

WASTE STREAM	2F41	LWR Pond Furniture (MEBs) in Interim Storage
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SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Ltd

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 535.7		
Future arisings:				
Total future arisings:		0.0		
Total waste volume:		535.7		

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

Comment on arising rates: MEB arisings are a function of keeping the ponds operational and removal as part of POCO. Since 2011, MEBs have been sent directly off-site without being placed in the interim store (MEBIS). MEBs reside in MEBIS are expected to be transferred and removed in line with pond furniture.

Additional information on quantities: Stock volume is based on an average envelope volume of 2.79 m³ per MEB for 266 MEBs. MEB size is variable (2.2m³ to 3.4m³). The arising volume can vary by +/- 25% but the overall volumetric uncertainty is low.

Uncertainty factors on volumes: Stock (upper): x 1.05 Arisings (upper): x -
Stock (lower): x 0.95 Arisings (lower): x -

WASTE SOURCE Transport and pond storage containers for LWR fuel prior to reprocessing.

PHYSICAL CHARACTERISTICS

General description: Multi Element Bottles (MEBs). MEBs vary in size, but are generally cylindrical in shape. All MEBs are large (2.2m³ to 3.4m³) and heavy (1.3 to 4.34t).

Changes since waste generated: The waste has not undergone any changes since it was generated.

Bulk density (t/m³): ~ 1.0

Comment on density: The bulk density is based on the summed mass and the summed envelope volumes of the MEBs.

CHEMICAL COMPOSITION

General description and components (%wt): Boronated stainless steel, stainless steel, boral, lead, aluminium. Minor components include copper/bronze, nickel and traces of rubber. The following composition is for a representative MEB design: stainless steel (80%), aluminium bronze (0.3%), aluminium in boral (<6%, of which 1% is elemental boron), lead (<12%), rubber (TR). The proportions of materials will vary between different designs and may be between the following ranges: stainless steel 80-99% (some of which may be boronated), boral 0.2-10%, lead 0-12%, concrete 0-15%, aluminium bronze 0.1-0.5%. Other materials are present in small or trace quantities.

Chemical state: Neutral

Sheet metal proportion / thickness: 62% sheet metal (thickness approx 1/4 inch), 24% bulk metal (thickness from 1-3 inches), 14% lead ballast (1 7/8 inches diam.).

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 80.0	304L.	
Other ferrous metals.....	= 0	-	
Iron.....	-	-	
Aluminium.....	= 6.0	Boral	
Beryllium.....	-	-	
Cobalt.....	= 0	-	
Copper.....	TR	-	
Lead.....	< 12.0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	NE	-	
Uranium.....	NE	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 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.....	~ 0.07	-	
Halogenated rubber.....	~ 0.07	-	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	NE	-	
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	-	100.0
Inorganic sludges and flocs.....	< 1.9	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 0	-	
Sand.....	-	-	
Glass/Ceramics.....	-	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	= 0	-	
Non/low friable.....	-	-	
Moderately friable.....	-	-	
Highly friable.....	-	-	
Free aqueous liquids.....	< 0.02	-	
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.....	= 0	-
Chloride.....	= 0	-
Iodide.....	= 0	-
Cyanide.....	= 0	-
Carbonate.....	= 0	-
Nitrate.....	= 0	-
Nitrite.....	= 0	-
Phosphate.....	= 0	-
Sulphate.....	= 0	-
Sulphide.....	= 0	-

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.....	= 0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....	P	Activity is present in the crud particles (<2wt%).
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.....	= 1.0	1%wt Boron is the value per MEB (for 2F36, 2F15 & 2F41) but the total Boron for all MEBs (1,673) comes to 44.5te noted here to reserve the capacity at LLWR.
Boron (in Boral).....	= 1.0	-
Boron (non-Boral).....	= 0	-
Cadmium.....	NE	-
Caesium.....	NE	-
Selenium.....	NE	-
Chromium.....	NE	-
Molybdenum.....	NE	-
Thallium.....	NE	-
Tin.....	NE	-
Vanadium.....	NE	-
Mercury compounds.....	NE	-
Others.....	NE	-

Complexing agents (%wt):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....	NE	-
NTA.....	NE	-
Polycarboxylic acids.....	NE	-
Other organic complexants.....	NE	-
Total complexing agents.....	NE	-

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 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	Off-site	= 100.0

Comments on planned treatments:

The MEBs will be transferred off-site to a metal recycling facility. Current experience suggests that ~40% of the waste may comprise unrecyclable material, and for the purpose of the 2025 UK Inventory this assumption has been used. Unrecyclable material is assumed to be consigned to the LLWR from the MRF, but is reported here to ensure it is captured in the 2025 UK Inventory.

