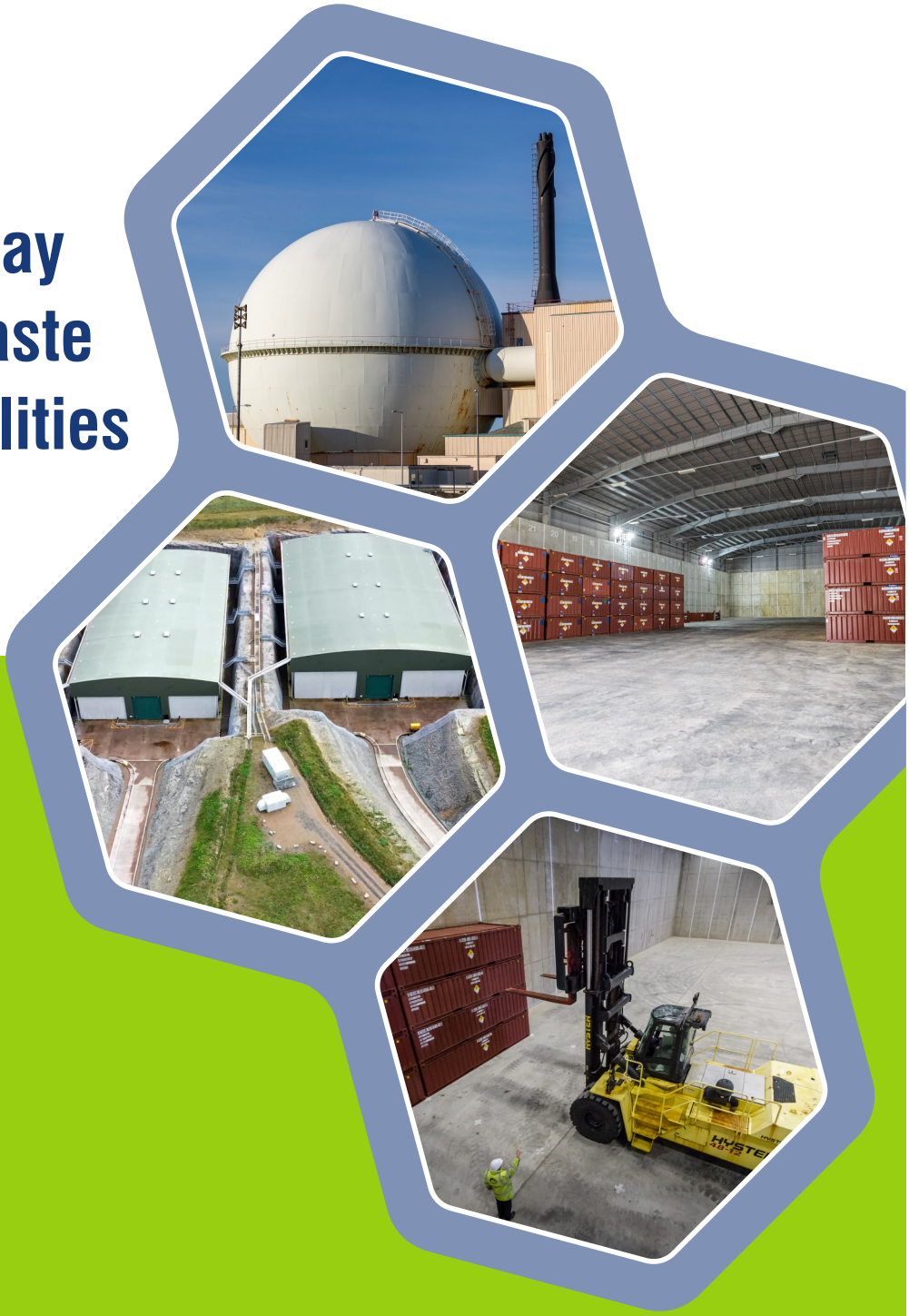
Dounreay

Overview of the Dounreay Low Level Waste Disposal Facilities



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Overview of the Dounreay Low-Level Waste Disposal Facilities 2021

1 Introduction

The nuclear research site at Dounreay in Caithness, Scotland, is being decommissioned by Dounreay Site Restoration Limited (DSRL) in accordance with UK Government policy and on behalf of the Nuclear Decommissioning Authority (NDA). The decommissioning and restoration activities at the site to date and in the future are expected to lead to the production of a significant volume (up to 175,000 m^3) of solid low-level radioactive waste (LLW), although waste generation will be minimised wherever practicable. Dedicated disposal facilities, referred to as the Dounreay LLW Disposal Facilities, have been constructed to manage the LLW. This document explains why the disposal facilities were constructed, describes the requirements for and the design of the facilities, explains how safety is ensured, and sets out why DSRL submitted an application in 2021 to the regulator, the Scottish Environment Protection Agency (SEPA), to revise the current permit for the LLW Disposal Facilities.

Figure 1.1: Aerial view of the Dounreay site in 2015 with the LLW Disposal Facilities in the foreground.

2 Decision to construct the LLW Disposal Facilities

Historically, Dounreay disposed of its LLW on site in authorised disposal facilities, known as the LLW Pits. However, the LLW Pits were nearing their capacity in the

late 1990s and did not meet modern standards. Following closure of the LLW Pits, LLW was placed into large steel containers, similar to the half-height International Standards Organisation (HHISO) containers that are used for transportation on public roads, and stored in buildings on site as an interim measure (Figure 2.1). Therefore, a solution for the long-term management of the stored LLW and the LLW to be generated during site decommissioning was required.

Figure 2.1: Photograph showing storage of LLW HHISO containers at Dounreay.

In 2002 the United Kingdom Atomic Energy Authority (UKAEA)[1] made an application to SEPA to dispose of Dounreay LLW to the national LLW Repository (the LLWR) in Cumbria.

