

WASTE STREAM	2N06	LLW from Site LLW Operations
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SITE LLW Repository

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Waste Services (NWS)

WASTE TYPE VLLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025			
Future arisings:	1.4.2025 - 31.3.2026			
	1.4.2026 - 31.3.2027			
	1.4.2027 - 31.3.2137			
Total future arisings:	741.0			
Total waste volume:	799.5			

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: Arisings are based on continuing LLW disposal operations and the Repository Infrastructure Programme. Some programmed activities have no future date set, hence the wide range of dates in the last volume category.

Additional information on quantities: Future arisings are estimated based on planned future projects and operations activities; there may be considerable variance in the volumes generated, particularly after the next 3 years. Volumes are more likely overestimates as some material could be suitable for Clearance and Exemption and diversion routes.

Uncertainty factors on volumes: Stock (upper): x 1.20 Arisings (upper): x 1.50
Stock (lower): x 0.70 Arisings (lower): x 0.70

WASTE SOURCE Waste is generated as a result of operations to handle VLLW consigned to an offsite facility and from maintenance of the repository infrastructure (e.g. leachate management system).

PHYSICAL CHARACTERISTICS

General description: Waste primarily comprises of contaminated waste grout and sediment generated during maintenance work on the leachate management system / streams. Redundant equipment from refurbishment projects, PPE and waste from historical experiments are also covered by this waste stream.

Changes since waste generated: Waste will be segregated where possible to optimise diversion from the repository. Sediment arising from maintenance of the leachate system, streams and weirs will be dewatered prior to final packaging. The process to dewater the leachate sediment involved adding flocculating agents (these sum to negligible quantities with respect to the whole of this waste stream).

Bulk density (t/m³): ~ 0.50

Comment on density: Based on total stream mass divided by total stream volume. Note: grout and sediment densities are typically 0.9 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): As described in the physical characteristics. Some of the sediment is likely to contain organic matter. Magnafloc 90L and Coagulant C50 will be present in dewatered leachate system sediments.

Chemical state: Alkali

Sheet metal proportion / thickness: Up to 7% of the metal content is sheet metal (ductwork and tanks).

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~~ 1.2	Not known for the majority.	
Other ferrous metals.....	~ 17.7	Not known for the majority.	
Iron.....	NE	-	
Aluminium.....	~~ 0.09	Not known for the majority.	
Beryllium.....	= 0	-	
Cobalt.....	= 0	-	
Copper.....	~~ 0.11	In electrical equipment.	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	= 0	-	
Uranium.....	= 0	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	NE	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~~ 0.52	-	
Paper, cotton.....	~~ 0.26	In soft waste / PPE.	
Wood.....	~~ 0.26	Trees from stream clearance.	
Halogenated plastics.....	~~ 1.9	From soft waste / PPE and redundant equipment.	
Total non-halogenated plastics.....	~~ 0.22	-	
Condensation polymers.....	~~ 0.01	In soft waste / PPE.	
Others.....	~~ 0.21	Various from redundant equipment.	
Organic ion exchange materials.....	0	-	
Total rubber.....	~~ 0.44	-	
Halogenated rubber.....	~~ 0.44	PPE and redundant equipment.	
Non-halogenated rubber.....	0	(All rubber assumed halogenated).	
Hydrocarbons.....		-	
Oil or grease.....		-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....		-	
Asphalt/Tarmac (no coal tar).....		-	
Bitumen.....		-	
Others.....		-	
Other organics.....	~ 12.4	Sediment and vegetation.	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	0	-	
Inorganic sludges and flocs.....	~ 1.7	-	
Soil.....	~~ 0.47	Legacy drummed waste containing sand / soil.	
Brick/Stone/Rubble.....	~~ 0	-	
Cementitious material.....	~ 61.3	Excess grout (pulverised fuel ash and ordinary portland cement)	
Sand.....	NE	-	
Glass/Ceramics.....	~~ 2.0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	= 0	-	
Asbestos.....	= 0	-	
Non/low friable.....	= 0	-	
Moderately friable.....	= 0	-	
Highly friable.....	= 0	-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	NE	covered under cementitious material (pulverised fuel ash)	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	NE	-
Chloride.....	NE	-
Iodide.....	NE	-
Cyanide.....	NE	-
Carbonate.....	NE	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	NE	-
Sulphate.....	NE	-
Sulphide.....	NE	-

