to be decommissioned and have the added benefit of allowing all the solid RHILW, which is to be transferred to the RHILW-IEP to be flaked in a standard, more efficient manner.
- 248) Once the RHILW-IEP becomes available in 2013, waste drums will be retrieved from the DCP Stores and transferred by WPEP flask, 4 drums at a time. The waste drums will be opened and the waste inside sorted, assayed and repackaged before being encapsulated into 500 litre drums. It is anticipated that 2 drums of raw waste a day will be processed producing a single 500 litre drum of conditioned waste.
- 249) Based on DRWI data, it is currently anticipated that around 1433 x 500 litre drums will be produced from the encapsulation of historic and future solid RHILW streams. The figure below shows the anticipated solid waste volumes being processed in the RHILW Encapsulation line.

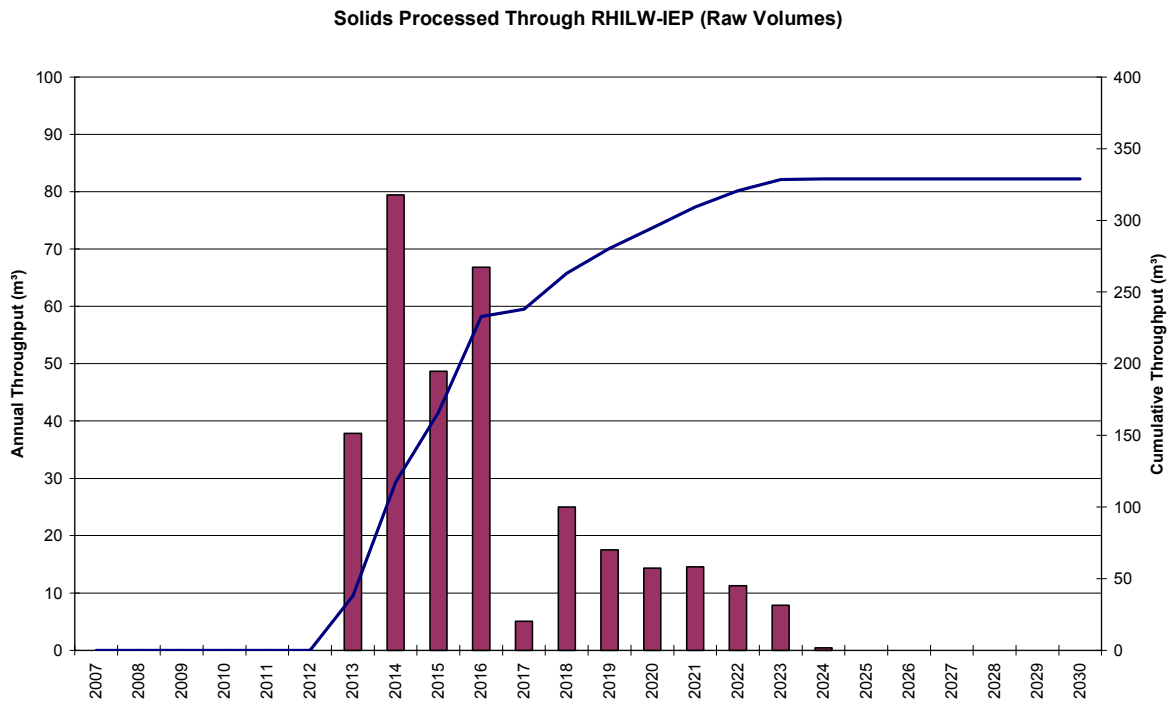


Figure 22: Solids processed through RHILW-IEP

- 250) Dounreay has received an Interim stage LoC for the historic RHILW currently in storage. It is currently assumed that future arisings from decommissioning will have been bound by the physical and radionuclide data in this submission. However, if the waste differs significantly then these will be the subject of separate submissions in the future.
- 251) The RHILW strategy is currently identified for the packaging of the following RHILW waste streams as well as those described above:
- 252) **Ion Exchange Columns**: Dounreay uses ion exchange as its primary abatement technology for the removal of Caesium from liquor streams arising from ponds or reactor coolants. The ion exchange columns are designed inside existing RHILW 200 litre drums. This allows existing flasks and storage facilities to be used.



Figure 23: DFR Ion Exchange Column inside transport overpack

- 253) When transferred to the RHILW-IEP for final conditioning and packaging for disposal, the columns will either be cut open and the contents intimately mixed in a 500 litre

drum or a polymer will be injected into the columns to immobilise the resin, the column would then be placed into a 500 litre drum and encapsulated.

254) Work is identified in next years LTP to confirm the most appropriate methodology to package the waste. There are Letters of Compliance in place for the ion exchange columns before they are generated.

255) **Radioactive Sources:** Dounreay has a wide range of sources in storage on the Site. A strategy is currently being drafted which will then be integrated into the Dounreay Waste manual. This strategy will result in some sources being consigned as LLW whilst the others will be moved into the RHILW category and storage. They will not be consigned as CHILW.

256) The sources will be placed in interim storage in a manner, which simplifies their final packaging in the RHILW-IEP. In the RHILW-IEP they will be packaged along with the other RHILW materials but against prescribed limits. To this end, activity limits set down in the management of sources at Harwell, due to their similar packaging process has been used as the basis for the new Dounreay Strategy. This will be followed up with the production of an addendum to the existing RHILW Interim LoC specifically for sources.

6.1.7 Intermediate Level Waste – Waste Treatment Plant (WTP)

257) A key finding from the ILW strategy review was the continued required for a dedicated Waste Treatment Plant for the packaging of waste retrieved from the Shaft and Silo. However, the strategy review also identified that some of the capabilities being built in the WTP could also be used to treat additional waste streams, namely CHILW and some Thorium High Temperature Reactor (THTR) graphite.

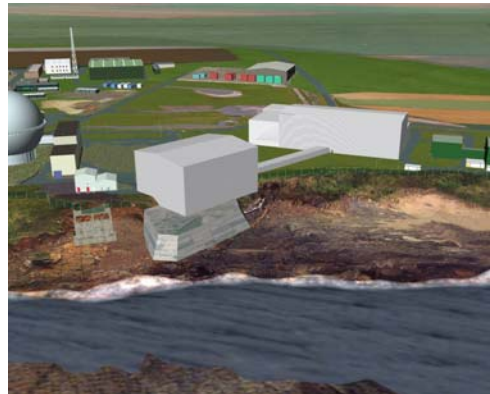


Figure 24: Shaft & Silo Headworks & Waste Treatment Plant

258) The proposed management schedule for the processing of these waste is detailed below:

Year	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20	21	22	22	22	23	23	23	
Wastestream	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	
CHILW																							
Shaft																							
Silo																							
THTR																							

Figure 25: Waste Treatment Plant – Waste Feed Timescales

259) The following sections provide details on the wastes and also the strategy associated with their management:

6.1.7.1 Silo Solids and Sludge (Reference Strategy)

260) The D9833 Silo is an engineered store that contains long-lived solid RHILW under water. The RHILW is mainly redundant and waste items from various cell operations including PIE, analytical, defuelling, POCO. The facility also contains sludge, which has arisen through waste disposal, material degradation, and UPP operation. The silo shut for the receipt of solid waste in 1998.



Figure 26: RHILW inside the Silo

261) The strategy is to remotely retrieve the solid RHILW from the silo using newly constructed headworks. The material will then be transferred to the Waste Treatment Plant where it will be shredded into sacrificial 200 litre drums, characterised (physical/radionuclide) before being supercompacted and then encapsulated into 500l drums.

262) The headworks will also retrieve sludge which will then be stored and sampled prior to being immobilised within 500 l drums. All operations will take place in the proposed Waste Treatment Plant.

263) The silo retrieval operations are scheduled to commence in 2019 with all material packaged by 2022. This will produce around 700 x 500 litre drums.

264) The conditioned product from the Waste Treatment Plant will be transferred by 4 drum WPEP flask to the RHILW-IEP drum store.

265) A Conceptual LoC is now under assessment by NDA RWMD for the packaging of the solid and sludge material.

6.1.7.2 Remote Handleable ILW in the D1225 Shaft (Reference Strategy)

266) The Shaft contains solid ILW arising from historic fuel cycle operations from the period 1959 through to 1977. In addition to the solid waste, there will also be a sludge stream to be treated. The sludge arises from discrete disposals and waste degradation.

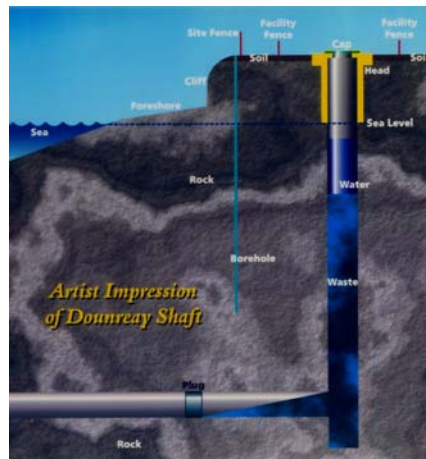


Figure 27: Artists Impression of Dounreay Shaft

- 267) The strategy is to remotely retrieve the solid RHILW from the Shaft using newly constructed headworks. The material will then be transferred to the Waste Treatment Plant where it will be shredded into sacrificial 200 litre drums, characterised (physical/radionuclide) before being supercompacted and then encapsulated into 500l drums.
- 268) The headworks will also retrieve sludge which will then be stored and sampled prior to being immobilised within 500l drums. All operations will take place in the proposed Waste Treatment Plant.
- 269) The shaft retrieval operations are scheduled to commence in 2019 with all material packaged by 2023. This will produce around 1300 x 500 litre drums.
- 270) The conditioned product from the Waste Treatment Plant will be transferred by 4 drum WPEP flask to the RHILW-IEP drum store.
- 271) A Conceptual LoC is now under assessment by NDA RWMD for the packaging of the solid and sludge material.

6.1.7.3 Waste Treatment Plant – Other Streams:

- 272) The waste streams from the Shaft and Wet Silo are the primary wastes to be treated and packaged in the Waste Treatment Plant. The revised ILW strategy also recognised an opportunity to utilise some of the capabilities of the WTP to allow packaging of some other ILW wastes, namely CHILW and THTR Graphite. These are explained in the following sections.
- 273) The ILW strategy review identified that similar processes, assay, supercompaction and grouting into 500 litre drum was to be undertaken in “back end” of the WTP. Therefore and opportunity was realised to utilise this part of the facility ahead of its main function of treating shaft & silo wastes and also saving monies from providing a separate facility for CHILW and THTR graphite elsewhere on the Site.
- 274) An options study is currently underway for the management of CHILW at Dounreay. This will determine whether the reference strategy described below is the BPEO.

Contact Handled ILW - PCM (Reference)

- 275) This waste stream comprises Plutonium Contaminated Material (PCM) from fume-cupboard and glovebox operations as well as various decommissioning operations. The waste is currently stored in 200 litre drums within the CHILW store alongside

Uranium Contaminated Material (UCM) and Thorium Contaminated Material (ThCM) waste.



Figure 28: View inside CHILW drum store

276) Current predictions demonstrate that there is sufficient capacity to store all the wastes until the PCM treatment facility is available.

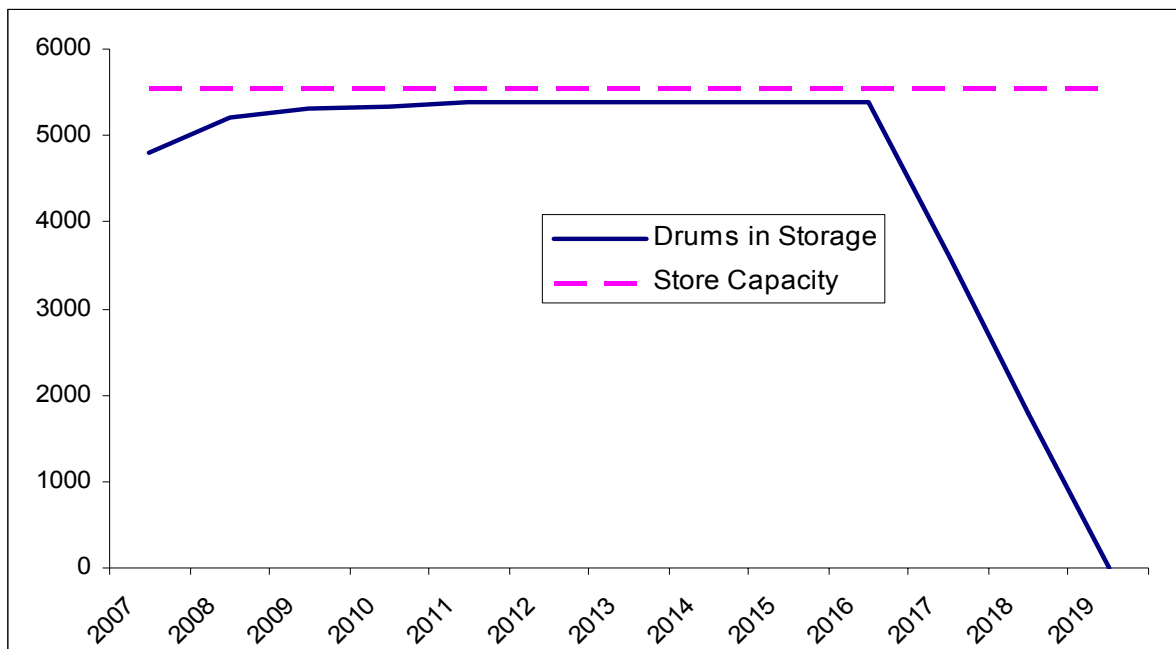


Figure 29: Graph of CHILW Store Capacity until 2019

277) The reference strategy for LTP07 was to convert WRACS (Waste Receipt, Assay, Characterisation and Supercompaction facility for LLW) in 2012 to allow PCM (and UCM/ThCM) to be treated and packaged there in a two year period. However as stated above the ILW strategy review recommended using the WTP rather than WRACS, as the latter facility will still be required for processing of LLW. The reference strategy for the 2008 LTP is therefore assay and supercompaction of the 200 litre drums followed by grouting of the pucks in 500 litre drums within the WTP.