In April 2004, following consultation with stakeholders and members of the public, UKAEA completed a study which concluded that the Best Practicable Environmental Option (BPEO) for managing Dounreay's LLW is disposal in shallow below-surface facilities to be constructed at Dounreay. The BPEO study involved an assessment of potential management options for the LLW. These options were assessed against a range of criteria, including technical, environmental, cost, health and safety issues. The study was conducted in line with best practice and involved consultation with a range of people, including the local community and organisations with an interest in radioactive waste management. The recommendations and conclusions from the study provided the basis for the "Dounreay Solid LLW Overall Strategy", which was published in March 2005. A fundamental component of this strategy is the development of new specialised below-ground disposal facilities for LLW at Dounreay. Siting on land at Dounreay avoided any need to transport LLW from Dounreay on public roads. Disposal at

[1] In 2008, Dounreay Site Restoration Limited (DSRL) took over the site licence and environmental authorisations and permits from UKAEA.

Dounreay therefore satisfies the proximity principle of managing the waste at source. Disposal at Dounreay is also consistent with UK Government policy on LLW management and the NDA strategy on management of LLW from the UK nuclear industry.

On 10 May 2005, the Scottish Executive (now the Scottish Government) issued SEPA with a Direction to refuse the 2002 application to dispose of Dounreay LLW to the LLWR in Cumbria, and indicated instead that a new LLW disposal facility should be constructed on UKAEA-owned land at Dounreay. Hence, DSRL pursued the development of new specialised facilities (the LLW Disposal Facilities) adjacent to the Dounreay nuclear licensed site.

DSRL continues to keep the strategy of on-site disposal under review. The most recent review has identified that diversion of some waste that is suitable for incineration may be more cost effective than disposal in the LLW Disposal Facilities and hence reduce the total volume of waste that needs to be disposed of in the LLW Disposal Facilities.

3 Regulatory requirements and performance standards

In order to construct and operate the disposal facilities at Dounreay, planning permission was required from the Highland Council and authorisation to dispose of radioactive wastes was required from SEPA.

Following detailed site investigation, design and assessment studies, DSRL initially lodged a planning application with the Highland Council in June 2006. The period for the determination of this application was extended to allow SEPA sufficient time to assess fully the supporting Environmental Safety Case (ESC). The planning application was re-activated in May 2008, and planning permission was granted by the Highland Council in April 2009. The planning permission included some 26 conditions on DSRL, covering a wide range of environmental issues for which the Highland Council is responsible, such as construction noise/dust, traffic and visual impact. This approval represented a significant step in securing the future decommissioning programme for Dounreay.

Following 3 successful blasting trials, DSRL applied to the Highland Council for additional permission to excavate via blasting in October 2011. This permission was granted in November 2011 and included an additional 7 conditions on DSRL relating specifically to blasting operations.

The UK environment agencies set out the requirements for near-surface disposal facilities on land for solid radioactive wastes in their Guidance on Requirements for Authorisation (the GRA). The GRA explains the requirements that a developer or operator must fulfil when applying for an authorisation for a disposal facility. The guidance sets out the radiological protection requirements for humans and the environment, which derive from national legislation and international guidance and good practice (e.g. from organisations such as the International Commission on Radiological Protection [ICRP] and the International Atomic Energy Agency [IAEA]).

The GRA defines criteria for the protection of people and the environment from the harmful effects of ionising radiation. The statutory limits for operational facilities limit doses to less than 0.3 mSv/y and risks in the far future to even more stringent

criteria approximately 10 times less than for the operational period. Both of these criteria are very low in comparison to the average annual radiation dose received by people in the UK of 2.6 mSv/y. The main sources of radiation giving rise to everyday doses are illustrated in Figure 3.1 and are compared to the regulatory guidance level assuming exposure occurs; this figure illustrates the stringent nature of the radiological protection requirements for a waste disposal facility.

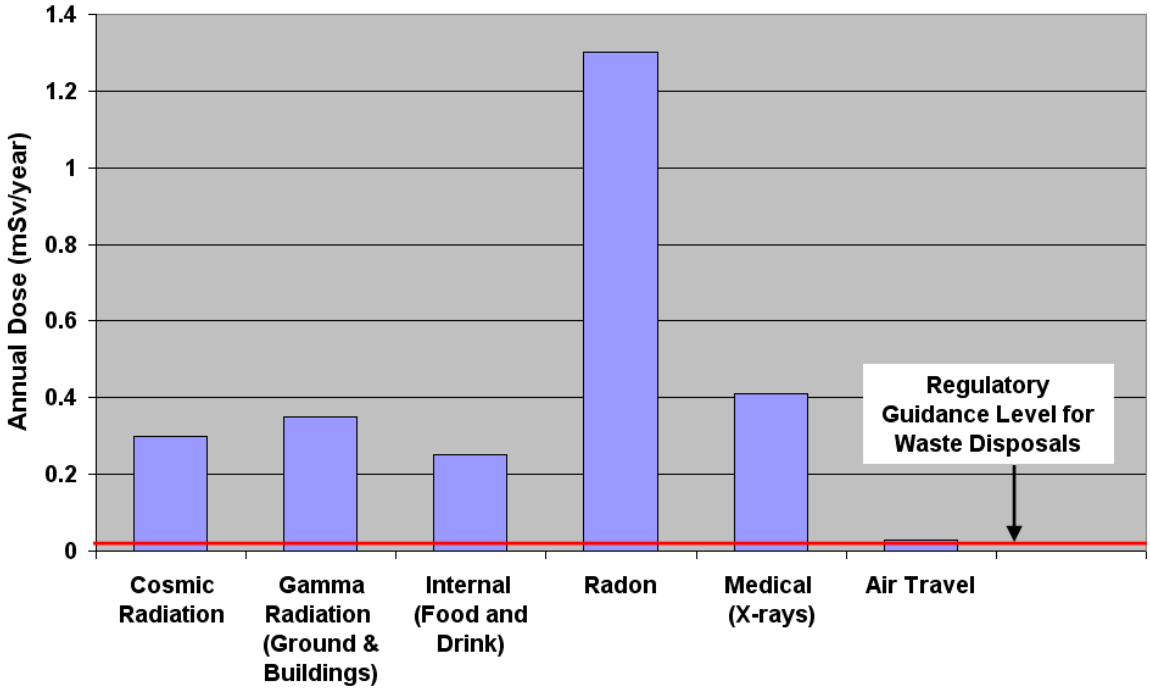

Figure 3.1: Average annual radiation dose (mSv per year) to a typical member of the UK public from various sources of radiation. The solid red line compares these doses to the regulatory risk guidance level for disposal of radioactive waste to specialised land disposal facilities.

