

WASTE STREAM	2D200	Contact Handled ILW from Harwell
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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.....	704.6 m ³
Future arisings -	1.4.2022 - 31.3.2026.....	0 m ³
Total future arisings:		0 m ³
Total waste volume:		704.6 m ³

Comment on volumes: The CHILW stream is not an ongoing arising but an approximate inventory of 4,004 x 200 litre drums. Future transfers of 270m³ (1,347 drums) are not quantified in this waste stream to avoid double counting as they are reported by Magnox Ltd in waste stream 5C317. The waste stream has a fixed inventory of 4,004 drums to be transferred to Sellafield.

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

WASTE SOURCE The waste has originated from three sources; Harwell facility sources, Winfrith facility wastes and National Disposal services waste. The Harwell waste consists of solid operational waste from glovebox and alpha handling cell operations and also waste arising from the decommissioning of the cells, gloveboxes, ventilation system and pipework. The Winfrith waste has mostly arisen from the fast reactor oxide fuel manufacturing line and from the decommissioning of associated gloveboxes and facilities. The NDS waste has been produced by industry, research laboratories, educational establishments and hospitals.

PHYSICAL CHARACTERISTICS

General description: The waste consists of solid operational waste produced from Harwell glovebox and alpha-handling cell operations. It also includes waste arising from the decommissioning of gloveboxes and facilities. It also includes laboratory waste. Additionally there will be medical waste and sources. A portion of the drums have been repackaged since it was generated and the soft waste shredded before being repackaged again.

Physical components (%vol): Metal (78.3%), Soil/Rubble (3.6%), Soft Organics (0.1%), Plastic/Rubber (8.9%), Paper/Wood (1.5%), Absorbed liquid (0.3%), Other (7.3%).

Sealed sources: The waste contains sealed sources. The NDS waste drums accounting for 215 of the 4,004 drums had 47.4 wt% sources.

Bulk density (t/m³): 0.64

Comment on density: Mass of waste divided by volume.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (78.3%), Soil/Rubble (3.6%), Soft Organics (0.1%), Plastic/Rubber (8.9%), Paper/Wood (1.5%), Absorbed liquid (0.3%), Other (7.3%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: May be present as gaseous sources.
Th: Present as metal or oxide
U: Comprising mainly oxide and metal
Pu: Comprising mainly oxide and metal

Metals and alloys (%wt): Metal is present in a large range of thicknesses.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	33.0		
Other ferrous metals.....	13.0	Includes mild steel	
Iron.....	<0.50		
Aluminium.....	7.0		
Beryllium.....	TR		
Cobalt.....	NE		
Copper.....	3.0	Copper (2.5%) Brass (0.4%)	
Lead.....	1.3		
Magnox/Magnesium.....	TR		
Nickel.....	TR		
Titanium.....	TR		
Uranium.....	TR		
Zinc.....	TR		
Zircaloy/Zirconium.....	TR		
Other metals.....	20.5	Cadmium, Gold, Magneisum, Nickel, Silver, Tin.	

Organics (%wt):

-

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	1.5		
Paper, cotton.....	1.1		
Wood.....	0.40		
Halogenated plastics	6.8	Contains PVC	
Total non-halogenated plastics.....	1.1	Contains perspex and polystyrene	
Condensation polymers.....	TR	Contains nylon and bakelite	
Others.....	1.1		
Organic ion exchange materials....	TR		
Total rubber.....	1.0		
Halogenated rubber	1.0		
Non-halogenated rubber.....	TR		
Hydrocarbons.....	<1.0		
Oil or grease	TR		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar).....	0		
Bitumen.....	<1.0		
Others.....	0		
Other organics.....	6.7		

Other materials (%wt):

Other material includes Brick/Stone/Rubble (1.8%), Cementitious material (1.1%), Glass/Ceramics 0.7%.

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	TR		
Inorganic sludges and flocs.....	TR		
Soil.....	TR		
Brick/Stone/Rubble.....	1.8		
Cementitious material.....	1.1		
Sand.....	TR		
Glass/Ceramics.....	0.70		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	TR		
Non/low friable.....	NE		
Moderately friable.....	NE		
Highly friable.....	NE		
Free aqueous liquids.....	TR		
Free non-aqueous liquids.....	TR		
Powder/Ash.....	TR	Trace amount of Euctectic powder	

Inorganic anions (%wt): Carbonate ions are from solidified sodium and potassium.