Conditioning method:

-

Conditioning plants:	Plant Name	Location

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
	1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	40.0	10.0	18.3	22	-

Range in container waste loading:

Other information on packaging and conditioning: The waste loading is the typical value for uncompacted wastes grouted at LLWR.

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)	~ 40.0		
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	~ 60.0		
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: No

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

RADIOACTIVITY

Source: The activity arises from a) corrosion products in the reactor cooling circuit adhering to the fuel and being dislodged in the MEB and b) contamination from pond water.

Uncertainty: The specific activity is based on the average activity measured for a large number of MEBs already exported divided by the average mass per MEB and is the best estimate.

Measurement of radioactivities: Specific activity assessment unchanged from 2019 UKRWI assessment. The specific activity is based on the average measured internal Co-60 activity of a large number of MEBs already measured and disposed of divided by the average MEB volume of 2.88m³ (averaged over 2F15, 2F36, 2F41). Activity values for the other isotopes present are derived from the measured Co-60 activity using the fingerprint developed in 2014 after analysis of fuel crud from several MEBs in combination with external HP&S swab data. The external contamination is very much lower than the internal and the external fingerprint is equivalent to that of pond water which contributes only a very small fraction to the overall fingerprint.

Chemical form
of radionuclides:

H-3: -
C-14: Oxides.
Cl-36: -
Se-79: -
Tc-99: Oxides.
I-129: -
Ra: -
Th: -
U: Oxides.
Np: -
Pu: Oxides.

WASTE STREAM		2F41		LWR Pond Furniture (MEBs) in Interim Storage					
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	2.47E-07	B C 2			Gd 153				
Be 10					Ho 163				
C 14	5.52E-06	B C 2			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	6.22E-06	B C 2			Pb 210	1.66E-22	B C 2		
Co 60	5.32E-05	A A 1			Bi 208				
Ni 59					Bi 210m	1.61E-22	B C 2		
Ni 63	2.04E-04	B C 2			Po 210	8.98E-23	B C 2		
Zn 65					Ra 223	2.57E-22	B C 2		
Se 79					Ra 225	2.21E-22	B C 2		
Kr 81					Ra 226	7.36E-21	B C 2		
Kr 85					Ra 228	6.62E-26	B C 2		
Rb 87			Ac 227	2.97E-22	B C 2				
Sr 90	8.25E-07	B B 2	Th 227	2.64E-22	B C 2				
Zr 93			Th 228	1.39E-26	B C 2				
Nb 91			Th 229	2.41E-22	B C 2				
Nb 92			Th 230	1.70E-17	B C 2				
Nb 93m			Th 232	6.73E-25	B C 2				
Nb 94	5.63E-07	B B 2	Th 234						
Mo 93			Pa 231	9.60E-21	B C 2				
Tc 97			Pa 233	4.24E-13	B C 2				
Tc 99	5.12E-08	B B 2	U 232						
Ru 106			U 233	2.65E-18	B C 2				
Pd 107			U 234	1.23E-12	B C 2				
Ag 108m			U 235	3.03E-16	B C 2				
Ag 110m			U 236	9.09E-15	B C 2				
Cd 109			U 238						
Cd 113m			Np 237	4.41E-13	B C 2				
Sn 119m			Pu 236						
Sn 121m			Pu 238	1.43E-07	B C 2				
Sn 123			Pu 239	1.02E-07	B C 2				
Sn 126			Pu 240	1.02E-07	B C 2				
Sb 125	5.82E-07	B B 2	Pu 241	5.62E-06	B C 2				
Sb 126			Pu 242						
Te 125m	1.46E-07	B C 2	Am 241	4.66E-07	B C 2				
Te 127m			Am 242m						
I 129			Am 243						
Cs 134	1.33E-08	B B 2	Cm 242						
Cs 135			Cm 243						
Cs 137	1.88E-05	B C 2	Cm 244	3.63E-08	B C 2				
Ba 133			Cm 245						
La 137			Cm 246						
La 138			Cm 248						
Ce 144			Cf 249						
Pm 145			Cf 250						
Pm 147	5.03E-07	B C 2	Cf 251						
Sm 147	1.51E-17	B C 2	Cf 252						
Sm 151	8.89E-06	B C 2	Unsp a	2.37E-20	B C 2				
Eu 152			Unsp b/g	1.87E-05	B C 2				
Eu 154			Total a	8.51E-07	*				
Eu 155			Total b/g	3.24E-04	*				

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