

WASTE STREAM	5B366/C	Decommissioning LLW Conditioned Mixed (Supercompacted + Bulk)
--------------	---------	---

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		= 799.5	799.5
Future arisings:				0.0
Total future arisings:			0.0	0.0
Total waste volume:			799.5	799.5

Number of waste packages in stock: At 1.4.2025..... 41 packages

Comment on arising rates: -

Additional information on quantities: The waste has already been generated and each item has a declared volume. This wastestream comprises 41 conditioned HHISO containers containing a mix of supercompacted waste plus bulk items

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

WASTE SOURCE This is conditioned waste currently held in storage awaiting disposal to the NRS Dounreay Disposal Vaults. This includes decommissioning of reactor facilities, reprocessing facilities, and facilities with support functions.

PHYSICAL CHARACTERISTICS

General description: The waste comprised two streams: LLW Bulk wastes and LLW supercompacted drums. This consists of: Gloveboxes, ducting, and other redundant bulk wastes that cannot be size reduced into 200 l drums. Also items which may be compactable such as general and soft trash, including intractable organics, glassware and metal waste. Size reduced pipework and other plant items will also be present.

Changes since waste generated: This waste has been packaged into disposal containers and encapsulated with grout.

Bulk density (t/m³): = 1.8

Comment on density: Total Mass of containers / Total volume of containers according to consignor's records

CHEMICAL COMPOSITION

General description and components (%wt): Steel (39.22%), Lead (8.22%), Aluminium (0.31%), Copper (1.03%), Glass (0.15%), Rubber (1.63%), Wood (2.54%), Paper (2.25%), Non-halogenated (4.19%), Halogenated Plastic (1.82%), Ceramic (0.01%), Rubble (16.95%), Concrete (15.14%), Soil (0.8%), Cemented Sludge(2.03%), Others (3.71%)

Chemical state: Alkali

Sheet metal proportion / thickness: Both bulk and sheet metals are likely to be present, proportions not specified. The waste includes the mild steel drums.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	-	-	-
Other ferrous metals.....	= 39.2	-	-
Iron.....	-	-	-
Aluminium.....	= 0.31	-	-
Beryllium.....	NE	-	-
Cobalt.....	-	-	-
Copper.....	= 1.0	-	-
Lead.....	= 8.2	-	-
Magnox/Magnesium.....	NE	-	-
Nickel.....	-	-	-
Titanium.....	-	-	-
Uranium.....	P	-	-
Zinc.....	NE	-	-
Zircaloy/Zirconium.....	NE	-	-
Other metals.....	= 3.7	-	-

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose...	= 4.8	-	
Paper, cotton...	= 2.3	-	
Wood...	= 2.5	-	
Halogenated plastics...	= 1.8	-	
Total non-halogenated plastics...	= 4.2	-	
Condensation polymers...	TR	-	
Others...	-	-	
Organic ion exchange materials...	-	-	
Total rubber...	= 1.6	-	
Halogenated rubber...	NE	-	
Non-halogenated rubber...	NE	-	
Hydrocarbons...	NE	-	
Oil or grease...	NE	-	
Fuel...	NE	-	
Asphalt/Tarmac (cont.coal tar)...	NE	-	
Asphalt/Tarmac (no coal tar)...	NE	-	
Bitumen...	NE	-	
Others...	NE	-	
Other organics...	TR	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials...	-	-	
Inorganic sludges and flocs...	-	-	
Soil...	= 0.80	-	
Brick/Stone/Rubble...	= 17.0	-	
Cementitious material...	= 17.2	Concrete + Cemented Sludge	
Sand...	-	-	
Glass/Ceramics...	= 0.16	-	
Graphite...	-	-	
Desiccants/Catalysts...	-	-	
Asbestos...	TR	-	
Non/low friable...	TR	-	
Moderately friable...	TR	-	
Highly friable...	TR	-	
Free aqueous liquids...	= 0	-	
Free non-aqueous liquids...	= 0	-	
Powder/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...	TR	-
Nitrite...	NE	-
Phosphate...	TR	-
Sulphate...	NE	-
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...	-	-
Putrescible wastes...	-	-
Non-putrescible wastes...	-	-
Corrosive materials...	-	-
Pyrophoric materials...	= 0	-
Generating toxic gases...	= 0	-
Reacting with water...	= 0	-
Higher activity particles...	-	-
Soluble solids as bulk chemical compounds...	-	-

Hazardous substances / non hazardous pollutants:

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

Complexing agents (%wt):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....	NE	-
NTA.....	NE	-
Polycarboxylic acids.....	NE	-
Other organic complexants.....	NE	-
Total complexing agents.....	NE	-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....	P	a few references to hoovers, power tools etc. within consignment descriptions
EEE Type 2.....		-
EEE Type 3.....	P	a few references to hoovers, power tools etc. within consignment descriptions
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		
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	On-site	= 100.0

Comments on planned treatments:

All waste has been encapsulated within HHISOs and is in temporary storage awaiting final disposal.