In addition to radiological protection regulations, an authorised disposal facility must comply with other relevant regulations, such as those concerning groundwater protection, hazardous substances management, conventional health and safety, environmental impacts, and construction protocols. Appropriate application of national and international standards and good engineering practice, including design principles such as reliance on passive safety features and multiple barriers, must also be applied.

The GRA requires that the waste is disposed of in such a way that the radiological risks to individual members of the public and the population as a whole are as low as reasonably achievable (ALARA) under the circumstances prevailing at the time of disposal, taking into account economic and societal factors and the need to manage radiological risks to other living organisms and any non-radiological hazards. The design of the disposal facilities has been optimised to ensure that the required standards in the GRA are met while balancing other criteria such as operator risks, environmental impact, material use and cost.

DSRL initially applied to SEPA for the necessary authorisation to dispose of radioactive wastes in the facilities in April 2008. Following dialogue with SEPA, the application was updated in October 2010. In support of the application, the ESC was developed to demonstrate that the waste will be disposed of safely.

An authorisation with conditions was issued by SEPA in January 2013. SEPA will continue to regulate the facilities until such time after their closure when they can be safely released from regulatory control.

In August 2014, DSRL submitted operational documentation to SEPA for review, seeking permission to commence waste emplacement. Permission was subsequently granted, and the first waste emplacement took place in April 2015.

4 LLW at Dounreay

For waste to be defined as LLW its radioactivity level must be below set limits. These limits are prescribed by the UK Government in its LLW Policy, and are consistent with guidance from the IAEA on waste suitable for disposal in facilities at, or near, the ground surface.

The LLW inventory at Dounreay that is proposed to be disposed of in the LLW Disposal Facilities contains less than 0.001% of the radioactivity that is present in all radioactive waste on the Dounreay site. However, it comprises about 90% of the volume of solid radioactive waste that is expected to be generated during operation and decommissioning of the site.

Solid LLW includes metals and concrete, building rubble, contaminated soils, glass, and other materials, such as polythene sheets, plastic gloves and paper, which have been lightly contaminated with radioactivity. Figure 4.1 shows the typical content of a drum of Dounreay LLW. Figure 4.2 presents a breakdown of the total inventory for disposal in the LLW Disposal Facilities and shows a dominance of metals (mostly steel), concrete and soil.

Figure 4.1: Photograph showing typical contents of a drum of Dounreay LLW.

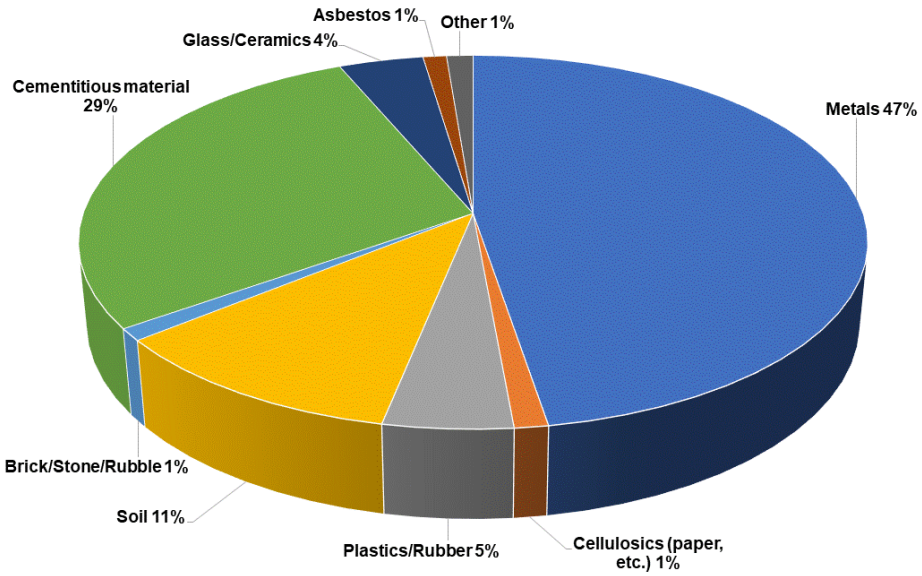

Figure 4.2: The percentage of each material type by mass in Dounreay LLW.

The majority of the LLW for disposal is from the Dounreay site, but a small fraction comes from the adjacent Ministry of Defence (MoD) Vulcan Nuclear Reactor Test Establishment. No higher-activity wastes or non-radioactive wastes, such as putrescible domestic wastes of the type that are typically sent to landfill, will be accepted in the Dounreay LLW Disposal Facilities.

5 Phased construction and operation

The planning application included 3 phases of vault construction and operation, comprising 6 vaults with a total capacity of 175,000 m^3. Construction is phased to provide flexibility due to uncertainties in the total waste volumes and the timing of waste arisings. The first phase consisted of construction of the first 2 vaults between 2011 and 2014, which were sized to accommodate the minimum predicted waste volumes. The current programme of future construction phases is uncertain and dependant on the rates of decommissioning and associated volumes of waste; the next phase of vault construction may occur between 2022 and 2026, with a potential third phase dependent on decommissioning of the Dounreay site.

The following photographs illustrate the excavation and construction of the first 2 vaults. Work was undertaken on both vaults simultaneously, excavating around 243,000 m^3 of rock. Blasting techniques were used to minimise the duration of the construction period and reduce the duration of nuisance impacts on local residents.

When excavation was complete, steel reinforcement was placed and concrete poured to construct the floor slabs. This was followed by the construction of the reinforced walls and then the installation of the steel support structure and materials that form the roof. Mechanical and electrical installation then followed, in parallel with the construction of the vault apron, ramps and access roads.

Figure 5.1: August 2012 – installation of the floor slab.

Figure 5.2: November 2012 – construction of reinforced walls.

Figure 5.3: October 2012 – aerial view of construction.

Figure 5.4: February 2013 – construction of reinforced walls complete.

Figure 5.5: May 2013 – roof installation complete.

