INTEGRATED MANAGEMENT OF ALL HISTORIC, OPERATIONAL AND FUTURE DECOMMISSIONING SOLID ILW AT DOUNREAY

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ABSTRACT

This paper describes major components of the Dounreay Site Restoration Plan, DSRP to deal with the site's solid intermediate level waste, ILW legacy. Historic solid ILW exists in the Shaft (disposals between 1959 and 1977), the Wet Silo (operated between 1973 and 1998), and in operating engineered drummed storage. Significant further arisings are expected from future operations, post-operations clean out and decommissioning through to the completion of site restoration, expected to be complete by about 2060. The raw waste is in many solid forms and also incorporates sludge, some fissile material and hazardous chemical components. The aim of the Solid ILW Project is to treat and condition all this waste to make it passively safe and in a form which can be stored for a substantial period, and then transported to the planned U.K. national deep repository for ILW disposal. The Solid ILW Project involves the construction of head works for waste retrieval operations at the Shaft and Wet Silo, a Waste Treatment Plant and a Conditioned Waste Store to hold the conditioned waste until the disposal facilities become available. In addition, there are infrastructure activities to enable the new construction: contaminated ground remediation, existing building demolition, underground and overground services diversion, sea cliff stabilisation, and groundwater isolation at the Shaft. The Solid ILW Project involves many sub-projects and therefore the challenge is to integrate the whole to ensure that it is:

(i) managed effectively and safely;
(ii) undertaken in a way that is environmentally friendly;
(iii) clearly value-for-money;
(iv) carried out in a way that is publicly acceptable; and,
(v) delivered on the time-scales the United Kingdom Atomic Energy Authority, U.K.A.E.A. has committed itself to in DSRP.

INTRODUCTION

U.K. ILW, has a specific radioactivity content exceeding 12 GBq/tonne beta/gamma or 4 GBq/tonne alpha, but which is not significantly heat generating. There is currently no disposal route for this waste in the U.K. It is produced on nuclear sites, like Dounreay, from reactor operations, fuel fabrication, fuel reprocessing, research and development activities, and decommissioning. The solid ILW from these operations is generally accumulated in its raw form, within historic waste facilities or stored in drums in currently operated engineered purpose-built stores. The waste management strategy now in place is to ensure passive safe storage as soon as possible after waste generation, and to retrieve and encapsulate the raw waste not already in a passive safe state. The primary aim of this strategy of early encapsulation is to reduce the level of hazard on the site as soon as practicable.

Where solid ILW is to be encapsulated for disposal, packaging arrangements need to be agreed in advance with U.K. Nirex Ltd, confirming that the waste package should be acceptable for disposal.

The U.K.A.E.A. site at Dounreay, with its two fast reactors and a materials testing reactor, fuel fabrication buildings, reprocessing plants and fuel cycle research and development facilities, has a significant amount of this waste in solid and sludge form. As part of Dounreay's concerted restoration programme, all the existing solid ILW will be safely retrieved from its historical storage and disposal locations and treated and conditioned for its long-term storage and eventual disposal. Newly produced solid ILW will be routed directly into this waste treatment route, rather than into long-term storage in its unconditioned raw form. This paper describes the complex Solid ILW Project, which seeks to carry forward this key activity in the DSRP.

DOUNREAY SITE HISTORY

The 68 hectare Dounreay site, located on the northern coast of Scotland in the U.K. is the U.K.A.E.A.'s largest and most complex site, with three former nuclear reactors and a full range of fuel cycle, research and development facilities and radioactive waste plant.

The site started operations in 1958, with the operation of materials test reactor fuel-cycle activities, including fuel fabrication, operation of the Dounreay Materials Test Reactor, DMTR and irradiated MTR fuel reprocessing. This was rapidly followed by fast reactor fuel-cycle activities, centred about the operation of the Dounreay Fast Reactor, DFR. The higher active fraction of solid waste from both these fuel-cycles was disposed of into the Shaft, described below. When this was filled, the Wet Silo was used, also described below.