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	NE	-
Low flash point liquids.....	= 0	-
Explosive materials.....	= 0	-
Phosphorus.....	= 0	-
Hydrides.....	= 0	-
Biological etc. materials.....	= 0	-
Biodegradable materials.....	P	-
Putrescible wastes.....	P	Vegetation.
Non-putrescible wastes.....	P	Paper, cotton, wood.
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....	NE	Potentially in sediment, but unlikely.
Soluble solids as bulk chemical compounds.....	= 0	-

Hazardous substances / non hazardous pollutants:

-

	(%wt)	Type(s) and comment
Acrylamide.....	= 0	-
Benzene.....	= 0	-
Chlorinated solvents.....	= 0	-
Formaldehyde.....	= 0	-
Organometallics.....	= 0	-
Phenol.....	= 0	-
Styrene.....	= 0	-
Tri-butyl phosphate.....	= 0	-
Other organophosphates.....	= 0	-
Vinyl chloride.....	= 0	-
Arsenic.....	= 0	-
Barium.....	= 0	-
Boron.....	= 0	-
Boron (in Boral).....	= 0	-
Boron (non-Boral).....	= 0	-
Cadmium.....	= 0	-
Caesium.....	= 0	-
Selenium.....	= 0	-
Chromium.....	NE	Could be present in stainless steel alloy.
Molybdenum.....	NE	Could be present in stainless steel alloy.
Thallium.....	= 0	-
Tin.....	= 0	-
Vanadium.....	= 0	-
Mercury compounds.....	= 0	-
Others.....	NE	-

Complexing agents (%wt):

Yes

	(%wt)	Type(s) and comment
EDTA.....	= 0	-
DPTA.....	= 0	-
NTA.....	= 0	-
Polycarboxylic acids.....	= 0	-
Other organic complexants.....	TR	Vegetation treated with glyphosate.
Total complexing agents.....	TR	-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....	= 2	x 2 stripped down circuit boards
EEE Type 2.....	NE	-
EEE Type 3.....	= 2	x 2 Electrical and electronic tools (e.g. corded drills cordless drills, hoovers etc.)
EEE Type 4.....		-
EEE Type 5.....	= 2	x 2 batteries from battery powered tools/ equipment.

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction	On-site	NE
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration	Off-site	~ 8.0
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment	Off-site	~ 2.0
Recycling / reuse	On-site	NE
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment	On-site	~ 10.0
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None	Off-site	~ 80.0

Comments on planned treatments:

Sediment will be dewatered (this is 'other / various'). Waste will be size reduced to optimise packing efficiency and minimise voidage for wastes disposed of in the LLW repository. Project waste management plans have already identified wastes suitable for reuse, but these are not included in the volumes for this waste stream.

Conditioning method: -

Conditioning plants:

Plant Name	Location

Likely conditioning matrix: -

Further information on the conditioning matrix: -

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
-	-	-	-	-	-

Range in container waste loading:

Other information on packaging and conditioning: -

Conditioned density (t/m³): -

Conditioned density comment: -

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository	NE		
Expected to be consigned to a Landfill Facility	~ 90.0	~ 0.50	2026
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	~ 8.0	~ 0.20	2026
Expected to be consigned to a Metal Treatment Facility	~ 2.0	~ 0.50	2026
Expected to be Out of Scope	NE		
Expected to be recycled / reused	NE		
Disposal route not known	NE		

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
Landfill	Out of scope	~ 10.0	GREEN	Currently reviewing the Wastestream Document and this includes an in depth investigation into the sources of radioactive contamination which may realise opportunities for further segregation.

