

WASTE STREAM	2D132	Plutonium Plants Initial/Interim Decommissioning: Processing Plants (PCM)
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SITE Sellafield
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Sellafield Limited
WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2029.....	0 m ³
	1.4.2029 - 31.3.2032.....	93.6 m ³
	1.4.2032 - 31.3.2038.....	822.5 m ³
	1.4.2038 - 31.3.2040.....	62.4 m ³
	1.4.2040 - 31.3.2049.....	148.5 m ³
	1.4.2049 - 31.3.2059.....	476.9 m ³
	1.4.2059 - 31.3.2060.....	31.2 m ³
	1.4.2060 - 31.3.2062.....	0 m ³
	1.4.2062 - 31.3.2063.....	54.3 m ³
	1.4.2063 - 31.3.2070.....	368.4 m ³
	1.4.2070 - 31.3.2073.....	93.6 m ³
	1.4.2073 - 31.3.2083.....	0 m ³
	1.4.2083 - 31.3.2094.....	343.1 m ³
1.4.2094 - 31.3.2121.....	0 m ³	
Total future arisings:		2494.5 m ³
Total waste volume:		2494.5 m ³

Comment on volumes: Arisings are in line with current decommissioning programmes and strategy. Waste within this waste stream is generated from decommissioning projects which will commence at a future date. As a result of this, minimal characterisation of waste volumes and fingerprints has been carried out and hence there is a large uncertainty in the potential arisings. Preliminary assessments indicate that the volumes may vary from -30% to +200% for ILW.

Uncertainty factors on volumes:
 Stock (upper): x Arisings (upper) x 3.0
 Stock (lower): x Arisings (lower) x 0.7

WASTE SOURCE Dismantling of plutonium process plants.

PHYSICAL CHARACTERISTICS

General description: Plant and equipment, internal building fabric and miscellaneous soft waste, i.e. rubber/PVC/paper. Most items size reduced in-situ. Some large items may be present.

Physical components (%vol): Gloveboxes (41%), pipework, valves and fittings (7%), plant and equipment (36%), ducting (6%), soft waste (10%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.35

Comment on density: Density stated is average for PCM.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (59%), mild steel (29%), copper (0.5%), lead (trace), aluminium (0.5%), zinc (<0.05%), plastic (7%), rubber (2.5%), glass (0.5%), cellulose (1%). Percentages are by volume.

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): Some sheet metal present (~30%), bulk metal (70%). Composition percentages are by volume.

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Stainless steel.....	59.0	The most commonly used stainless steel is 304L.
Other ferrous metals.....	29.0	
Iron.....		
Aluminium.....	0.50	
Beryllium.....		
Cobalt.....	0	
Copper.....	0.50	
Lead.....	TR	
Magnox/Magnesium.....	0	
Nickel.....	0	
Titanium.....		
Uranium.....		
Zinc.....	<0.05	
Zircaloy/Zirconium.....	0	
Other metals.....	0	

Organics (%wt):

The waste contains PVC and other plastics, small amounts of rubber and cellulose. Percentages are by volume. PVC oversuits, Windscale suits, waste bags, rubber gloves.

Total cellulosics.....	1.0
Paper, cotton.....	TR
Wood.....	~1.0
Halogenated plastics	5.0
Total non-halogenated plastics.....	2.0
Condensation polymers.....	1.0
Others.....	1.0
Organic ion exchange materials....	0
Total rubber.....	2.5
Halogenated rubber	P
Non-halogenated rubber.....	P
Hydrocarbons.....	
Oil or grease	
Fuel.....	
Asphalt/Tarmac (cont.coal tar)...	
Asphalt/Tarmac (no coal tar)....	
Bitumen.....	
Others.....	
Other organics.....	0

Other materials (%wt):

Percentages are by volume.	
Inorganic ion exchange materials.	0
Inorganic sludges and flocs.....	0
Soil.....	0
Brick/Stone/Rubble.....	TR
Cementitious material.....	TR
Sand.....	0

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	Glass/Ceramics.....	0.50	
	Graphite.....	0	
	Desiccants/Catalysts.....	0	
	Asbestos.....	TR	Asbestos cement cladding, sheets, ceiling tiles and roof cladding.
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....	0	
	Free non-aqueous liquids.....	0	
	Powder/Ash.....	0	
Inorganic anions (%wt):	-		
	Fluoride.....	0	
	Chloride.....	0	
	Iodide.....	0	
	Cyanide.....	0	
	Carbonate.....	0	
	Nitrate.....	0	
	Nitrite.....	0	
	Phosphate.....	0	
	Sulphate.....	0	
	Sulphide.....	0	
Materials of interest for waste acceptance criteria:	Asbestos cement cladding, sheets, ceiling tiles and roof cladding.		
	Combustible metals.....	0	
	Low flash point liquids.....	0	
	Explosive materials.....	0	
	Phosphorus.....	0	
	Hydrides.....	0	
	Biological etc. materials.....	0	
	Biodegradable materials.....	0	
	Putrescible wastes.....	0	
	Non-putrescible wastes.....	0	
	Corrosive materials.....	0	
	Pyrophoric materials.....	0	
	Generating toxic gases.....	0	
	Reacting with water.....	0	
	Active particles.....	NE	
	Soluble solids as bulk chemical compounds.....	0	

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Processing Plants (PCM)**Hazardous substances /
non hazardous pollutants:

Lead and asbestos are present in trace quantities.

