

WASTE STREAM	2D96.2	FGMSP Non Fuel Bearing Materials
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SITE Sellafield
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	2015.8 m ³
Total future arisings:		0 m ³
Total waste volume:		2015.8 m ³

Comment on volumes: No future arisings are expected. The pond is no longer an operational plant. This waste stream now includes all miscellaneous beta/gamma waste in the Magnox Fuel Storage Pond, Decanners and Inlet building, the Magnox Fuel End Crops (formerly 2D59) and the Cemented Waste in Skips (formerly 2D17).

Uncertainty factors on volumes:	Stock (upper):	x 1.3	Arisings (upper)	x
	Stock (lower):	x 0.7	Arisings (lower)	x

WASTE SOURCE Redundant equipment and other debris resulting from operations in the Magnox fuel storage and decanning plant.

PHYSICAL CHARACTERISTICS

General description: The waste consists of redundant equipment and other debris.

Physical components (%vol): The waste consists of redundant pumps, plant items, cobalt cartridges, Wylfa lugs and future size reduced machinery currently in use. Quantities of irradiated fuel rods and end crops are also present. A full breakdown of the physical constituents is not available as a detailed inventory is not yet known.

Sealed sources: Not yet determined.

Bulk density (t/m³): 2

Comment on density: The density range is from 1.5 t/m³ to approximately 3 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Includes steel, magnesium alloy, cobalt, PVC. Traces of oil may be present. Fuel bits and end crops, some of which are cemented into skips, are also present.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Present in elemental and reacted forms.
 Ra: Present in trace amounts in fuel.
 U: Present in metallic and reacted forms (e.g. oxides and possibly hydrides).
 Pu: Present in metallic and reacted forms (e.g. mixed oxides).

Metals and alloys (%wt): Pumps are steel with dimensions of 510mm high x 280mm diameter. Wylfa lugs are the fin sections of Magnox casings. Other waste is in the form of sheet metal and pipes.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	P	Nickel will be present in stainless steel.	
Other ferrous metals.....	P		
Iron.....			
Aluminium.....	TR		
Beryllium.....			
Cobalt.....	P		
Copper.....	TR		
Lead.....	TR		

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Magnox/Magnesium.....	P
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	TR
Zircaloy/Zirconium.....	TR
Other metals.....	

Organics (%wt): There is some reinforced PVC piping present in the waste which due to its low density only accounts for a small percentage of the total waste stream. Traces of oil may be present. Halogenated plastics are present as reinforced PVC hose pipe.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	P		
Paper, cotton.....	0		
Wood.....	P		
Halogenated plastics	P		
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.....	P		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	TR		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	TR		
Sand.....	TR		
Glass/Ceramics.....	NE		
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	0		

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Non/low friable.....
 Moderately friable.....
 Highly friable.....
 Free aqueous liquids..... 0
 Free non-aqueous liquids..... P
 Powder/Ash..... 0

Inorganic anions (%wt): Traces of magnesium hydroxide sludge present, adhered to beta/gamma waste.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....		
Carbonate.....	0	
Nitrate.....	0	
Nitrite.....		
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: Contaminated pond water is present. Pyrophoric uranium hydride and zirconium fines may also be present.

	(%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.....		
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.....	NE	

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Chlorinated solvents.....
 Formaldehyde.....
 Organometallics.....
 Phenol..... NE
 Styrene.....
 Tri-butyl phosphate..... NE
 Other organophosphates.....
 Vinyl chloride..... NE
 Arsenic..... NE
 Barium.....
 Boron..... NE
 Boron (in Boral).....
 Boron (non-Boral).....
 Cadmium..... NE
 Caesium.....
 Selenium..... NE
 Chromium..... NE
 Molybdenum..... NE
 Thallium.....
 Tin..... NE
 Vanadium..... NE
 Mercury compounds.....
 Others..... NE
 Electronic Electrical Equipment (EEE)
 EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt): Not yet determined

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....	TR	The items have been underwater for many years and decontamination chemicals will have been diluted to negligible concentrations.
Total complexing agents.....	TR	

Potential for the waste to contain discrete items: Not yet determined.

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PACKAGING AND CONDITIONING

Conditioning method: The beta gamma waste will be washed prior to dispatch to BEP. The skips will be loaded into 3 m³ boxes. Loose waste will be transported in a liner to BEP.