From 1980, fast reactor fuel cycle activities centred about the operation of the Prototype Fast Reactor, PFR and reprocessing of the irradiated PFR fuel, until the shutdown of PFR in 1996, and the subsequent cessation of PFR fuel reprocessing. Solid ILW from this fuel cycle has been stored in the Wet Silo and in engineered drum stores.

In 1998, the U.K.A.E.A. decided to cease pursuing commercial activities. This together with the decision in 2001, to terminate all fuel reprocessing operations at Dounreay, provided a clear direction to the site to concentrate on a single vision – site restoration. Dealing with the solid ILW from all these operations is a key task in the DSRP.

THE DOUNREAY SITE RESTORATION PLAN

In 2000 U.K.A.E.A. launched the DSRP, which presented proposals for the completion of the complex and challenging task of restoring the Dounreay site within 60 years, including the removal of all significant radioactive hazards within 25 years.

DSRP is the first example in the U.K. of a detailed strategic plan for the total restoration of a major nuclear site of this kind. Restoration includes decommissioning of all facilities, historic and decommissioning radioactive waste management, and contaminated land remediation. At Dounreay, liquid high level waste, HLW will be vitrified, liquid ILW will be immobilised in cement, fuels will be treated appropriately, whilst solid and sludge ILW will be encapsulated and immobilised in cement respectively. Solid low level waste, LLW will be conditioned and eventually disposed, whilst low level liquid effluent and gaseous effluent is treated before discharge, well within liquid and gaseous discharge authorisation limits.

In all in DSRP, there are about 1,500 individual decommissioning and waste management activities, which need effective integrated management. As part of DSRP, U.K.A.E.A. will deal with all of its solid ILW. The current solid ILW inventory at Dounreay is in its raw form, with no conditioning yet undertaken. The objective of the Solid ILW Project is to render all solid ILW passively safe and in a form for long-term storage and eventual disposal.

THE SOLID ILW FACILITIES

The Shaft

The 4.6m diameter, 65m deep Shaft was sunk into rock in the 1950's as part of the enabling works for the construction of the Dounreay Low Level Liquid Effluent Discharge Tunnel, LEDT. The Shaft was used as the transfer route for equipment and spoil from the LEDT and the main collection and pumping point for groundwater to keep the tunnel dry during excavation. The Shaft and LEDT were constructed using drilling and blasting techniques, with the former being rock bolted at intervals down the Shaft for stabilisation purposes.

Following construction of the LEDT, a concrete plug was installed in the Stub tunnel linking the Shaft to the LEDT, and both the Shaft and the LEDT were allowed to naturally fill with groundwater once the LEDT was commissioned. Following this, an Authorisation was then given to U.K.A.E.A. for the disposal of raw solid high active waste (later classed as solid ILW) by tumble tipping. The facility, which had a capacity for about $1000m^3$ of waste, was used through to 1977, when a gas-phase explosion took place in the headspace above the waste.

The Wet Silo

The Wet Silo is an engineered storage facility consisting of a heavily steel reinforced watertight thick walled concrete box with the roof near ground level. The facility has a nominal capacity of $760m^3$, and internal dimensions of 9.14 metres deep, 8.53 metres wide and 10.36 metres long, divided into two equal compartments by a full height partition wall. Waste was transferred into the facility by tumble tipping from flasks through ports in the roof. Water, allowed to accumulate in the Wet Silo, provided some shielding and heat removal from highly activated and contaminated components from the reactors and reprocessing plants. The facility was brought into operation in 1971, and became the sole solid ILW facility from 1977, until 1980 when an engineered drum store also became available. The Wet Silo, operated until 1998, nominally accepted low alpha, high beta/gamma wastes, although some fissile material is also known to be present

Figure 1 shows part of the Dounreay site, the Wet Silo, and a cutaway into the rock showing the location of the Shaft. It is expected that other new solid ILW plants will notionally be situated in the same area, once existing facilities have been dismantled and the area prepared.

