

WASTE STREAM	2F15	LWR Pond Furniture (MEBs)
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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	= 0		
Future arisings:	1.4.2025 - 31.3.2036	= 0		
	1.4.2036 - 31.3.2037	= 14.7		
	1.4.2037 - 31.3.2038	= 117.2		
	1.4.2038 - 31.3.2039	= 117.2		
	1.4.2039 - 31.3.2040	= 117.2		
	1.4.2040 - 31.3.2041	= 117.2		
	1.4.2041 - 31.3.2042	= 117.2		
	1.4.2042 - 31.3.2043	= 117.2		
	1.4.2043 - 31.3.2044	= 117.2		
	1.4.2044 - 31.3.2045	= 117.2		
	1.4.2045 - 31.3.2046	= 117.2		
	1.4.2046 - 31.3.2047	= 117.2		
	1.4.2047 - 31.3.2048	= 117.2		
	1.4.2048 - 31.3.2049	= 117.2		
	1.4.2049 - 31.3.2050	= 117.2		
	1.4.2050 - 31.3.2051	= 117.2		
	1.4.2051 - 31.3.2052	= 117.2		
	1.4.2052 - 31.3.2053	= 117.2		
	1.4.2053 - 31.3.2054	= 61.5		
	1.4.2055 - 31.3.2056	= 36.5		
	1.4.2056 - 31.3.2057	= 112.4		
	1.4.2057 - 31.3.2058	= 95.5		
	1.4.2058 - 31.3.2086	= 0		
	1.4.2086 - 31.3.2087	= 112.4		
	1.4.2087 - 31.3.2088	= 70.3		
Total future arisings:	2378.5			
Total waste volume:	2378.5			

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

Comment on arising rates: Arisings are a function of MEB removal rate from the pond. Initial volumes anticipated from removal from TR&S followed by removal from FGOFSF.

Additional information on quantities: Each MEB is assumed to have a raw volume of 2.91 m³. This volume represents the average volume of the types included in the ILW population.

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

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 (~4.5m x 0.8m diam) and heavy (1.2-4.34t).

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

Bulk density (t/m³): ~ 1.2

Comment on density: The density is based on the weighted average MEBs in FGOFSF (1.21 t/m³) and TR&S (1.01 t/m³).

CHEMICAL COMPOSITION

General description and components (%wt): Boronated stainless steel, stainless steel, boral, lead, aluminium. Minor components include metallic crud, copper/bronze, nickel and traces of rubber. The following composition is for a representative MEB design: stainless steel (80%), aluminium bronze (0.3%), boral (<6%, of which 1% is elemental boron), lead (<14%), 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%, aluminium bronze 0.1-0.5%, crud 0-2%. Other materials are present in small or trace quantities.

Chemical state: -

Sheet metal proportion / thickness: 62% sheet metal (thickness approx 1/4 inch), 24% bulk metal (thickness from 1 to 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	-	
Other ferrous metals.....	= 0	-	
Iron.....	-	-	
Aluminium.....	< 6.0	Aluminium content in boral	
Beryllium.....	-	-	
Cobalt.....	= 0	-	
Copper.....	TR	-	
Lead.....	< 12.0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

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.....	~ 0.07	-	
Halogenated rubber.....	~ 0.07	-	
Non-halogenated rubber.....	NE	-	
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	-	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 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 are likely to be consigned 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	96	-

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	~ 1.0	
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 primarily from corrosion products from the reactor primary cooling circuit adhering to fuel then becoming dislodged in the MEB and secondly to contamination from pond water. Much of this wastestream will have decayed to LLW levels by the time removals start. It may be possible to decontaminate remaining higher level waste and reclassify it as LLW.
Uncertainty:	The specific activity has been assumed to be three times the activity of the LLW MEBs (reported under 2F36) at the time of arising.
Measurement of radioactivities:	The specific activity is based on the average measured internal Co-60 activity of a large number of MEBs already measured divided by the average MEB volume of 2.88m ³ . Activity values for the other isotopes present are derived from the measured Co-60 activity using the fingerprint developed after analysis of fuel crud from several LLW MEBs in combination with external HP&S swab data. The external contamination is very much lower than the internal and the 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 2F15 LWR Pond Furniture (MEBs)									
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			1.97E-06	B C 2	Gd 153				
Be 10					Ho 163				
C 14			4.84E-05	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			7.74E-05	B C 2	Pb 210				
Co 60			5.21E-04	A A 1	Bi 208				
Ni 59					Bi 210m				
Ni 63			1.53E-03	B C 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			4.18E-06	B B 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94			3.44E-06	B B 2	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			9.83E-07	B C 2
Sn 123					Pu 239			4.92E-07	B C 2
Sn 126					Pu 240			4.92E-07	B C 2
Sb 125			1.50E-05	B B 2	Pu 241			3.44E-05	B C 2
Sb 126					Pu 242				
Te 125m					Am 241			2.95E-06	B C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			1.92E-04	B C 2	Cm 244			2.46E-07	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			4.18E-06	B C 2	Cf 251				
Sm 147					Cf 252				
Sm 151			1.62E-05	B C 2	Unsp a				
Eu 152					Unsp b/g				
Eu 154					Total a	0	*	5.16E-06	*
Eu 155					Total b/g	0	*	2.45E-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