278) The conditioned product from the Waste Treatment Plant will be transferred by 4 drum WPEP flask to the RHILW-IEP Drum Store for interim storage.

279) A Conceptual LoC for supercompacted waste was received from NDA RWMD for this waste stream in 2001. An updated Conceptual LoC will be prepared in 2008/09.

Contact Handled ILW – Uranium Contaminated Material (Reference)

- 280) This waste stream comprises uranium contaminated waste from fume-cupboard and glovebox operations as well as various decommissioning operations and includes 63 drums of concrete. The waste stream also covers a number of ex-fuel type materials such as residues so some pre-treatment may be required. The waste is physically different to the main PCM materials.
- 281) The waste is currently stored in 200 litre drums within the CHILW store alongside the PCM drums.
- 282) The reference strategy is that the UCM material will follow the PCM strategy. Therefore the drums will be exported to the WTP for assay, supercompaction of the 200 litre drums before they are grouted into a 500 litre drum.
- 283) The conditioned product from the Waste Treatment Plant will be transferred by 4 drum WPEP flask to the RHILW-IEP Drum Store for interim storage.
- 284) A Conceptual LoC will be prepared in 2008/09.

Contact Handled ILW - ThCM (Reference)

- 285) This waste stream comprises of thorium contaminated graphite waste currently in storage along with thorium contaminated glovebox wastes from historical operations. The waste is currently stored in 200 litre drums in the CHILW store alongside the PCM/UCM drums.
- 286) The reference strategy is that the ThCM will follow the UCM and PCM strategy. Therefore the drums will be exported to the WTP for assay and supercompaction of the 200 litre drums before they are grouted into 500 litre drums.
- 287) The conditioned product from the Waste Treatment Plant will be transferred by 4 drum WPEP flask to the RHILW-IEP Drum Store for interim storage.
- 288) A Conceptual LoC will be prepared in 2008/09.

Summary of CHILW Streams:

- 289) It is estimated that there will be a maximum of 6000 CHILW drums requiring treatment. Based on a supercompaction factor of 5:1 and using 5 pucks per 500 litre drum. It is anticipated that all the CHILW material will produce around 1200 x 500 litre drums for storage in the RHILW-IEP drum store.

THTR Graphite (Reference)

- 290) The final waste stream that there will be processed through the WTP is some THTR graphite. This material is a legacy from an historical reprocessing contract and due to the powdery nature of the material it has been decided that this stream should be packaged last. The material is currently held in approx. 440 drums.
- 291) The wastes would be taken to the WTP and either passed through the shredding process or simply loose tipped into new sacrificial containers and the placed individually into a 500 litre drum, thus generating 440 conditioned waste packages.
- 292) The conditioned product from the Waste Treatment Plant will be transferred by 4 drum WPEP flask to the RHILW-IEP Drum Store for interim storage.
- 293) A Conceptual LoC will be prepared for this material in 2008/09.

6.1.8 Reactor Decommissioning

6.1.8.1 PFR Decommissioning Waste – (Reference)

- 294) The decommissioning of a reactor like PFR will generate a wide range of solid and liquid wastes. The following sections briefly describe the key decommissioning processes associated with PFR.
- 295) Bulk sodium removal: PFR was a sodium cooled reactor. The 1500te of caesium rich coolant has almost been totally removed from the reactor vessel. The sodium is reacted to produce a sodium hydroxide solution with the pH then adjusted by the addition of hydrochloric acid and the neutralised liquor is then fed through an ion exchange column to abate the caesium 137. The abated liquor is then discharged to the LLETP and subsequently discharged to sea
- 296) The SDP columns of ion exchange resin generated by the abatement process is categorised as RHILW and transferred into storage. The columns will be retrieved in the future and the resin treated before being packaged into 500 litre drums and placed into interim conditioned waste storage.
- 297) The reactor vessel will then be treated using Water Vapour Nitrogen (WVN) mix to remove sodium residues. The liquors will require abatement and this will be done through the PFR Effluent Treatment Plant. This facility was constructed 2 years ago and will receive all future liquor arisings from PFR for abatement prior to discharge to the LLETP. This facility will have filtration and ion exchange capabilities with the ion exchange columns selectively removing either caesium or cobalt.
- 298) PFR still holds irradiated fuel and this will be removed and placed into casks for long term storage. Once this is completed, the Irradiated Fuel Caves (IFC) can be decommissioned. Solid RHILW generated from this facility will follow existing routes into interim storage. LLW will also be consigned via established routes.
- 299) The decommissioning of the reactor vessel and components will generate RHILW and therefore dedicated shielded facilities will be required. The current strategy will see a Size Reduction facility (SRF) constructed to size reduce items which are already out the reactor and in temporary storage. This will then be complimented by a Reactor Dismantling Facility which will be built to remove those items still in the reactor and the vessel itself.
- 300) The previous LTP stated that Dounreay would utilise 2m boxes for packaging reactor ILW. However both as a result of the ILW strategy review and an assessment of a Conceptual LoC submission by NDA RWMD, the reference strategy will see both the SRF and RDF package their RHILW into 3m³ boxes. The waste will be grouted at PFR then flaked across site to the RHILW-IEP Box store.



Figure 30 – 3m³ Box

301) The remainder of the decommissioning of the reactor hall and associated buildings will generate wastes which are either drummed or bulk LLW along with much smaller quantities of oils, mercury and tritiated steels. There will be much more volumes of HVLA and clean and exempt soils and rubbles. PFR is the first facility on the Dounreay site to trial the production of a Building Waste Plan.

6.1.8.2 DFR Decommissioning Waste – (Reference)

302) DFR ceased operations in 1977 and decommissioning progress was initially slow but has made significant progress in recent times.

303) DFR, like PFR, used a liquid metal coolant, this time 57 tonnes of Sodium/Potassium Alloy (NaK) that is heavily contaminated with caesium. DFR has built a NaK Disposal Plant (NDP), which will chemically treat the NaK before passing the resultant liquor through filters and ion exchange columns. Both of these will be categorised as RHILW with the abated liquors being discharged to the LLETP. The facility is just about to start active commissioning.

304) Once the coolant has been removed from the reactor, the next step is the removal of around 1000 DFR breeder elements. A dedicated facility has been built adjacent to DFR where the retrieved elements will be declad and then washed to remove any residual NaK. The cladding and fuel will then be placed into waste drums for interim storage. The material will then be treated at a later date as per the current site LTP.

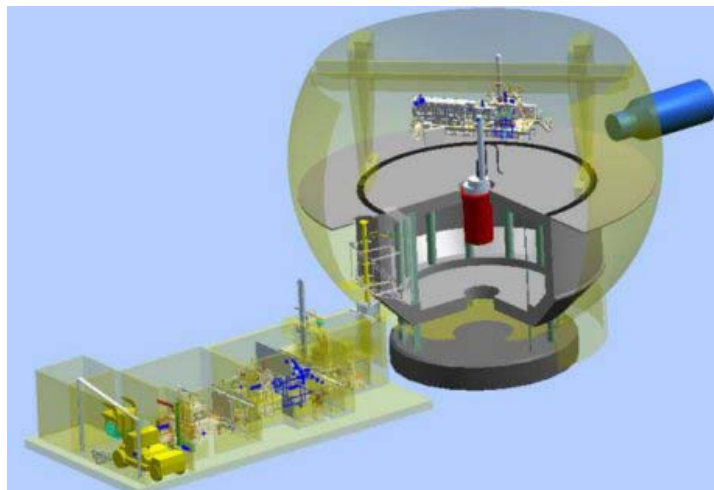


Figure 31: DFR Breeder Removal Facility

- 305) Having completed the removal of the breeder fuel, work will then be required to remove NaK wetted pipework. The internals of the pipework will be chemically cleaned with the resultant liquor abated using Ion exchange. The assumption is that the pipework will remain RHILW after cleaning. Therefore the breeder fuel removal building will be modified to allow the sectioned pipework to be packaged directly into 3m³ boxes and then grouted. The conditioned waste packages will then be flaked across site to the RHILW-IEP box store using the WPEP flask.

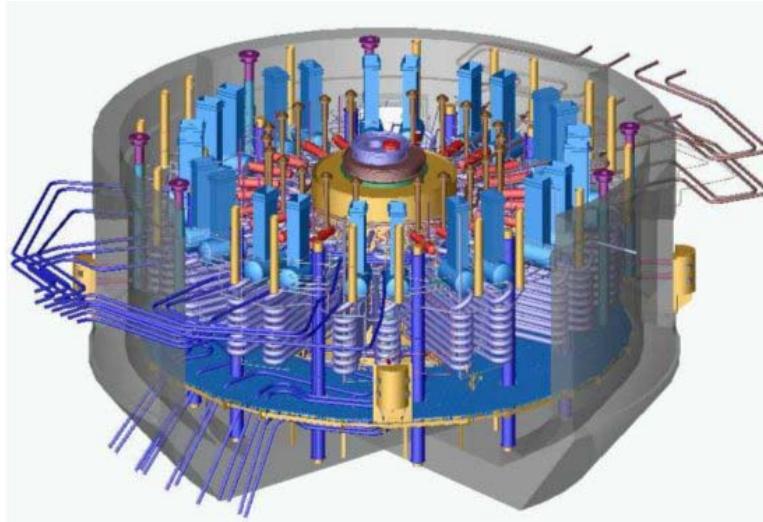


Figure 32: DFR Reactor Primary Circuit Pipework

- 306) To allow the Primary Circuit Decontamination (PCD) operations to proceed, there will also be a requirement to remove several hundred kilogrammes of contaminated mercury. The mercury will then be placed into storage until it can be treated for disposal.
- 307) Although the breeder fuel will have been removed from the reactor, the reactor internals and structure will still require to be packaged. These will again be cleaned of NaK residues before being packaged into 3m³ boxes.
- 308) The reactor vessel has a graphite (boronated graphite) shield. It is anticipated that this material will be suitable for packaging direct into 4m boxes due to low expected levels of contaminations. However this assumption still has to be validated and work is identified in LTP for sampling of the graphite. However dose restrictions mean that this is unlikely to happen until after the bulk NaK has been removed. The 4m boxes will NOT be grouted so as not to foreclose future treatment options should the NDA wish to implement a national strategy for graphite.
- 309) There are 2 other major projects associated with DFR both of which are related to buildings out with the reactor sphere. Those are the decommissioning of the DFR Pond and the treatment of stored NaK wetted components.
- 310) The DFR pond was used for cooling of removed fuel prior to reprocessing. There has been no fuel in the pond for a number of years and facilities have been built to assist in decommissioning the pond.
- 311) The initial step was to reduce the activity of the pond water and this was achieved successfully using Ion exchange and filtration. However, initial expectations that the

inner concrete wall of the pond could then be consigned as LLW have proved to be incorrect. The activity levels are such that the concrete will require disposal as ILW.

- 312) The proposals in the LTP are that a “wet” concrete removal technique will be used and the waste placed into standard RHILW 200 litre drums. These will be dried and then placed into interim storage. At a later date, they will be removed and processed through the RHILW-IEP alongside other RHILW. Ongoing monitoring will be used in the Pond to allow segregation of the wastes into appropriate categories.
- 313) DFR stopped operation in 1977 and since that time, an inventory of NaK wetted items has been accumulated and placed into interim storage as there was no disposition route for them. These are a mixture of mainly LLW items with some ILW. The baseline assumption is that a new facility will be built at DFR which will clean the items before packaging them into appropriate waste containers. The liquors generated by the cleaning process will undergo ion exchange to remove the caesium prior to discharge to the LLETP.
- 314) Remaining wastes from the decommissioning of associated buildings will be a mixture of LLW, HVLA and exempt. The current assumption is that the DFR Sphere will remain at present.

6.1.8.3 DMTR Decommissioning Waste – (Reference)

- 315) DMTR was the first reactor on the Dounreay site but has been shutdown since 1969. Most of the ancillary systems have been removed and the facility is under care and surveillance. It will remain so until the middle of next decade as the facility is passively safe and a low priority.
- 316) Sampling has taken place through the shield block into the core to allow improved characterisation data to be generated and support future planning.



Figure 33: View of Coring Hole at DMTR

- 317) Once decommissioning restarts there will be some ILW generated and this will be packaged into a handful of 4m boxes. This package was selected due to low contamination levels and wide box opening. This packaging strategy still has to go through the LoC process.
- 318) The remaining material will be a mix of LLW and exempt materials which will follow established waste routes.

