WASTE STREAM	2D03	Plutonium Contaminated Materials; Drums

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	1309.4			
Future arisings:	1.4.2025 - 31.3.2026	85.0			
	1.4.2026 - 31.3.2027	104.2			
	1.4.2027 - 31.3.2028	99.8			
	1.4.2028 - 31.3.2029	157.8			
	1.4.2029 - 31.3.2030	149.0			
	1.4.2030 - 31.3.2031	136.0			
	1.4.2031 - 31.3.2032	136.0			
	1.4.2032 - 31.3.2033	134.0			
	1.4.2033 - 31.3.2034	134.0			
	1.4.2034 - 31.3.2035	134.0			
	1.4.2035 - 31.3.2036	134.0			
	1.4.2036 - 31.3.2037	134.0			
	1.4.2037 - 31.3.2038	134.0			
	1.4.2038 - 31.3.2039	134.0			
	1.4.2039 - 31.3.2040	134.0			
	1.4.2040 - 31.3.2041	134.0			
	1.4.2041 - 31.3.2042	134.0			
	1.4.2042 - 31.3.2043	134.0			
	1.4.2043 - 31.3.2044	134.0			
	1.4.2044 - 31.3.2045	134.0			
	1.4.2045 - 31.3.2046	134.0			
	1.4.2046 - 31.3.2047	134.0			
	1.4.2047 - 31.3.2048	134.0			
	1.4.2048 - 31.3.2049	134.0			
	1.4.2049 - 31.3.2050	134.0			
	1.4.2050 - 31.3.2051	134.0			
	1.4.2051 - 31.3.2052	134.0			
	1.4.2052 - 31.3.2053	58.0			
	1.4.2053 - 31.3.2054	58.0			
	1.4.2054 - 31.3.2055	58.0			
	1.4.2055 - 31.3.2056	58.0			
	1.4.2056 - 31.3.2057	58.0			
	1.4.2057 - 31.3.2058	58.0			
	1.4.2058 - 31.3.2059	58.0			
Total future arisings:		**3953.8**			
Total waste volume:		**5263.2**			

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

Comment on arising rates: Arisings of PCM are not generally predictable. For the majority of production plants arisings are not linked to production throughputs but are related to maintenance, refurbishment and breakdown.

Additional information on quantities: The figures provided list current stocks as those held at Sellafield in designated PCM stores, these items are tracked and hence known to a good level of accuracy. Prediction of future arisings are updated annually by consignors however experience of actual receipts has shown that these predictions typically have a high level of uncertainty associated with them.

Uncertainty factors on volumes:

Stock (upper):	x 1.10	Arisings (upper):	x 1.50
Stock (lower):	x 0.90	Arisings (lower):	x 0.50

WASTE SOURCE PCM arising from reprocessing operations at Sellafield. The arisings also include secondary waste from product repackaging and minor quantites of residue disposal.

PHYSICAL CHARACTERISTICS

General description: The waste consists of solid materials such as PVC gloves, filters, paper towels, small plant items etc. The waste is basically any item that can be bagged or wrapped in PVC and placed in a 200 litre drum and small quantities of residues placed in 200L drums.

Changes since waste generated: No physical and chemical changes.

Bulk density (t/m^3): = 0.30

Comment on density: Range of densities is approximately 0.1 to 0.5 t/m^3.

CHEMICAL COMPOSITION

General description and components (%wt): The waste has a mixed chemical composition: PVC (22%), Rubber (10%), Metals (54%), Cellulose (5%), Polythene (5%), Glass (2%), Other (2%). The composition includes the sacrificial 200 litre drum.

Chemical state: Neutral

Sheet metal proportion / thickness: Mostly sheet metal, from the 200 litre drum. Some bulk metals present, largest dimensions 1m x 30mm square. May also include cut up scaffold poles and items of plant.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel	= 0.40	-	
Other ferrous metals	= 52.7	-	
Iron	= 0	-	
Aluminium	= 0.90	-	
Beryllium	= 0	-	
Cobalt	TR	May be present as part of hand tool alloy.	
Copper	P	-	
Lead	P	-	
Magnox/Magnesium	= 0	-	
Nickel	TR	May be present as part of hand tool alloy.	
Titanium	TR	May be present as part of hand tool alloy.	
Uranium	0	-	
Zinc	P	-	
Zircaloy/Zirconium	P	-	
Other metals	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	= 5.4	-	
Paper, cotton	= 5.4	-	
Wood	TR	-	
Halogenated plastics	= 22.2	Typically PVC.	
Total non-halogenated plastics	= 4.9	Includes perspex and polythene.	
Condensation polymers	= 0	-	
Others	= 4.9	-	
Organic ion exchange materials	TR	-	
Total rubber	= 10.1	-	
Halogenated rubber	= 10.1	-	
Non-halogenated rubber	= 0	-	
Hydrocarbons	= 0	-	
Oil or grease	= 0	-	
Fuel	= 0	-	
Asphalt/Tarmac (cont.coal tar)	= 0	-	
Asphalt/Tarmac (no coal tar)	= 0	-	
Bitumen	= 0	-	
Others	= 0	-	
Other organics	= 0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	TR	-	
Inorganic sludges and flocs	= 0	-	
Soil	= 0	-	
Brick/Stone/Rubble	= 0	-	
Cementitious material	= 1.0	-	
Sand	= 0	-	
Glass/Ceramics	= 2.4	-	
Graphite	= 0	-	
Desiccants/Catalysts	NE	-	
Asbestos	P	-	
Non/low friable	NE	-	
Moderately friable	NE	-	
Highly friable	NE	-	
Free aqueous liquids	TR	-	
Free non-aqueous liquids	TR	-	
Powder/Ash	P	-	