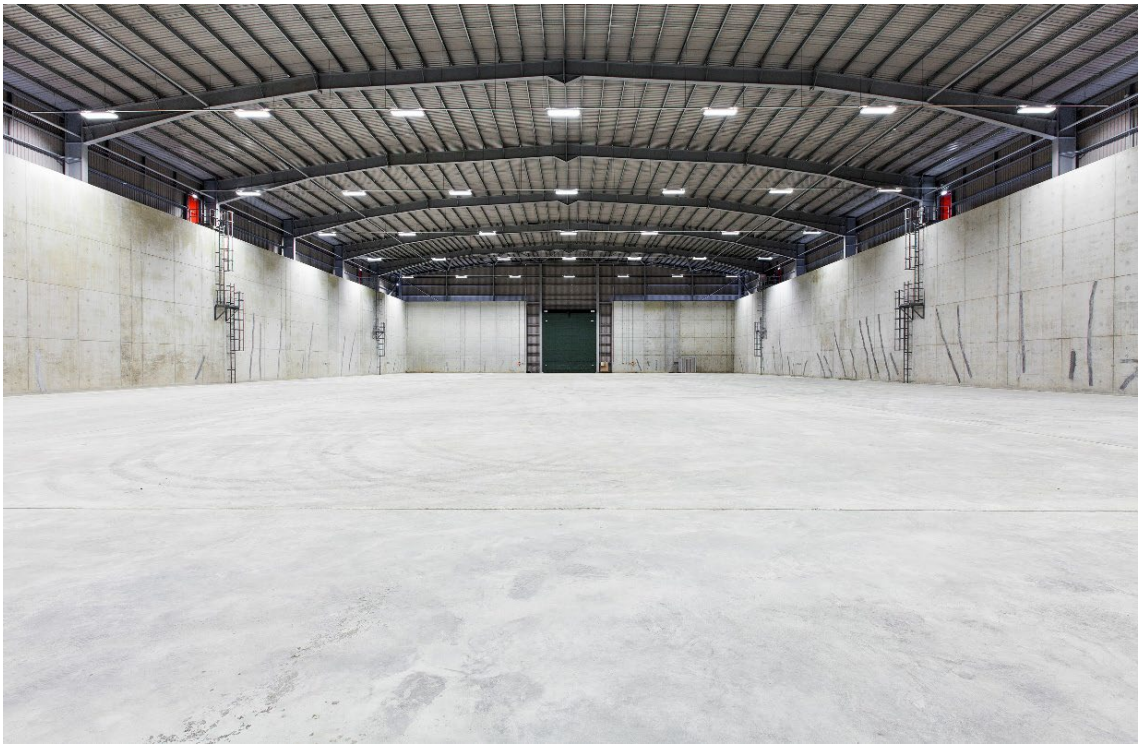

Figure 5.6: February 2014 – internal view of completed vault.

6 The LLW Disposal Facilities

The facilities consist of concrete vaults built a few metres below the ground surface and located immediately to the northeast of the Dounreay nuclear licensed site. Construction of the first 2 vaults, including the necessary roads and services, was completed in 2014 (Figure 6.1) and waste emplacement commenced in 2015.

Figure 6.1: Photograph of the Dounreay LLW Disposal Facilities during construction (2012-2014).

The first 2 vaults constructed are designed for the disposal of two distinct types of LLW. The right-hand vault in Figure 6.1 is for the disposal of LLW that is managed on the Dounreay site using HHISO-type containers and comprises a wide range of contaminated items. The left-hand vault in Figure 6.1 is designed for Demolition LLW, which mainly comprises lightly contaminated building rubble and soils with radioactivity levels lower than the LLW vault waste.

Looking in more detail at the waste that is managed in the right-hand LLW vault, much of it is packaged in steel drums which are compacted to reduce volume and placed into HHISO-type containers (Figure 6.2).

Figure 6.2: Photographs of the interior of the Dounreay Waste Receipt, Assay, Characterisation and Supercompaction (WRACS) facility, showing compaction of LLW drums into thin “pucks” (left), and filling of a HHISO container with compacted LLW drums (right).

Before disposal, any voids in the HHISO-type containers are filled with a cement-based grout at a purpose-built grouting plant located on the Dounreay site. The containers and grout help ensure that the radioactive waste remains contained for as long as is practicable.

The grouted HHISO-type containers are transported to the LLW Disposal Facilities and are stacked in the LLW vault (Figure 6.3). HHISO containers are stacked 4-high in the LLW vault and will be encased in more grout. Once the entire vault is stacked to this level, a reinforced floor will be constructed above the containers and the vault access ramp raised to this level. Four more containers will then be stacked in the upper section of the vault and encased in grout. Once full, the temporary steel roof structure will be removed and the vault will be closed with a reinforced concrete slab lid.

Figure 6.3: Photograph from 2018 inside the LLW vault showing emplaced HHISO containers stacked 4-high across the width of the vault.

The Demolition LLW is disposed of in large one tonne bags directly into the Demolition LLW vault (Figure 6.4). Void spaces between bags and within the waste are minimised with inert granular material (e.g. sand or crushed rock). This, along with waste compaction during the operational phase, minimises voids, stabilises the waste and provides a clean working surface for the next layer of waste. Once full, the roof structure will be removed and the vault will be covered with a flexible low-permeability material to allow for any subsequent settlement of the waste.

Large individual non-containerised items, such as concrete blocks, may also be disposed of in the vaults if the activity limits are satisfied and the operational impact minimised.

Figure 6.4: Photographs of Demolition LLW packaged in 1 te bags (left) and the interior of the Demolition LLW vault in 2017 showing emplaced layers of 1 te bags backfilled with sand (right).

As the vaults are below ground, there is minimal visual impact even with the temporary roof structures. When filled the top of the waste will be at least 4 metres below ground level and the base of the vaults is about 12 metres below that.

Through the use of roofs, ditches and pumps, the interior of the vaults are kept dry during operation of the facilities.

When the vaults are full, they will be closed and any remaining excavated voids filled in. The temporary metal roofs will be removed and the vaults and the access roads will be covered over with an engineered cap containing an anti-intrusion layer over the vaults and a low-permeability layer to isolate deeper groundwater from the more active near-surface groundwater system.

Once the pumps are removed at closure, groundwater will gradually enter the vaults. However, the low permeability of the concrete vaults, and the steel containers and grout (where used) mean that it will take a long time before the groundwater comes into contact with any of the radioactive waste.

