

WASTE STREAM	2D96.5	FGMSP Fuel Bearing Materials
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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:				
Total future arisings:				
Total waste volume:	0.0			
	37.1			

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

Comment on arising rates: No further waste is expected to arise.

Additional information on quantities: This waste stream consists of a number of different items (cemented bit bins, uncemented TMEC bins, cemented TMEC bins, paint tins) all of which will have varying volume uncertainty. 25% has been deemed to be a conservative estimate.

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper): x -
Stock (lower): x 0.75 Arisings (lower): x -

WASTE SOURCE Legacy fuel decanning and cropping operations (bit bins) and general waste from PIE facilities (paint tins).

PHYSICAL CHARACTERISTICS

General description: Uranium pieces in cement (cemented bit bins), uranium/zirconium pieces (uncemented TMEC bins), uranium/zirconium pieces in cemented (cemented TMEC bins), miscellaneous PIE waste (paint tins).

Changes since waste generated: -

Bulk density (t/m³): < 8.7

Comment on density: Conservative estimate based on detailed analysis of the various waste type volumes/densities.

CHEMICAL COMPOSITION

General description and components (%wt): Cemented bit bins - irradiated uranium (will include daughter isotopes) in a cement matrix.
TMECs - irradiated uranium (could include daughter isotopes) attached to a zirconium plug, sometimes in a cement matrix. Paint tins - miscellaneous waste e.g. floor sweepings.

Chemical state: -

Sheet metal proportion / thickness: Uranium and zirconium are metals. The bit bins and paint tins themselves are made of mild steel. The cement is Ordinary Portland Cement.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	-	-	-
Other ferrous metals.....	P	-	-
Iron.....	TR	-	-
Aluminium.....	TR	-	-
Beryllium.....	TR	-	-
Cobalt.....	TR	-	-
Copper.....	TR	-	-
Lead.....	TR	-	-
Magnox/Magnesium.....	TR	-	-
Nickel.....	TR	-	-
Titanium.....	TR	-	-
Uranium.....	P	-	-
Zinc.....	TR	-	-
Zircaloy/Zirconium.....	P	-	-
Other metals.....	TR	-	-

Organics (%wt):

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

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.....	= 0	-	
Cementitious material.....	P	-	
Sand.....	= 0	-	
Glass/Ceramics.....	= 0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	= 0	-	
Asbestos.....	= 0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	P	Water within bit bins	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 0	-	

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.....	= 0	-
Low flash point liquids.....	= 0	-
Explosive materials.....	= 0	-
Phosphorus.....	= 0	-
Hydrides.....		-
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	-
Higher activity particles.....	NE	-
Soluble solids as bulk chemical compounds.....	NE	-

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.....	-	-
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.....	-	-
Electronic & Electrical Equipment (EEE)	-	-
EEE Type 1.....	-	-
EEE Type 2.....	-	-
EEE Type 3.....	-	-
EEE Type 4.....	-	-
EEE Type 5.....	-	-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction	On-site	= 100.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

For waste destined for buffer storage in the ISF, any future conditioning or treatment has yet to be determined. Uncemented waste destined for encapsulation plants via FHP is likely to be grouted directly. Any cemented waste will be routed to ISF.

Conditioning method:

Waste initially transferred to the ISF for buffer storage, is baselined to be conditioned and packaged in the planned BUFT facility. There are opportunities for alternative treatment and conditioning including removal from SSBs and repackaging and grouting in 3m3 boxes in BEP for interim storage in BEPPS or direct disposal to the GDF in SSBs. Waste transferred from FGMSP via FHP to encapsulation plants will likely be grouted in 500l drums before transfer to the EPS stores for interim storage.

Conditioning plants:	Plant Name	Location
	Magnox Encapsulation Plant (MEP)	Sellafield
	Box Encapsulation Plant (BEP)	Sellafield

Likely conditioning matrix: -

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
	500 l drum	-	-	-	-	-
	Sellafield 3 m³ box	-	-	-	-	-
	Sellafield self-shielded box	-	-	-	-	-

Range in container waste loading:

Other information on packaging and conditioning: -

Conditioned density (t/m³): -

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)	= 100.0		
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			

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: Spent uranium fuel pieces ("u-bits"), TMECs.

Uncertainty: -

Measurement of radioactivities: The activity values are conservative and based on the most challenging parts of the inventory expected.

