WASTE STREAM	2F22/C	High Level Contaminated Waste

SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Ltd

WASTE TYPE HLW

WASTE VOLUMES

	Reported (m^3)	OR	Conditioned (m^3)	Packaged (m^3)
Stocks: At 1.4.2025			= 0	0.0
Future arisings: 1.4.2025 - 31.3.2026			= 0	0.0
1.4.2029 - 31.3.2030			= 1.5	2.0
1.4.2030 - 31.3.2031			= 1.5	2.0
1.4.2031 - 31.3.2032			= 1.5	2.0
1.4.2032 - 31.3.2033			= 1.5	2.0
1.4.2033 - 31.3.2034			= 1.5	2.0
1.4.2034 - 31.3.2035			= 0.8	1.0
Total future arisings:			**8.3**	**10.8**
Total waste volume:			**8.3**	**10.8**

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

Comment on arising rates: Total arisings based on pessimistic assumption that 55 containers of HA tech waste will be produced. Arisings dates are based on most up to date PSWP.

Additional information on quantities: Current assessments of the total waste arising in this stream indicate uncertainties of the order of +/-x3.

Uncertainty factors on volumes: Stock (upper): x - Arisings (upper): x 3.00
Stock (lower): x - Arisings (lower): x 0.33

WASTE SOURCE HLW contaminated plant items. Intention is to cut glass product from plant items.

PHYSICAL CHARACTERISTICS

General description: WVP highly active plant items consigned to this waste stream are primarily failed melter components contaminated with a quantity of vitrified waste. The vitrified waste will be cut from the plant items for storage in standard stainless steel vitrification containers.

Changes since waste generated: -

Bulk density (t/m³): = 2.7

Comment on density: Density of vitrified product glass.

CHEMICAL COMPOSITION

General description and components (%wt): SiO2 (47.2%), Na2O (8.6%), B2O3 (17.3%), Li2O (2.0%), waste oxides (25%).

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel……		-	
Other ferrous metals……		-	
Iron……		-	
Aluminium……		-	
Beryllium……		-	
Cobalt……		-	
Copper……		-	
Lead……		-	
Magnox/Magnesium……		-	
Nickel……		-	
Titanium……		-	
Uranium……		-	
Zinc……		-	
Zircaloy/Zirconium……		-	
Other metals……		-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics		-	
Paper, cotton		-	
Wood		-	
Halogenated plastics		-	
Total non-halogenated plastics		-	
Condensation polymers		-	
Others		-	
Organic ion exchange materials		-	
Total rubber		-	
Halogenated rubber		-	
Non-halogenated rubber		-	
Hydrocarbons		-	
Oil or grease		-	
Fuel		-	
Asphalt/Tarmac (cont.coal tar)		-	
Asphalt/Tarmac (no coal tar)		-	
Bitumen		-	
Others		-	
Other organics		-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	= 0	-	
Inorganic sludges and flocs	= 0	-	
Soil	= 0	-	
Brick/Stone/Rubble	= 0	-	
Cementitious material	= 0	-	
Sand	= 0	-	
Glass/Ceramics	= 100.0	-	
Graphite	= 0	-	
Desiccants/Catalysts	= 0	-	
Asbestos	= 0	-	
Non/low friable	= 0	-	
Moderately friable	= 0	-	
Highly friable	= 0	-	
Free aqueous liquids	= 0	-	
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		-
Chloride		-
Iodide		-
Cyanide		-
Carbonate		-
Nitrate		-
Nitrite		-
Phosphate		-
Sulphate		-
Sulphide		-

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals		-
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		-
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): No

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

Physical components:

	Number	Type(s) and comment
Sources	= 0	-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1	= 0	-
EEE Type 2	= 0	-
EEE Type 3	= 0	-
EEE Type 4	= 0	-
EEE Type 5	= 0	-

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	On-site	= 100.0
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments: All HLW is vitrified.

Conditioning method: Vitrification

Conditioning plants:

Plant Name	Location
Waste Vitrification Plant (WVP)	Sellafield

Likely conditioning matrix: Glass

Further information on the conditioning matrix: Borosilicate glass matrix.

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
Steel Disposal Container HLW	100.0	0.08	0.15	110	-

Range in container waste loading: Based on 50% voidage when waste loaded into vitrification canisters.

Other information on packaging and conditioning: -

Conditioned density (t/m^3): = 2.7
Conditioned density comment: Assumed same density as vitrified product, based on 400kg average glass per container in $1.5m^3$.

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	= 100.0		
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			

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: Adherent vitrified fission product oxides and calcined fission product nitrates.

Uncertainty: The activities are estimated since there is no significant operational experience yet in producing HA waste containers. As such uncertanties are large.

Measurement of radioactivities: This waste is stored with a 50% stored volume voidage and is assumed to be equivalent to vitrification plant product glass. On this basis the specific activity of this waste is estimated to be ~50% of the specific activity of the waste being processed in the vitrification plants.

Chemical form of radionuclides:

H-3: Not present.
C-14: Not present.
Cl-36: Present as oxide in trace quantities.
Se-79: Likely to be present as oxide.
Tc-99: Likely to be present as oxide.
I-129: Present as oxide.
Ra: Likely to be present as oxide.
Th: Likely to be present as oxide.
U: Present as oxide.
Np: Likely to be present as oxide.
Pu: Present as oxide.