6.1.9 Other Radioactive Wastes (ILW)

6.1.9.1 Contaminated Solvent/Oils (Reference Strategy)

- 319) ILW Contaminated Solvent resulting from PFR fuel reprocessing is stored in the Plant Washings Tank (PWT) and a recently constructed 50m³ tank. There will be no significant future arisings. The site also has low level contaminated oils which arise

from many areas on-site and are collected for storage in Intermediate Bulk storage Containers (IBCs) within the Oils & Solvents store along with a historical batch of 10m³ in a tank in the FCA. Both streams are included here as they have the same disposition path.

- 320) The reference strategy for disposal of the Contaminated Solvent/Oils is destruction in a new incinerator after passing the ILW Solvent through a decontamination process to remove much of the activity (a wet abatement system). The operation of this facility is scheduled to begin in 2017 and run for a period of 4 years to 2019.
- 321) This strategy was endorsed following a publicly consulted BPEO. Work in 2008/09 will revisit the strategy to ascertain if any new technologies exist, which may impact on the reference strategy.

6.1.9.2 Thorium Nitrate Liquors (Reference)

- 322) During the recovery of uranium from THTR spheres, the resultant liquors were passed through a solvent extraction process and the Thorium Nitrate liquors were generated.
- 323) There are currently 4 tanks of thorium liquors stored in the FCA at Dounreay. The inventory increased in 2007 with the return of liquors from overseas. This material is more concentrated than that in the tanks and is also stored in drums.
- 324) The current strategy is for the material to be cemented into 500 litre drums using a mobile cementation facility. It is currently estimated that there are around 230 drums of conditioned ILW requiring storage. The option of using a mobile plant is currently under review.
- 325) The conditioned waste will be transferred to either the RHILW-IEP drum store or the DCP-SE.
- 326) There is currently a Conceptual Letter of Compliance in place for the conditioning of the thorium liquors in the tanks. Further work will be required to include the drummed material.

6.1.9.3 LSA Scale (Reference)

- 327) Based on work already undertaken looking at the post closure requirements for both a new LLW disposal facility and the existing Pits complex, some current waste streams will be unsuitable for consignment to such a facility.
- 328) One currently identified stream, which does not meet the LLW disposal criteria, is that of cemented LSA Scale. These are historical drums of cemented Radium and Thorium contaminated, low specific activity wastes originating from oil tubular descaling operations at Dounreay, which have been ceased for a number of years. The waste is currently stored in 200 litre drums within an interim LLW store.
- 329) The reference strategy in LTP08 is that the material will be transferred into 4m boxes, potentially grouted, and then placed into Interim Storage before being consigned to a national repository.
- 330) It is currently estimated that 38 x 4m boxes will be produced for interim storage.
- 331) A Conceptual LoC will be prepared in the next financial year 2008/09.

6.1.10 Conditioned ILW Storage

- 332) The immobilisation and encapsulation of ILW materials in the RHILW-IEP will produce a conditioned waste product in 500 litre drums. Those conditioned waste packages will be transferred into a drum store which is part of the RHILW-IEP facility. There the drums will remain until they are transferred off-site to a national repository. The drum store has a capacity of 8000 drums.
- 333) This drum store will also receive 500 litre drums from the Shaft and Silo Waste Treatment Plant. Those drums will be a mix of RHILW and CHILW drums. The storage of both these sub-categories of waste together in a shielded facility is a step change from previous management strategies at Dounreay. The Figure below shows the anticipated consignment of 500 litre drums to the RHILW-IEP drum store.

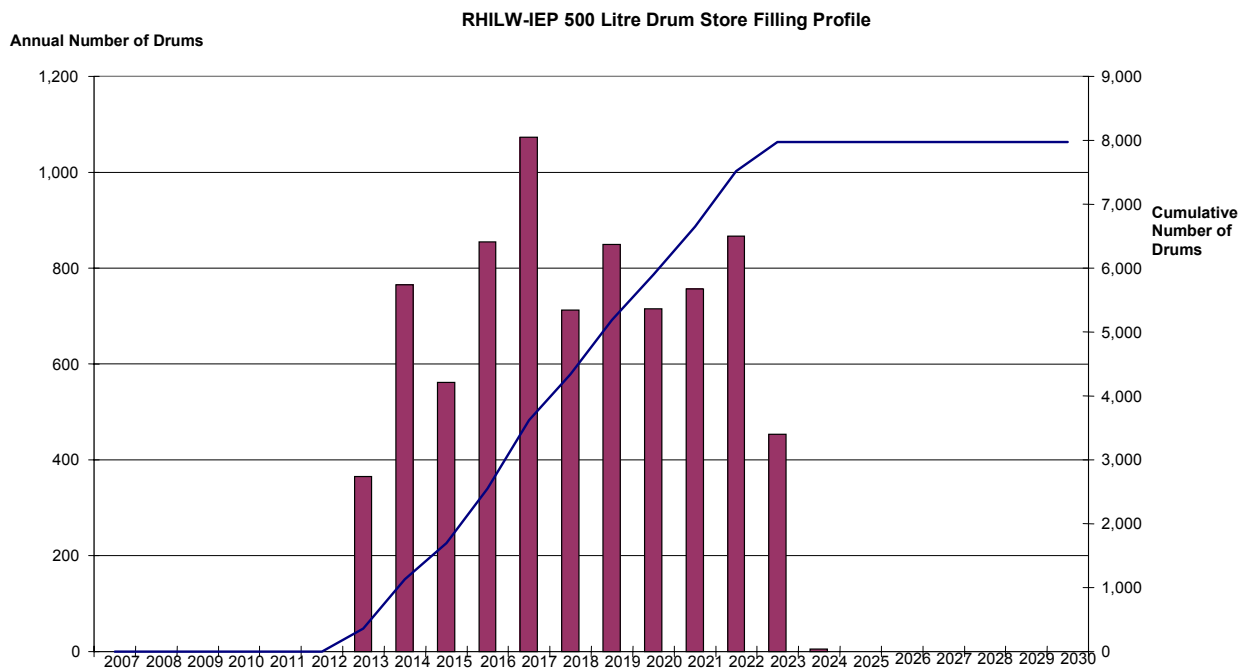


Figure 34: RHILW Drum Store – Filling Profile

- 334) The reactor packaging plants at PFR and DFR will both produce 3m³ boxes as will the ILW Liquor storage facility decommissioning plant. These 3m³ boxes will be stored in a new box store, again part of the RHILW-IEP facility. The store will hold up to 2000 3m³ boxes.

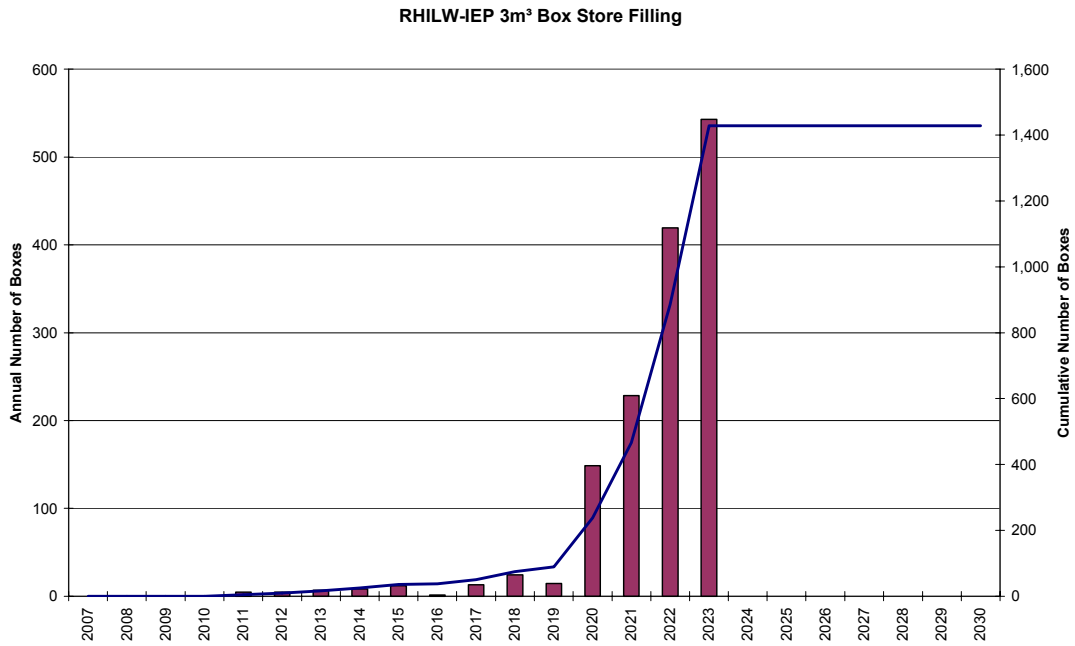


Figure 35: RHILW-IEP 3m³ Box Store

- 335) Both these stores will have a design life of 100 years. The current design also identified the stores to have a common import/export facility and will have monitoring and drum inspection capabilities.
- 336) The 4m boxes produced at DMTR and DFR will be placed into a modified interim LLW store alongside boxes of repackaged LSA scale. This facility currently holds HHISO containers that will be transferred to the new LLW disposal facility around 2014. The facility will then be modified to provide ILW storage with a specified building life of 100 years.

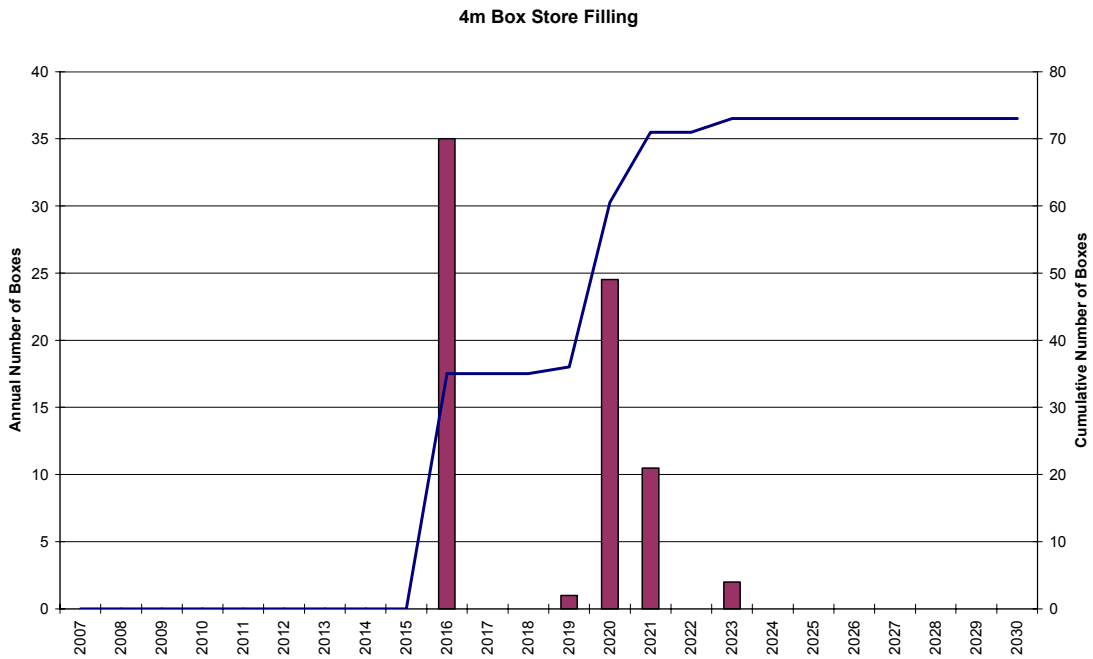


Figure 36: 4m Box Store Filling Profile

337) These new facilities will supplement the only current conditioned ILW waste stores on the Dounreay site which are the Interim Drum Store (DCP-IDS) and the Store Extension (DCP-SE) which is part of the DCP. Both of these facilities are vault stores where 500 litre drums are “free stacked”. The DCP-IDS contains cemented MTR raffinate and some unconditioned drummed RHILW. The Store extension has recently been brought into operation. Both facilities have 100 year design life. The figure below shows future arising of 500 litre drums being consigned to the DCP stores as well as the total number of drums in storage.

