WASTE STREAM	2D90	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	= 3147.4			
Future arisings:	1.4.2025 - 31.3.2026	= 95.0			
	1.4.2026 - 31.3.2027	= 63.4			
	1.4.2027 - 31.3.2028	= 35.2			
	1.4.2028 - 31.3.2029	= 32.7			
	1.4.2029 - 31.3.2030	= 40.0			
	1.4.2030 - 31.3.2031	= 51.6			
	1.4.2031 - 31.3.2032	= 29.6			
	1.4.2032 - 31.3.2033	= 29.6			
	1.4.2033 - 31.3.2034	= 29.6			
	1.4.2034 - 31.3.2035	= 11.6			
	1.4.2035 - 31.3.2036	= 11.6			
	1.4.2036 - 31.3.2037	= 11.6			
	1.4.2037 - 31.3.2038	= 0			
	1.4.2038 - 31.3.2039	= 0			
	1.4.2039 - 31.3.2040	= 0			
	1.4.2040 - 31.3.2041	= 0			
	1.4.2041 - 31.3.2042	= 20.0			
	1.4.2042 - 31.3.2043	= 30.7			
	1.4.2043 - 31.3.2044	= 448.2			
	1.4.2044 - 31.3.2045	= 472.3			
	1.4.2045 - 31.3.2046	= 449.7			
	1.4.2046 - 31.3.2047	= 445.6			
	1.4.2047 - 31.3.2048	= 467.9			
	1.4.2048 - 31.3.2049	= 493.5			
	1.4.2049 - 31.3.2050	= 594.2			
	1.4.2050 - 31.3.2051	= 672.6			
	1.4.2051 - 31.3.2052	= 553.3			
	1.4.2052 - 31.3.2053	= 283.1			
	1.4.2053 - 31.3.2054	= 181.2			
	1.4.2054 - 31.3.2055	= 395.6			
	1.4.2055 - 31.3.2056	= 312.1			
	1.4.2056 - 31.3.2057	= 362.1			
	1.4.2057 - 31.3.2058	= 305.0			
	1.4.2058 - 31.3.2059	= 303.4			
	1.4.2059 - 31.3.2060	= 303.6			
	1.4.2060 - 31.3.2061	= 303.4			
	1.4.2061 - 31.3.2062	= 303.4			
	1.4.2062 - 31.3.2063	= 337.4			
	1.4.2063 - 31.3.2064	= 125.4			
	1.4.2064 - 31.3.2065	= 102.9			
	1.4.2065 - 31.3.2066	= 102.9			
	1.4.2066 - 31.3.2067	= 119.2			
	1.4.2067 - 31.3.2068	= 112.4			
	1.4.2068 - 31.3.2069	= 103.5			
	1.4.2069 - 31.3.2070	= 81.0			
	1.4.2070 - 31.3.2071	= 81.0			
	1.4.2071 - 31.3.2072	= 81.0			
	1.4.2072 - 31.3.2073	= 98.1			
	1.4.2073 - 31.3.2074	= 360.6			
	1.4.2074 - 31.3.2075	= 348.1			
	1.4.2075 - 31.3.2076	= 348.1			
	1.4.2076 - 31.3.2077	= 348.1			
	1.4.2077 - 31.3.2078	= 530.5			
	1.4.2078 - 31.3.2079	= 509.6			
	1.4.2079 - 31.3.2080	= 529.6			
	1.4.2080 - 31.3.2081	= 242.7			
	1.4.2081 - 31.3.2082	= 247.7			
	1.4.2082 - 31.3.2083	= 227.7			
	1.4.2083 - 31.3.2084	= 925.6			
	1.4.2084 - 31.3.2085	= 999.1			
	1.4.2085 - 31.3.2086	= 816.7			
	1.4.2086 - 31.3.2087	= 816.7			
	1.4.2087 - 31.3.2088	= 816.7			
	1.4.2088 - 31.3.2089	= 775.6			
	1.4.2089 - 31.3.2090	= 775.6			
	1.4.2090 - 31.3.2091	= 776.2			
	1.4.2091 - 31.3.2092	= 776.2			

1.4.2092 - 31.3.2093	= 767.7			
1.4.2093 - 31.3.2094	= 767.7			
1.4.2094 - 31.3.2095	= 767.7			
1.4.2095 - 31.3.2096	= 913.6			
1.4.2096 - 31.3.2097	= 913.6			
1.4.2097 - 31.3.2098	= 913.6			
1.4.2098 - 31.3.2099	= 794.2			
1.4.2099 - 31.3.2100	= 794.2			
1.4.2100 - 31.3.2101	= 794.2			
1.4.2101 - 31.3.2102	= 794.2			
1.4.2102 - 31.3.2103	= 794.2			
1.4.2103 - 31.3.2104	= 794.2			
1.4.2104 - 31.3.2105	= 794.2			
1.4.2105 - 31.3.2106	= 794.2			
1.4.2106 - 31.3.2107	= 794.2			
1.4.2107 - 31.3.2108	= 794.2			
1.4.2108 - 31.3.2109	= 794.2			
1.4.2109 - 31.3.2110	= 794.2			
1.4.2110 - 31.3.2111	= 794.2			
1.4.2111 - 31.3.2112	= 794.2			
1.4.2112 - 31.3.2113	= 648.3			
1.4.2113 - 31.3.2114	= 648.3			
Total future arisings:	**38118.0**			
Total waste volume:	**41265.4**			

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

Comment on arising rates: Arisings of PCM are not generally predictable. Arisings volumes comprise PCM from current decommissioning projects and PCM transferred to Sellafield from the LLWR.

