WASTE STREAM	2D402	AHF Miscellaneous beta gamma wastes to WEP

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:	1.4.2026 - 31.3.2027	= 0.4			
	1.4.2027 - 31.3.2028	= 0.4			
	1.4.2028 - 31.3.2029	= 0.4			
	1.4.2029 - 31.3.2030	= 0.4			
	1.4.2030 - 31.3.2031	= 0.4			
	1.4.2031 - 31.3.2032	= 0.4			
	1.4.2032 - 31.3.2033	= 0.4			
	1.4.2033 - 31.3.2034	= 0.4			
	1.4.2034 - 31.3.2035	= 0.4			
	1.4.2035 - 31.3.2036	= 0.4			
	1.4.2036 - 31.3.2037	= 0.4			
	1.4.2037 - 31.3.2038	= 0.4			
	1.4.2038 - 31.3.2039	= 0.4			
	1.4.2039 - 31.3.2040	= 0.4			
	1.4.2040 - 31.3.2041	= 0.4			
	1.4.2041 - 31.3.2042	= 0.4			
	1.4.2042 - 31.3.2043	= 0.4			
	1.4.2043 - 31.3.2044	= 0.4			
	1.4.2044 - 31.3.2045	= 0.4			
	1.4.2045 - 31.3.2046	= 0.4			
Total future arisings:		**8.3**			
Total waste volume:		**8.3**			

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

Comment on arising rates: Arising rates are estimated based on historic production and is dependent on the operational generation of wastes.

Additional information on quantities: Volumes are estimated based on historic production and is dependent on the operational generation of wastes.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 2.00
Stock (lower):	x -	Arisings (lower):	x 0.50

WASTE SOURCE

The AHF is used for the storage of an inventory of MBGW waste which exists in various physical form generated as a result of operations in the facility over the last several decades. This waste stream also covers wastes which will be generated from future operations.

All of this material will be loaded into waste baskets, and then transferred to the WEP to be packaged into 500 litre drums using cementitious grout, for long-term interim storage in the Encapsulated Product Stores, and eventual disposal in a Geological Disposal Facility.

PHYSICAL CHARACTERISTICS

General description: Operational wastes such as tissues, swabs, etc. Empty bottles, trays cans, used to transport and store irradiated fuels, fuel related items, reactor components, etc. Items of in-cave equipment used during de-bottling activities that cannot be decontaminated to Low Level Waste (LLW). Cladding fragments that were separated from fuel on arrival or that have separated from fuel materials during processing. Nimonic springs from Magnox elements and similar irradiated fuel components from other reactor systems, e.g. plenum springs from Light Water Reactor (LWR) fuel, aluminium oxide insulator pellets from AGR fuel, etc. Irradiated graphite, e.g. from core graphite samples, sleeve graphite samples and other highly irradiated graphite associated with fuels or irradiation testing. Mounted and unmounted samples of irradiated cladding or irradiated non-fissile materials, e.g. from reactor or fuel element components. High Efficiency Particulate Air (HEPA) filters. High fuel content materials from processing, preparation, examination and testing (e.g. grinding and polishing pads, ion exchange materials) currently considered to be ILW.

Changes since waste generated: Air based corrosion and radiolysis.

Bulk density (t/m^3): = 3.0

Comment on density: Material mass and material volume of the waste stream.

CHEMICAL COMPOSITION

General description and components (%wt): See detailed breakdown.

Chemical state: Neutral

Sheet metal proportion / thickness: Various steel sheet components and aluminium HEPA filter foils.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel	= 35.7	Various and unknown grades but includes 316L	35.7
Other ferrous metals	= 13.6	Various and unknown grades	13.6
Iron		-	
Aluminium	= 5.6	Unknown but likely akin to 1050	5.6
Beryllium		-	
Cobalt		-	
Copper		-	
Lead	TR	-	
Magnox/Magnesium	= 2.4	Predominantly AL80 but includes MN80, MN150, Zr50	2.4
Nickel		-	
Titanium		-	
Uranium	TR	Contamination of oxides and particulate	
Zinc		-	
Zircaloy/Zirconium	= 1.7	Zirconium Alloy	1.7
Other metals	= 10.9	E.g. brass, copper, Nimonic 80A	10.9

