WASTE STREAM 2D115 Miscellaneous Plants Initial/Interim Decommissioning: Ponds

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.....	0 m³
Future arisings -	1.4.2022 - 31.3.2023.....	0 m³
	1.4.2023 - 31.3.2024.....	0 m³
	1.4.2024 - 31.3.2025.....	0 m³
	1.4.2025 - 31.3.2029.....	0 m³
	1.4.2029 - 31.3.2030.....	0.5 m³
	1.4.2030 - 31.3.2031.....	0.9 m³
	1.4.2031 - 31.3.2033.....	0 m³
	1.4.2033 - 31.3.2034.....	0.4 m³
	1.4.2034 - 31.3.2035.....	0.4 m³
	1.4.2035 - 31.3.2036.....	0.5 m³
	1.4.2036 - 31.3.2044.....	0 m³
	1.4.2044 - 31.3.2045.....	0.2 m³
	1.4.2045 - 31.3.2046.....	10.5 m³
	1.4.2046 - 31.3.2047.....	21.7 m³
	1.4.2047 - 31.3.2048.....	40.9 m³
	1.4.2048 - 31.3.2049.....	37.3 m³
	1.4.2049 - 31.3.2050.....	43.2 m³
	1.4.2050 - 31.3.2051.....	36.5 m³
	1.4.2051 - 31.3.2052.....	40.3 m³
	1.4.2052 - 31.3.2053.....	41.9 m³
	1.4.2053 - 31.3.2054.....	39.7 m³
	1.4.2054 - 31.3.2055.....	29.4 m³
	1.4.2055 - 31.3.2056.....	6.6 m³
	1.4.2056 - 31.3.2057.....	6.6 m³
	1.4.2057 - 31.3.2094.....	0 m³
	1.4.2094 - 31.3.2107.....	30.0 m³
	1.4.2107 - 31.3.2120.....	0 m³
Total future arisings:		387.3 m³
Total waste volume:		387.3 m³

Comment on volumes: Arisings are in line with current decommissioning programmes and strategy. Waste within this waste stream is generated from a number of decommissioning projects which will commence at a future date. As a result of this, minimal characterisation of waste volumes and fingerprints has been carried out and hence there is a large uncertainty in the potential arisings. Preliminary assessments indicate that the volumes may vary from -30% to +200% for ILW.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 3.0
Stock (lower):	x	Arisings (lower)	x 0.7

WASTE SOURCE Dismantling of spent fuel storage ponds and associated facilities.

PHYSICAL CHARACTERISTICS

General description: Plant and equipment, internal building fabric and soft waste ie. rubber/PVC/paper. Most items size reduced in-situ. Some large items may be present.

Physical components (%vol): Vessels, tanks (3%), plant and equipment (81%), ducting (5%), secondary steelwork (1%), soft waste (10%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.5

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Comment on density: Density stated is average for ILW.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (38%), mild steel (49%), copper (1%), aluminium (1%), plastic (7%), rubber (2%), cellulose (1%), glass (1%). Percentages are by volume.

Chemical state: Neutral

Chemical form of radionuclides:
Cl-36: Not expected to be present in significant quantity.
Se-79: Not expected to be present in significant quantity.
Tc-99: Not expected to be present in significant quantity.
I-129: Not expected to be present in significant quantity.
Ra: Not expected to be present in significant quantity.
Th: Not expected to be present in significant quantity.
U: Not expected to be present in significant quantity.

Metals and alloys (%wt): Some sheet metal present (~30%), bulk metal (70%).

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	38.0	The most commonly used stainless steel is 304L.	
Other ferrous metals	49.0		
Iron	P	Cast iron may be present but the quantity is dependent on Plant POCO not yet started.	
Aluminium	1.0		
Beryllium	0		
Cobalt	0		
Copper	1.0		
Lead	TR		
Magnox/Magnesium	0		
Nickel	0		
Titanium			
Uranium	P		
Zinc	0		
Zircaloy/Zirconium	0		
Other metals	0		

Organics (%wt): The waste contains PVC and other plastics, small amounts of rubber and cellulose. Percentages are by volume. PVC oversuits, Windscale suits, waste bags, rubber gloves.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	1.0		
Paper, cotton	TR		
Wood	~1.0		
Halogenated plastics	5.0		
Total non-halogenated plastics	2.0		
Condensation polymers	1.0		
Others	1.0		
Organic ion exchange materials	0		
Total rubber	2.0		
Halogenated rubber	P		
Non-halogenated rubber	P		
Hydrocarbons			

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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.....	TR		
Soil.....	0		
Brick/Stone/Rubble.....	TR		
Cementitious material.....	TR		
Sand.....	TR		
Glass/Ceramics.....	~1.0		
Graphite.....	0		
Desiccants/Catalysts.....	P		
Asbestos.....	TR		
Non/low friable.....	TR		
Moderately friable.....	TR		
Highly friable.....	TR		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Inorganic anions are not expected to be present.

	(%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: -

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	(%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.....	NE	
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: Lead is present in trace quantities. Asbestos.

	(%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.....		

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Mercury compounds.....

Others.....