Additional information on quantities: The stock level provided reflects the current volume held at Sellafield in designated PCM stores, these items are tracked and hence known to a good level of accuracy. Arisings are linked to the decommissioning project schedule, hence are subject to variation depending on the change of priorities within the decommissioning area, which leads to an increase in uncertainty.

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 current decommissioning projects at Sellafield and LLWR.

PHYSICAL CHARACTERISTICS

General description: The waste consists of a range of solid materials, including: PPE such as PVC suits and rubber gloves, wastes from routine plant operations such as swabs and lab equipment to more substantial items and pieces of building fabric such as perspex sheets, metal items and brickwork. No items require special handling.

Changes since waste generated: No physical or chemical changes.

Bulk density (t/m³): = 0.30

Comment on density: Range of densities is approximately 0.1 to 0.9 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The waste has a mixed chemical composition: PVC (26%), Rubber (9%), Metal (54%), Cellulose (2%), Plastic (3%), Other (6%). Note that this includes the sacrifical mild steel drums and mild steel drum liner.

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	= 5.9	-	
Other ferrous metals	= 47.1	-	
Iron	= 0	-	
Aluminium	< 0.60	-	
Beryllium	= 0	-	
Cobalt	TR	May be present in hand tool alloys.	
Copper	TR	-	
Lead	= 0.30	-	
Magnox/Magnesium	= 0	-	
Nickel	TR	May be present in hand tool alloys.	
Titanium	TR	May be present in hand tool alloys.	
Uranium	= 0	-	
Zinc	= 0	-	
Zircaloy/Zirconium	= 0	-	
Other metals	P	Trace quantities of gold may be present.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	= 2.2	-	
Paper, cotton	= 1.8	-	
Wood	= 0.40	-	
Halogenated plastics	= 27.0	Includes PVC	
Total non-halogenated plastics	= 2.6	-	
Condensation polymers	= 0	-	
Others	= 2.6	Includes Perspex and Polythene	
Organic ion exchange materials	TR	-	
Total rubber	= 9.4	-	
Halogenated rubber	= 9.4	-	
Non-halogenated rubber	= 0	-	
Hydrocarbons	~ 1.3	-	
Oil or grease	TR	-	
Fuel	= 0	-	
Asphalt/Tarmac (cont.coal tar)	= 1.3	-	
Asphalt/Tarmac (no coal tar)	P	-	
Bitumen	TR	-	
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	P	-	
Brick/Stone/Rubble	= 1.8	-	
Cementitious material	= 0.80	-	
Sand	= 0	-	
Glass/Ceramics	= 1.0	-	
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 0	-	
Powder/Ash	= 0	-	

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

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride	< 0.10	-
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	NE	-
Putrescible wastes	NE	-
Non-putrescible wastes	NE	-
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)	NE	-
Boron (non-Boral)	NE	-
Cadmium	TR	-
Caesium	NE	-
Selenium	NE	-
Chromium	TR	May be present in hand tool alloys.
Molybdenum	NE	-
Thallium	NE	-
Tin	NE	-
Vanadium	TR	May be present in hand tool alloys.
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	= 5	5 Drums with Thorium sources identified
Electronic & Electrical Equipment (EEE)		-
EEE Type 1	NE	-
EEE Type 2	NE	-
EEE Type 3	P	-
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	= 13.3
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification	On-site	= 77.1
Encapsulation	On-site	= 9.6
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments: WTC currently treats the drums using supercompaction. The plan for the WTC replacement plant however (WTC2), which is planned to become operational in 2047 is to use thermal treatment instead of supercompaction.

Conditioning method: The current conditioning method for 2D90 is processing through the Waste Treatment Complex (WTC) 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 thermal treatment instead, with the product being a 4m box with an internal capacity of 15.6 m3. 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: Unknown

Further information on the conditioning matrix: GGBS/CEM I

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
500 l drum	9.6	0.20	0.50	19849	-
500 l drum (basket for waste)	13.3	1.1	0.50	4815	2025
4 m box (0 mm concrete shielding)	77.1	0	-	-	2047

Range in container waste loading: 90% of waste stream 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 into a 500 litre drum, with an average of 5.7. the future WTC facility (WTC2) is projected to use thermal treatment instead of supercompaction and is expected to become operational and replace the current WTC in 2047.

Other information on packaging and conditioning: -

Conditioned density (t/m³): = 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/m³, 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	~ 2.5	GREEN	It is estimated that ~5134 drums will be consigned as LLW from 2D90 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, Pu241, Pu 242 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 suites) 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.
Np: -
Pu: Metal, oxides, fluorides, nitrates.

WASTE STREAM **2D90** **Plutonium Contaminated Materials; Drums**

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ 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	2.94E-07	B B 2		
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232	3.01E-07	B B 2		
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	7.14E-07	B B 2		
Ag 110m					U 236				
Cd 109					U 238	6.03E-06	B B 2	8.07E-07	C C 2
Cd 113m					Np 237	1.32E-05	B B 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	6.85E-03	B B 2	3.80E-02	C C 2
Sn 123					Pu 239	8.59E-02	B B 2	8.38E-02	C C 2
Sn 126					Pu 240	2.69E-02	B B 2	7.10E-02	C C 2
Sb 125					Pu 241	2.90E-01	B B 2	2.07E+00	C C 2
Sb 126					Pu 242	8.72E-06	B B 2	4.52E-05	C C 2
Te 125m					Am 241	3.55E-02	B B 2	3.93E-02	C C 2
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					Unsp a				
Eu 152					Unsp b/g				
Eu 154					**Total a**	**1.55E-01**	*	**2.32E-01**	*
Eu 155					**Total b/g**	**2.90E-01**	*	**2.07E+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