

WASTE STREAM	2D601	Prototype Fast Reactor Decommissioning Wastes
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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			
Future arisings:	1.4.2044 - 31.3.2045	= 90.0		
	1.4.2045 - 31.3.2046	= 90.0		
	1.4.2046 - 31.3.2047	= 90.0		
	1.4.2047 - 31.3.2048	= 90.0		
	1.4.2048 - 31.3.2049	= 90.0		
	1.4.2049 - 31.3.2050	= 90.0		
	1.4.2050 - 31.3.2051	= 90.0		
	1.4.2051 - 31.3.2052	= 90.0		
	1.4.2052 - 31.3.2053	= 90.0		
	1.4.2053 - 31.3.2054	= 90.0		
	1.4.2054 - 31.3.2055	= 90.0		
	1.4.2055 - 31.3.2056	= 90.0		
	1.4.2056 - 31.3.2057	= 90.0		
	1.4.2057 - 31.3.2058	= 90.0		
	1.4.2058 - 31.3.2059	= 90.0		
	1.4.2059 - 31.3.2060	= 90.0		
	1.4.2060 - 31.3.2061	= 90.0		
	1.4.2061 - 31.3.2062	= 90.0		
	1.4.2062 - 31.3.2063	= 90.0		
	1.4.2063 - 31.3.2064	= 90.0		
	1.4.2064 - 31.3.2065	= 90.0		
	1.4.2065 - 31.3.2066	= 90.0		
	1.4.2066 - 31.3.2067	= 90.0		
	1.4.2067 - 31.3.2068	= 90.0		
	1.4.2068 - 31.3.2069	= 90.0		
	1.4.2069 - 31.3.2070	= 90.0		
	1.4.2070 - 31.3.2071	= 90.0		
	1.4.2071 - 31.3.2072	= 90.0		
	1.4.2072 - 31.3.2073	= 90.0		
	1.4.2073 - 31.3.2074	= 90.0		
	1.4.2074 - 31.3.2075	= 90.0		
	1.4.2075 - 31.3.2076	= 90.0		
	1.4.2076 - 31.3.2077	= 90.0		
	1.4.2077 - 31.3.2078	= 90.0		
Total future arisings:	3060.0			
Total waste volume:	3060.0			

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

Comment on arising rates: Decommissioning arisings assume a uniform profile from 2044 until 2078. This profile will be refined when decommissioning plans for the facility are better developed.

Additional information on quantities: -

Uncertainty factors on volumes: Stock (upper): x - Arisings (upper): x 1.50
Stock (lower): x - Arisings (lower): x 0.50

WASTE SOURCE Waste arises from the decommissioning of a facility that was used to manufacture MOX fuel assemblies for use in PFR Reactor. Facility was operational until 1992 and is awaiting decommissioning.

PHYSICAL CHARACTERISTICS

General description: The waste mainly consists of material from the fabric of the building including concrete, brick and metal.

Changes since waste generated: The waste is reported as it is currently - decontamination techniques may be applied in the future.

Bulk density (t/m³): = 1.8

Comment on density: Bulk density has been calculated from the raw volume and mass.

CHEMICAL COMPOSITION

General description and components (%wt):

Brick (17%), Concrete (48%), Equipment (0.3%), Insulation materials (8.4%), Metal (25.4%), Plaster (0.8%), Wood (0.1%) and glass (0.03%). The waste classification of the facility (assuming segregation) is estimated to be (also %wt): PCM (3.6%), LLW (7.2%), LA-LLW (CLES) (49.1%), LLW for metal treatment (22.4%), VLLW (9.1%) and Out of Scope (8.7%).

Chemical state:

Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	25.4	-	
Other ferrous metals.....		-	
Iron.....		-	
Aluminium.....		-	
Beryllium.....		-	
Cobalt.....		-	
Copper.....		-	
Lead.....	P	Lead compounds and Zinc Oxide may be present in paint	
Magnox/Magnesium.....	P	-	
Nickel.....		-	
Titanium.....		-	
Uranium.....		-	
Zinc.....		-	
Zircaloy/Zirconium.....		-	
Other metals.....		-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0.10	-	
Paper, cotton.....	0.10	-	
Wood.....		-	
Halogenated plastics.....		-	
Total non-halogenated plastics.....		-	
Condensation polymers.....		-	
Others.....	0.01	-	
Organic ion exchange materials.....		-	
Total rubber.....		-	
Halogenated rubber.....		-	
Non-halogenated rubber.....		-	
Hydrocarbons.....		-	
Oil or grease.....		-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....		-	
Asphalt/Tarmac (no coal tar).....		-	
Bitumen.....		-	
Others.....		-	
Other organics.....	0.30	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	17.0	-	
Inorganic sludges and flocs.....		-	
Soil.....		-	
Brick/Stone/Rubble.....		-	
Cementitious material.....	48.8	includes concrete (in and out cell) and plaster	
Sand.....	0.03	-	
Glass/Ceramics.....		-	
Graphite.....		-	
Desiccants/Catalysts.....	8.4	-	
Asbestos.....		Asbestos (amosite and chrysotile) is reported to be present in insulation, wall boards/panels and ceiling panes. There may also be asbestos present in the paint	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....		-	
Free non-aqueous liquids.....		-	
Powder/Ash.....		-	