Electronic Electrical Equipment (EEE)

EEE Type 1.....

EEE Type 2.....

EEE Type 3.....

EEE Type 4.....

EEE Type 5.....

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		
Total complexing agents.....	0	

Potential for the waste to contain discrete items: Yes. Tools and steel fabrications are likely to be present in this waste stream.

PACKAGING AND CONDITIONING

Conditioning method: The waste will be subject to in-situ size reduction prior to placing in one of the following options, a 500 l drum, a 3 m³ Decommissioning Concrete Container (DCC) or a 3 m³ box liner. No further size reduction or compaction will be carried out. Waste in drums will be vibro-encapsulated where the other containers may be flood grouted if required for disposal.

Plant Name: Box Encapsualtion Plant, Low End Encapsulation Capability and future replacement facilties, Final ILW Encapsulation plant

Location: Sellafield.

Plant startup date: BEP 2024, LEEC 2027, FILWEP 2060

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: 2029

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

Other information: LEEC treatment capability and capacity are currently under develoment.Use of BEP is dependent on spare operating capacity being released from High hazard and risk reduction priorities

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
3m³ box (round corners)	~7.0	~0.68	~2.8	40
Sellafield 3m³ box	~73.0	~0.522	2.15	542
Other(DCC)	~20.0	~0.51	~2.15	152

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Likely container type comment:	DCC - external envelope of a Sellafield 3 m³ box however it is made of fibre-reinforced concrete.
Range in container waste volume:	The volume of raw waste in a container can vary from 5% to 65% by volume (Note a full container of dry sharp sand would be 50% by volume).
Other information on containers:	Sellafield 3m³ box and decommissioning liner used to load boxes. Fibre reinforced concrete for DCC. Magnox 3 m³ used for late arisings after new facilities in operation.
Likely conditioning matrix:	Not Specified
Other information:	-
Conditioned density (t/m³):	~1.0
Conditioned density comment:	Conditioned waste density varies depending on waste loading.
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	2028	Medium	There is potential for up to 30% of the waste to be diverted to LLWR. Note diverted waste will be classed as 2D108

RADIOACTIVITY

Source:	The main sources of activity are actinides and fission products.
Uncertainty:	Waste within this waste stream is generated from a number of decommissioning projects which will commence at a future date. The uncertainties quoted for each nuclide represent both the uncertainty in quantification without detailed sampling and the likely variation of nuclide in different building consigned wastes under this waste stream. It is exceptionally unlikely that all the waste included in this waste stream will have the same variation in nuclide fingerprint. Also activity levels will depend on degree of decontamination achieved.
Definition of total alpha and total beta/gamma:	Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.
Measurement of radioactivities:	-
Other information:	Other beta/gamma includes S35 1.23E-9 TBq/m³, Zr95 8.41E-5 TBq/m³, Nb95 4.66E-4 TBq/m³ and Ru103 1.63E-4 TBq/m³. Nuclides making up remaining "other beta/gamma" not specified.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			3.00E-07	C C 2	Gd 153				
Be 10				8	Ho 163				
C 14			2.12E-05	C C 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36				8	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41				8	Pt 193				
Mn 53					Tl 204				
Mn 54				8	Pb 205				
Fe 55				8	Pb 210				8
Co 60			6.67E-04	C C 2	Bi 208				
Ni 59				8	Bi 210m				
Ni 63				8	Po 210				8
Zn 65				8	Ra 223				
Se 79				8	Ra 225				
Kr 81					Ra 226				8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			1.66E-01	C C 2	Th 227				
Zr 93				8	Th 228				
Nb 91					Th 229				8
Nb 92					Th 230				8
Nb 93m				8	Th 232				8
Nb 94				8	Th 234				
Mo 93				8	Pa 231				8
Tc 97					Pa 233				
Tc 99				8	U 232				
Ru 106			1.28E-02	C C 2	U 233				8
Pd 107				8	U 234				8
Ag 108m				8	U 235				8
Ag 110m					U 236				8
Cd 109					U 238				8
Cd 113m					Np 237			8.77E-06	C C 2
Sn 119m					Pu 236				
Sn 121m				8	Pu 238			2.38E-05	C C 2
Sn 123					Pu 239			7.78E-04	C C 2
Sn 126				8	Pu 240			2.35E-04	C C 2
Sb 125					Pu 241			3.19E-03	C C 2
Sb 126					Pu 242				8
Te 125m					Am 241			5.46E-04	C C 2
Te 127m					Am 242m				8
I 129				8	Am 243				8
Cs 134			6.91E-04	C C 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			4.10E-01	C C 2	Cm 244				8
Ba 133					Cm 245				8
La 137					Cm 246				8
La 138					Cm 248				
Ce 144			6.88E-03	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147				8	Cf 251				
Sm 147					Cf 252				
Sm 151				8	Other a				8
Eu 152			1.92E-06	C C 2	Other b/g			2.00E-02	C C 2
Eu 154			1.47E-05	C C 2	**Total a**	**0**		**1.59E-03**	**C C 2**
Eu 155			7.24E-06	C C 2	**Total b/g**	**0**		**6.20E-01**	**C B 2**

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