Chemical form of radionuclides:

- H-3: Probably trace amounts in fuel
- C-14: Probably trace amounts in fuel
- Cl-36: Probably trace amounts in fuel
- Se-79: Probably trace amounts in fuel
- Tc-99: Probably trace amounts in fuel
- I-129: Probably trace amounts in fuel
- Ra: Probably trace amounts in fuel
- Th: Probably trace amounts in fuel
- U: As fuel
- Np: Probably trace amounts in fuel
- Pu: Probably trace amounts in fuel

WASTE STREAM			2D96.5		FGMSP Fuel Bearing Materials				
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	4.58E-01	B B 2			Gd 153				
Be 10	5.71E-06	B B 2			Ho 163	1.67E-09	B B 2		
C 14	6.11E-02	B B 2			Ho 166m	2.54E-05	B B 2		
Na 22					Tm 170				
Al 26					Tm 171	1.59E-11	B B 2		
Cl 36	8.24E-06	B B 2			Lu 174				
Ar 39	1.00E-26	B B 2			Lu 176				
Ar 42	8.30E-39	B B 2			Hf 178n				
K 40	1.35E-39	B B 2			Hf 182	4.31E-14	B B 2		
Ca 41	6.29E-05	B B 2			Pt 193				
Mn 53	4.24E-10	B B 2			Tl 204				
Mn 54	6.77E-21	B B 2			Pb 205	1.04E-23	B B 2		
Fe 55	5.14E-06	B B 2			Pb 210	7.37E-08	B B 2		
Co 60	8.15E-03	B B 2			Bi 208				
Ni 59	2.67E-03	B B 2			Bi 210m	9.47E-21	B B 2		
Ni 63	2.06E-01	B B 2			Po 210	7.04E-08	B B 2		
Zn 65					Ra 223	9.59E-07	B B 2		
Se 79	8.53E-03	B B 2			Ra 225	3.89E-09	B B 2		
Kr 81	2.75E-09	B B 2			Ra 226	2.74E-07	B B 2		
Kr 85	5.91E+00	B B 2			Ra 228	1.40E-11	B B 2		
Rb 87	5.19E-07	B B 2			Ac 227	9.61E-07	B B 2		
Sr 90	4.67E+02	B B 2			Th 227	9.47E-07	B B 2		
Zr 93	4.59E-02	B B 2			Th 228	6.26E-05	B B 2		
Nb 91	2.95E-15	B B 2			Th 229	3.90E-09	B B 2		
Nb 92	1.94E-13	B B 2			Th 230	2.07E-05	B B 2		
Nb 93m	4.19E-02	B B 2			Th 232	1.63E-11	B B 2		
Nb 94	2.86E-06	B B 2			Th 234	4.31E-02	B B 2		
Mo 93	1.44E-06	B B 2			Pa 231	1.50E-06	B B 2		
Tc 97	5.65E-12	B B 2			Pa 233	4.04E-03	B B 2		
Tc 99	3.74E-01	B B 2			U 232	6.10E-05	B B 2		
Ru 106	1.42E-13	B B 2	U 233	9.80E-07	B B 2				
Pd 107	2.80E-03	B B 2	U 234	3.77E-02	B B 2				
Ag 108m	4.07E-07	B B 2	U 235	8.06E-04	B B 2				
Ag 110m			U 236	5.58E-03	B B 2				
Cd 109	1.12E-19	B B 2	U 238	4.31E-02	B B 2				
Cd 113m	3.96E-02	B B 2	Np 237	4.05E-03	B B 2				
Sn 119m	2.91E-22	B B 2	Pu 236	1.26E-09	B B 2				
Sn 121m	3.45E-01	B B 2	Pu 238	1.39E+01	B B 2				
Sn 123			Pu 239	1.78E+01	B B 2				
Sn 126	2.04E-02	B B 2	Pu 240	2.85E+01	B B 2				
Sb 125	1.82E-04	B B 2	Pu 241	1.87E+02	B B 2				
Sb 126	2.85E-03	B B 2	Pu 242	2.61E-02	B B 2				
Te 125m	4.57E-05	B B 2	Am 241	8.77E+01	B B 2				
Te 127m			Am 242m	1.55E-01	B B 2				
I 129	8.24E-04	B B 2	Am 243	8.23E-02	B B 2				
Cs 134	6.69E-06	B B 2	Cm 242	1.28E-01	B B 2				
Cs 135	1.94E-02	B B 2	Cm 243	2.38E-02	B B 2				
Cs 137	7.07E+02	B B 2	Cm 244	3.58E-01	B B 2				
Ba 133	5.48E-09	B B 2	Cm 245	9.23E-05	B B 2				
La 137	9.35E-08	B B 2	Cm 246	9.29E-06	B B 2				
La 138	2.92E-12	B B 2	Cm 248	6.82E-12	B B 2				
Ce 144	3.22E-18	B B 2	Cf 249	1.53E-11	B B 2				
Pm 145	1.05E-09	B B 2	Cf 250	3.50E-12	B B 2				
Pm 147	1.70E-03	B B 2	Cf 251	2.00E-13	B B 2				
Sm 147	2.29E-07	B B 2	Cf 252	8.73E-18	B B 2				
Sm 151	6.18E+00	B B 2	Unsp a						
Eu 152	1.77E-02	B B 2	Unsp b/g						
Eu 154	1.02E+00	B B 2	Total a	1.49E+02	*				
Eu 155	1.85E-02	B B 2	Total b/g	1.38E+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