WASTE STREAM **2F22/C** **High Level Contaminated Waste**

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				8	Gd 153			= 3.46E-08	C C 2
Be 10			= 3.19E-05	C C 2	Ho 163			= 8.33E-09	C C 2
C 14				8	Ho 166m			= 3.24E-04	C C 2
Na 22				6	Tm 170			= 1.15E-12	C C 2
Al 26				6	Tm 171			= 9.42E-06	C C 2
Cl 36				8	Lu 174			= 1.45E-10	C C 2
Ar 39				8	Lu 176			= 1.79E-14	C C 2
Ar 42				8	Hf 178n				
K 40			= 3.91E-09	C C 2	Hf 182			= 2.67E-13	C C 2
Ca 41			= 9.72E-05	C C 2	Pt 193			= 5.07E-09	C C 2
Mn 53			= 9.52E-11	C C 2	Tl 204			= 2.30E-10	C C 2
Mn 54			= 2.84E-06	C C 2	Pb 205			= 1.49E-10	C C 2
Fe 55			= 3.93E-02	C C 2	Pb 210			= 2.65E-07	C C 2
Co 60			= 7.04E-01	C C 2	Bi 208			= 3.08E-14	C C 2
Ni 59			= 1.33E-03	C C 2	Bi 210m			= 6.39E-15	C C 2
Ni 63			= 1.30E-01	C C 2	Po 210			= 2.59E-07	C C 2
Zn 65			= 1.10E-09	C C 2	Ra 223			= 2.95E-06	C C 2
Se 79			= 8.72E-03	C C 2	Ra 225			= 1.44E-08	C C 2
Kr 81				8	Ra 226			= 5.85E-07	C C 2
Kr 85			= 6.34E-21	C C 2	Ra 228			= 2.69E-11	C C 2
Rb 87			= 3.21E-06	C C 2	Ac 227			= 2.96E-06	C C 2
Sr 90			= 4.72E+03	C C 2	Th 227			= 2.91E-06	C C 2
Zr 93			= 2.76E-01	C C 2	Th 228			= 1.52E-05	C C 2
Nb 91			= 3.18E-08	C C 2	Th 229			= 1.44E-08	C C 2
Nb 92			= 2.49E-10	C C 2	Th 230			= 3.75E-05	C C 2
Nb 93m			= 2.19E-01	C C 2	Th 232			= 2.86E-11	C C 2
Nb 94			= 1.90E-05	C C 2	Th 234			= 1.06E-05	C C 2
Mo 93			= 1.05E-04	C C 2	Pa 231			= 4.41E-06	C C 2
Tc 97			= 1.71E-11	C C 2	Pa 233			= 1.86E-02	C C 2
Tc 99			= 1.34E+00	C C 2	U 232			= 3.60E-07	C C 2
Ru 106			= 1.47E-01	C C 2	U 233			= 1.62E-06	C C 2
Pd 107			= 1.43E-02	C C 2	U 234			= 5.15E-05	C C 2
Ag 108m			= 2.46E-06	C C 2	U 235			= 5.05E-07	C C 2
Ag 110m			= 6.48E-06	C C 2	U 236			= 5.85E-06	C C 2
Cd 109			= 2.26E-09	C C 2	U 238			= 1.06E-05	C C 2
Cd 113m			= 7.12E-01	C C 2	Np 237			= 1.86E-02	C C 2
Sn 119m			= 1.04E-06	C C 2	Pu 236			= 1.14E-07	C C 2
Sn 121m			= 2.34E+00	C C 2	Pu 238			= 3.86E-01	C C 2
Sn 123			= 1.79E-08	C C 2	Pu 239			= 8.48E-02	C C 2
Sn 126			= 2.05E-02	C C 2	Pu 240			= 2.05E-01	C C 2
Sb 125			= 1.63E+00	C C 2	Pu 241			= 4.99E+00	C C 2
Sb 126			= 1.52E-02	C C 2	Pu 242			= 3.31E-04	C C 2
Te 125m			= 3.98E-01	C C 2	Am 241			= 1.83E+02	C C 2
Te 127m			= 1.50E-08	C C 2	Am 242m			= 4.93E-01	C C 2
I 129			= 1.49E-19	C C 2	Am 243			= 7.87E-01	C C 2
Cs 134			= 1.59E+00	C C 2	Cm 242			= 4.07E-01	C C 2
Cs 135			= 9.74E-02	C C 2	Cm 243			= 3.17E-01	C C 2
Cs 137			= 6.62E+03	C C 2	Cm 244			= 2.34E+01	C C 2
Ba 133			= 2.75E-06	C C 2	Cm 245			= 7.15E-03	C C 2
La 137			= 4.63E-07	C C 2	Cm 246			= 1.35E-03	C C 2
La 138			= 2.59E-11	C C 2	Cm 248			= 1.07E-08	C C 2
Ce 144			= 4.34E-02	C C 2	Cf 249			= 1.04E-07	C C 2
Pm 145			= 1.18E-05	C C 2	Cf 250			= 1.61E-07	C C 2
Pm 147			= 2.58E+01	C C 2	Cf 251			= 4.49E-09	C C 2
Sm 147			= 1.26E-06	C C 2	Cf 252			= 4.92E-10	C C 2
Sm 151			= 4.67E+01	C C 2	Unsp a			NE	
Eu 152			= 2.31E-01	C C 2	Unsp b/g			NE	
Eu 154			= 5.30E+01	C C 2	**Total a**		**0** *	**2.09E+02**	*
Eu 155			= 4.19E+00	C C 2	**Total b/g**		**0** *	**1.15E+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