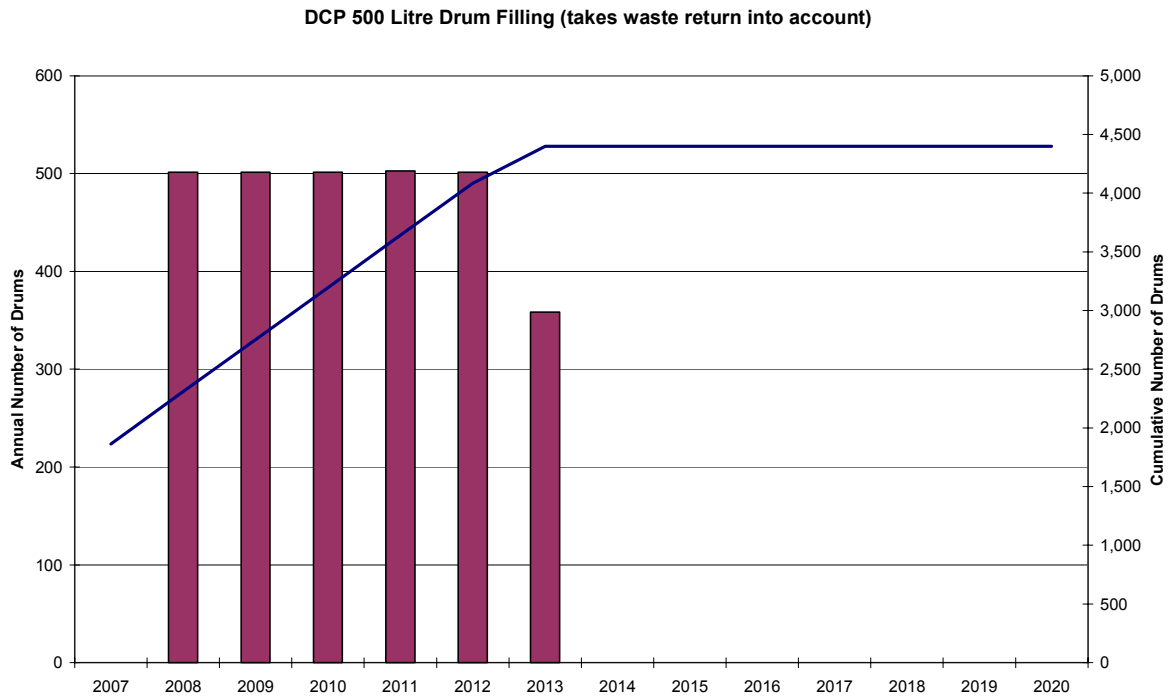


Figure 37: DCP Drum Store Conditioned Waste Filling Profile

338) A new Import/Export facility has recently received consent to start active operations. This will allow the store to import solid RHILW for interim storage or export solid RHILW for treatment or to return cemented MTR raffinate to be returned to overseas customers.



Figure 38: DCP Import Export Facility, Store Extension and Interim Drum Store

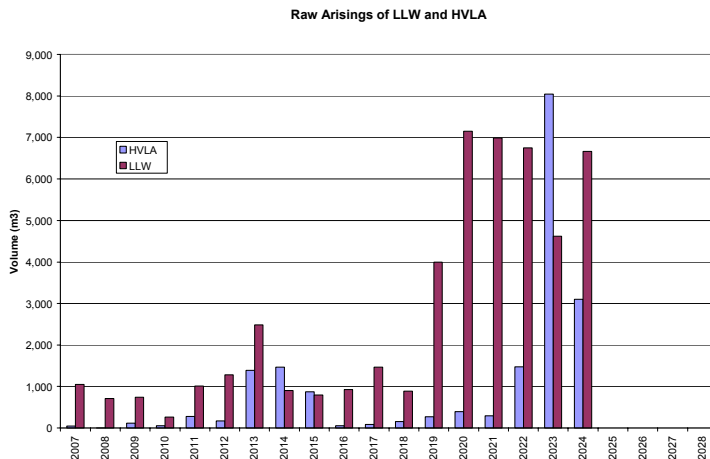


Figure 40: Raw Solid LLW and HVLA arisings (m³) per year over the LTP

6.1.12.1 Low Level Waste – current and future arisings (Reference/Operational)

345) Where appropriate, LLW from operations and decommissioning on the Dounreay site is packaged in 200 litre drums. The waste volume arising is minimised by use of the Waste, Receipt, Assay, Characterisation and Supercompaction (WRACS) facility.



Figure 41: View of WRACs

346) The current estimates of throughput of waste drums through WRACS are provided in the following figure.

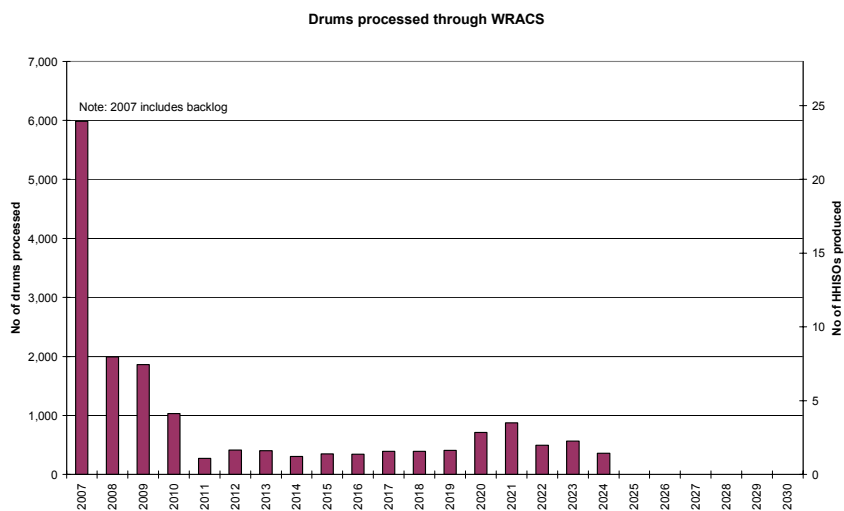


Figure 42: LLW Drums processed through WRACS – Current Estimates

- 347) The supercompacted drums are placed into half-height ISO freight containers and transferred into interim on-site storage.



Figure 43: HHISOs in Interim Storage

- 348) Large items (not suitable for 200 litre drums), or bags of contaminated soil (HVLA) are separately loaded, at the source facility, directly into HHISOs for interim storage in one of 2 interim LLW stores.
- 349) Part of the forward LLW strategy, Dounreay has converted an existing building to undertake segregation and/or size reduction of LLW from exempt and clean waste to ensure the best use of available capacities both on and off-site. This facility is currently undergoing inactive commissioning. The facility will also offer a monitoring station for exempt wastes.
- 350) As stated earlier, Dounreay disposed of its own LLW in a series of pits excavated from the rock along the northern coast of the site. It is assumed that UKAEA will not be able to make a post closure safety case for this facility and therefore a strategy is in place to remove and dispose of waste, repackage into HHISOs and then re-dispose of the materials to the new LLW disposal facility. This is currently scheduled to happen between 2019 and 2023. Current predictions estimate that this work will produce around 1300 HHISOs of waste.
- 351) The following graph shows the consignment profile of wastes, containerised LLW and bagged HVLA, to the new LLW disposal facility.

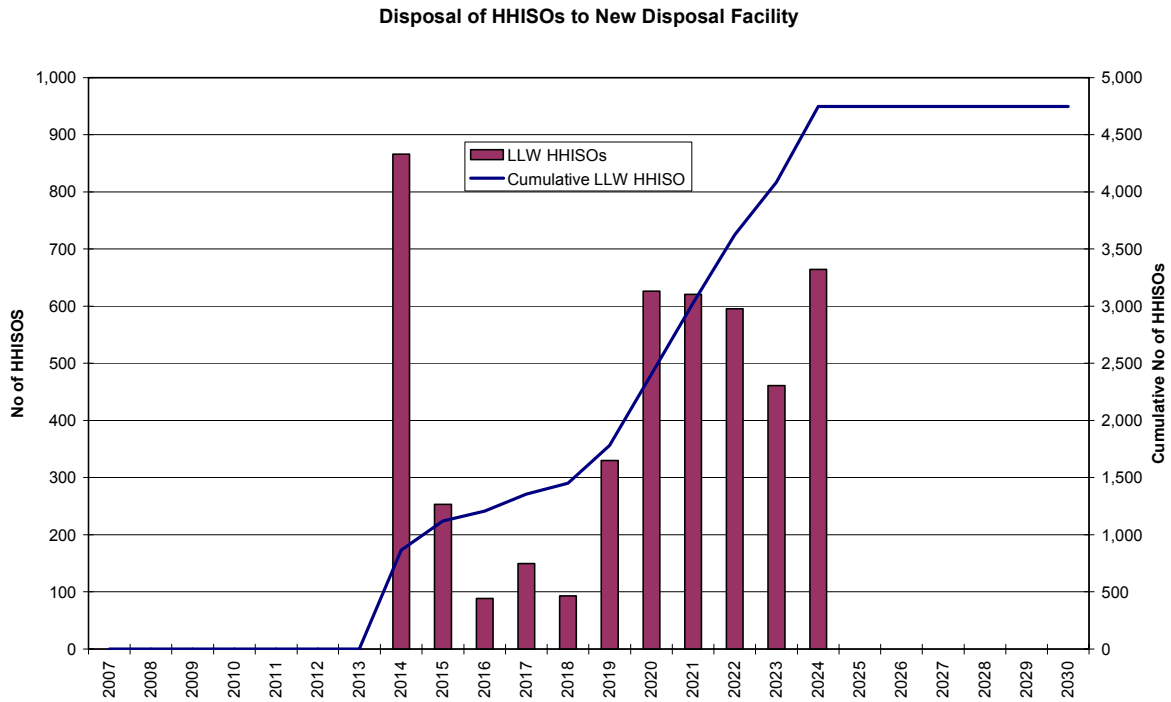


Figure 44: HHISO disposals to LLW Disposal Facility

Contaminated Soil (Reference Strategy)

- 352) Dounreay has areas of contaminated land. These are currently managed through a Contaminated Land safety case against risk criteria (15). Estimates of contaminated land which will potentially be excavated are included in DRWI estimates of LLW, HVLA and exempt.
- 353) Whilst Dounreay already has those estimates of contaminated ground, LTP08 clearly sets out that further characterisation work will be undertaken with a considerable effort focussed on when buildings are due to be demolished. This is supplemented by “at source segregation” which assists in correctly sentencing material as it is packaged.
- 354) Dounreay are also looking at initiatives such as bio remediation as a method for reducing the volumes of contaminated materials to be disposed of. Current arisings of this type of waste are held in 1 tonne bags within HHISO containers.

6.1.12 Nuclear Materials

- 355) Dounreay continue to look at opportunities to consign certain types of nuclear materials to suitable waste routes either in compliance with the NDA RWMD guidance for a HLW/Spent fuel repository or an ILW repository where appropriate.
- 356) This approach has resulted in Dounreay receiving a Conceptual Letter of Compliance for the packaging of Mixer Breeder material as ILW. This LoC will now be used as part of a strategy review for the material to ascertain if this route should be followed.
- 357) The reference strategy for Uranium and Plutonium nuclear materials is to produce a passively safe stable product and to place it in storage pending a decision on national policy. In order to achieve this, the operations will produce both secondary wastes and also identify some nuclear materials that will not be suitable and hence require management as a waste. Work will progress in 08/09 on refining these estimates.

6.1.13 Discharges

- 358) The Dounreay site discharges its liquid and gaseous wastes in accordance with the current authorisations under RSA, IPPC and CAR, previously CoPA. Although this covers the main site discharge points contributory sources (facilities) are identified in the accompanying Technical Implementation Document (TiD).
- 359) In addition to these regulatory limits for both liquid and gaseous discharges, Dounreay has a management system which sets down Derived Discharge Limits (DDL) and Discharge Control Objectives (DCO).
- 360) The facility or Building DDL is an internal equivalent to the RSA authorisation limits and is provided as a safeguard against a breach of the RSA limits.
- 361) Whilst the facility or building DCO is an internal control based on operational requirements and the full application of BPM. The DCO should be challenging but has no regulatory or internal consequence if exceeded.

6.1.13.1 Liquid Waste Discharges - Source of Discharges

- 362) This stream covers all the liquid discharges from the Dounreay site, discharged under the authorisation of SEPA. There are no current stocks as wastes are discharged as they accumulate.
- 363) The sources of discharge of radioactive effluent are mainly from operations in radiologically controlled areas and may be from sample analysis, liquor transfer operations and from decontamination operations through to simple hand washing in a controlled area. Other sources, which generally contain highest activity, are those liquors which require abatement by Ion Exchange processes at PFR and DFR.

6.1.13.2 Main radiological Characteristics.

- 364) The Dounreay site, due to the nature of both its historical and current operations, discharges a wide range of radionuclides. The main ones considered in the discharge authorisation are: tritium, sodium 22, strontium 90 and caesium 137. There is also a requirement to record total alpha and beta/gamma radionuclides. This is in addition to some non-radiological content.

6.1.13.3 Key Controls to minimise Discharges:

- 365) There are a number of key controls in place at Dounreay to minimise and control liquid discharges, namely:
- The RSA authorisation sets down the 12 month rolling limits which the Site works to. It is assumed that the RSA authorisation remains in place.
 - There is a requirement for facilities to demonstrate BPM with respect to their own discharges and these documents are reviewed and approved by Qualified Experts
 - There are ongoing improvements to characterisation of potential liquor feeds.
 - All liquor discharges are filtered at source to remove particulate from the streams.
 - Dounreay operates its quality management system - "Specification for the management, Control and Disposal of Aqueous Liquid Low Level; radioactive Waste (LLW) and Non-active aqueous effluent at Dounreay"
 - Dounreay's commitment to meet its OSPAR Obligations.

6.1.13.4 Treatment of Liquid Effluent

- 366) Dounreay originally operated the effluent treatment plant, constructed in 1957, which provided a facility for discharging effluent and inactive acids from various source buildings to sea. This was a facility, which had 2 below ground tanks which were recirculated and sampled before discharge to sea. Some pH control was used. This

facility has now been removed from service and has been replaced by the low level liquid effluent treatment plant (LLEETP).