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

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride	< 0.10	Fluorides of calcium, sodium and potassium may be present.
Chloride	< 0.10	-
Iodide	< 0.10	-
Cyanide	= 0	-
Carbonate	< 0.10	-
Nitrate	< 0.10	-
Nitrite	NE	-
Phosphate	< 0.10	-
Sulphate	< 0.10	-
Sulphide	< 0.10	-

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	= 0	-
Non-putrescible wastes		-
Corrosive materials	= 0	-
Pyrophoric materials	= 0	-
Generating toxic gases	= 0	-
Reacting with water	= 0	-
Higher activity particles	= 0	-
Soluble solids as bulk chemical compounds	= 0	-

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)		-
Boron (non-Boral)		-
Cadmium	NE	-
Caesium	NE	-
Selenium	NE	-
Chromium	TR	May be present as part of hand tool alloy.
Molybdenum	NE	-
Thallium	NE	-
Tin	NE	-
Vanadium	TR	May be present as part of hand tool alloy.
Mercury compounds	TR	-
Others	NE	-

Complexing agents (%wt): Yes

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

Physical components:

	Number	Type(s) and comment
Sources	= 3	Two Co-60 sources and one Am-241 source are believed to be present in this waste stream.
Electronic & Electrical Equipment (EEE)		-
EEE Type 1	NE	-
EEE Type 2	NE	-
EEE Type 3	NE	-
EEE Type 4	NE	-
EEE Type 5	NE	-

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)	On-site	= 78.0
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification	On-site	= 20.0
Encapsulation	On-site	= 2.0
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments: -

Conditioning method: The current conditioning method for 2D03 is processing through the Waste Treatment Complex (TWC) where 200 litre drums of waste are supercompacted and the pucks loaded into a basket within a 500 litre drum (such that there is a cement annulus between the basket and the drum skin). Replacement WTC facilities are currently projected to use a thermal treatment method, loading either 16 CLDs or 2 gloveboxes into a 4m box with an internal capacity of 15.6m^3. Once thermally treated, additional drummed waste will be used as top up feed to optimise the waste in the product. Consequently, it will appear as 0 packages in the container types due to the absence of any package creation.

Conditioning plants:

Plant Name	Location
Waste Treatment Complex 1 (WTC1)	Sellafield
Waste Treatment Complex 2 (WTC2)	Sellafield

Likely conditioning matrix: Non-standard

Further information on the conditioning matrix: GGBS/CEM I

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
500 l drum	2.0	0.20	0.50	527	-
500 l drum (basket for waste)	78.0	0.50	0.50	8211	2025
4 m box (0 mm concrete shielding)	20.0	0	-	-	2047

Range in container waste loading: 95% of current waste and 99% of future waste is assumed to be compatible with the current WTC supercompaction and grout process. Typically between 1 and 10 compacted 200 litre drums will be loaded in to a 500 litre drum, with an average of 5.7. Waste that is not suitable for supercompaction could be processed in the future using direct encapsulation, loading the 200 litre feed drum into a 500 litre product drum with no attempted volume reduction before being grouted. The volume of waste processed through a future thermal treatment plant per product would be significantly higher (estimated at ~20m^3) due to the larger volume of the product container.

Other information on packaging and conditioning: -

Conditioned density (t/m^3): = 2.1

Conditioned density comment: Conditioned density calculated using data from current WTC product drum stock. The density is typically between 1.8 and 2.6 t/m^3, although values outside of this range are possible.

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland) 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	~ 100.0		2050

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
GDF	LLWR	~ 8.0	GREEN	It is estimated that ~2,100 drums will be consigned as LLW from 2D03 under the 2X40/1 waste stream. The work to introduce this new LLW waste stream is well advanced.

RADIOACTIVITY

Source: The principal nuclides are Pu-238, Pu-239, Pu-240, Pu-241, Pu242 and Am241.

Uncertainty: The activity accuracy is based on records of arisings.

Measurement of radioactivities: The specific activities were calculated using an average fingerprint for the stream (determined through measurements of several thousand drums through the WTC and EDS assay suite) and the total Pu mass of the current stocks.

Chemical form of radionuclides:

H-3: -
C-14: -
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: Metal, oxides, nitrates, fluorides.
Np: -
Pu: Metal, oxides, fluorides, nitrates.

WASTE STREAM	2D03	Plutonium Contaminated Materials; Drums									
	Mean radioactivity, TBq/m³					Mean radioactivity, TBq/m³					
Nuclide	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Nuclide	Waste at 1.4.2025	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	1.07E-07	B B 2			
Nb 94						Th 234					
Mo 93						Pa 231	1.07E-07	B B 2			
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	4.78E-06	B B 2	5.98E-07	C C 2	
Cd 113m						Np 237	2.26E-05	B B 2	3.49E-06	C C 2	
Sn 119m						Pu 236					
Sn 121m						Pu 238	3.71E-01	B B 2	2.44E-01	C C 2	
Sn 123						Pu 239	7.81E-01	B B 2	5.58E-01	C C 2	
Sn 126						Pu 240	6.72E-01	B B 2	4.57E-01	C C 2	
Sb 125						Pu 241	1.97E+01	B B 2	1.35E+01	C C 2	
Sb 126						Pu 242	4.35E-04	B B 2	2.84E-04	C C 2	
Te 125m						Am 241	4.04E-01	B B 2	2.32E-01	C C 2	
Te 127m						Am 242m					
I 129						Am 243	3.35E-07	B B 2			
Cs 134						Cm 242					
Cs 135						Cm 243					
Cs 137	2.83E-03	B B 2				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						Unsp a					
Eu 152						Unsp b/g					
Eu 154						**Total a**	**2.23E+00**	*	**1.49E+00**	*	
Eu 155						**Total b/g**	**1.97E+01**	*	**1.35E+01**	*	

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