A layer of excavated material, approximately 3 metres thick, has been placed across the existing ground surface between the vaults and the coast, to ensure the water table lies well below the new ground surface after closure of the vaults, and that any future potential trace contaminated groundwater flows out to the sea rather than to the soil zone. This layer is referred to in project documents as the "enhanced geosphere". After disposals are completed and the vaults are closed, this layer will be joined to the capping over the vaults so that the ensemble merges visually with the surrounding landscape. The original vegetation and soil mix will be returned as far as is practicable.

Figure 6.5 and Figure 6.6 show illustrations of the LLW and Demolition LLW vaults during their operation and eventual closure. The illustrations show cross-sections across the width of the LLW vault and across the length of the Demolition LLW vault.

The design of the LLW Disposal Facilities at Dounreay is regarded as best practice and is comparable with the designs for near-surface disposal facilities in other countries, such as those in England, France, and Spain. The design is appropriate to the hazard presented by the waste and has been optimised to ensure that the required standards in the GRA are met while balancing other criteria such as operator risks and cost.

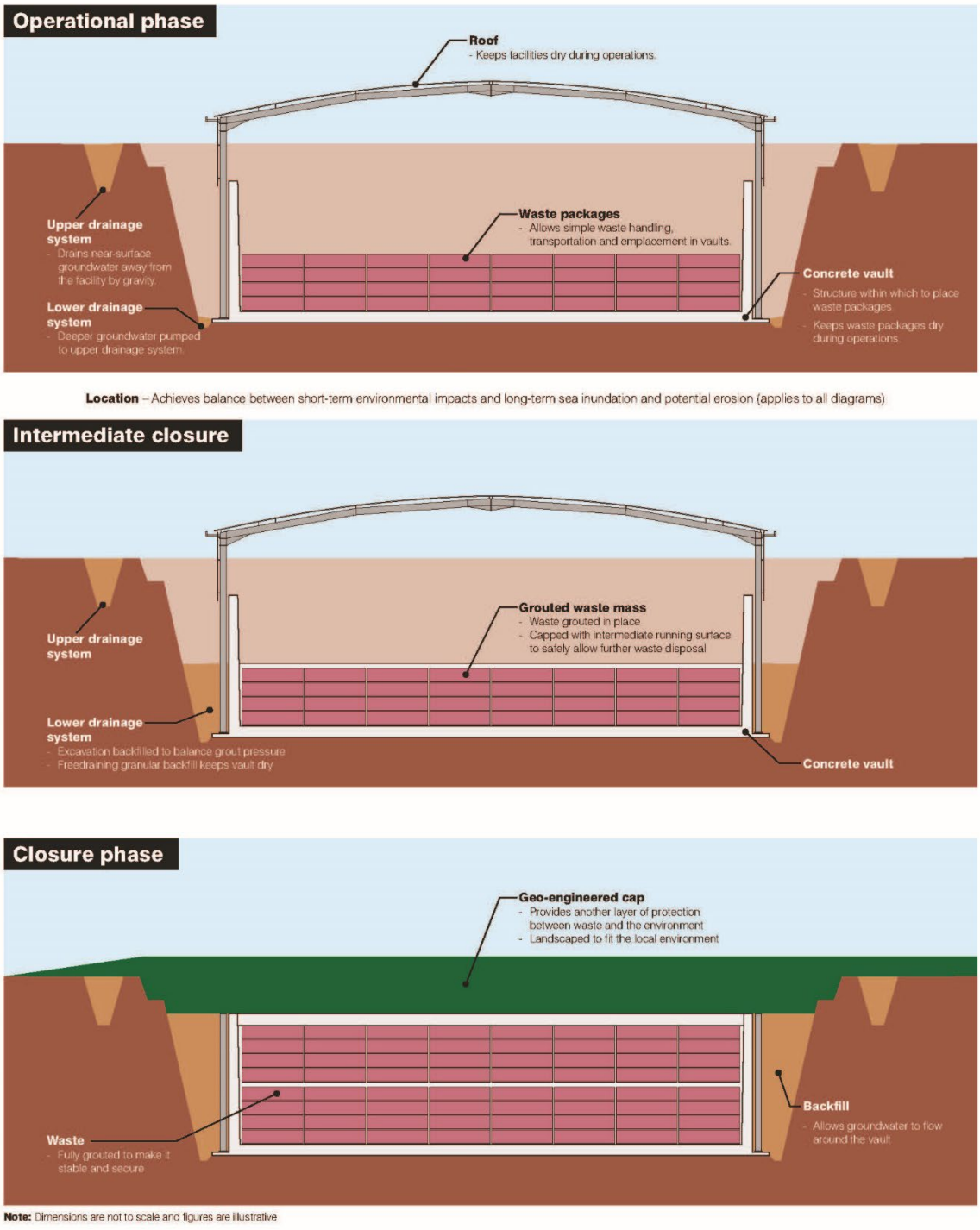

Figure 6.5: Illustrations across the width (east to west) of a single disposal LLW vault during the operational phase (top), at intermediate closure when HHISOs are stacked 4-high across the floor and a new running surface is laid (middle), and after closure and capping (bottom). The red rectangles illustrate individual LLW containers stacked in the vaults, eventually in 8-high stacks.