- 367) LLEETP consists of an underground effluent receipt tank, a buffer tank, two main effluent treatment tanks and sludge removal equipment. The main purpose of the plant is to adjust the pH of incoming low active effluent to between pH5 and pH9, and to separate the resulting sludge (and if necessary, remove solvents from the liquid effluent) before discharging the effluent to sea. The LLEETP started operating in October 2004 and an additional filter system, the 'goalkeeper' filter, has been fitted in the sea discharge line.
- 368) All liquid waste streams are filtered prior to being discharged to the site Low Active Drains system which takes the liquor to LLEETP.



Figure 45: Low Active Drain System & Discharge Points

- 369) Based on the current lifetime plan, LLEETP will remain in operation until 2022. Dounreay will continue to manage its liquid effluent through this facility, therefore no new treatment facilities will be required.
- 370) Dounreay has already undertaken a considerable amount of R&D and this has related to the use of Ion Exchange technology for the abatement of liquors from PFR and DFR as well as Pond Clean-up Units. Future abatement will continue to be focussed "at source" rather than a Site solution.
- 371) Plans to meet the requirements of the National Radioactive Discharge Strategy involve an ongoing programme of effluent minimisation through best practicable means (BPM).
- 372) Dounreay are already committed through their BPM review process to review any abatement of waste streams should technology or decommissioning methodologies change. A key risk is that there still remains some immaturity related to how the liquid effluent strategy will develop as the site approaches the interim end point although this will become clearer as more detailed planning of decommissioning tasks are undertaken.
- 373) Due to the nature and source of the liquors which are consigned to LLEETP, and the subsequent pH adjustment, there is the potential for sludge formation. It is predicted that the sludge will be LLW and that the reference strategy for this stream will be

immobilisation in cement using a mobile cementation facility. Some sludge has already been generated but not sufficient to allow characterisation at this time.

6.1.13.5 Discharge Graphs

374) It should be noted that the discharges from the site have little or no impact on the environment. When converted into dose to the critical group these are well below any level of regulatory interest. Hence there are no key stakeholder issues associated with Dounreay's discharge strategy

375) As part of its RSA authorisation submission, Dounreay produced some estimates of potential future arisings. These estimates cover the period from 2007 to 2017 and are based on LTP06 and are presented below. New data has not been prepared to support the change of authorisation to DSRL from UKAEA. The figure below shows predicted liquid discharges in the period 2007 to 2017.

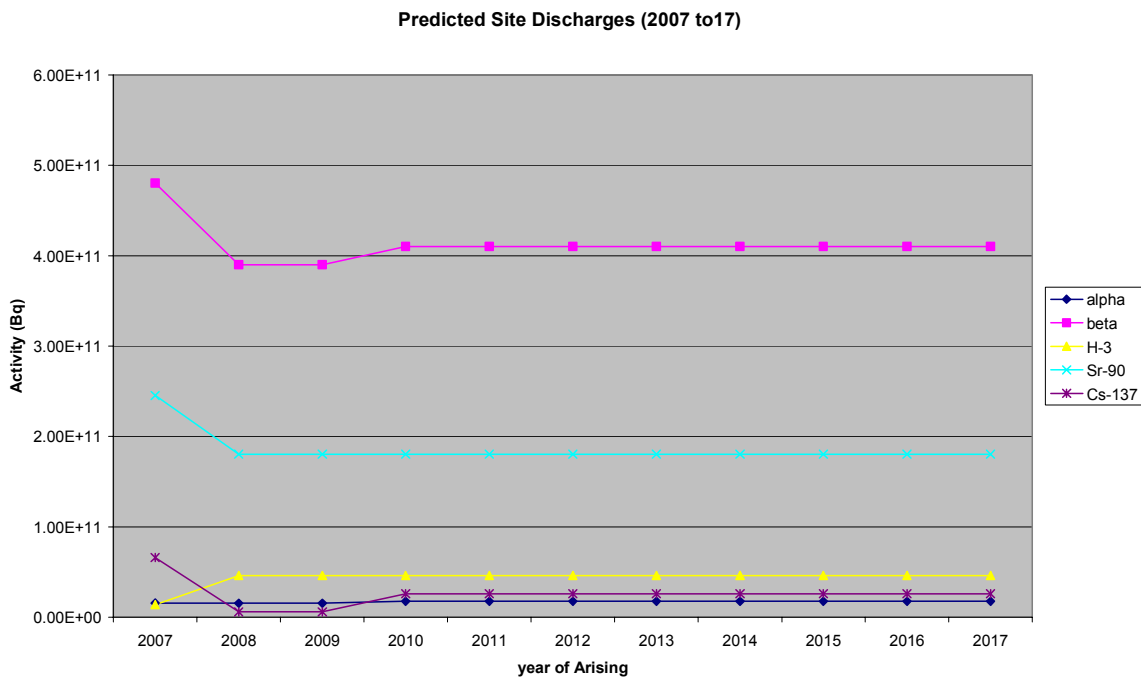


Figure 46: Predicted Radioactive Site Liquid Discharges up to 2017

Gaseous Wastes

6.1.13.6 Source of Gaseous Discharges

376) This waste stream covers all gaseous discharges from the Dounreay site, discharged under authorisation from SEPA.

377) The wastes come from a number of sources such as filtered cell, glovebox and fumecupboard extracts along with active area space extracts.

378) This waste is currently discharged from a number of stacks on the site: PFR, DFR, the FCA along with groupings called East Minor sources and West Minor Sources.

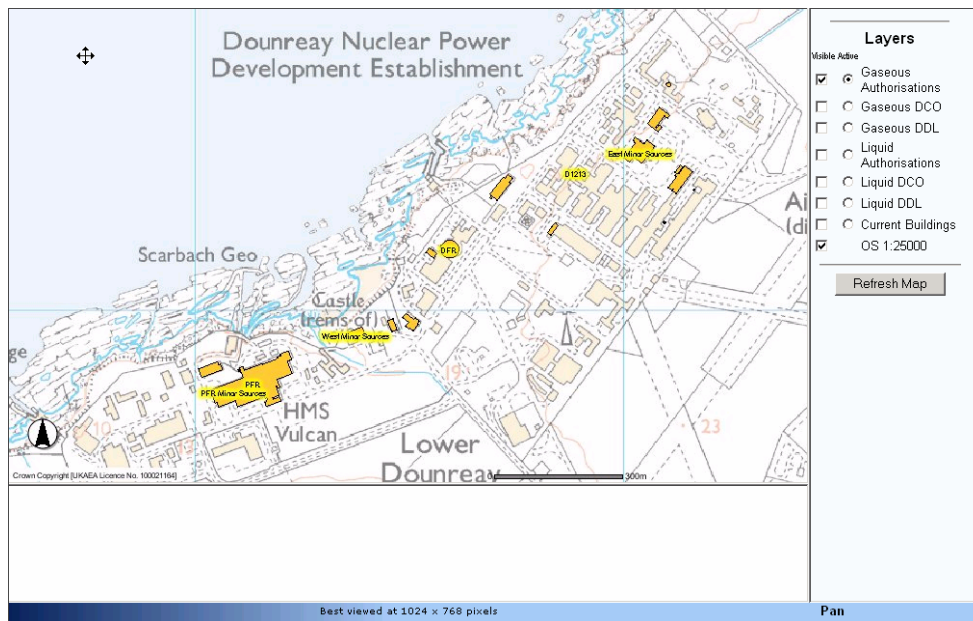


Figure 47: Gaseous Discharge Points on the Dounreay Site

6.1.13.7 Main radiological characteristics

379) The Dounreay site, due to the nature of both its historical and current operations, discharges a wide range of radionuclides. Based on the information provided in the RSA authorisation, the main ones requiring reporting are:

- Tritium, Krypton 85, Strontium 90, Ruthenium 106, Iodine 129, Iodine 131, Caesium 134, Caesium 137, cerium 144, Plutonium 241, curium 242 and curium 244;
- There is also a requirement to record total alpha and total beta/gamma radionuclides by analysis

380) Dependant on the location, such as PFR, there may only be a requirement to measure for tritium and krypton due to the nature of those operations.

6.1.13.8 Key Controls to Minimise Discharges

381) There are a number of key controls in place at Dounreay to minimise and control gaseous discharges, namely:

- The RSA authorisation sets down the 12 month rolling limits which the Site works to. It is assumed that the RSA authorisation will remain in place.
- There is a requirement for facilities to demonstrate BPM with respect to their own discharges and these documents are reviewed and approved by Qualified Experts
- All facilities have “at source” filtration in line with BPM requirements. Dependant on the location, additional filtration at the main discharge point may also be undertaken.
- All discharge points are sampled
- Dounreay operates its quality management system - “Specification for the management, Control and release of Radioactive and non radioactive gases to air at Dounreay”

6.1.13.9 Treatment of Gaseous Effluent

382) As was shown in the earlier figure, Dounreay currently has multiple discharge points or stacks. The gaseous effluent passing out through the stacks are filtered prior to discharge.

- 383) Dounreay’s approach is to define the likely gaseous discharge from a facility or project and then determine the BPM for that stream. This will most likely result in local filtration. Alternatively, by better defining the waste stream, it may be possible to justify increased discharge levels for specific tasks.
- 384) Airborne discharges are measured and sampled to demonstrate compliance with agreed discharge limits. Where appropriate, the discharges are passed through two stages of testable High Efficiency Particulate in Air (HEPA) filters, considered to represent Best Practicable Means (BPM) for treatment of gaseous discharges. Filters are then consigned as either solid LLW or ILW.
- 385) Within the Fuel Cycle Area, the main stack, which is 50 years old, is not suitable for supporting future decommissioning of the facilities around it. Therefore Dounreay has recently submitted a planning application for its replacement by 2 smaller stacks which will provide better flexibility to support decommissioning.



Figure 48: Two Replacement Stacks for Fuel Cycle Area

- 386) As part of its RSA authorisation submission, Dounreay produced some estimates of potential future arisings. These estimates, cover the period 2007 to 2017 and are based on LTP06 and presented in the figure below.

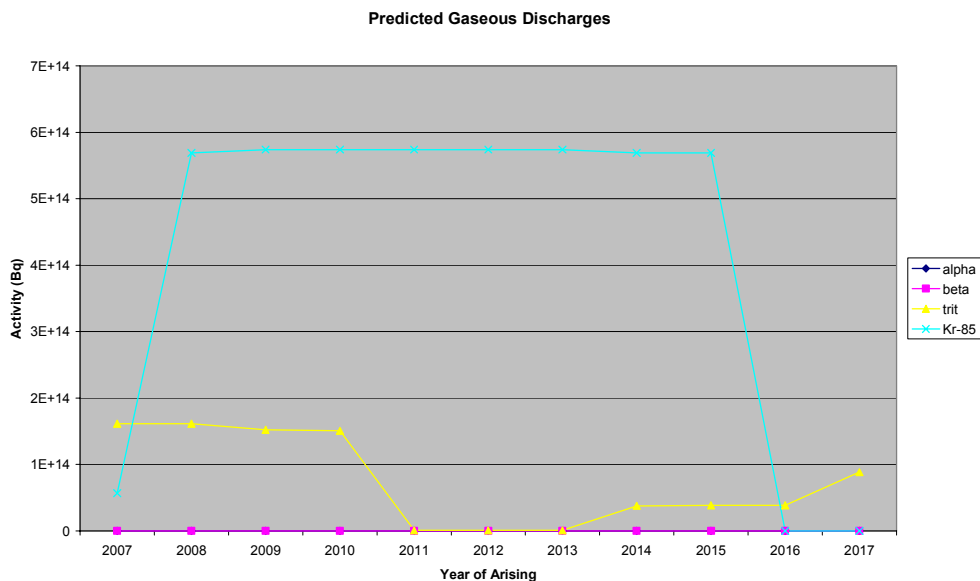


Figure 49: Predicted Site Gaseous Discharges up to 2017.

6.2 Non-radioactive Wastes (Clean & Exempt)

387) During 2007/08, Waste Services Unit undertook an options assessment process to ascertain the best waste management option or options for its clean and exempt wastes. The groups reviewed were:

- Clean Inert
- Clean Non-Hazardous
- Clean Hazardous
- Exempt Inert
- Exempt Non-Hazardous
- Exempt Hazardous

388) This strategy is being implemented as routes become available. Some will happen quicker than others.

389) Following optioneering workshops, the reference strategies identified were:

6.2.1 Clean Inert

390) Inert waste typically comprises of soil/spoil and rubble. The majority of inert waste will arise from decommissioning project and this includes new build projects also.

391) This stream accounts for around 50% of the volume of clean and exempt material on the Dounreay Site. This equates to around 118,000m³.

392) The strategy states:

- Waste hierarchy principles will be applied
- Inert material (soil, spoil and rubble) will be processed for on or off-site reuse, where practicable
- Materials not suitable for processing will be disposed of off-site via appropriate final disposal routes. This is currently landfill.
- The level of separation carried out will be determined by project specific safety requirements, industry good practice and economic factors.

6.2.2 Clean Non-Hazardous

393) Clean Non-hazardous waste will be produced from both operational and decommissioning projects which include new build projects. Operational wastes are typically predictable and consistent over time. These waste streams are very similar to any typical industrial facility, employing a medium sized workforce and are usually termed municipal solid wastes.

394) Clean Non-hazardous waste from decommissioning projects will include:

- Building fixtures and fittings
- Surplus machinery
- Scrap metal

395) This stream accounts for around 9% of the volume of clean and exempt material on the Dounreay Site. This equates to around 24,000m³.