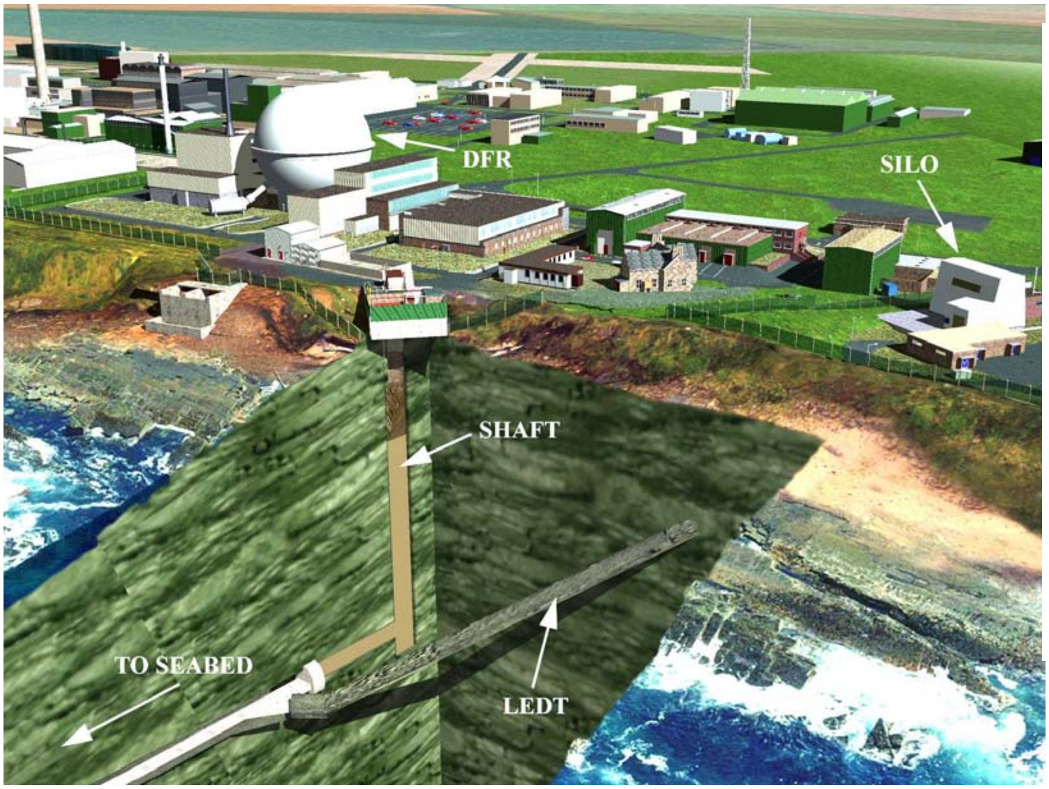

Fig. 1. The Shaft and Wet Silo at Dounreay

The Drummed Solid ILW Stores

Since 1980, Dounreay has had an engineered drum store for the storage of raw solid ILW in 200l drums. This was supplemented with additional drummed solid ILW storage in the late 1990's. The waste in these facilities has been reasonably well characterised. It is expected that all drummed solid ILW will form part of the raw waste feed to the solid ILW waste treatment facilities, in addition to the waste from the Shaft and Wet Silo.

Decommissioning Projects

A certain amount of decommissioning has been undertaken at Dounreay over the past 40 years. However, there were few drivers to complete decommissioning once plants and processes were phased out. With compelling encouragement of our regulators in recent times, Dounreay has now focussed on decommissioning and waste management activities. With the publication of DSRP, decommissioning plans have been prepared for all plants, including plants not yet built. It is clear that decommissioning solid ILW will be transferred into the Solid ILW route, though exactly where depends on the type of waste and its volume.

Decommissioning solid ILW that is reasonably well characterised and of a similar type, could be treated at source, especially if volumes are large. In this case simple waste treatment plants could be situated in the reactors, where solid ILW could comprise large volumes of activated steel and concrete. In these cases the treatment plant might consist of sorting, cutting, assaying, package loading and encapsulation. The product would then be routed to the solid ILW conditioned waste store, CWS, for storage alongside conditioned solid ILW, which has come through the central waste treatment plant, WTP. In some cases, where there is clear benefit, some decommissioning solid ILW could be routed directly to the WTP, because of its characteristics, e.g. it was heavily contaminated, the volumes were small or there was some hazardous component that required specialised treatment. In this case, constructing waste treatment facilities for these wastes at source would not be worthwhile.