	(%wt)	Type(s) and comment
Fluoride.....	TR	
Chloride.....	TR	
Iodide.....	TR	
Cyanide.....	0	
Carbonate.....	0.20	
Nitrate.....	P	
Nitrite.....	TR	
Phosphate.....	TR	
Sulphate.....	TR	
Sulphide.....	TR	

Materials of interest for waste acceptance criteria: -

	(%wt)	Type(s) and comment
Combustible metals.....	P	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	P	Trace amounts present
Hydrides.....	P	Trace amounts present
Biological etc. materials.....	P	Trace amounts present
Biodegradable materials.....	0	
Putrescible wastes.....		
Non-putrescible wastes.....		

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Corrosive materials.....	P	Trace amounts present
Pyrophoric materials.....	P	Trace amounts present
Generating toxic gases.....	0	
Reacting with water.....	P	Trace amounts present
Higher activity particles.....	P	
Soluble solids as bulk chemical compounds.....	NE	

Hazardous substances / non hazardous pollutants: The waste contains cadmium and tin.

	(%wt)	Type(s) and comment
Acrylamide.....	NE	
Benzene.....	NE	
Chlorinated solvents.....	NE	
Formaldehyde.....	NE	
Organometallics.....	NE	
Phenol.....	NE	
Styrene.....	NE	
Tri-butyl phosphate.....	0	
Other organophosphates.....	NE	
Vinyl chloride.....	P	As PVC.
Arsenic.....	NE	
Barium.....	NE	
Boron.....	NE	
Boron (in Boral).....	NE	
Boron (non-Boral).....	NE	
Cadmium.....	P	
Caesium.....	NE	
Selenium.....	NE	
Chromium.....	P	
Molybdenum.....	P	
Thallium.....	NE	
Tin.....	P	
Vanadium.....	P	
Mercury compounds.....	NE	
Others.....	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	<0.10	
EEE Type 2.....	<0.10	
EEE Type 3.....	<0.10	
EEE Type 4.....	<0.10	
EEE Type 5.....	<0.10	

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Complexing agents (%wt): Yes

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

Potential for the waste to contain discrete items: Yes.

PACKAGING AND CONDITIONING

Conditioning method: At present there is no disposal route for the CHILW drums, however it is believed that with an extension to the current LOC a portion of this population could be processed through the Waste Treatment Complex (WTC). These drums could then be supercompacted in WTC and loaded into a basket within a 500 l drum such that there is a cement annulus between the basket and the drum skin. Future Waste Treatment Complex (WTC) facilities are currently projected to use a similar treatment method.

Plant Name: Waste Treatment Complex (future capabilities are anticipated to be titled WTC2 & WTC3).

Location: Sellafield.

Plant startup date: 1997 (It is anticipated that WTC2 will become operational in ~2034 and WTC3 in ~2061).

Total capacity (m³/y incoming waste): NE

Target start date for packaging this stream: -

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

Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum (basket for waste)	100.0	~0.759	~0.504	929

Likely container type comment: -

Range in container waste volume: The reported waste loading is for the current WTC (supercompaction) process. Typically between 1 and 10 compacted 200 litre drums will be loaded into a 500 litre drum, with an average of 5.6. The range and variability for WTC2 & WTC3 have yet to be assessed, although it is assumed that the values will be similar to those for the current WTC facility. We also assume that ~10% of CHILW drums may need direct grouting if they are not compactable.

Other information on containers: Stainless Steel

Likely conditioning matrix: Other

Other information: A GGBS/CEM I grout mix is used to generate the grout annulus which surrounds the compacted feed drums in a WTC product drum. The conditioning matrix relevant to future facilities (WTC2 and WTC3) is currently unknown.

Conditioned density (t/m³): 2.1

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Conditioned density comment:

Conditioned density calculated using data from current WTC product drum stock. The density is typically between 1.8 and 2.6 t/m³, although values outside of this range are possible.

