

WASTE STREAM	5B15	Compacted LLW
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SITE Dounreay

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025			
Future arisings:	= 9185.3			
Total future arisings:	0.0			
Total waste volume:	9185.3			

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

Comment on arising rates: This waste stream captures all LLW which is packaged into drums, supercompacted and then loaded into containers for storage awaiting disposal. Future arisings are not reported to avoid double counting, as future arisings are captured within the waste streams from which the waste originates before being compacted. These waste streams are: 5B301, 5B303, 5B305, 5B307, 5B309, 5B311, 5B313, 5B315, 5B329, 5B331, 5B333, 5B335, 5B337, 5B339, 5B341, 5B343, 5B345, 5B348, 5B349, 5B351, 5B352, and 5B358.

Additional information on quantities: Stocks are stored onsite in HHISOs. They comprise of compacted and uncompacted drums. All drums assigned 0.2m3 volume.

Uncertainty factors on volumes: Stock (upper): x 1.02 Arisings (upper): x -
Stock (lower): x 0.98 Arisings (lower): x -

WASTE SOURCE Waste from analytical laboratories, reactor and reprocessing plant.

PHYSICAL CHARACTERISTICS

General description: General and soft trash, including intractable organics, glassware and metal waste. Trace quantities of laboratory chemicals may be present. Waste is placed in metal drums which are supercompacted. The waste contains no large items.

Changes since waste generated: The majority of waste is supercompacted drums.

Bulk density (t/m³): = 0.31

Comment on density: Based on consignors records for consigned drums.

CHEMICAL COMPOSITION

General description and components (%wt): Steel (47.45%), aluminium (0.89%), copper (1.85%), lead (1.59%), paper (7.63%), wood (4.06%), halogenated plastics (2.77%), non halogenated plastics (8.00%), rubber (4.66%), soil (0.16%), rubble (3.68%), concrete (5.08%), glass (0.38%), ceramics (0.05%), cemented sludge (3.13%), others (8.61%).

Chemical state: Neutral

Sheet metal proportion / thickness: The metals are supercompacted, and include the mild steel drums themselves.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	= 47.5	-	
Iron.....	= 0	-	
Aluminium.....	= 0.89	-	
Beryllium.....	= 0	-	
Cobalt.....	= 0	-	
Copper.....	= 1.9	-	
Lead.....	= 1.6	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	= 0	-	
Uranium.....	P	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	8.6	Traces of other, unspecified, metals will be present.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 11.7	-	
Paper, cotton.....	= 7.6	-	
Wood.....	= 4.1	-	
Halogenated plastics.....	= 2.8	-	
Total non-halogenated plastics.....	= 8.0	-	
Condensation polymers.....	TR	-	
Others.....	= 8.0	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 4.7	-	
Halogenated rubber.....	NE	-	
Non-halogenated rubber.....	= 4.7	-	
Hydrocarbons.....	= 0	-	
Oil or grease.....	= 0	-	
Fuel.....	NE	-	
Asphalt/Tarmac (cont.coal tar).....	= 0	-	
Asphalt/Tarmac (no coal tar).....	= 0	-	
Bitumen.....	= 0	-	
Others.....	NE	-	
Other organics.....	TR	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 0.16	-	
Brick/Stone/Rubble.....	= 3.7	-	
Cementitious material.....	= 8.2	Cementitious material + cemented sludge	
Sand.....	= 0	-	
Glass/Ceramics.....	= 0.43	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	= 0	-	
Asbestos.....	TR	-	
Non/low friable.....	NE	-	
Moderately friable.....	NE	-	
Highly friable.....	NE	-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 0	-	

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

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	= 0	-
Chloride.....	NE	-
Iodide.....	NE	-
Cyanide.....	= 0	-
Carbonate.....	NE	-
Nitrate.....	TR	-
Nitrite.....	NE	-
Phosphate.....	= 0	-
Sulphate.....	= 0	-
Sulphide.....	NE	-

Materials of interest for waste acceptance criteria:

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

Hazardous substances / non hazardous pollutants:

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

Complexing agents (%wt):

Yes		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....	NE	-
NTA.....	NE	-
Polycarboxylic acids.....	NE	-
Other organic complexants.....	TR	Trace amounts of complexing agents, including DECON 90, may be present.
Total complexing agents.....	TR	-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....	TR	-
EEE Type 2.....		-
EEE Type 3.....	TR	-
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction	On-site	= 100.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

No further treatment will be carried out while the waste remains in storage. The waste will be encapsulated before final disposal.

Conditioning method:

For LLW, waste will be grouted into non IP rated HHISOs through a dedicated grouting facility

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

Dounreay uses: Cement OPC 1:3 PFA ~35% water content and plasticiser.

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	Non IP-2 rated 1/2 Height ISO (DC02)	100.0	50.0	15.6	184	-

Range in container waste loading:

Other information on packaging and conditioning: The majority of waste consists of 200 litre drums that have already been compacted. No further compaction is possible. The remains of the waste are drums awaiting compaction which are in temporary storage. All drums, once compacted will go into HHISO containers, mixed with bulk LLW wastes, prior to encapsulation and final disposal. A general assumption is 250 drums per HHISO (as pucks). Each drum - precompact - is 0.2m3. 250*0.2 = 50m3 Loading. Volume in Datasheet is precompact volume.