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

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	-	-
Low flash point liquids.....	-	-
Explosive materials.....	-	-
Phosphorus.....	-	-
Hydrides.....	-	-
Biological etc. materials.....	-	-
Biodegradable materials.....	-	-
Putrescible wastes.....	-	-
Non-putrescible wastes.....	-	-
Corrosive materials.....	-	-
Pyrophoric materials.....	-	-
Generating toxic gases.....	-	-
Reacting with water.....	-	-
Higher activity particles.....	-	-
Soluble solids as bulk chemical compounds.....	-	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	-	-
Benzene.....	-	-
Chlorinated solvents.....	-	-
Formaldehyde.....	-	-
Organometallics.....	-	-
Phenol.....	-	-
Styrene.....	-	-
Tri-butyl phosphate.....	-	-
Other organophosphates.....	-	-
Vinyl chloride.....	-	-
Arsenic.....	-	-
Barium.....	-	-
Boron.....	-	-
Boron (in Boral).....	-	-
Boron (non-Boral).....	-	-
Cadmium.....	-	-
Caesium.....	-	-
Selenium.....	-	-
Chromium.....	P	Chromium (VI) Oxide may be present in paint
Molybdenum.....	-	-
Thallium.....	-	-
Tin.....	-	-
Vanadium.....	-	-
Mercury compounds.....	-	-
Others.....	-	-

Complexing agents (%wt):

No		
	(%wt)	Type(s) and comment
EDTA.....	-	-
DPTA.....	-	-
NTA.....	-	-
Polycarboxylic acids.....	-	-
Other organic complexants.....	-	-
Total complexing agents.....	-	-

Physical components:

	Number	Type(s) and comment
Sources.....	NE	-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....	= 0	-
EEE Type 2.....	= 0	-
EEE Type 3.....	= 0	-
EEE Type 4.....	= 0	-
EEE Type 5.....	= 0	-

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	Off-site	= 5.2
Recycling / reuse		
Thermal treatment, including vitrification	On-site	= 5.3
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		= 89.5

Comments on planned treatments:

5.3% is assumed to be PCM for Thermal treatment, 5.2% for off site metal treatment and the remaining 89.5% is made up of (3% to LLWR, 37.9% to off site landfill, 42.1% to CLESA on site and 6.5% to be out of scope).

Conditioning method:

-

Conditioning plants:

Plant Name	Location
Waste Treatment Complex 2 (WTC2)	Sellafield

Likely conditioning matrix:

Unknown

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
4 m box (0 mm concrete shielding)	5.3	0	-	-	-
1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	3.0	9.4	18.3	10	-

Range in container waste loading: NE

Other information on packaging and conditioning:

-

Conditioned density (t/m³):

NE

Conditioned density comment:

-

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)			
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	= 5.3		
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository	= 3.0		
Expected to be consigned to a Landfill Facility	= 37.9		
Expected to be disposed On-Site	= 42.1		
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	= 5.2		
Expected to be Out of Scope	= 6.5		
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: Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: The source of the activity comes from the manufacture of fuel assemblies for use in the PFR at Dounreay.

Uncertainty: -

Measurement of radioactivities: -

Chemical form of radionuclides: H-3: -
C-14: -
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: -
Np: -
Pu: -

WASTE STREAM 2D601 Prototype Fast Reactor Decommissioning Wastes									
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					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					Ti 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			~ 2.51E-04	C C 2
Sn 123					Pu 239			~ 7.07E-04	C C 2
Sn 126					Pu 240			~ 6.79E-04	C C 2
Sb 125					Pu 241			~ 6.36E-03	C C 2
Sb 126					Pu 242			~ 3.73E-07	C C 2
Te 125m					Am 241			~ 1.09E-03	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			~ 1.87E-05	C C 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	0	*	2.73E-03	*
Eu 155					Total b/g	0	*	6.38E-03	*

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