

WASTE STREAM	2D39	Miscellaneous Beta/Gamma Waste Store
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SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Ltd

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 3685.5		
Future arisings:	1.4.2025 - 31.3.2026	= 346.5		
	1.4.2026 - 31.3.2027	= 280.0		
	1.4.2027 - 31.3.2028	= 357.0		
	1.4.2028 - 31.3.2029	= 371.0		
	1.4.2029 - 31.3.2030	= 493.5		
	1.4.2030 - 31.3.2031	= 801.5		
	1.4.2031 - 31.3.2032	= 619.5		
	1.4.2032 - 31.3.2033	= 630.0		
	1.4.2033 - 31.3.2034	= 553.0		
	1.4.2034 - 31.3.2035	= 227.5		
	1.4.2035 - 31.3.2036	= 231.0		
	1.4.2036 - 31.3.2037	= 178.5		
	1.4.2037 - 31.3.2038	= 66.5		
	1.4.2038 - 31.3.2039	= 17.5		
	1.4.2039 - 31.3.2040	= 10.5		
	1.4.2040 - 31.3.2041	= 10.5		
	1.4.2041 - 31.3.2042	= 3.5		
	1.4.2042 - 31.3.2043	= 3.5		
	1.4.2043 - 31.3.2044	= 3.5		
	1.4.2044 - 31.3.2045	= 3.5		
	1.4.2045 - 31.3.2046	= 0		
	1.4.2046 - 31.3.2047	= 0		
	1.4.2047 - 31.3.2048	= 0		
	1.4.2048 - 31.3.2049	= 10.5		
	1.4.2049 - 31.3.2050	= 10.5		
	1.4.2050 - 31.3.2051	= 10.5		
Total future arisings:	5239.5			
Total waste volume:	8925.0			

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

Comment on arising rates: The generation of waste from site operations is not constant hence the arisings in the annual period are not constant and may vary from predicted arisings stated. Stocks and arisings volumes include miscellaneous beta/gamma waste from current decommissioning projects. Total arisings are correct for known future wastes, however the throughput from the MPS is probably excessively ambitious. There is potentially a larger uncertainty in this submission for arisings given that the data has been collected from the different consignors and their predictions.

Additional information on quantities: Volumes are boxed waste internal volume of 3.5m³, displacement of box is taken as 4.7m³. Stock volumes are considered to be accurate as number of boxes and internal volume is known. Forecast volumes are expected to be within a factor of +/- 0.2.

Uncertainty factors on volumes:

Stock (upper):	x 1.00	Arisings (upper):	x 1.20
Stock (lower):	x 1.00	Arisings (lower):	x 0.80

WASTE SOURCE The waste arises from general site operations. Small quantities are from other sites (Chapelcross, UKAEA) and possibly from other sealed sources in the UK, e.g. MOD, hospitals, research establishments, universities.

PHYSICAL CHARACTERISTICS

General description: The waste is miscellaneous beta/gamma contaminated items. Laboratory chemicals will normally be immobilised in concrete and oils and liquids will be fully absorbed or otherwise immobilised, if they cannot be eliminated at source. MBGWS Conditions for Acceptance state waste is to be dry. MBGWS Conditions for Acceptance dictates/limits size of large items - this is determined by box envelope.

Changes since waste generated: No waste compaction or dilution is carried out to waste consigned to MBGWS, however, size reduction can be performed at source to produce a better packing fraction of containers consigned by donor plants.

Bulk density (t/m³): ~ 1.4

Comment on density: Calculated using boxed volume = 3.5 m³ and average weight of full box = 4.8 t. Therefore density = 1.371 t/m³, ie. approx 1.4 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt):

Various steels (70%), other metals including copper, aluminium, lead, brass (15%), paper (2%), plastics and rubber (3%), concrete (8%), fibreglass and asbestos (1%), others including laboratory chemicals, oils, liquids (1%).

Chemical state:

Neutral

Sheet metal proportion / thickness: Both sheet and bulk metals likely to be present, proportions may vary dependant on consignment.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 59.9	Grades 316L, 304 ratio unknown.	
Other ferrous metals.....	= 10.0	Mild steel, carbon steel ratio unknown.	
Iron.....	-	-	
Aluminium.....	= 5.0	Unknown grade(s).	
Beryllium.....	TR	-	
Cobalt.....	NE	-	
Copper.....	= 5.0	Unknown grade(s).	
Lead.....	~ 4.0	Unknown grade(s).	
Magnox/Magnesium.....	< 0.01	-	
Nickel.....	NE	-	
Titanium.....	P	Unknown grade(s).	
Uranium.....	= 0.02	-	
Zinc.....	= 1.0	-	
Zircaloy/Zirconium.....	< 0.01	-	
Other metals.....	NE	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 2.0	-	
Paper, cotton.....	P	-	
Wood.....	P	-	
Halogenated plastics.....	= 2.0	-	
Total non-halogenated plastics.....	= 0.50	-	
Condensation polymers.....	= 0.25	-	
Others.....	= 0.25	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 0.50	-	
Halogenated rubber.....	= 0.25	-	
Non-halogenated rubber.....	= 0.25	-	
Hydrocarbons.....	<< 0.10	-	
Oil or grease.....	<< 0.10	-	
Fuel.....	0	-	
Asphalt/Tarmac (cont.coal tar).....	0	-	
Asphalt/Tarmac (no coal tar).....	0	-	
Bitumen.....	0	-	
Others.....	0	-	
Other organics.....	TR	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	NE	-	
Inorganic sludges and flocs.....	NE	-	
Soil.....	NE	-	
Brick/Stone/Rubble.....	NE	-	
Cementitious material.....	= 8.0	-	
Sand.....	P	-	
Glass/Ceramics.....	< 1.0	-	
Graphite.....	NE	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	< 1.0	-	
Non/low friable.....	<< 1.0	-	
Moderately friable.....	<< 1.0	-	
Highly friable.....	<< 1.0	-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	NE	-	

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

Inorganic anions (%wt):

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

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.....	NE	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	NE	-
Corrosive materials.....	= 0	-
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.....	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):

Yes		
	(%wt)	Type(s) and comment
EDTA.....	= 0	-
DPTA.....	= 0	-
NTA.....	= 0	-
Polycarboxylic acids.....	NE	-
Other organic complexants.....	NE	Trace amounts of organic complexing agents may be present in the waste.
Total complexing agents.....	TR	-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
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		= 100.0

Comments on planned treatments:

Assumed to be processed through future treatment plant.

