

CHEMICAL COMPOSITION

General description and components (%wt):

Cementitious material (e.g. concrete) (1.76%), Lead (4.69%), Mild Steel (11.92%), Other (0.03%), Plastic (0.03%), Stainless steel (81.56%), □

Chemical state:

Neutral

Sheet metal proportion / thickness:

0.37% by wt of all metals will be sheet from ventilation and ducting. Assumed sheet metal thickness is of a range between 1.6-2.5mm.
78.75% by wt of all metals will be bulk from tanks and gloveboxes.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 81.6	-	
Other ferrous metals.....	= 11.9	-	
Iron.....	0	-	
Aluminium.....	0	-	
Beryllium.....	0	-	
Cobalt.....	0	-	
Copper.....	0	-	
Lead.....	= 4.7	-	
Magnox/Magnesium.....	0	-	
Nickel.....	0	-	
Titanium.....	0	-	
Uranium.....	0	-	
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.....	= 0.02	-	
Total non-halogenated plastics.....	= 0.02	-	
Condensation polymers.....		-	
Others.....		-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 0	-	
Halogenated rubber.....		-	
Non-halogenated rubber.....		-	
Hydrocarbons.....	= 0	-	
Oil or grease.....	= 0	-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....	= 0	-	
Asphalt/Tarmac (no coal tar).....	= 0	-	
Bitumen.....	= 0	-	
Others.....		-	
Other organics.....	= 0.03	-	

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.....	= 1.8	-	
Sand.....	= 0	-	
Glass/Ceramics.....	= 0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	= 0	-	
Asbestos.....	= 0	-	
Non/low friable.....	NE	-	
Moderately friable.....	NE	-	
Highly friable.....	NE	-	
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.....	= 0	-
Chloride.....	NE	-
Iodide.....	NE	-
Cyanide.....	= 0	-
Carbonate.....	NE	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	= 0	-
Sulphate.....	= 0	-
Sulphide.....	NE	-

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	NE	-
Low flash point liquids.....	NE	-
Explosive materials.....	NE	-
Phosphorus.....	NE	-
Hydrides.....	NE	-
Biological etc. materials.....	NE	-
Biodegradable materials.....	= 0	-
Putrescible wastes.....	NE	-
Non-putrescible wastes.....	NE	-
Corrosive materials.....	NE	-
Pyrophoric materials.....	NE	-
Generating toxic gases.....	NE	-
Reacting with water.....	= 0	-
Higher activity particles.....	NE	-
Soluble solids as bulk chemical compounds.....	NE	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	NE	-
Benzene.....	= 0	-
Chlorinated solvents.....	NE	-
Formaldehyde.....	NE	-
Organometallics.....	NE	-
Phenol.....	NE	-
Styrene.....	NE	-
Tri-butyl phosphate.....	NE	-
Other organophosphates.....	NE	-
Vinyl chloride.....	NE	-
Arsenic.....	= 0	-
Barium.....	NE	-
Boron.....	= 0	-
Boron (in Boral).....	NE	-
Boron (non-Boral).....	NE	-
Cadmium.....	= 0	-
Caesium.....	NE	-
Selenium.....	= 0	-
Chromium.....	= 0	-
Molybdenum.....	= 0	-
Thallium.....	NE	-
Tin.....	= 0	-
Vanadium.....	= 0	-
Mercury compounds.....	= 0	-
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.....	= 0	no sources
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 Encapsulation Polymer encapsulation Other physical treatment Other chemical treatment Containerisation Treatment not yet determined None	On-site	~ 100.0

Comments on planned treatments:

The strategy has yet to be confirmed but it is likely that the waste will be packaged into 6m3 RCBs in the HAL Waste packaging plant

Conditioning method:

The strategy has yet to be confirmed but it is likely that the waste will be packaged into 6m3 RCBs in the HAL Waste Packaging plant

Conditioning plants:

Plant Name	Location
HAL Waste Packaging Plant	Dounreay

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

Dounreay will use: Cement OPC 1:3 PFA

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
6 m³ concrete box (HD)	100.0	3.0	5.7	54	-

Range in container waste loading: Not yet estimated

Other information on packaging and conditioning:

Strategy being developed including aggressive washouts to potentially change the waste category of the plant items.