Conditioned density (t/m³): ~ 2.0
 Conditioned density comment: This value is the midpoint between a range of densities going from 1.49-2.47. These were taken from HHISOs disposed of in NRSD LLW Disposal Vaults

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)	= 100.0		
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			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

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
Dounreay LLWDV	Incineration facility	< 100.0	RED	This opportunity is still at an early stage of development. A small scale trial has taken place. This can potentially divert up to all compactable LLW. The majority of this waste is already compacted and it is unlikely it would be incinerated at this stage.

RADIOACTIVITY

Source: A mixture of fission products, actinides and activation products.

Uncertainty: Activity is based on consignor's records.

Measurement of radioactivities: The specific activities have been measured or derived using consignment data. Consignment data was collated and summed together, then divided by the total volume of consignments. A decay was applied to the average consignment date of the consignments.

Chemical form of radionuclides: H-3: Possibly present.
 C-14: Possibly present.
 Cl-36: Possibly present.
 Se-79: Possibly present.
 Tc-99: Possibly present.
 I-129: Possibly present.
 Ra: Not known to be present.
 Th: Present in the form of contamination.
 U: Present in the form of contamination.
 Np: Possibly present.
 Pu: Possibly present in the form of contamination.

WASTE STREAM		5B15		Compacted LLW					
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	=	1.44E-05	B B 2		Gd 153				
Be 10					Ho 163				
C 14	=	2.87E-06	B B 2		Ho 166m	=	9.87E-15	B B 2	
Na 22	=	3.27E-08	B B 2		Tm 170				
Al 26					Tm 171				
Cl 36	=	9.74E-13	B B 2		Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54	=	3.61E-12	B B 2		Pb 205				
Fe 55	=	1.75E-09	B B 2		Pb 210	=	1.21E-06	B B 2	
Co 60	=	1.86E-06	B B 2		Bi 208				
Ni 59	=	2.03E-13	B B 2		Bi 210m				
Ni 63	=	4.98E-08	B B 2		Po 210	=	1.10E-06	B B 2	
Zn 65	=	3.20E-15	B B 2		Ra 223	=	9.83E-12	B B 2	
Se 79					Ra 225	=	1.26E-16	B B 2	
Kr 81					Ra 226	=	7.08E-06	B B 2	
Kr 85	=	1.47E-13	B B 2		Ra 228	=	1.05E-09	B B 2	
Rb 87					Ac 227	=	1.02E-11	B B 2	
Sr 90	=	8.53E-06	B B 2		Th 227	=	9.84E-12	B B 2	
Zr 93					Th 228	=	1.38E-08	B B 2	
Nb 91					Th 229	=	1.27E-16	B B 2	
Nb 92					Th 230	=	1.76E-09	B B 2	
Nb 93m	=	3.57E-08	B B 2		Th 232	=	1.37E-09	B B 2	
Nb 94	=	3.94E-10	B B 2		Th 234	=	2.06E-07	B B 2	
Mo 93	=	3.67E-08	B B 2		Pa 231	=	1.14E-10	B B 2	
Tc 97					Pa 233	=	4.74E-11	B B 2	
Tc 99	=	7.25E-10	B B 2		U 232	=	1.43E-08	B B 2	
Ru 106	=	2.75E-10	B B 2		U 233	=	2.25E-13	B B 2	
Pd 107					U 234	=	3.19E-05	B B 2	
Ag 108m	=	3.22E-10	B B 2		U 235	=	8.98E-07	B B 2	
Ag 110m					U 236	=	2.46E-06	B B 2	
Cd 109	=	2.48E-10	B B 2		U 238	=	2.06E-07	B B 2	
Cd 113m	=	1.86E-15	B B 2		Np 237	=	4.76E-11	B B 2	
Sn 119m					Pu 236				
Sn 121m	=	2.82E-10	B B 2		Pu 238	=	3.68E-06	B B 2	
Sn 123					Pu 239	=	3.53E-06	B B 2	
Sn 126					Pu 240	=	4.77E-06	B B 2	
Sb 125	=	1.15E-08	B B 2		Pu 241	=	1.43E-05	B B 2	
Sb 126					Pu 242	=	5.88E-10	B B 2	
Te 125m	=	2.72E-09	B B 2		Am 241	=	6.14E-06	B B 2	
Te 127m					Am 242m	=	1.94E-08	B B 2	
I 129					Am 243	=	2.23E-10	B B 2	
Cs 134	=	1.35E-08	B B 2		Cm 242	=	1.62E-08	B B 2	
Cs 135					Cm 243	=	1.44E-09	B B 2	
Cs 137	=	1.78E-05	B B 2		Cm 244	=	8.33E-08	B B 2	
Ba 133	=	4.42E-09	B B 2		Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	=	1.65E-11	B B 2		Cf 249				
Pm 145					Cf 250				
Pm 147	=	2.27E-07	B B 2		Cf 251				
Sm 147		2.18E-17			Cf 252				
Sm 151	=	2.43E-07	B B 2		Unsp a				
Eu 152	=	4.07E-07	B B 2		Unsp b/g				
Eu 154	=	4.84E-07	B B 2		Total a	6.19E-05	*	0	*
Eu 155	=	7.52E-08	B B 2		Total b/g	6.27E-05	*	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