Conditioning method:

-

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

Cement = 1:3 OPC:PFA
35% Water content

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	19.5	19.5	41	-

Range in container waste loading: The waste loading value is a rough average using previously consigned waste data

Other information on packaging and conditioning: The waste has been loaded into an alternative non-IP2 rated LLW Disposal HHISO and is awaiting transfer to the NRS Dounreay LLW Vaults. Each container will contain waste from various waste streams.

Conditioned density (t/m³): = 2.0
Conditioned density comment: This value is the midpoint between a range of densities going from 1.49 to 2.47. These were taken from HHISOs disposed of in NRS Dounreay 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: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

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 by a variety of methods which are outlined in the PSWPs. Specific activities are derived from consignor's records.

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		5B366/C		Decommissioning LLW Conditioned Mixed (Supercompacted + Bulk)					
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	= 4.98E-06	B B 2			Gd 153				
Be 10					Ho 163				
C 14	= 7.26E-07	B B 2			Ho 166m				
Na 22	= 4.20E-10	B B 2			Tm 170				
Al 26					Tm 171				
Cl 36	= 4.98E-12	B B 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40	= 3.77E-12	B B 2			Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54	= 3.59E-14	B B 2			Pb 205				
Fe 55	= 1.18E-11	B B 2			Pb 210	= 2.03E-11	B B 2		
Co 60	= 8.25E-07	B B 2			Bi 208				
Ni 59					Bi 210m				
Ni 63	= 1.18E-08	B B 2			Po 210	= 1.97E-11	B B 2		
Zn 65	= 2.04E-18	B B 2			Ra 223	= 3.46E-12	B B 2		
Se 79					Ra 225	= 1.92E-19	B B 2		
Kr 81					Ra 226	= 5.53E-11	B B 2		
Kr 85					Ra 228	= 2.17E-09	B B 2		
Rb 87					Ac 227	= 3.52E-12	B B 2		
Sr 90	= 7.60E-06	B B 2			Th 227	= 3.43E-12	B B 2		
Zr 93					Th 228	= 3.57E-09	B B 2		
Nb 91					Th 229	= 1.94E-19	B B 2		
Nb 92					Th 230	= 4.00E-10	B B 2		
Nb 93m	= 1.95E-07	B B 2			Th 232	= 2.41E-09	B B 2		
Nb 94	= 2.24E-09	B B 2			Th 234	= 3.29E-08	B B 2		
Mo 93	= 2.05E-07	B B 2			Pa 231	= 1.94E-11	B B 2		
Tc 97					Pa 233	= 7.86E-12	B B 2		
Tc 99	= 2.18E-09	B B 2			U 232	= 1.49E-09	B B 2		
Ru 106	= 2.77E-13	B B 2			U 233	= 3.91E-16	B B 2		
Pd 107					U 234	= 3.35E-06	B B 2		
Ag 108m	= 3.51E-10	B B 2			U 235	= 7.07E-08	B B 2		
Ag 110m					U 236	= 4.05E-07	B B 2		
Cd 109	= 3.71E-12	B B 2			U 238	= 3.29E-08	B B 2		
Cd 113m					Np 237	= 7.89E-12	B B 2		
Sn 119m					Pu 236				
Sn 121m	= 1.43E-09	B B 2			Pu 238	= 6.30E-07	B B 2		
Sn 123					Pu 239	= 1.08E-06	B B 2		
Sn 126					Pu 240	= 9.72E-07	B B 2		
Sb 125	= 8.93E-10	B B 2			Pu 241	= 7.75E-06	B B 2		
Sb 126					Pu 242	= 1.14E-08	B B 2		
Te 125m	= 2.11E-10	B B 2			Am 241	= 8.55E-07	B B 2		
Te 127m					Am 242m	= 3.24E-09	B B 2		
I 129					Am 243	= 6.89E-11	B B 2		
Cs 134	= 2.40E-10	B B 2			Cm 242	= 2.70E-09	B B 2		
Cs 135					Cm 243	= 3.62E-10	B B 2		
Cs 137	= 2.04E-05	B B 2			Cm 244	= 8.45E-09	B B 2		
Ba 133	= 9.24E-10	B B 2			Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	= 1.99E-14	B B 2			Cf 249				
Pm 145					Cf 250				
Pm 147	= 2.51E-08	B B 2			Cf 251				
Sm 147	= 1.87E-17	B B 2			Cf 252				
Sm 151	= 6.67E-08	B B 2			Unsp a				
Eu 152	= 2.88E-07	B B 2			Unsp b/g				
Eu 154	= 2.29E-07	B B 2			Total a	7.43E-06	*	0	*
Eu 155	= 9.53E-09	B B 2			Total b/g	4.34E-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