Acrylamide.....

Benzene.....

Chlorinated solvents.....

Formaldehyde.....

Organometallics.....

Phenol.....

Styrene.....

Tri-butyl phosphate.....

Other organophosphates.....

Vinyl chloride.....

Arsenic.....

Barium.....

Boron.....

Cadmium.....

Caesium.....

Selenium.....

Chromium.....

Molybdenum.....

Thallium.....

Tin.....

Vanadium.....

Mercury compounds.....

Others.....

Electronic Electrical Equipment (EEE)

EEE Type 1.....

EEE Type 2.....

EEE Type 3.....

EEE Type 4.....

EEE Type 5.....

Complexing agents (%wt):

No

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids.....

Other organic complexants.....

Total complexing agents..... 0

PACKAGING AND CONDITIONING

Conditioning method:

The waste is assumed to leave decommissioning in 200 litre mild steel drums. Where possible these drums will be supercompacted. Pucks generated and any non-compactable drums will be loaded into 500 litre product drums.

Plant Name:

Waste Treatment Complex (WTC) 2

Location:

Sellafield.

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Plant startup date: 2034

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: 2029

Throughput for this stream (m³/y incoming waste): -

Other information: WTC 1 due to operate until April 2028. WTC2 begins operations in 2034 - waste generated in the interim period is planned to be interim stored in 200 l drums.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum (basket for waste)	100.0	~0.239	~0.504	10438

Likely container type comment: Conditioning and packaging factors revised as currently 6 feed drums are compacted on average per product drum.

Range in container waste volume: Between 1 and 9 compacted 200l drums will be put into a 500l drum.

Other information on containers: -

Likely conditioning matrix: PFA/OPC

Other information: -

Conditioned density (t/m³): 2.0

Conditioned density comment: The density of the conditioned product will range from 1.5 to 2.6 t/m³ for drums.

Other information on conditioning: -

Opportunities for alternative disposal routing: Not yet determined

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source: The main sources of activity are plutonium isotopes.

Uncertainty: Activity levels will depend on degree of decontamination achieved.

Definition of total alpha and total beta/gamma: Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.

Measurement of radioactivities: -

Other information: -

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3				8	Gd 153				
Be 10					Ho 163				
C 14				8	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36				8	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41				8	Pt 193				
Mn 53					Tl 204				
Mn 54				8	Pb 205				
Fe 55				8	Pb 210				8
Co 60				8	Bi 208				
Ni 59				8	Bi 210m				
Ni 63				8	Po 210				8
Zn 65				8	Ra 223				
Se 79				8	Ra 225				
Kr 81					Ra 226				8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90				8	Th 227				
Zr 93				8	Th 228				
Nb 91					Th 229				8
Nb 92					Th 230				8
Nb 93m				8	Th 232				8
Nb 94				8	Th 234				
Mo 93				8	Pa 231				8
Tc 97					Pa 233				
Tc 99				8	U 232				
Ru 106				8	U 233				8
Pd 107				8	U 234		2.49E-08	BC	2
Ag 108m				8	U 235		5.40E-07	BC	2
Ag 110m					U 236		2.49E-08	BC	2
Cd 109					U 238		7.73E-07	BC	2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m				8	Pu 238		1.32E-02	BC	2
Sn 123					Pu 239		1.65E-02	BC	2
Sn 126				8	Pu 240		2.28E-02	BC	2
Sb 125					Pu 241		4.81E-01	BC	2
Sb 126					Pu 242		1.55E-05	BC	2
Te 125m					Am 241		4.99E-02	BC	2
Te 127m					Am 242m				
I 129				8	Am 243				
Cs 134				8	Cm 242				
Cs 135				8	Cm 243				
Cs 137				8	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144				8	Cf 249				
Pm 145					Cf 250				
Pm 147				8	Cf 251				
Sm 147					Cf 252				
Sm 151				8	Other a				
Eu 152				8	Other b/g				
Eu 154				8	Total a	0	1.02E-01	BC	2
Eu 155				8	Total b/g	0	4.81E-01	BC	2

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