396) The strategy states:

- Waste hierarchy principles will be applied;
- Non-hazardous material will be reused/recycled where practicable
- Material not suitable for reuse or recycling will be consigned via appropriate final disposal route, currently landfill
- Procurement of new materials will consider their reuse/recycling potential

6.2.3 Clean Hazardous

397) Clean hazardous wastes will be produced throughout the LTP as a result of decommissioning and routine operations across the Dounreay site. Existing disposal routes are already in place for these wastes which includes Asbestos, chemically contaminated materials or items classed as under WEEE

398) This stream accounts for less than 1% of the volume of clean and exempt material on the Dounreay Site. This equates to 270m³.

399) The strategy states:

- Waste hierarchy principles will be applied;
- All clean hazardous materials will be managed in accordance with legislative requirements and opportunities to either recycle or down categorise hazardous wastes will be utilised as appropriate
- Cost benefit principles will be applied to the choice of treatment applied to chemically contaminated materials

6.2.4 Exempt Inert

400) Exempt Inert waste typically comprises of soil/spoil and rubble for which provenance cannot be found to prove the material is clean. The majority of inert waste will arise from decommissioning project and this includes new build projects also.

401) This stream accounts for around 24% of the volume of clean and exempt material on the Dounreay Site. This equates to around 65,000m³.

402) The strategy states:

- Waste minimisation will be carried out;
- Suitable exempt inert materials will be reused on-site where practicable
- Materials not suitable for on-site reuse will be disposed of off-site via appropriate final disposal route, currently landfill
- The processing of SoLA exempt inert materials will take priority over the processing of clean inert materials due to reduced available waste routes and higher landfill costs.

6.2.5 Exempt Non-hazardous

403) Exempt Non-hazardous waste from decommissioning projects will include, where provenance cannot be found to confirm they are clean:

- Building fixtures and fittings
- Surplus machinery
- Scrap metal

404) This stream accounts for around 23% of the volume of clean and exempt material on the Dounreay Site. This equates to around 61,000m³.

405) The strategy states:

- Waste minimisation will be carried out;
- Materials will be recycled/reused on site where practicable
- Material not suitable for on-site reuse will be disposed of via appropriate final disposal route, currently designated landfill
- Suitable LLW will be treated to render it exempt

6.2.6 Exempt Hazardous

406) Exempt hazardous wastes will be produced throughout the LTP as a result of decommissioning and routine operations across the Dounreay site. Existing disposal routes are already in place for these wastes which includes Asbestos, chemically contaminated materials or items classed as under WEEE. Again it is classed as exempt as its provenance as clean cannot be determined.

407) This stream accounts for around 1% of the volume of clean and exempt material on the Dounreay Site. This equates to around 300m³.

408) The strategy states:

- Waste minimisation will be carried out;
- Suitable materials will be treated on site for on site reuse, where practicable
- All other hazardous exempt wastes will be consigned to an appropriate designated waste disposal facility.

6.3 SPECIFIC STREAMS

6.3.1 Asbestos

409) Asbestos is likely to be the largest single hazardous waste category produced during decommissioning. The majority of removal works in association with demolition is carried out by specialist companies who also have responsibility for the disposal and consignment of the asbestos. Small amounts of asbestos arising from maintenance are bulked and disposed of to specialist waste management contractor. As better estimates of future arising are obtained, Dounreay will look to ascertain the security of waste routes.

6.3.2 Lead

410) There is an estimated 5000 tonnes of lead at Dounreay for which there has been a draft strategy produced. Whilst a small amount of this lead is used in cells or gloveboxes most of the lead is either clean or has very minor contamination. The strategy at Dounreay is to segregate lead at source during decommissioning. Clean or exempt lead is sent to a central on-site facility to be stored pending reuse on site, or reuse or disposal off site. Lightly contaminated lead can be decontaminated in the aforementioned facility. Lead which cannot be decontaminated is disposed of as LLW or ILW as appropriate.

6.3.3 Zinc Bromide

411) There is no exemption on non-organic liquids. Although no formal strategy document exists, this material can be disposed of through a specialist waste management contractor.

6.3.4 Mercury

- 412) Clean mercury on site can be disposed of as a hazardous waste via a specialist contractor. The SoLA exempt material currently has to be stored on site. Most contaminated mercury on site will become available, through the decommissioning of facilities over the next 10 years.
- 413) The strategy is not to treat and dispose of the mercury until the bulk has become available. A triple distillation mercury treatment facility will be provided to decontaminate the mercury for disposal off-site through a specialist contractor.

6.3.5 Oils and Solvents (Including PCB contaminated oils)

- 414) The site has an inventory of clean oils and solvents and disposing of these as clean hazardous waste is quite straightforward through a specialised contractor. The materials are always sampled and analysed for any nuclide contamination such as H3 and C14. It is recognised that some oils will come onto site with trace contamination and this is also checked to ensure that the material can be demonstrated as clean.
- 415) There are some transformer oils containing PCB's on site, but disposal routes exist for clean, PCB-contaminated oils again through licensed contractors.

6.3.6 Non-Radioactive Discharges

Liquid Waste Discharges

- 416) Dounreay has set out its goals and objectives for the management of both radioactive and non-radioactive discharges (22). It states: "UKAEA will strive to reduce the content of its inactive waste discharges at Dounreay so that they are as clean as possible, by employing a holistic waste management approach to minimise environmental damage and using the best available techniques and practices, where this does not incur excessive costs."
- 417) Discharges are via a number of outfalls along the northern shoreline of the Dounreay Site which are routinely checked for pH, flow and radioactivity. In addition as part of its obligations under its PPC authorisation the site records discharges of trace metals, which run at a small percentage of the PPC limits.
- 418) The only future issue which may challenge these limits is the discharge of nitrates from the DFR NaK Disposal Plant. Dependant on commissioning data Dounreay may look to request a variation on PPC limits or review plant operational parameters.

Gaseous Discharges

- 419) The Dounreay Site has a number of major and minor stacks although it is only the non-radioactive discharges from the Main FCA Stack which arise from Uranium Processing facility process air extract that are covered by the Pollution Prevention and Control Permit for the site, issued by SEPA.
- 420) In terms of future gaseous discharges, the only operation likely to be covered is related to the discharge of ammonia gases from the treatment of ADU Flocc in either the ILW Liquor Storage Facility or the RHILW-IEP. As the process flowsheet is still under development, exact information cannot be put forward at this time. However, whichever process flowsheet is chosen it will undergo a BPM assessment and also will be licensed under PPC.

6.3.7 Waste Disposal and Transfer Routes

421) The preceding sections have identified a considerable number of waste disposals and transfer routes currently in use by Dounreay, see figure 35 below. These are discussed further in the following sections. Due consideration is given to the selection of waste disposal routes through either optioneering where appropriate or may be based purely on available contractors:

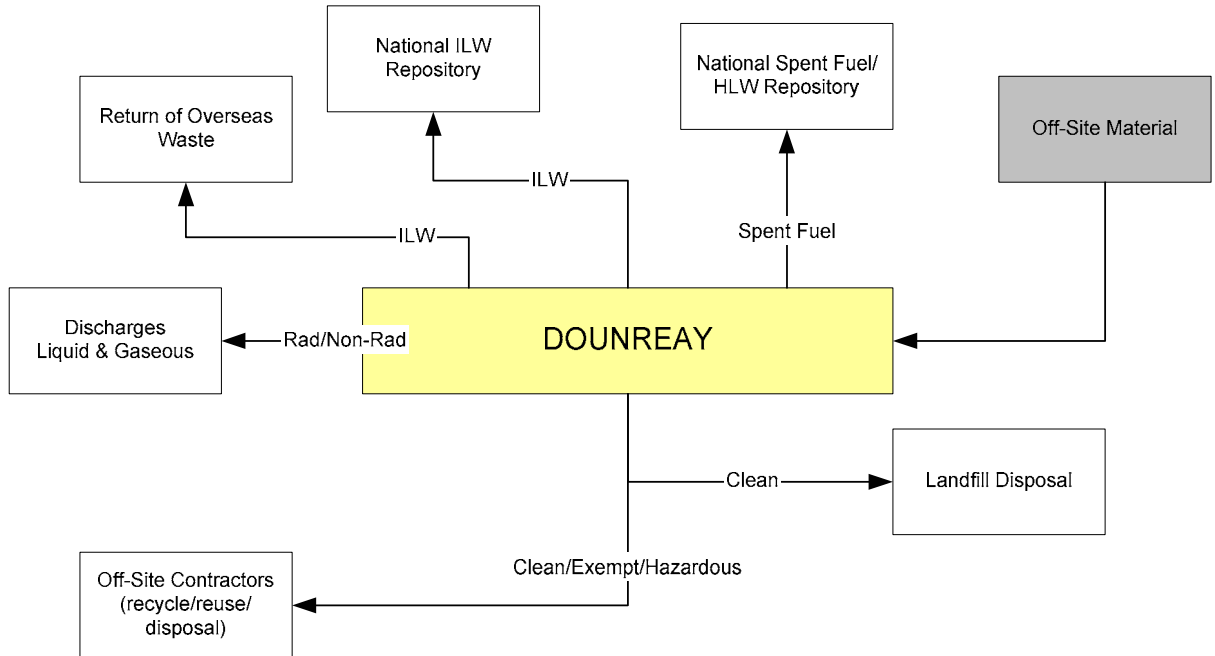


Figure 50: Waste Disposal & Transfer Routes

6.3.8 Liquid & Gaseous Disposal Routes

6.3.8.1 Radioactive Liquid Discharges

422) Dounreay discharges its radioactive liquors direct to sea via its own dedicated pipeline via the Low Level Liquid Effluent Treatment Plant. Discharges utilising this route will continue until 2022 when LLLETP will be decommissioned. Thereafter it is assumed that radioactive liquor arisings will be minimal and conditioned as solid waste for disposal.

6.3.8.2 Radioactive Gaseous Discharges

423) Dounreay discharges its radioactive gaseous wastes through a number of major and minor stacks. The bulk of these will be decommissioned by the Interim End Point in 2025. Thereafter, there will continue to be radioactive gaseous discharges on the Dounreay site until all the conditioned ILW and nuclear material are transported from the Site and the facilities decommissioned. This is programmed to be completed by 2078.

6.3.8.3 Non-Radioactive Liquid Waste Discharges

424) Up until the Interim End Point in 2025, non radioactive liquors will either be discharged via milliscreen systems and designated outfalls or as part of the radioactive discharges via the LLLETP system.

425) During the work in the Final End State, 2025 to 2078, there will still be a requirement to manage non-radioactive liquors. These will essentially be trade effluents associated

with staff still involved on the Site and these will be discharged via authorised outfalls.

6.3.8.4 Non-Radioactive Gaseous Waste Discharges

- 426) Dounreay currently has only one specific facility which discharges only non-radioactive gaseous waste. That facility is the boiler house which provides steam heating for the Dounreay site.
- 427) Otherwise gaseous discharges are monitored for compliance purposes for both radiological and non-radiological content. This would continue into the Final End State should there be a regulatory requirement.

6.4 WASTE DISPOSAL ROUTES

6.4.1 Waste Disposal Routes – Off-Site – Clean, Exempt and Hazardous:

- 428) The waste disposal and transfer routes from the site identified in LTP08 are tabulated in Annex 3. All transfers will be integrated with the receipt programme of the operators of a national repository in order to minimise the safety, environmental and cost impacts.
- 429) Dounreay currently has contracts in place for the disposal of clean, exempt and some hazardous material with local and national specialist contractors. These are assumed to remain in place through the lifetime of the Dounreay LTP although they will be under regular review.
- 430) Dounreay will continue to review opportunities for changes to the strategy including reuse and recycling if appropriate or should disposal route to landfill become unavailable.

6.4.2 Transfer Off-Site – Return of ILW to Overseas Customers

- 431) Dounreay is working to meet its contractual obligations in returning waste to customers for whom it reprocessed reactor fuels. At this time it is estimated that there will be a around 330 500 litre drums of cemented MTR raffinate to be returned to Germany, Belgium and Australia. There may also be an additional 97 drums if an exchange agreement is signed for reprocessing work which has not been undertaken.
- 432) This requirement is enshrined in the current disposal authorisation for the Dounreay Site. Shipments are scheduled to start around 2010. Transport studies are being undertaken by the various customers. These will be finalised over the coming year.

6.4.3 Transfer Off-Site – National Facilities:

- 433) At the Interim End Point, all ILW will have been conditioned and placed in on-site storage.
- 434) Following meetings with the NDA on the scheduling of waste to a national facility, Dounreay has assumed that Conditioned ILW will be transferred off the Dounreay Site to a National Facility in the Period 2050 to 2075 during the final end state. This will involve transporting the waste by road to the nearest railhead, which is assumed to be Georgemas junction.
- 435) The graph below shows the export of conditioned ILW from the Site.