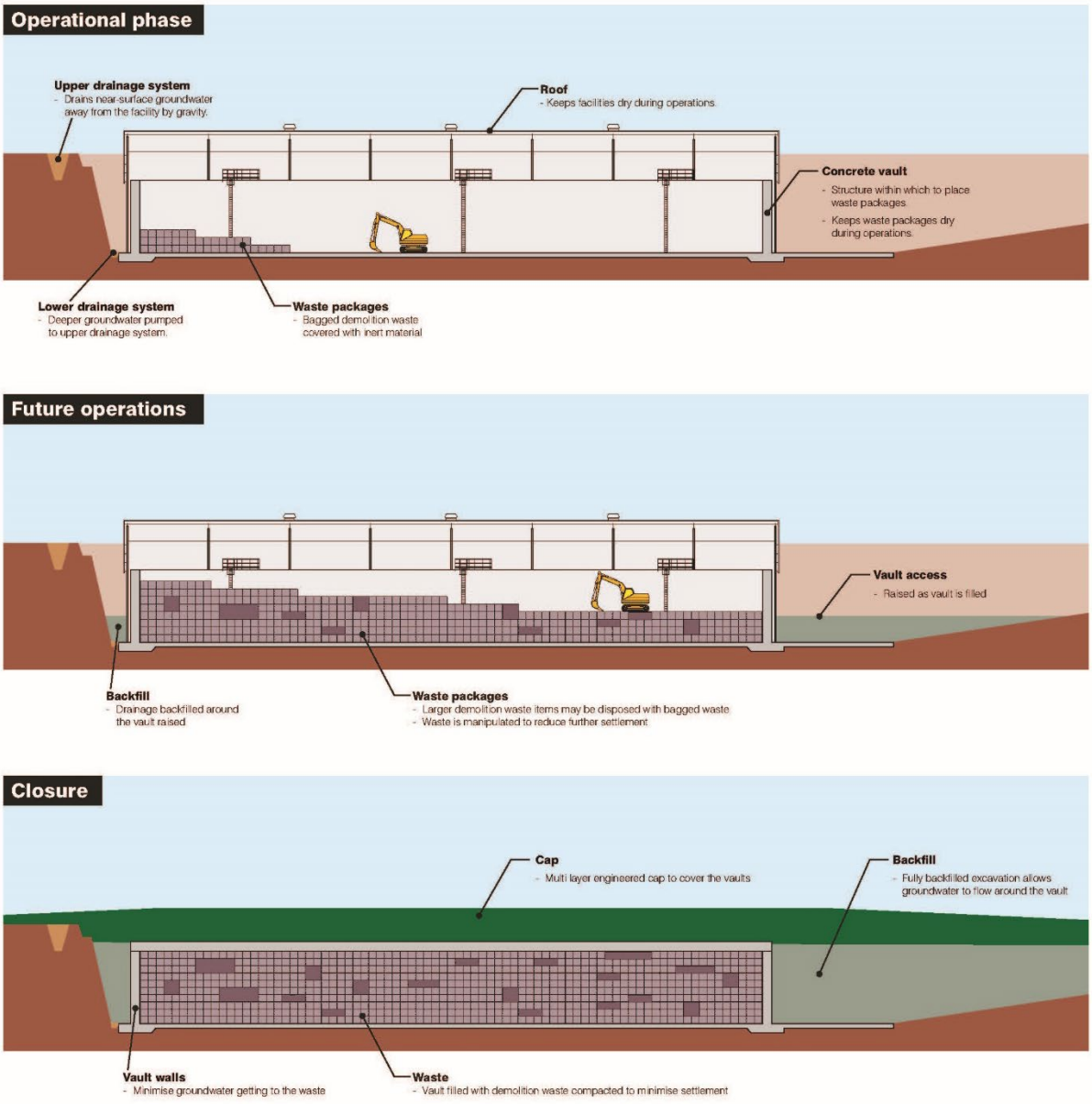

Figure 6.6: Illustrations across the length (south to north) of a single disposal Demolition LLW vault during the operational phase (top), at a future operational point as waste continues to be emplaced and settlement reduced (middle), and after closure and capping (bottom). The grey cubes illustrate individual Demolition LLW bags, along with the possible presence of occasional large non-bagged waste items.

7 Radiological safety

The LLW Disposal Facilities have a Nuclear Safety Case (NSC) and an Environmental Safety Case (ESC). The NSC covers safety to workers and the public during operations. The ESC demonstrates that the LLW Disposal Facilities meet the regulatory requirements specified in the GRA by ensuring that the

radioactive waste is disposed of in a manner that protects the health and interests of people and the integrity of the environment, at the time of disposal and in the future.

The ESC was prepared initially to support the planning application and an application to SEPA to authorise disposals. The ESC is updated periodically as the facilities are operated and further developed. The ESC considers how radioactive substances disposed of in the facilities (the source) might migrate over time through the environment (pathways), and the potential effects of this radioactivity on flora and fauna, including humans (receptors). The key arguments made in the ESC are summarised below in terms of the source-pathway-receptor linkages used in the environmental safety assessment.

The vaults have been designed to contain the radioactive content of the waste within the vaults for as long as is practicable. The radioactivity is contained in two main ways. First, the packaging, backfill and concrete structure of the LLW vaults restrict groundwater flow through the LLW, reducing the amount of radioactivity that can be leached out. Second, the cement-based grout alters the chemical conditions within the groundwater, effectively reducing the solubility of radionuclides and binding radionuclides to the grout, again reducing the amount of radioactivity that can be released.

The radioactivity levels in the Demolition LLW vaults are sufficiently low that they pose limited risks to people and the environment. Therefore, the waste packaging is less robust and no grout is used in either the packaging or vault backfill. However, the concrete structure of the vaults restricts penetration of groundwater.

The vast majority of the wastes to be disposed of in the LLW Disposal Facilities are contaminated mainly by short-lived radionuclides (i.e. radionuclides with half-lives shorter than approximately 30 years). After 300 years, roughly 90% of the total radioactivity initially disposed of in the facilities will have decayed, and the average radioactivity of the remaining material will be comparable to that currently found naturally in soils around the Dounreay site (albeit comprised of a different mix of radionuclides).

The LLW Disposal Facilities have been designed primarily to provide containment and isolation while the vast majority of the radioactivity decays over the next few hundred years. Owing to the long half-life of a small proportion of the radionuclides to be disposed of in the facilities, it is not possible to prevent small releases of radioactivity from the concrete vaults over thousands of years. However, by this time, the hazard posed by the radioactivity released will be comparable to that associated with naturally occurring radioactivity in the environment.

The long-lived radionuclides will be slowly released and will migrate through the rock. Some of the radionuclides will migrate to the topsoil between the facilities and the coast, and some will migrate directly to the sea. However, most of the radioactivity will ultimately reach the sea, where the resulting concentration will be minute, owing to the small inventory and the inevitable dilution. Radioactivity from the facilities will form only a small fraction of the natural radioactivity flowing into the sea from the terrestrial environment around Dounreay.