It is part of DSRP to find the right balance between waste treatment at source and in central facilities. In summary, the factors which play a role in determining where solid ILW is treated, include the:

- waste volume, composition and form of the radioactive component: contamination, activation;
- assay requirements;
- hazardous/toxic nature, requiring passivation;
- the range and complexity of additional treatments needed before encapsulation;
- specific decommissioning and waste management programming; and,
- decommissioning waste production rates and waste treatment plant throughputs.

SOLID ILW DESCRIPTION

The radioactive waste inventory of the historic liabilities has been captured in the Dounreay Radioactive Waste Inventory, DRWI. This is an Access database, which describes in detail the volumes and composition of each radioactive waste stream presently at Dounreay, and which will be produced in the future as site restoration as described in DSRP progresses. There are likely to be over 100 individual waste streams in total. DRWI is compiled annually in order to provide an up-to-date record, to:

- allow U.K.A.E.A. to plan waste treatment, packaging, storage and disposal;
- provide information to government departments and agencies responsible for radioactive waste policy and regulation; and,
- inform other interested parties , including the public.

Through the waste management arrangement of tumble tipping, the waste inventory of the Shaft and Wet Silo is relatively poorly understood. They are known to include all forms of solid waste from reactor operations and fuel reprocessing over four decades. Both facilities were operated wet and contain a sludge component.

Table I. Shaft Waste – Physical Details
From 1959-1977, there were over 16,000 disposals to the Shaft. Water is continuously removed to maintain an in-flow of groundwater and hence minimise leakage of contamination into the surrounding bedrock. No retrieval facilities were incorporated, since the Shaft was licensed as a disposal facility. However, the waste is in retrievable form as it has not been immobilised. Disposed wastes include reactor components, metallic fuel element debris and cladding, redundant equipment and tools, discarded plastics from bag posting operations and wrappings on undrummed components and gaiters, metallic components from plant decommissioning and refurbishment work, sludges and smaller items such as manipulator jaws, tools, laboratory samples and residues. The waste was disposed of loosely or in drums, cans and plastic bags.
Shaft Waste continued…

The sludge component in the Shaft consists of a mixture of ferri/alumino floc, as well as rust, degredation products from waste decay and other items. The exact composition will not be determined until retrieval operations begin.

Table II. Wet Silo Waste – Physical Details
Redundant and waste items from cell operations including post-irradiation examination (PIE), analytical, defuelling, post-operational clean out (POCO), as well as routine operations. The wastes include redundant metallic reactor components, metallic fuel element debris and cladding, redundant equipment and tools, discarded plastics from bag posting operations and wrappings on undrummed components and gaiters, and metallic components from plant decommissioning and refurbishment work. Sludge is thought to be present both from direct consignments and from degradation of some of the solid wastes. The Wet Silo sludge will consist of a mixture of ferri/alumino floc, cyanoferrate flocs, $HTiO_2$ flocs, as well as rust, degredation products from waste decay and other items. The exact composition will not be determined until retrieval operations begin.

Table III. Drummed Solid ILW Store waste – Physical Details
Drummed waste consists of fuel hulls, centrifuge bowls, plenums, filters, glassware, wrappers and other assorted scrap equipment and tools. It arises from both reactor fuel breakdown and PIE. All waste is held in 160 litre crates within the 200 litre drums.

The description of the many potential decommissioning wastes that may be treated via the solid ILW route are not included here.