Conditioning method:

Proposed that current storage box is flood grouted if suitable, the product will form final conditioned package.

Conditioning plants:

Plant Name	Location
Intermediate Level Waste Final Conditioning Plant (ILWFCP)	Sellafield

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
MBGWS box	100.0	3.5	3.5	2550	-

Range in container waste loading:

There is a 65% packing fraction target applied to boxes however this has not always been the case. There is opportunity for boxes with lower packing fractions to be repacked in the future to conform with the target but not all boxes will be available for this.

Other information on packaging and conditioning:

-

Conditioned density (t/m³):

~ 1.6

Conditioned density comment:

Average weight of full box = 4.8Te and Average weight of grout (assumed to be 43% of payload) = 2.5Te.
Average weight of conditioned box = 7.3Te Container displacement = 4.7m³.

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: Miscellaneous Beta/Gamma waste containing variety of contamination including fission products, activated materials (e.g. steel), Uranium (enriched, natural and depleted) along with a variety of sources.

Uncertainty: -

Measurement of radioactivities: No direct measurements were taken for the specific activity values, they were derived from an amalgamation of fingerprints taking into accounts the key consignors.

Chemical form of radionuclides: H-3: Not estimated.
C-14: Not estimated.
Cl-36: Present as trace amounts of clathrate compounds of metallic salts readily lost to aqueous solution.

Se-79: Not estimated.
Tc-99: Not estimated.
I-129: Present as trace amounts of clathrate compounds of metallic salts readily lost to aqueous solution.

Ra: Not estimated.
Th: Not estimated.
U: Not estimated.
Np: Not estimated.
Pu: Not estimated.

WASTE STREAM		2D39		Miscellaneous Beta/Gamma Waste Store					
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	= 5.00E-04	C C 2	= 4.32E-04	C C 2	Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55	= 2.50E-04	C C 2	= 2.16E-04	C C 2	Pb 210				
Co 60	= 2.50E-04	C C 2	= 2.16E-04	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				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	= 1.46E+00	C C 2	= 5.38E-01	C C 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230	= 2.75E-05	C C 2	= 2.38E-05	
Nb 93m					Th 232				
Nb 94					Th 234	= 3.97E-07	C C 2		
Mo 93					Pa 231				
Tc 97					Pa 233	= 3.02E-07	C C 2		
Tc 99	= 1.25E-03		= 1.08E-03	C C 2	U 232				
Ru 106	= 5.97E-02	C C 2	= 1.10E-02	C C 2	U 233				
Pd 107					U 234	= 2.50E-04	C C 2	= 2.16E-04	C C 2
Ag 108m					U 235	= 2.50E-06	C C 2	= 2.16E-06	C C 2
Ag 110m					U 236	= 1.75E-05	C C 2	= 1.51E-05	C C 2
Cd 109					U 238	= 1.37E-02	C C 2	= 1.19E-02	C C 2
Cd 113m					Np 237	= 3.00E-03	C C 2	= 2.59E-03	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	= 2.19E-03	C C 2	= 4.32E-04	C C 2
Sn 123					Pu 239	= 4.86E-04	C C 2	= 2.16E-04	C C 2
Sn 126					Pu 240	= 6.54E-04	C C 2	= 2.16E-04	C C 2
Sb 125	= 1.06E-02	C C 2	= 4.75E-03	C C 2	Pu 241	= 4.64E-02	C C 2	= 8.64E-03	C C 2
Sb 126					Pu 242	= 1.35E-06	C C 2		
Te 125m	= 1.82E-05	C C 2			Am 241	= 3.22E-02	C C 2	= 1.14E-02	C C 2
Te 127m					Am 242m				
I 129	= 1.30E-03	C C 2	= 1.50E-03	C C 2	Am 243				
Cs 134	= 1.06E-01	C C 2	= 4.32E-03	C C 2	Cm 242	= 1.84E-04	C C 2	= 9.93E-05	C C 2
Cs 135					Cm 243				
Cs 137	= 2.89E+00	C C 2	= 1.52E+00	C C 2	Cm 244	= 3.28E-02	C C 2	= 4.53E-03	C C 2
Ba 133					Cm 245	= 8.02E-07	C C 2		
La 137					Cm 246				
La 138					Cm 248				
Ce 144	= 4.53E-02	C C 2	= 3.67E-03	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147	= 9.21E-02	C C 2	= 2.22E-02	C C 2	Cf 251				
Sm 147	= 2.45E-12	C C 2			Cf 252				
Sm 151	= 5.25E-03	C C 2	= 4.53E-03	C C 2	Unsp a				
Eu 152					Unsp b/g				
Eu 154	= 4.08E-02	C C 2	= 6.69E-03	C C 2	Total a	8.56E-02	*	3.17E-02	*
Eu 155	= 3.09E-03	C C 2	= 2.59E-03	C C 2	Total b/g	4.76E+00	*	2.13E+00	*

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