Other information on conditioning:

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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 a Geological Disposal Facility	-	N/A	Low	Potential for stream volume reduction if one of the planned future treatment plants utilises thermal treatment

RADIOACTIVITY

Source:

The source of radioactivity is from glovebox and cell operations at Harwell, Winfrith site and NDS waste.

Uncertainty:

The specific activity uncertainty is based on records of arisings.

Definition of total alpha and total beta/gamma:

The total alpha and total beta/gamma are the sum of the individual radionuclide activities.

Measurement of radioactivities:

Specific activity data has been derived using measured activity and dividing by the measured waste volume.

Other information:

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	2.70E-01	BB 2			Gd 153				
Be 10	1.41E-15	BB 2			Ho 163				
C 14	2.33E-06	BB 2			Ho 166m				
Na 22	4.99E-08	BB 2			Tm 170				
Al 26					Tm 171				
Cl 36	2.87E-07	BB 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40	6.20E-12	BB 2			Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204	1.72E-07	BB 2		
Mn 54	4.53E-11	BB 2			Pb 205				
Fe 55	1.64E-05	BB 2			Pb 210	7.93E-06	BB 2		
Co 60	4.25E-06	BB 2			Bi 208				
Ni 59					Bi 210m				
Ni 63	4.15E-04	BB 2			Po 210	3.98E-12	BB 2		
Zn 65					Ra 223				
Se 79	3.80E-10	BB 2			Ra 225				
Kr 81					Ra 226	3.78E-10	BB 2		
Kr 85	2.43E-05	BB 2			Ra 228	4.97E-06	BB 2		
Rb 87					Ac 227	6.95E-07	BB 2		
Sr 90	4.15E-04	BB 2			Th 227				
Zr 93	4.41E-09	BB 2			Th 228	5.79E-06	BB 2		
Nb 91					Th 229	2.64E-07	BB 2		
Nb 92					Th 230				
Nb 93m	5.94E-11	BB 2			Th 232	5.01E-06	BB 2		
Nb 94					Th 234				
Mo 93	4.97E-06	BB 2			Pa 231	5.80E-05	BB 2		
Tc 97					Pa 233				
Tc 99	2.51E-05	BB 2			U 232	5.38E-07	BB 2		
Ru 106	7.44E-09	BB 2			U 233	1.23E-05	BB 2		
Pd 107					U 234	2.92E-05	BB 2		
Ag 108m	1.20E-13	BB 2			U 235	1.70E-06	BB 2		
Ag 110m					U 236	1.58E-07	BB 2		
Cd 109	4.37E-08	BB 2			U 238	4.32E-05	BB 2		
Cd 113m					Np 237	3.50E-05	BB 2		
Sn 119m					Pu 236	9.33E-13	BB 2		
Sn 121m					Pu 238	3.15E-02	BB 2		
Sn 123					Pu 239	1.98E-02	BB 2		
Sn 126	1.84E-11	BB 2			Pu 240	1.75E-02	BB 2		
Sb 125	1.02E-07	BB 2			Pu 241	7.42E-01	BB 2		
Sb 126					Pu 242	9.89E-06	BB 2		
Te 125m					Am 241	2.83E-02	BB 2		
Te 127m					Am 242m				
I 129	2.14E-10	BB 2			Am 243	1.93E-06	BB 2		
Cs 134	2.19E-05	BB 2			Cm 242	3.53E-12	BB 2		
Cs 135	3.10E-08	BB 2			Cm 243	8.77E-13	BB 2		
Cs 137	6.74E-04	BB 2			Cm 244	3.23E-05	BB 2		
Ba 133	1.70E-07	BB 2			Cm 245	1.15E-08	BB 2		
La 137					Cm 246				
La 138					Cm 248	2.88E-07	BB 2		
Ce 144	8.99E-09	BB 2			Cf 249	5.91E-07	BB 2		
Pm 145					Cf 250				
Pm 147	1.05E-04	BB 2			Cf 251				
Sm 147					Cf 252	1.93E-07	BB 2		
Sm 151	1.92E-06	BB 2			Other a	2.39E-06	BB 2		
Eu 152	3.77E-08	BB 2			Other b/g	8.59E-06	BB 2		
Eu 154	1.46E-06	BB 2			Total a	9.72E-02	BB 2	0	
Eu 155	2.66E-09	BB 2			Total b/g	1.01E+00	BB 2	0	

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