The small concentrations of radionuclides that are predicted to reach the sea and their subsequent dilution mean that calculated doses to users of the marine

environment (for example, anglers, swimmers, surfers, seafood collectors and eaters) are vanishingly low. This is reinforced by calculations that show radionuclide releases from the LLW Disposal Facilities will be considerably lower than authorised discharges from the current Dounreay site, which have been shown to have negligible impacts on people and the environment.

Insignificant doses are also calculated for potential users of the land between the facilities and the coast. Any potential doses will be related to the slow release and build-up of long-lived radioactivity discussed earlier. The most important potential exposure pathway is consumption of livestock that might be reared on the small strip of grassland between the facilities and the coast - an area of around 12 hectares, including the cap over the facilities.

Even with the extremely pessimistic assumption of a complete return to a subsistence economy in the far future, resulting in a crofter family living on and working the land around the facilities for their food (vegetables, meat, poultry, eggs), the calculated potential peak dose would still be below the regulatory guidance level. Assuming a dose is received, it would not be discernible when included in the total dose from natural radiation in the Dounreay area. Further, the dose from background radiation in the Highlands is quite low when compared to other areas of the UK, such as Cornwall, where a higher level of radioactivity in the rocks can occur naturally. This helps to put the possible radiological impacts from the LLW Disposal Facilities into perspective - moving to Cornwall would treble an individual's annual dose, while the dose from the facilities will be indiscernible even with pessimistic assumptions about exposure pathways. This is illustrated in Figure 7.1.

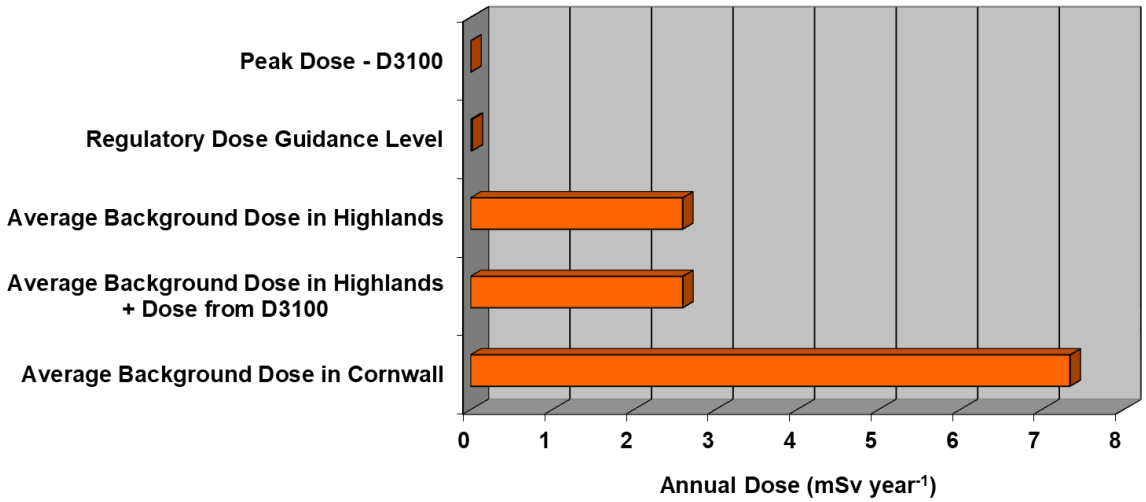

Figure 7.1: Calculated maximum dose from the LLW Disposal Facilities, compared to existing background doses in the Highlands and in Cornwall. Even the maximum possible dose from the facilities adds an indiscernible amount to the existing background doses.

The ESC demonstrates that there will be no significant risk to people as a result of the radioactivity in the waste to be disposed of in the Dounreay LLW Disposal

Facilities. In addition, the calculated concentrations of radionuclides that might enter the environment in the future are so low that there will be no significant impacts on other fauna or flora.

8 Other environmental impacts

The Environmental Impact Assessment conducted in support of the planning application for the LLW Disposal Facilities considered other possible environmental impacts of the vaults during their construction, operation and closure, and beyond. The site selection process minimised many environmental impacts, but some impacts were inevitable, such as noise, dust and vehicle movement during construction. The most significant of these occurred during the vault construction stage, as discussed below. The expected impacts during operations are low, primarily associated with abstraction of groundwater and material use, and some impacts are expected during vault closure and restoration of the area.

Noise and visual impacts were minimised by locating the vaults over the brow of a hill and as far from neighbouring properties as is practicable. Noise during construction was minimised through implementation of best working practices such as using quiet plant, shrouding of equipment and switching machinery off when not in use. Following dialogue with stakeholders and additional permission from the Highland Council, blasting was used for excavation of the vaults in order to minimise the duration of the construction period and reduce construction impacts.

Impacts to air quality were anticipated mainly through the generation and spread of dust, particularly during excavation and construction. This was minimised through implementation of best working practices, such as using construction equipment designed to minimise dust generation, ensuring vehicles were clean before leaving site, removal of dust-generating materials as soon as practicable, and cleaning and damping down of roads. The impact was also minimised by increasing the distance of the vaults from the nearest local neighbours as far as was practicable.

Transport impacts were minimised through design and location. Keeping the excavated material at an on-site location had a significant effect in minimising vehicle movements on public roads. Further reduction was achieved through a Traffic Management Plan. This included measures such as staggering construction site working to avoid Dounreay peak traffic periods, using on-site materials where possible, and agreeing haulage routes to minimise disruption.

Other environmental impacts were also assessed and measures were established to minimise those impacts. For example, the Scheduled Ancient Monument, Cnoc-nah'Uiseig, was fenced off to avoid disturbance. Vault locations underwent archaeological survey and monitoring to identify, record and, where appropriate, carefully excavate archaeological remains of cultural heritage value prior to the start of the main vault excavation works.

Disturbance to birds was minimised though the timing of the commencement of construction and the habitat will be restored when the vaults are closed. Impacts on the sea from construction have been minimised through the implementation of a specially designed drainage system.

9 Assurance and regulatory oversight

In accordance with current legislation and international best practice, the performance of the LLW Disposal Facilities does not rely on actions by future generations to maintain the integrity of the disposal system. Despite this, during the operational period and for a time after capping and closure of the vaults, the facilities and surrounding environment will be monitored and access will be controlled. This will ensure that the facilities are not disrupted while the short-lived radioactivity decays. It also allows a period to demonstrate that the facilities are functioning as designed.