Table IV. The Radioactivity

Facility	Waste	Total Alpha TBq	Total Beta/Gamma TBq
Shaft	Solids + Sludge	13	500
Silo	Solids + sludge	7	3,000
Drummed Stores	Solids	800	200,000
Decommissioning*	Solids	~ 500	~140,000

* Estimated values

THE SOLID ILW PROJECT

Major Project Timelines

For planning purposes, it has been convenient to split the major projects at Dounreay, including Solid ILW, into the following phases:

Table V. Major Project Timelines

Phase	Description	Including….
I	Strategy stage	Major strategic agreements
II	Project definition	Concept designs
III	Design	Preliminary & detailed design
IV	Construction	Major on-site construction
V	Commissioning	Inactive and Active commissioning
VI	Operation	Waste Treatment
VII	Decommissioning	POCO and dismantling

The Major Solid ILW Project Components

The Solid ILW Project consists of 8 main inter-linked sub-projects:

A. Hydrogeological investigations in the Shaft environment;
B. Shaft isolation from the environment;
C. Construction of Head-works and retrieval of solid ILW from the Shaft;
D. Construction of Head-works and retrieval of solid ILW from the Wet Silo;
E. Construction and operation of a waste treatment plant, WTP;
F. Construction and operation of a conditioned waste store, CWS;
G. Preparation of new waste routes and construction of new flasks;
H. Preparation of the ground for all of the above.

Significant work was done in the 1990's in Phase I of the Solid ILW Project to finalise the solid ILW management strategy and gain Government approval for the Project. The conclusions from this were that historic solid ILW would be retrieved as soon as practicable and that all solid ILW would be treated for long-term storage, with eventual deep disposal. The practice of raw waste storage, albeit in drums, would be minimised in the future, to achieve passive safety as soon as possible.

Figure 2 depicts the main transfer routes to be implemented in the Solid ILW Project.

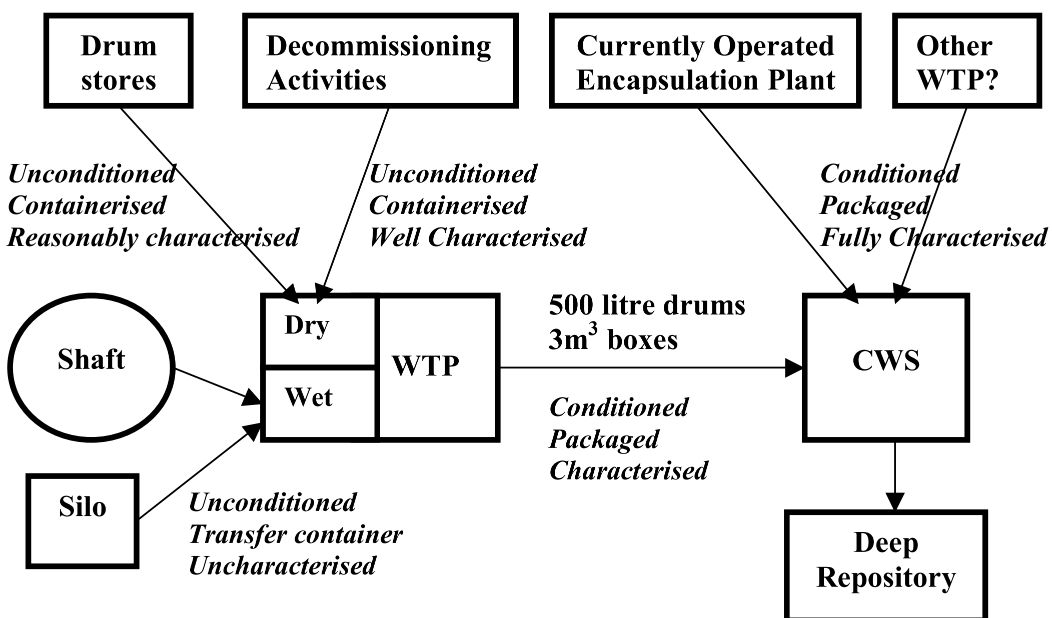

Fig. 2. Solid ILW Waste Routes

Phase II – Project Definition – is now underway to better define and specify all requirements, prior to Phase III – Preliminary and Detailed Design. Project Definition involves undertaking technical option assessments, preparing user statement-of-requirements and design specifications, preparing preliminary safety cases, defining environmental principles, implementing the preliminary stages of regulator and stakeholder consultation, and recommending contract strategies for Phase III onwards. The following sections describe these Solid ILW sub-projects further.