Plant Name: Multiple routes: BEP, WAGR, MBGWS

Location: Sellafield

Plant startup date: Already operational

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: -

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

Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	Sellafield 3m ³ box	38.6	~2.315	2.7	337
	Other(Multiple types)	61.4	NE	NE	NE

Likely container type comment: The waste will either go to BEP in 3m³ boxes, to LLWR in PacTec bags or Dolav boxes, to WAGR in PacTec bags or Dolav boxes, or to MBGWS in PacTec bags, Dolav boxes, or 416 liners. It is assumed that 38.6% of the waste is destined for 3m³ boxes, 56.5% is destined for PacTec bags, 29.3% is destined for Dolav boxes, and 13.2 is destined for 416 liners. The 'Other' container type includes PacTec begs, Dolav boxes, and 416 liners.

Range in container waste volume: Assume 50% packing

Other information on containers: Stainless Steel

Likely conditioning matrix: Not specified

Other information: -

Conditioned density (t/m³): NE

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at a Geological Disposal Facility	Disposal at LLWR	30.0	-	Medium	Potential for up to 30% to be reclassified as LLW

RADIOACTIVITY

Source: The main source of activity is from irradiated fuel.

Uncertainty: -

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

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Measurement of radioactivities:

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Other information:

The radionuclide fingerprint has been calculated from the fingerprints of 2D14, 2D17 & 2D59 in the 2010 UK RWI and the volumes data from the source data for the 2012 Annual Report on Radioactive Waste Stocks, Arisings and Disposals. Bands have been estimated based on the bands used in the 2010 UK RWI. Codes have been taken from the 2010 UK RWI and the other radioactivity information has been based largely based on 2D17 in the 2010 UK RWI as this stream comprises ~90% of the total activity.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	7.43E-03	BB 2			Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	3.23E-05	BC 2			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	1.45E-05	CD 2			Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79	9.20E-06	BB 2			Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227	1.01E-08	BB 2		
Sr 90	5.21E+00	AB 2			Th 227				
Zr 93	3.33E-04	BB 2			Th 228	9.30E-11	BB 2		
Nb 91					Th 229				
Nb 92					Th 230	2.47E-07	BB 2		
Nb 93m	2.80E-04	BB 2			Th 232				
Nb 94	2.31E-07	BB 2			Th 234				
Mo 93					Pa 231	2.02E-08	BB 2		
Tc 97					Pa 233				
Tc 99	2.75E-03	BB 2			U 232				
Ru 106	7.12E-10	CC 2			U 233	4.35E-09	BB 2		
Pd 107	1.17E-05	CB 2			U 234	5.90E-04	CB 2		
Ag 108m					U 235	1.89E-05	BB 2		
Ag 110m					U 236	5.03E-05	BB 2		
Cd 109					U 238	6.44E-04	AB 2		
Cd 113m					Np 237	1.84E-05	BB 2		
Sn 119m					Pu 236				
Sn 121m	1.25E-03	BB 2			Pu 238	3.61E-02	BB 2		
Sn 123					Pu 239	2.03E-01	BB 2		
Sn 126	4.89E-05	BB 2			Pu 240	1.72E-01	AB 2		
Sb 125					Pu 241	1.83E+00	BB 2		
Sb 126					Pu 242	4.94E-05	BB 2		
Te 125m					Am 241	3.90E-01	BB 2		
Te 127m					Am 242m	3.38E-04	BB 2		
I 129	4.49E-06	BB 2			Am 243	7.13E-05	BB 2		
Cs 134	5.12E-06	BB 2			Cm 242	2.79E-04	BB 2		
Cs 135	1.47E-04	BB 2			Cm 243	2.69E-05	BB 2		
Cs 137	4.63E+00	BB 2			Cm 244	2.31E-04	BB 2		
Ba 133					Cm 245	1.45E-08	BB 2		
La 137					Cm 246				
La 138					Cm 248				
Ce 144	4.70E-12	CC 2			Cf 249				
Pm 145					Cf 250				
Pm 147	8.91E-04	BB 2			Cf 251				
Sm 147					Cf 252				
Sm 151	5.19E-02	BB 2			Other a	8.95E-03	AB 2		
Eu 152	6.15E-04	BB 2			Other b/g	7.56E-01	AB 2		
Eu 154	9.55E-03	BB 2			Total a	8.11E-01	BB 2		0
Eu 155	2.37E-03	BB 2			Total b/g	1.25E+01	AB 2		0

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