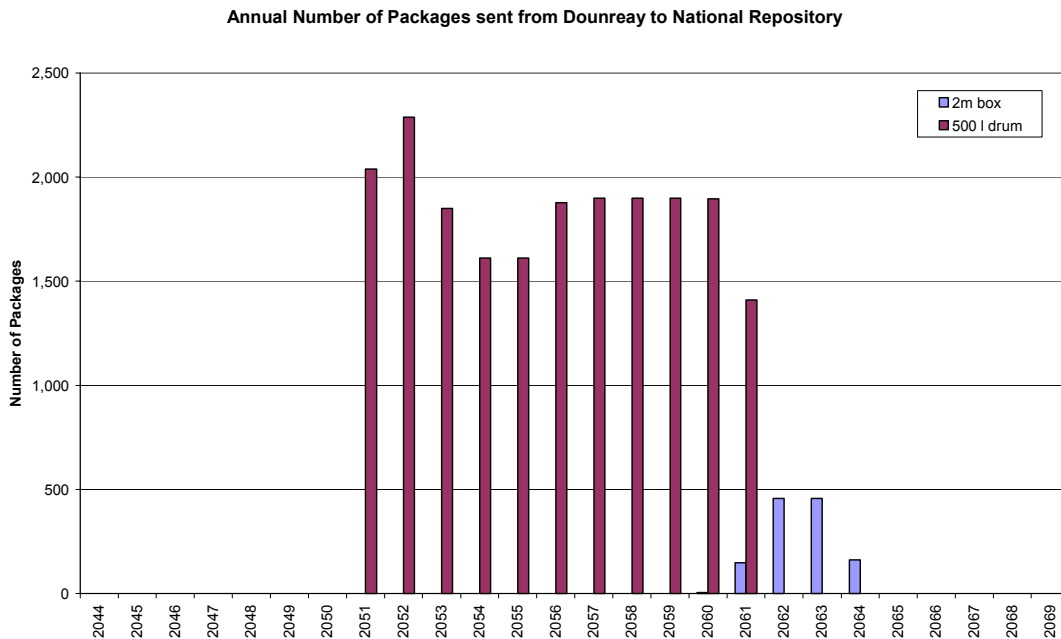


Figure 51: Predicted ILW packages transferred to National Repository

436) However, the Scottish Government has intimated its intent to implement a “proximity principle” to any waste disposal solution and the impact of such a policy remains to be assessed by both Dounreay and the NDA.

6.4.4 Transport Off-Site – National Disposal facility - Fuels:

437) At the Interim End Point, Dounreay will have packaged its irradiated fuel inventory and other items into storage casks or into a new nuclear material store.

438) The current assumption is that the casks will be transported off-site during 2075/76 and the associated facilities then decommissioned by 2078.

439) The remaining nuclear material will await a decision on National Policy.

7 AREAS REQUIRING FURTHER DEVELOPMENT AND ACTION PLAN

440) The following section outlines work which will assist and improve the Site waste strategy and its integration. Only those actions taking place in the next one to two years are presented.

441) Waste Services Unit has completed the production of a clean and exempt waste strategy for the Site. Work is still required in the coming year to ensure that the waste routes identified in the strategy can be implemented and those available can be secured.

442) Working with SEPA to allow retention of clean/exempt spoil for more than 3 years where a future use can be demonstrated.

443) There is proposals in place to produce Building Waste Plans for a number of buildings on the Dounreay site to (i) improve waste characterisation data and hence DRWI and (ii) to confirm that the strategies identified outlined in the wiring diagrams in Annex 4 remain valid.

- 444) Ongoing improvements to near time data management and predictions, through the PSWP system.
- 445) Work will be undertaken on the development of a flask strategy for the Dounreay site. This is an area which requires to be addressed in order to improve the integration of the ILW strategy. This will assist will address any potential bottleneck in the Dounreay Lifetime Plan.
- 446) There is an ongoing requirement for the review of the current disposition paths for fuels items to determine if opportunities exist for their disposal as ILW and also ensure that any wastes generated from future processing are correctly integrated into the waste strategies.
- 447) Dounreay will produce an all wastes BPEO study over the next 2 years as part of an RSA Authorisation requirement. This will undergo internal consultation but no decision has been made as yet on external consultation. This is due to the fact any consultation on the RSA authorisation is mandatory.
- 448) The project to provide a LLW disposal facility at Dounreay will continue.
- 449) Dounreay will continue to develop and implement its ILW strategy and seek standardisation on design of waste packages and waste packaging plant design.
- 450) Undertake identified Letter of Compliance submissions and associated development work.
- 451) Continue to work with the NDA and other SLCs on waste strategy and treatment initiatives and sharing of information where appropriate.

7.1 Action Plan and Programme

- 452) Key areas of the IWS requiring further development in the next 1 to 2 years are tabulated below:

Development Requirement	Action Plan and Status
Finalise all Commercial Fuel Liabilities and their future treatment routes.	There are a number of fuels items where the disposition strategy is being reviewed. Dependant on the studies undertaken this has the potential to impact on the IWS.
Further develop strategies for CHILW	During 2007/08 WSU has been assumed to have produced a CHILW strategy. This will then require further underpinning and packages of work to allow its implementation.
Continuous Improvement of Waste estimates & Strategies	The production of Building Waste Plans will be undertaken by facilities. This will involve a standard approach to characterisation and ensure that potential wastes are integrated into the existing waste routes, or new routes identified.
ILW Strategy	Ongoing work to implement and underpin the ILW strategy approved by Dounreay management in 2007/8.
Liquid and Gaseous Wastes	Produce updated estimates against the current Lifetime Plan and investigate their inclusion in DRWI.
Flask Strategy	Review of flask availability, lifetime and possible use. Production of a strategy to underpin the LTP and avoid bottlenecks.
Clean and Exempt Waste Strategy	Continue to monitor and review this strategy and implement identified waste routes.

453) The IWS document, areas requiring further development and action plan are monitored on an ongoing basis by Waste Services Unit. Formal update of the IWS will take place as part of the next LTP submission.

8 CONCLUSIONS

454) The Dounreay IWS has been produced in accordance with NDA procedures and submitted as part of LTP08.

455) The IWS remains in “interim” status as further work is required to fully integrate, optimise, the waste strategies on the Dounreay Site.

456) Considerable work has been completed in the past year with notable achievements being:

- Interim End Date brought forward from 2032 to 2025
- Clean and Exempt Waste Strategy issued
- Rigorous review of ILW strategy resulting in the development of a more robust and integrated ILW strategy

457) The main challenges ahead to underpin the Dounreay IWS during LTP08 are:

- Dounreay have undertaken a considerable amount of work in the past year looking at improving waste data for the next 2 years, through the production of Project Specific Waste Plans. This has been aimed at improving the quality of the “near term” volume data in DRWI. Work identified in the LTP for the next 2 years will be focussed on the writing of Building Waste Plans. These will become the strategic document for a facility and will detail the expected waste to be generated during the full lifecycle of the facility. These will be supplemented with improved facility wiring diagrams.
- Continued initiatives to improve facility and waste characterisation and hence better define treatment, packaging and disposal strategies.
- Whilst every attempt has been made to put in place a reference strategy for a number of smaller waste streams these still require to be underpinned with specific strategy documents. This will be an important focus in the coming years to ensure the data generated from the production of the Building Waste Plans are formally assessed for their impact on the reference strategies, the identification of gaps and undertaking the work to address those gaps.
- Ongoing tasks to characterise facilities to underpin the reference strategies and associated development work.
- The consultation process on Site End Points has been completed and the outcome advised to the NDA, it will still require acceptance by the Government and therefore results in a potential challenge to the reference IWS position in future years.
- Having produced a clean and exempt strategy in the past year, further work is still required in refining the non-radioactive waste strategy at Dounreay in order to maximise the opportunities for re-use and recycling of waste particularly on site as

part of the site remediation. Work is also required to better understand the capacity of non-radioactive waste routes and facilities and demonstrate BPM.

- Opportunities for the transfer of materials off-site will still be investigated as waste strategies are developed. However, Dounreay's IWS currently plans to treat and package all its radioactive wastes on-site, with only the timing of the transfer of conditioned waste packages to national facilities requiring further work.
- A new ALL Wastes BPEO will be prepared in support of Dounreay's next RSA Authorisation.

458) Overall, the waste strategies detailed in this document have been integrated into the 2008 Lifetime Plan schedule for the Dounreay Site.

9 GLOSSARY

ALARA (As Low As Reasonably Achievable)

To satisfy the ALARA Principle, radiological doses and risks are kept as low as reasonably practicable, taking a proportionate approach, whereby priority is given to reducing discharges which have greatest radiological significance or which present most risk of damaging the marine environment, whilst ensuring that the costs of such reductions are not grossly disproportionate to their benefits in line with current Government guidance on better regulation.

ALARP (As Low as Reasonably Practicable)

To satisfy the ALARP Principle, measures necessary to reduce risk are undertaken until or unless the cost of these measures, whether in money, time or trouble, is disproportionate to the reduction in risk.

Best Practicable Environmental Option (BPEO)

This is the waste management option, which is the outcome of a systematic and consultative decision-making procedure which emphasises the protection and conservation of the environment across land, air and water. The BPEO procedure establishes, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long term as well as in the short term.

Best Practicable Means (BPM)

BPM is a term used by EA and SEPA in authorisations issued under the Radioactive Substances Act. Essentially, it requires operators to take all reasonably practicable measures in the design and operational management of their facilities to minimise discharges and disposals of radioactive waste, so as to achieve a high standard of protection for the public and the environment. BPM is applied to such aspects as minimising waste creation, abating discharges and monitoring plant, discharges and the environment. It takes account of such factors as the availability and cost of relevant measures, operator safety and the benefits of reduced discharges and disposals. If the operator is using BPM, radiation risks to the public and the environment will be ALARA.

Brownfield

See **Site End Point**

Characterisation

Characterisation of radioactive materials involves analysing the materials in terms of their physical and chemical form, radioactive content, origin, present state, current storage conditions and other relevant information and properties. This radiological characterisation may involve obtaining data from several sources:

- Reviewing existing information. Such as historical facility usage records and radiological survey data
- Calculations using codes for activation, nuclear fuel burn-up, and radioactive decay
- In situ measurements e.g. taking swabs and measuring using a dose rate counter
- Sampling and analysis – accurate characterisation requires representative sampling of materials (for example non-homogeneous samples (e.g. concrete) require careful sampling and homogenisation to ensure that representative samples are taken for analysis. If contamination is not uniform, but an “averaged” value of activity is required, then some form of systematic sampling (e.g. using a grid) and homogenisation of the samples should be used.

- Documentation

Characterisation is an essential step at the beginning of the decommissioning process and may need to be repeated at different stages during the decommissioning. For more

information, refer to “Radiological Characterisation of Shutdown Nuclear Reactors for Decommissioning, IAEA Technical Report Series No. 389, IAEA, Vienna (1998).

Clean

An article or substance which has had no reasonable potential to have become contaminated or activated, or upon or within which no radioactivity other than normal background is detectable when suitable comprehensive measurement (monitoring and sampling) is practicable and has been undertaken

Clearance

The process to confirm that an article or substance is **clean** (free from radioactivity), or **excluded** or **exempt** from further control under all relevant legislation on the basis of its radioactivity

Clinical Waste

This is controlled waste that includes any waste which consists wholly or partly of human or animal tissue, blood or other bodily fluids, swabs, needles, or sharp instruments. Clinical waste is classified as industrial waste for legislative purposes; however it is also subject to the Hazardous Waste Regulations.

Commercial Waste

Commercial Waste includes wastes from premises used for a trade or business or for the purposes of sport, recreation or entertainment e.g. general office wastes.

Controlled Waste

This includes industrial and commercial waste (s.75 of EPA 1990 as modified by the Waste Management Licensing Regulations 1994) both of which are subject to control by the Environment Agency under waste management regulations. Controlled waste can be inert, hazardous or non-hazardous.

Directive Waste

This is any substance or object which the producer or the person in possession of it discards or intends or is required to discard. This forms the basic definition of waste in the UK. Other categories of waste are subsets within Directive Waste.

Designation

Under the Energy Act 2004 the Nuclear Decommissioning Authority (NDA) has responsibility for, amongst other things, the decommissioning of designated nuclear installations and the cleaning-up of designated nuclear sites. The designation of installations, sites and facilities is subject to the form of a direction to the NDA given by the Secretary of State for Trade and Industry.

De-designation

De-designation is the revocation of a direction by the Secretary of State to the NDA for the designation of an installation, site or facility. The direction can only be revoked once the Secretary of State (jointly with Scottish Ministers for installations, sites and facilities in Scotland) is satisfied that the NDA has discharged all its responsibilities in relation to the decommissioning or cleaning-up of the installation or site.

Delicensing

Delicensing is referred to by the NII as meaning “ending of the period of responsibility under The Nuclear Installations Act”. This is defined in section 5(3) of the Nuclear Installations Act and can only happen when the HSE gives notice in writing to the licensee that in its opinion there has “ceased to be any danger from ionising radiations from anything on the site or, as the case may be, on that thereof”. Before delicensing any land on nuclear site, HSE must satisfy itself that delicensing is appropriate and that licensable activities are no longer being carried out on the

site or that part of the site to be delicensed. This means that no radioactive waste remains on the site or the part of the site to be delicensed.

The HSE has indicated that for practical purposes the criterion of 'no danger' for the purpose of delicensing is an additional risk of death to an individual of one in a million per year (10^{-6}). Compliance with this criterion would normally mean that HSE can remove the site from regulatory control under NIA65.