A. Hydrogeological investigations in the Shaft environment, and
B. Studies of Shaft isolation from the environment

As noted above, the Shaft waste is in direct contact with rock and groundwater pumping (about 15-20 m^3/day) reduces the potential for significant radioactive contamination to migrate into the surrounding rocks and beyond. The water level in the Shaft is reduced to about 3 metres below the surrounding water table.

Investigations so far have identified two different approaches to safely retrieve waste:

- an 'archaeological dig', where individual waste items would be identified and removed by remotely operated robotic or grab equipment; and,
- a 'freeze and mill' approach, where the Shaft waste column would be frozen solid and the waste subsequently removed by drilling or milling.

In addition, two versions of the 'archaeological dig' approach have been identified:

- 'dry retrieval', where the level of the water in the Shaft is lowered so that it always remained below the top of the waste column; and,
- 'wet retrieval', where the water level inside the Shaft is maintained at its current level throughout the waste retrieval programme.

In the 'Dry Retrieval' approach, increasing amounts of water would need to be pumped as the waste level was reduced, therefore means of isolating the Shaft from the environment to reduce or terminate groundwater in-flow have been considered. There are 3 possible approaches to Shaft Isolation by:

- freezing the groundwater in the rock by sinking freezing wells round the Shaft. To ensure the contents of the Shaft do not also freeze, a set of heater wells would be drilled within the encircling freeze wells;
- grout injection into the rock, to fill all fissures and fractures, where groundwater can flow; and,
- insertion of secant piles, where intersecting holes are filled with concrete, in order to form a concrete curtain round the Shaft.

To design the above requires an accurate picture of the geological and hydrogeological environment round the Shaft. A considerable amount of work has been undertaken since 1998, to achieve this. A number of boreholes have been sunk close to and further away from the Shaft for geophysical investigations. These have been supplemented by seismic studies. A model has now been produced which depicts the geological and hydrogeological environment and provides considerable comfort that approaches, such dry retrieval and Shaft isolation by ground freezing, can be established.

In addition to the groundwater isolation works, there are additional preparatory tasks before construction of the Shaft Waste Retrieval Headworks. These include:

- reinforcement of the sea cliffs close to the Shaft. This is necessary to allow the construction of the Shaft Waste Retrieval Headworks foundations; and,
- reinforcement of the plug in the stub tunnel at the base of the Shaft. Though the plug is safe as it is, there may be occasions during waste retrieval when

pressures across the plug may become unacceptable. Reinforcement on the seaward side of the plug will negate this problem.

C. Construction of Head-works and retrieval of solid ILW from the Shaft

Dry retrieval is currently the reference case; the main reason for this being the ability to see what waste is being retrieved. The belief is that this is a safer option. That does however bind the project into isolation of the Shaft from groundwater ingress.

The Shaft Waste Retrieval Project will learn from other waste retrieval projects world-wide, though the location and the dimensions of the Shaft make it a novel and unique challenge. A range of robust, retrieval tools will be employed, which have been proven in similar radioactive and hazardous environments. A robotic platform will probably be utilised, from which the retrieval tools can be used. The platform would be lowered into the Shaft and, via extending legs, would position and lock itself centrally in the Shaft bore. Operations such as grasping, gripping, pulling, cutting and grinding are likely, with the recovered waste either being drawn directly to the surface or via a hoisted basket.

At the surface the waste would be drawn into the Headworks and prepared for transit to the WTP. Since the waste is potentially hazardous, then either (a) the hazards need to be managed to allow the waste to be transported (e.g. by transporting the waste within a flask with an inert gas blanket), or (b) the hazards need to be passivated in the Headworks prior to transport. These alternatives are being 'optioneered', in order to ensure the most appropriate solution is chosen.

Other design considerations, beyond the need to adopt safe operations, to be environmentally friendly, to employ publicly acceptable solutions and achieve value for money, include:

- achieving a sensible process throughput;
- tool deployment arrangements and crane requirements;
- tool performance, e.g. ruggedness, radiation and wet environment durability;
- deployment control systems and services
- tool changing needs;
- availability, reliability, operability, maintainability, and failure recovery.