RADIOACTIVITY

Source: The activity derives from waste disposed of to the repository. Grout, equipment and PPE becomes contaminated as a result of contact with consignors' waste. Sediment from the leachate system is contaminated by activity that has leached from the vaults and trenches. Previously the activity content of this waste stream has been reported as NE to avoid duplication of data. However, activity has been declared for waste intended for diversion from the repository (e.g. the sediment).

Uncertainty: Some of the sediment has been characterised by sampling, but the specific activity and range of nuclides present has been found to vary. The uncertainties reflect the limitations of extrapolating from available sample data.

Measurement of radioactivities: Specific activities have been based on sample results and assumptions regarding the variance in specific activity through the leachate system. Levels of contamination on equipment have been based on operational experience and are generally conservative. The specific activities of soft waste reflect typical consignment activities.

Chemical form of radionuclides: H-3: Of any form that has been disposed of to the repository.
C-14: Of any form that has been disposed of to the repository.
Cl-36: Of any form that has been disposed of to the repository.
Se-79: Not expected to be present.
Tc-99: Of any form that has been disposed of to the repository.
I-129: Of any form that has been disposed of to the repository.
Ra: Of any form that has been disposed of to the repository.
Th: Of any form that has been disposed of to the repository.
U: Of any form that has been disposed of to the repository.
Np: Of any form that has been disposed of to the repository.
Pu: Of any form that has been disposed of to the repository.

WASTE STREAM		2N06		LLW from Site LLW Operations					
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	~ 1.14E-04	C C 2			Gd 153				
Be 10					Ho 163				
C 14	~ 3.79E-06	C C 2			Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	~ 2.64E-06	C C 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40	~ 3.85E-07	C C 2			Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210	~ 9.31E-08	C C 2		
Co 60	~ 1.88E-05	C C 2			Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	~ 9.11E-06	C C 2		
Kr 85					Ra 228	~ 2.02E-07	C C 2		
Rb 87					Ac 227				
Sr 90	~ 4.55E-05	C C 2			Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232	~ 3.85E-07	C C 2		
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99	~ 1.25E-05	C C 2			U 232				
Ru 106	~ 4.72E-08	C C 2			U 233				
Pd 107					U 234	~ 2.25E-06	C C 2		
Ag 108m					U 235	~ 3.85E-07	C C 2		
Ag 110m					U 236				
Cd 109					U 238	~ 2.25E-06	C C 2		
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	~ 2.90E-06	C C 2		
Sn 123					Pu 239	~ 1.02E-05	C C 2		
Sn 126					Pu 240	~ 1.87E-06	C C 2		
Sb 125					Pu 241	~ 5.10E-05	C C 2		
Sb 126					Pu 242				
Te 125m					Am 241	~ 6.17E-06	C C 2		
Te 127m					Am 242m				
I 129	~ 3.85E-07	C C 2			Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	~ 1.62E-04	C C 2			Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138				Cm 248					
Ce 144				Cf 249					
Pm 145				Cf 250					
Pm 147				Cf 251					
Sm 147				Cf 252					
Sm 151				Unsp a					
Eu 152				Unsp b/g					
Eu 154				Total a	3.55E-05	*	0	*	
Eu 155				Total b/g	4.11E-04	*	0	*	

Bands (Upper and Lower)

A a factor of 1.5
B a factor of 3
C a factor of 10
D a factor of 100
E a factor of 1000

Note: Bands quantify uncertainty in the mean radioactivity.

Code

1 Measured activity
2 Derived activity (best estimate)
3 Derived activity (upper limit)
4 Not present
5 Present but not significant
6 Likely to be present but not assessed
7 Present in significant quantities but not determined
8 Not expected to be present in significant quantity
* Total calculated from the 114 declared radionuclides