

WASTE STREAM	2D73	MSSS - Miscellaneous Beta/Gamma Waste in Voids
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SITE Sellafield
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Limited

WASTE TYPE ILW; SPD1

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

	Reported
Stocks: At 1.4.2022.....	10.0m ³
Total future arisings:	0 m ³
Total waste volume:	10.0 m ³

Comment on volumes: Although no future arisings are predicted, it is possible that certain items of failed decommissioning equipment (such as MSMs) may arise as additional waste during retrievals from the silos. The waste in the voids is in a dry environment, and there are 81 known tipped items. Video footage gives a very good indication of waste volume.

Uncertainty factors on volumes: Stock (upper): x 1.5 Arisings (upper) x
 Stock (lower): x 0.5 Arisings (lower) x

WASTE SOURCE Waste arose from general site operations and other off-site establishments.

PHYSICAL CHARACTERISTICS

General description: The waste stream is dry stored in the voids and only includes activated and contaminated items. Items are of a very wide size range, and contain a high proportion of items longer than 2 metres.

Physical components (%vol): Bulky items (22 of) accounting for 82% of the waste volume. Other metal waste 8%. Thermocouples (25 of, 2%) other waste (8%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.65

Comment on density: The bulky items together have a calculated density of approx 650kg/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Ferrous metal (~92%), cellulose (~1%), plastics (~1%), others (~6%). Difficult to estimate masses for non metals.

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): Sheet metal (incl. uncrushed tins) 35%v/v; average thickness 4mm. Bulky metal items 23% v/v; average size 160mm dia x 400mm, average volume 20 l. Small items of metal (unknown dimensions) 42%v/v.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~85.0		
Other ferrous metals.....	~7.0		
Iron.....			
Aluminium.....	NE		
Beryllium.....	NE		
Cobalt.....	NE		
Copper.....	NE		
Lead.....	NE		
Magnox/Magnesium.....	NE		

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Nickel.....	NE		
Titanium.....	NE		
Uranium.....	NE		
Zinc.....	NE		
Zircaloy/Zirconium.....	NE		
Other metals.....	TR		
Organics (%wt):	PVC.		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	<1.0		
Paper, cotton.....	NE		
Wood.....	<1.0		
Halogenated plastics	<1.0	Difficult to estimate, but insignificant quantities.	
Total non-halogenated plastics.....	NE		
Condensation polymers.....			
Others.....			
Organic ion exchange materials....	NE		
Total rubber.....	NE		
Halogenated rubber			
Non-halogenated rubber.....			
Hydrocarbons.....	NE		
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		
Other materials (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	<5.0	Some loose material tipped.	
Cementitious material.....	NE		
Sand.....	NE		
Glass/Ceramics.....	NE		
Graphite.....	NE		
Desiccants/Catalysts.....	NE		
Asbestos.....	NE		
Non/low friable.....			
Moderately friable.....			

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Highly friable.....	
Free aqueous liquids.....	NE
Free non-aqueous liquids.....	NE
Powder/Ash.....	NE

Inorganic anions (%wt): The inorganic anion content is low; traces may be present.

	(%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: Considered bounded in characteristics by in-silo MBGW.

	(%wt)	Type(s) and comment
Combustible metals.....	0	<1% plastics and wood in small quantities.
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	P	
Putrescible wastes.....	NE	
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: Cleaning materials, and mechanical devices which may contain oil / grease may be present but in very small quantities.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....	0	
Chlorinated solvents.....		
Formaldehyde.....		

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Organometallics.....		
Phenol.....	0	
Styrene.....		
Tri-butyl phosphate.....	0	
Other organophosphates.....		
Vinyl chloride.....	0	
Arsenic.....	0	
Barium.....		
Boron.....	NE	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....	NE	
Caesium.....		
Selenium.....	NE	
Chromium.....	P	In steels.
Molybdenum.....	NE	
Thallium.....		
Tin.....	NE	
Vanadium.....	P	In steels.
Mercury compounds.....		
Others.....	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

Complexing agents (%wt): Not yet determined

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	Cleaning and decontamination materials may be present in trace quantities.
Total complexing agents.....	NE	

Potential for the waste to contain discrete items: Not yet determined.

PACKAGING AND CONDITIONING

Conditioning method: This waste stream is outside of the current cLoC. It is currently envisaged that it will be possible to use the same processing facility and package type as is the case for the other MSSS waste streams.

Plant Name: TBD

Location: Sellafield

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Plant startup date: 2070-2090
 Total capacity (m³/y incoming waste): -
 Target start date for packaging this stream: -
 Throughput for this stream (m³/y incoming waste): -
 Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	Sellafield enhanced 3m ³ box	NE	NE	2.15	NE

Likely container type comment: -

Range in container waste volume: There will be considerable variability in unconditioned waste volume per package due to variations in skip loading and content.

Other information on containers: Stainless Steel.

Likely conditioning matrix: BFS/OPC;PFA/OPC

Other information: -

Conditioned density (t/m³): ~2.0

Conditioned density comment: Density of conditioned waste will be fairly uniform.

Other information on conditioning: Waste matrix (as retrieved) will be in-filled with grout. A second pour of capping grout will be added. Void spaces between Skip wall and Box wall will be filled with grout.

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

RADIOACTIVITY

Source: The activity mainly arises from contamination with silo liquor. Source data quotes dose not activity in most cases (easier to determine using monitoring equipment).

Uncertainty: Best available. No additional data available at time of compilation of 2019 inventory.

Definition of total alpha and total beta/gamma: Only 1 entry with activity data 1.27E11 Bq beta total activity for thermocouples (steel activation products/in-reactor surface contam). Some entries quote dose rates greater than 7.5mSv/hr, other entries suggests total dose from 0.02 Sv to 1Sv beta/gamma (for material contacted by silo liquor). Main dose therefore from soluble Cs137.

Measurement of radioactivities: -

Other information: -

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3					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					Pb 210				
Co 60					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					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					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					Other a				
Eu 152					Other b/g				
Eu 154					Total a	NE			0
Eu 155					Total b/g	NE			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 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