D. Construction of Head-works and retrieval of solid ILW from the Wet Silo

A number of waste retrieval options are being examined to remove the waste from the Wet Silo. The main options involve entry through:

- the existing roof penetrations/plug holes;
- enlarged or new roof penetrations; and,
- an open-topped Silo, after Silo roof removal.

A range of manipulators and grabs are being considered, along with waste containers and baskets. A design consideration, which will drive the choice of retrieval technology, is that this store is 'over-filled' i.e. to the roof, thereby limiting waste recovery on initial entry. Similar design considerations, as listed for Shaft Waste Retrieval, are also being examined. Clearly, the Project is making good use of silo waste retrieval experience elsewhere. In particular, retrieval operations in the U.K. at

Magnox reactor sites at Trawsfynnd and Berkeley, in Europe at Vandellos in Spain and elsewhere are being investigated. Whereas the unique Shaft location will render that project a 'first', waste retrieval from a silo is better understood and should pose less of a challenge.

E. Construction and operation of a waste treatment plant, WTP

Solid ILW from the Shaft, Wet Silo, drummed stores and some decommissioning will be routed to the WTP, where it will be sorted, segregated, assayed and characterised. The key areas in the plant will be:

- waste receipt, sorting and segregation;
- WRATS (see below) and hazardous component treatment and passivation;
- bulk waste treatment;
- grout preparation;
- solid waste encapsulation and sludge immobilisation;
- export to the CWS;
- secondary waste management (including gaseous and effluent waste); and,
- services, ventilation, plant services.

The solid ILW will arrive at the WTP in a safe form for transport in drums and containers and flasks. In the case of sludge, the waste might be pumped or arrive in batches in sealed containers. At the WTP and through all WTP processes, the waste will be uniquely identified, in order to ensure that the physical, chemical and radiological description of the waste is not lost. Only by accurate records will the waste be properly tracked through the plant, hazards dealt with appropriately and knowledge exist of the exact waste composition once it is placed in its final container for encapsulation. A quality record system will be a pre-requisite for (i) regulator approval for the start-up of plant, but also (ii) approval from U.K. Nirex, the organisation charged with the delivery of a robust disposal management arrangement for solid ILW in the U.K.

Firstly the solid ILW will be tipped onto sorting mesh trays, for the initial separation of the sludge and under-sized solid components from the over-sized solid component. An initial radiological survey with gamma cameras will assist this process, with higher dose components being identified. Cans and sealed containers can be distinguished at this stage, for separate treatment. It is expected these items will be taken off-line and opened in an inert dry environment, using remotely operated cutting tools. In principle, hazardous material will be reacted and passivated in order to remove the possibility of energetic reactions.

Apart from hazardous waste passivation, there is a further waste component that needs attention before it can be encapsulated. This waste is designated as WRAT – Waste Requiring Additional Treatment. They may have a hazardous component (such as mercury, uranium hydride etc.), but they also include non-hazardous materials (such as aluminium, powders, containers) that need to be dealt with in order to produce an acceptable final waste package. The following table lists some of the main WRATs, their problem characteristic and the likely means of treatment:

Table VI. Waste Requiring Additional Treatment

WRATs	Problem characteristic	Treatment
Filters	Geometry hinders voidage being in-filled by grout	Use high fluid grout or shred filters
PVC	Acidic degradation products affect grout	Limit amount of PVC in each waste package
Free Na or NaK	Hazardous and incompatible with grout	React with water in controlled manner
Aluminium swarf	Reacts with grout to produce hydrogen	Limit high surface area Aluminium in each waste package
Borated glass	May affect assay of waste and waste grouting	Limit amount of glass in each waste package, and develop knowledge
Vacuumed Powders, cave sweepings	Difficult to fill voidage	Homogenise powder in grout
Sealed Cans, bottles, containers	Difficult to fill voidage, and know contents	Break open, investigate and treat contents

The product from the WTP will be standard Nirex 500 l drums and 3 m^3 boxes, containing encapsulated solids and immobilised sludges. The former will involve the pouring of specially formulated void-filling grout into the boxes containing the solids. Sludge wastes will be in-drum mixed, using a lost paddle incorporated into the container design, to enable a homogeneous mix of cemented waste to be produced. All waste packages will be manufactured to meet the Nirex waste package acceptance criteria, and will have acquired Nirex Letters of Comfort for waste package design. This gives U.K.A.E.A. comfort that the conditioned solid ILW is consistent with Nirex's disposal plans. It is expected that U.K.A.E.A. will produce about 10,000 conditioned waste containers (500l drums and 3m^3 boxes) from treating all Dounreay solid ILW.