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	= 13.3	Predominantly swabs, cotton, sisal	13.3
Paper, cotton		-	
Wood		-	
Halogenated plastics	= 5.3	Predominantly PVC	5.3
Total non-halogenated plastics	= 7.0	EPDM, epoxy resin and range of sheeting material e.g. PE, polyurethane	7.0
Condensation polymers		-	
Others		-	
Organic ion exchange materials		-	
Total rubber	= 3.4	Rubbers various	3.4
Halogenated rubber		-	
Non-halogenated rubber		-	
Hydrocarbons		-	
Oil or grease		-	
Fuel		-	
Asphalt/Tarmac (cont.coal tar)		-	
Asphalt/Tarmac (no coal tar)		-	
Bitumen		-	
Others	TR	Ethylene glycol, methanol, ethanol from polishes and etches	
Other organics	TR	Citric acid, oxalic acid, lactic acid, H_2O_2 from polishes and etches	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials		-	
Inorganic sludges and flocs		-	
Soil		-	
Brick/Stone/Rubble	= 0.44	Other natural materials	0.4
Cementitious material	= 0.75	5:1 GGBS CEM I	0.8
Sand		-	
Glass/Ceramics		-	
Graphite		-	
Desiccants/Catalysts		-	
Asbestos		-	
Non/low friable		-	
Moderately friable		-	
Highly friable		-	
Free aqueous liquids		-	
Free non-aqueous liquids		-	
Powder/Ash	TR	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride	TR	From polishes and etches
Chloride	TR	From polishes and etches, chlorinated solvents
Iodide		-
Cyanide		-
Carbonate		-
Nitrate	TR	-
Nitrite		-
Phosphate	TR	From polishes and etches
Sulphate	TR	From polishes and etches
Sulphide		-

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals	= 29.0	organic materials above
Low flash point liquids		-
Explosive materials		-
Phosphorus		-
Hydrides		-
Biological etc. materials		-
Biodegradable materials		-
Putrescible wastes		-
Non-putrescible wastes		-
Corrosive materials		-
Pyrophoric materials		-
Generating toxic gases		-
Reacting with water		-
Higher activity particles		-
Soluble solids as bulk chemical compounds		-

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide		-
Benzene		-
Chlorinated solvents	TR	-
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): Yes

	(%wt)	Type(s) and comment
EDTA		-
DPTA		-
NTA		-
Polycarboxylic acids		-
Other organic complexants	TR	Cleaning agents, polishes and etches, decontamination agent N10/SDG3
Total complexing agents	TR	-

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	On-site	= 100.0

Comments on planned treatments: Necessary size reduction of long items, pre-grouting of powders, compaction of plastics and filters and then encapsulation in WEP.

Conditioning method: Encapsulation in grout at Wastes Encapsulation Plant.

Conditioning plants:

Plant Name	Location
Wastes Encapsulation Plant (WEP)	Sellafield

Likely conditioning matrix: None

Further information on the conditioning matrix: 5:1 GGBS:CEM I 0.47 - 0.59 w/s

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
500 l drum (basket for waste)	100.0	0.10	0.50	80	2026

Range in container waste loading: MBGW scrap loading will be variable but will aimed to be maximised.

Other information on packaging and conditioning: -

Conditioned density (t/m^3): = 2.0

Conditioned density comment: Total waste form volume is 502 L with grout density of 1.74 kg/L. Total waste volume is 8.335 m3 with mass of 24.622 t. 80 drums.

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland) 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	= 100.0		2077

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: Contamination by AGR and Magnox fuels.

Uncertainty: From measured values range can be 600% to 4% of this figure.

Measurement of radioactivities: Estimate is based on a specific carryover 0.62g material per drum. The inventory is a combination of two fingerprints for the two types of scrap (C52 and C30). C52 fingerprint was derived from matching FISPIN data to physical swabs, with the best fit being 3 years cooled, 30 GWd/t, 3% enriched CAGR fuel. C30 fingerprint was derived from FISPIN data for high burn-up (10,500 MWd/t) irradiated uranium metal fuel with a cooling time of 44 years, based on an average of the oldest fuel and youngest fuel cooling time. Total fingerprint is based on 90% of the scrap inventory being C52, and 10% being C30.