Conditioned density (t/m³):

~ 2.5

Conditioned density comment:

The density is likely to be around 2 - 3 t/m³

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)	= 100.0		
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			
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: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
Non-NSDF HAW	Metal treatment facility	~ 97.0	RED	Trials have progressed to open the Metal treatment Route and it is expected the waste route will open in 2025. However, the waste will not be consigned until 2030 and will be subject to further characterisation
Non-NSDF HAW	Dounreay LLWDV	~~ 100.0	RED	Potential to use wash outs to change the waste category to LLW. This opportunity is in early stage of development

RADIOACTIVITY

Source: The main sources of activity are activated and contaminated equipment/structures.

Uncertainty: Factor of 10

Measurement of radioactivities: The fingerprint is based on the activity contained in the PFR, DFR and MTR raffinate tanks. It has estimated that each cubic metre of waste will be contaminated by activity equivalent to that contained in 0.5 m³ of raffinate. This is equivalent to a liquor film of 0.025 mm (or the dried out activity from the same film). This is probably pessimistic, though credible.

Chemical form of radionuclides:

- H-3: May be present at low concentrations
- C-14: May be present at low concentrations
- Cl-36: May be present at low concentrations
- Se-79: May be present at low concentrations
- Tc-99: May be present at low concentrations
- I-129: May be present at low concentrations
- Ra: Not known to be present
- Th: May be present at low concentrations
- U: Present as nitrate
- Np: May be present at low concentrations
- Pu: Present as nitrate

WASTE STREAM 5B314-2 HALS and Evaporation Plant ILW (6m3 Box)									
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					Gd 153				
Be 10					Ho 163				
C 14					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					Ti 204				
Mn 54					Pb 205				
Fe 55			= 6.24E-05	C C 2	Pb 210			= 1.48E-19	C C 2
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210			= 1.05E-19	C C 2
Zn 65					Ra 223			= 1.33E-19	C C 2
Se 79					Ra 225			= 1.22E-19	C C 2
Kr 81					Ra 226			= 3.29E-18	C C 2
Kr 85					Ra 228			= 5.71E-23	C C 2
Rb 87					Ac 227			= 1.41E-19	C C 2
Sr 90			= 1.31E-03	C C 2	Th 227			= 1.34E-19	C C 2
Zr 93					Th 228			= 2.18E-23	C C 2
Nb 91					Th 229			= 1.26E-19	C C 2
Nb 92					Th 230			= 3.78E-15	C C 2
Nb 93m					Th 232			= 2.81E-22	C C 2
Nb 94					Th 234				
Mo 93					Pa 231			2.33E-18	C C 2
Tc 97					Pa 233			= 7.97E-11	C C 2
Tc 99					U 232				
Ru 106					U 233			= 7.97E-16	C C 2
Pd 107					U 234			= 1.36E-10	C C 2
Ag 108m					U 235			= 3.67E-14	C C 2
Ag 110m					U 236			= 1.90E-12	C C 2
Cd 109					U 238				
Cd 113m					Np 237			= 8.21E-11	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238			= 7.85E-06	C C 2
Sn 123					Pu 239			= 6.21E-06	C C 2
Sn 126					Pu 240			= 1.08E-05	C C 2
Sb 125					Pu 241			= 5.08E-03	C C 2
Sb 126					Pu 242				
Te 125m					Am 241			= 6.90E-05	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134			= 1.45E-05	C C 2	Cm 242			= 3.04E-11	C C 2
Cs 135					Cm 243				
Cs 137			= 3.59E-03	C C 2	Cm 244			= 1.96E-06	C C 2
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			= 1.13E-04	C C 2	Cf 251				
Sm 147			= 1.08E-14	C C 2	Cf 252				
Sm 151			= 1.70E-04	C C 2	Unsp a				
Eu 152					Unsp b/g				
Eu 154			= 1.02E-04	C C 2	Total a	0	*	9.59E-05	*
Eu 155			= 6.87E-05	C C 2	Total b/g	0	*	1.05E-02	*

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