Approved quality assurance systems and procedures are in place for management activities that are currently ongoing, such as operations, waste characterisation and environmental safety assessment. Further quality assurance procedures and programmes will be developed as needed for future activities, such as further construction, closure activities and monitoring, and these procedures will be agreed with the regulators.

SEPA will continue to regulate the LLW Disposal Facilities over their operational lifetime and during post-closure monitoring, until such time when the vaults can be considered safe to be released from regulatory control. Site characterisation, waste characterisation, optimisation, safety assessment, and confidence-building activities will continue as appropriate during construction, operation and closure of the facilities. DSRL will develop regular updates to the ESC, and these will be scrutinised by SEPA as part of their periodic review of the permit.

10 Application to vary the current permit

The permit for the LLW Disposal Facilities specifies a series of conditions relating to the waste that can be accepted for disposal, including limits on the quantities of key radionuclides that can be disposed of within the facilities, and conditions relating to the design, construction and management of the facilities. The conditions ensure that waste disposed of within the facilities satisfies assumptions made in the ESC.

Experience from operating the facilities over the last 5 years has shown that some of the radionuclide activity limits in the current permit will prevent the disposal of LLW that is being, or is expected to be, generated by the Dounreay decommissioning programme. This issue arises due to uncertainty in the estimated inventory on which the current permit is based - the radionuclide limits were based on the anticipated inventory at the time of the original permit application using best estimates derived in 2009.

The inventory estimates are continuously revised as decommissioning on the Dounreay site progresses. Therefore, to provide more flexibility, DSRL has requested that SEPA replace the current approach of using an estimated inventory to set radionuclide limits with a risk-based ‘sum of fractions’ (SoF) approach.

All 5 of the other LLW and Very LLW (VLLW) disposal facilities in the UK (Calder Landfill, Clifton Marsh Landfill, East Northants Resource Management Facility, Lillyhall Landfill and the LLW Repository) now have permits that make use of a SoF approach. Such an approach at Dounreay will continue to ensure that waste disposals are controlled so that the assumptions about the inventory set out in the

ESC are met, but will also enable greater flexibility during waste acceptance to account for inventory uncertainty and to optimise disposal of DSRL LLW.

As part of the permit variation application, DSRL has also taken the opportunity to propose revisions to conditions regarding management of non-radiologically hazardous materials and fissile material controls. Additionally, recent inspections undertaken by SEPA have raised a number of opportunities to improve or provide further clarity in the permit and to reflect updates in relevant legislation.

None of the requested changes affect the central conclusions in the ESC that the LLW Disposal Facilities can be constructed, operated and closed safely and that they provide long-term safety.

11 Stakeholder dialogue and community benefits

Many consultation events have been undertaken during development of the LLW Disposal Facilities and dialogue with stakeholders has had a significant input to decisions on the overall LLW management strategy at Dounreay. The results of this stakeholder dialogue have also informed the ESC, and influenced aspects of the design (below-surface as opposed to above-surface vaults) and siting of the facilities (as close as is practicable to the Dounreay site).

DSRL established the Buldoo Liaison Group meeting for the closest residents and the Local Community Liaison Group meeting for wider local residents. The community is also supported financially, with the NDA establishing the Caithness & North Sutherland Fund in 2011, with an initial payment of £1M and ongoing contributions of £300,000 per year for the first 10 years of disposal facility operations.

Stakeholder engagement has been key in obtaining the necessary permissions and ensuring construction and operation of the facilities continues to programme with as little disruption to local residents as possible. Stakeholder dialogue will continue throughout the construction, operation and closure of the facilities. The Liaison Groups are provided with regular updates about Dounreay site activities, including the application to vary the D3100 permit. The views of near-neighbours will continue to be a particularly important input.

12 Summary

In order to enable decommissioning of the Dounreay site, it is necessary to manage the significant volume of solid LLW and Demolition LLW that will be generated. Following an evaluation of environmental, safety, social, technical and financial issues, DSRL has constructed specialised disposal facilities at Dounreay to deal with its LLW locally. The solid LLW is generally inert and the radioactivity content lies at the lower activity end of the radioactive waste spectrum.

The LLW Disposal Facilities are designed using well-established technology, are consistent with national and international guidance, and are similar to established disposal facilities elsewhere in the UK and in other European countries. The LLW Disposal Facilities use an appropriate level of engineering to ensure that the majority of the radioactivity is contained until it decays.

The facilities will consist of up to 6 shallow, below-surface concrete vaults into which the waste is emplaced. Planning permission was granted by the Highland Council in 2009 and a disposal authorisation was granted by SEPA in 2013. Construction of the first two vaults was completed in 2014, and - following approval from SEPA - the first waste was emplaced in 2015.

The ESC for the facilities demonstrates that the health and interests of people and the integrity of the environment, at the time of disposal and in the future, will be protected. Containment levels are close to 100% for hundreds of years and, even over thousands of years, when the engineering will slowly degrade, the quantities of radioactivity that might be released from the facilities are much lower than quantities of radioactivity that are naturally present in the environment. Consequently, radiological impacts on people and the environment from the facilities will be significantly less than impacts from the background radiation that people are exposed to in their everyday lives.

Drawing on 5 years of operational experience, DSRL submitted an application in June 2021 to SEPA to request that the permit is revised to set radionuclide control levels using a risk-based SoF approach rather than estimated waste inventory based limits. Such an approach will continue to ensure that waste disposals are controlled, but will also provide flexibility to account for inventory uncertainty and to optimise disposal of DSRL LLW. None of the requested changes affect the central conclusions in the ESC that the LLW Disposal Facilities can be operated and closed safely.

The Dounreay LLW Disposal Facilities are key to the successful and efficient decommissioning of the Dounreay site, upon which millions of pounds of investment and hundreds of jobs rely.

13 Further information

For those interested in obtaining further information, contact:

Marie Mackay
Community Relations Coordinator
DSRL
Dounreay
Caithness
KW14 7TZ
Telephone: 01847 803043
Email: marie.mackay@dounreay.com