F. <u>Construction and operation of a conditioned waste store, CWS</u>

Since the availability of the a deep repository for conditioned waste in the U.K. is not certain, the CWS is to be constructed with for a 100 year design life. The conditioned waste should not deteriorate during storage so that it can be transported at the end of the storage period and ultimately placed into a repository and meet the waste package performance requirements at that time. Particular attention will be given to the materials of store construction, the in-store ventilation and climatic control and the operation and maintenance of all in-store equipment.

Two generic store designs are being investigated: (a) a vault store with the waste packages placed in free-standing stacks using a mobile crane, and (b) a charge face store, with the waste packages loaded into supported stacks, with a flask through the charge face floor.

Proving the waste packages perform during the long period of storage is a major concern of all stakeholders, whilst the availability of a deep repository is so uncertain. Therefore, waste packages may need to be withdrawn occasionally from the store for inspection and monitoring. Exactly which characteristics need to checked and how often the inspection and monitoring needs to be undertaken is an issue that is being investigated as part of the project definition phase of the CWS Project.

G. <u>Preparation of new waste routes and construction of new flasks</u>

Major new plant construction is obviously the highlight of the Solid ILW Project. However, new waste facilities alone will not make an effective waste management system, without the necessary infrastructure to make it all happen. A significant element in the infrastructure requirement is the provision of modern flasks and cost effective waste routes that allow the right waste throughput. The current flasking arrangements at Dounreay were devised to support reactor operation and irradiated fuel reprocessing. Clearly to take forward decommissioning and waste management as part of DSRP, a different type of flasking requirement is needed. Arrangements are in hand to deliver this support to the Solid ILW Project.

H. <u>Preparation of the ground for all of the above</u>

The Dounreay site has an area of only 68 hectares. The small area within which the Shaft and Wet Silo sits, includes office accommodation, laboratories, above and below ground services, a low active effluent drain (LAD) and some contaminated ground associated with the latter. On the north side, the area is bounded by sea-cliffs. It is evident the whole area needs to be prepared before new construction can be contemplated. This part of the Solid ILW Project is the Solid ILW Enabling Works. The main components of the work involve:

- Relocation of existing staff accommodation and demolition of buildings;
- Remediation of contaminated ground; and,
- Relocation of services, including the LAD.

THE SOLID ILW PROJECT END POINT

The restored Dounreay site end point on completing DSRP will be defined by criteria similar to those adopted for the delicensing of nuclear licensed sites. While delicensing may be an achievable objective for some facilities or site areas, there are some for which it may not be practicable and a suitable end point will then have to be agreed with the Regulator. This will no doubt be the case for the decommissioned Shaft. The solid ILW has been in contact with bare rock and whilst every attempt will be made to decontaminate the facility, a case might be made to leave fixed very low level residual contamination at depth within the rock once the mobile and free contamination has been removed. This option depends on a reasonably practicable interpretation of the "no danger" clause in the Nuclear Installations Act, 1965, as amended (NIA65). *(Note: The NIA allows a site license to be revoked only when "there is no danger from any ionizing radiations from anything on the site". As yet there is no case law to interpret these words.)*

For the conditioned solid ILW, the medium term end point is its safe passive storage in the CWS. U.K.A.E.A.'s strategic plans assume that a U.K. national repository for ILW will become available, on a time scale of some 40 years or more. If U.K. Government policy remains the construction of a national repository, Dounreay's conditioned solid ILW will be transferred to it when that facility becomes available. If a deep disposal site does not become available, then the conditioned solid ILW will remain on the Dounreay site for the foreseeable future, unless alternative off-site management arrangements can be found. If the conditioned solid ILW remains on the Dounreay site for the long-term then the Dounreay site will not become truly restored.