Excluded

An article or substance that is not radioactive under the Radioactive Substances Act 1993 (RSA 93) (and not subject to any control under the Act) because it does not contain levels of any of the specified radioelements above the limits in Schedule 1 of RSA 93 or any non-specified radioelements at levels above normal backgrounds. An excluded article or substance is unlikely to be subject to control as radioactive under other legislation

Exempt

An article or substance that is radioactive or contaminated under the Radioactive Substances Act 1993 (RSA 93) because it contains levels of specified radioelements above RSA 93 Schedule 1 exclusion limits or because it contains other radioelements wholly or partly attributable to either an artificial process or as a result of the disposal of radioactive waste, but in both cases at levels below relevant limits in Exemption Orders under the Act. These exemptions are from the requirements of registration or authorisation under RSA 93. An (RSA) exempt article or substance may be subject to control as radioactive under other legislation (mostly due to the presence of exempt levels of RSA 93 Schedule 1 radioelements).

Final End State

See **Site End Point**

Greenfield

See **Site End Point**

Handoff

Waste stream for which an agreement has been made for transfer to a third party for treatment/processing/storage and/or disposal

Hazardous Wastes (formerly also known as Special Wastes)

Hazardous waste is controlled waste that contains any substance specified in The Hazardous Waste (England and Wales) Regulations 2005, ISBN 0110726855. Radioactivity does not in itself make waste hazardous waste. However radioactive waste may possess other properties, such as toxicity due to the presence of uranium, which bring it within the definition of hazardous waste and therefore subject to the requirements of the Hazardous Waste Regulations, in addition to the requirements of the Radioactive Substances Act 1993.

Examples of typical hazardous wastes are

- Scheduled poisons - (*Schedule 1 of the Appendix to the Poisons Rules, 1982, Statutory Instrument No 218*). This Schedule includes, amongst others, cyanides and compounds of barium, arsenic, thallium and mercury. Also includes significant quantities (greater than 10 grams per day) of copper, chromium, lead, cadmium, nickel, vanadium, zinc and other heavy metals.
- Laboratory and other chemicals;
- Drugs and/or medicines;
- Aerosols containing paints, adhesives, lubricants and cleaners;
- Asbestos;
- Bio-hazardous waste;
- Batteries, other than household;
- Pesticides and weed killers;

- Solvent based resins, paints and adhesives, paint strippers or similar materials from photographic or copying processes;
- Waste oils, oil filters, oil water mixtures and crude oil

Note - The methodology for classifying wastes as hazardous is based, in part, on deciding whether waste possess hazardous properties which requires a knowledge of the chemical composition of the waste. Assessing the hazardous properties is based the classification procedure for chemical products under the Chemicals (Hazard Information and Packaging for Supply) Regulations 1994 (as amended) (CHIP), although there are some modifications introduced by the Hazardous Waste Directive.

High Volume Low Activity (HVLA) Waste

HVLA waste is a label given by UKAEA to a category of solid Low Level Waste (LLW), where the waste contains radioactivity that is only just above the legal limits which would otherwise allow the waste to be exempted from being LLW. HVLA waste is only just radioactive enough to be treated as a radioactive waste. HVLA waste is not legally defined but there is an emerging UK and European dialogue concerning HVLA type wastes.

Industrial Wastes

This is controlled waste that includes wastes from a factory, wastes from laboratories, workshops, construction and demolition works, and clinical waste.

Inert Wastes

Inert waste is controlled waste that is defined in the Landfill Directive as waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.

Interim End State

See **Site End Point**

Intermediate Level Waste (ILW)

ILW is defined as waste with a radioactivity level that exceeds the upper boundaries for low level waste (4GBq/te α and 12GBq/te β/γ) but which does not require heating to be taken into account in the design of storage or disposal facilities (Cm2919).

Letter of Compliance (LoC) (formerly Letter of Comfort)

Under its Letter of Compliance system, in the context of a phased approach to disposal, NDA RWMD provides guidance to the nuclear industry on its requirements for the packaging and transport of ILW. LoCs are issued in three stages, which successively assess the suitability of the proposals against the requirements for safe disposal against the phased disposal concept.

Low Level Waste (LLW)

LLW is defined as waste containing radioactive materials other than those acceptable for disposal with ordinary refuse, but not exceeding 4GBq/g α or 12GBq/g β/γ activity (Cm2919).

Non-Hazardous Wastes

This is controlled waste which is not covered by the definition of hazardous waste. It comprises both inert waste and putrescible waste. Putrescible waste is controlled waste that will decompose readily under microbial attack. It includes green waste and wastes arising from residential, commercial and industrial sources.

Passive Safety

NII's guidance to its inspectors defines passive safety in the following way:

"Passive safety.....requires.....radioactive wastes.....to be immobilised in a form that is physically and chemically stable and stored in a manner which minimises the need for control and safety systems, maintenance, monitoring and human intervention. The wastes.....should be stored in discrete packages which are resistant to degradation and hazards and which can be inspected and retrieved for final disposal."

Proximity Principle

The proximity principle requires waste to be disposed of as close to the place of production as possible. This avoids passing the environmental costs of waste management to communities which are not responsible for its generation, and reduces the environmental costs of transporting waste. In considering waste management options there should be assessment of where environmental burdens fall in relation to particular sectors of society and recognition of potential adverse impacts on health and quality of life, in relation to other potential benefits to the social and economic needs of the area. The proximity principle has been defined primarily for non-radioactive wastes. For radioactive wastes it is a consideration to be taken into account, rather than an absolute principle. Most radioactive wastes that exist or will arise in the future will be owned by a small number of mainly public bodies (such as the NDA). For practical purposes radioactive waste creation and waste management are as closely linked as possible. Consideration needs to be given to balancing the impacts of waste transport against the concentration of radioactive wastes to ensure they can be securely and safely managed.

Secondary Waste

This is waste produced as a by-product of processing the primary waste stream.

Site End Point and Site End State

The 'end state' of a site is the physical condition at the point when the NDA has finished its business. The 'end point' of a site is the time at which this 'end state' is reached.

Site end states have previously been described as 'Greenfield' or 'Brownfield'. It is now accepted that these terms are not appropriate mainly because there is no agreed definition of what they mean and hence they cannot be recommended. It is likely that specific site end states will be defined as a result of a BPEO or an options study with appropriate stakeholder involvement. The current terms that are used to define end states are 'de-licensed' and 'de-designated', they are described above.

For some sites, reaching the **Final End State** is achieved after a long period of institutional care. An **Interim End State** is therefore defined which enables these sites to be decommissioned to a state which enables any residual hazards to be controlled by land use restrictions so that risks to human health and the environment are minimised to an acceptably low level.

Special Nuclear Material (SNM)

Special nuclear material" (SNM) is defined by Title I of the Atomic Energy Act of 1954 as plutonium, uranium-233, or uranium enriched in the isotopes uranium-233 or uranium-235. The definition includes any other material that the Commission determines to be special nuclear material, but does not include source material. The IWS will cover SNM that is currently identified as a waste or where it may be destined for a waste route in the future.

Sustainability – Sustainable development

This has been widely defined as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs. The following requirements should be met:

- Waste management should not impose undue burdens on future generations and their environment such that it compromises their ability to meet their needs.

- Even given a legacy of appropriate financial resources, future generations should preferably not have to divert time and effort to managing wastes generated by present and past generations. They should be free to pursue their own preoccupations.
- Decisions should be based on the *best possible scientific information* and analysis of risks
- Where there is uncertainty and potentially serious risk exists, *precautionary* action may be necessary
- Ecological impacts must be considered, particularly where resources are *non-renewable* or effects may be *irreversible*
- The underlying principle of “polluter pays” should be recognised in assessing cost implications (the ‘polluter pays’ principle requires producers and owners of wastes to bear the costs imposed by those wastes, including the costs of regulation and those of related research undertaken both by themselves and by the regulatory bodies. The evaluation of environmental and human costs of waste production, treatment and disposal should also be taken into account).

Sustainable development should be taken into account as one of the relevant considerations in considering the development of the Site IWS and of waste management policy.

Very Low Level Waste (VLLW)

Although still categorised within the scope of Low level Waste, VLLW contains less than 400 kBq of beta/gamma activity for each 0.1 m³ of material, or single items containing less than 40 kBq of beta/gamma activity.

Waste Hierarchy

The Waste Hierarchy encourages the adoption of options for managing waste in the following order of priority:

- Waste should be prevented or reduced at source as far as possible
- Where waste cannot be prevented, waste materials or products should be reused directly or refurbished then reused
- Waste materials should then be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material
- Where useful secondary materials cannot be reclaimed, the energy content of waste should be recovered and used as a substitute for non-renewable energy resources
- Only if waste cannot be prevented, reclaimed or recovered, should it be disposed of into the environment and this should only be undertaken in a controlled manner.

10 ACRONYMS

A	
ADU floc	Ammonium DiUranate floc
ALARA	As Low As Reasonably Achievable
ALARP	As Low As Reasonably Practicable
APEC	Authority (UKAEA) Product Evaluation Committee
ASFL	Annual Site Funding Limit
ATO	Authority To Operate
B	
BAT	Best Available Technique
BEPO	Best Practicable Environmental Option
BNG	British Nuclear Group
BPM	Best Practical Means
C	
CTTF	Cross-site Technology Task Force
CFA	Conditions for Acceptance
CHILW	Close Handled Intermediate Level Waste
CoRWM	Committee on Radioactive Waste Management
CSS	Chemistry Support Services
CWID	Common Waste Information Database
D	
DAM	Dounreay Accountability Meeting
DCP	Dounreay Cementation Plant
DCP-IDS	Dounreay Cementation Plant - Interim Drum Store
DCP-SE	Dounreay Cementation Plant - Store Extension
DEC	Dounreay Environment Committee
DFR	Dounreay Fast Reactor
DMTR	Dounreay Materials Test Reactor
DRWD	Dounreay Radioactive Waste management Database
DRWI	Dounreay Radioactive Waste Inventory
DSG	Dounreay Stakeholder Group
DSRL	Dounreay Site Restoration Limited
DSRS	Dounreay Site Restoration Strategy
DTI	Department of Trade and Industry
DWR	Deep Waste Repository
E	
EA	Environment Agency
EPA	Environment Protection act
EURATOM	European Atomic Energy Community
EW	Exempt Waste
F	
FCA	Fuel Cycle Area
H	
HEPA	High Efficiency Particulate in Air
HHISO	Half Height ISO container
HLW	High Level Waste
HSE	Health and Safety Executive
HVLA	High Volume Low Activity

I	
IAEA	International Atomic Energy Authority
IBC	Intermediate Bulk storage Containers
ICCM	Investment and Change Control Meeting
IEF	Import/Export Facility (DCP Store)
IEP	Immobilisation and Encapsulation Plant
ILW	Intermediate Level Waste
IRR	Ionising Radiations Regulations
ISO	International Organisation for Standardisation
ISRS	International Safety Rating System
IWS	Integrated Waste Strategy
L	
LCBL	Lifecycle Baseline (now Lifetime Plan)
LLLE	Low Level Liquid Effluent
LLLETP	Low Level Liquid Effluent Treatment Plant
LLW	Low Level Waste
LoC	Letter of Compliance (formerly Letter of Comfort)
LSA	Low Specific Activity
LTP	Lifetime Plan
M	
MEP	Member of the European Parliament
MP	Member of Parliament
MSM	Management Systems Manual
MSP	Member of the Scottish Parliament
MTR	Materials Test Reactor
N	
NaK	Sodium/Potassium alloy
NDA	Nuclear Decommissioning Authority
NDP	NaK Disposal Plant
NIA	Nuclear installations Act
NII	Nuclear Installations Inspectorate
NISR	Nuclear Industries Security Regulations
O	
OECD	Organisation for Economic Co-operation and Development
OCNS	Office of Civil Nuclear Security
OSPAR	Oslo Paris Convention
P	
PCB	Poly Chlorinated Bi-phenyl
PCCB	Police Command and Control Building
PCM	Plutonium Contaminated Waste
PCSC	Post Closure Safety Case
PFR	Prototype Fast Reactor
PPC	Pollution Prevention and Control
PSWP	Project Specific Waste Plan
PWT	Plant Washings Tank
Q	
QA	Quality Assurance
R	

R&D	Research and Development
RCEP	Royal Commission on Environmental pollution
RHILW	Remote Handled Intermediate Level Waste
RSA	Radioactive Substances Act
S	
SEPA	Scottish Environmental Protection Agency
SEG	Safety and Environment Group
SEP	Solids Encapsulation Plant
SDMSM	Site decommissioning Multi-Site Manager
SDP	Sodium Destruction Plant
SD:SPUR	Site Decommissioning: Sustainable Practices in the Use of Resources
SILW	Solid Intermediate Level Waste
SNM	Special Nuclear Material
SoLA	Substances of Low Activity
SPRS	Sellafield Product and Residue Store
SSC	Shaft and Silo Complex
T	
ThCM	Thorium Contaminated Material
THORP	Thermal Oxide Reprocessing Plant (at Sellafield)
U	
UCM	Uranium Contaminated Waste
UFP	Ultra Filtration Plant
UK	United Kingdom
UKAEA	United Kingdom Atomic Energy Authority
V	
VLLW	Very Low Level Waste
W	
W&F	Waste & Fuels
WPEP	Waste Product Encapsulation Plant Flask
WPC	Waste Posting Cell
WRACS	Waste Receipt, Assay, Characterisation & Supercompaction Facility
WSU	Waste Services Unit
WTC	Waste Treatment Complex (at Sellafield)
WTP	Waste Treatment Plant