Chemical form of radionuclides:

H-3: As metal and oxides
C-14: As metal, graphite and oxides
Cl-36: As metal, graphite and oxides
Se-79: As metal and oxides
Tc-99: As metal and oxides
I-129: As metal and oxides
Ra: As metal and oxides
Th: As metal and oxides
U: As metal and oxides
Np: As metal and oxides
Pu: As metal and oxides

WASTE STREAM **2D402** **AHF Miscellaneous beta gamma wastes to WEP**

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3			= 2.48E-04	C C 2	Gd 153				6
Be 10				6	Ho 163				6
C 14				6	Ho 166m				6
Na 22				6	Tm 170				6
Al 26				6	Tm 171				6
Cl 36				6	Lu 174				6
Ar 39				6	Lu 176				6
Ar 42				6	Hf 178n				6
K 40				6	Hf 182				6
Ca 41				6	Pt 193				6
Mn 53				6	Tl 204				6
Mn 54			= 8.03E-02	C C 2	Pb 205				6
Fe 55			= 3.79E-01	C C 2	Pb 210				6
Co 60			= 2.72E-01	C C 2	Bi 208				6
Ni 59				6	Bi 210m				6
Ni 63				6	Po 210				6
Zn 65				6	Ra 223				6
Se 79			= 4.06E-06	C C 2	Ra 225				6
Kr 81				6	Ra 226				6
Kr 85			= 2.56E-03	C C 2	Ra 228				6
Rb 87				6	Ac 227				6
Sr 90			= 1.11E+00	C C 2	Th 227				6
Zr 93			= 2.66E-05	C C 2	Th 228			= 1.70E-07	C C 2
Nb 91				6	Th 229				6
Nb 92				6	Th 230			= 1.36E-09	C C 2
Nb 93m				6	Th 232				6
Nb 94			= 1.69E-08	C C 2	Th 234				6
Mo 93				6	Pa 231			= 4.60E-10	C C 2
Tc 97				6	Pa 233				6
Tc 99			= 2.90E-04	C C 2	U 232			= 2.57E-07	C C 2
Ru 106			= 6.57E-01	C C 2	U 233			= 3.01E-10	C C 2
Pd 107				6	U 234			= 1.95E-05	C C 2
Ag 108m				6	U 235			= 2.24E-07	C C 2
Ag 110m			= 1.92E-03	C C 2	U 236			= 5.41E-06	C C 2
Cd 109					U 238			= 5.06E-06	C C 2
Cd 113m			= 1.63E-05	C C 2	Np 237			= 3.65E-06	C C 2
Sn 119m				6	Pu 236			= 2.01E-06	C C 2
Sn 121m				6	Pu 238			= 4.23E-02	C C 2
Sn 123			= 1.86E-05	C C 2	Pu 239			= 5.79E-03	C C 2
Sn 126				6	Pu 240			= 1.53E-02	C C 2
Sb 125			= 4.42E-02	C C 2	Pu 241			= 1.13E+00	C C 2
Sb 126				6	Pu 242			= 2.91E-05	C C 2
Te 125m				6	Am 241			= 2.19E-02	C C 2
Te 127m				6	Am 242m			= 1.67E-04	C C 2
I 129				6	Am 243			= 2.01E-03	C C 2
Cs 134			= 6.18E-01	C C 2	Cm 242			= 5.91E-03	C C 2
Cs 135				6	Cm 243			= 1.77E-04	C C 2
Cs 137			= 1.58E+00	C C 2	Cm 244			= 2.04E-02	C C 2
Ba 133				6	Cm 245			= 1.21E-06	C C 2
La 137				6	Cm 246			= 3.09E-07	C C 2
La 138				6	Cm 248				6
Ce 144			= 7.24E-01	C C 2	Cf 249			= 2.06E-11	C C 2
Pm 145				6	Cf 250			= 1.23E-10	C C 2
Pm 147			= 8.96E-01	C C 2	Cf 251				6
Sm 147				6	Cf 252			= 1.86E-11	C C 2
Sm 151			= 2.93E-03	C C 2	Unsp a				
Eu 152			= 4.61E-05	C C 2	Unsp b/g				
Eu 154			= 6.74E-02	C C 2	**Total a**		**0** *		**1.14E-01** *
Eu 155			= 5.18E-02	C C 2	**Total b/g**		**0** *		**7.62E+00** *

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