

WASTE STREAM	5C304	Radiochemical Laboratory Decommissioning CHILW
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SITE Harwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

	Reported
Stocks: At 1.4.2022.....	0 m ³
Future arisings - 1.4.2022 - 31.3.2040.....	34.0 m ³
Total future arisings:	34.0 m ³
Total waste volume:	34.0 m ³

Comment on volumes: Radiochemical Laboratory CHILW drums in stock are captured in 5C317

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.2
 Stock (lower): x Arisings (lower) x 0.8

WASTE SOURCE CHILW from decommissioning of the Radiochemical laboratory.

PHYSICAL CHARACTERISTICS

General description: Mainly metallic waste arising from miscellaneous items from decommissioning of cells, gloveboxes, ventilation systems and pipework. CHILW will be minimised by a number of techniques (size reduction, segregation, packing efficiency, compaction of soft wastes, etc.).

Physical components (%vol): Cell equipment, fume cupboards, glove boxes, laboratory equipment and tools, ventilation system and pipework. Will also include soft wastes etc.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~3

Comment on density: The density of the waste varies with the nature of the waste items; 3 t/m³ is an average value.

CHEMICAL COMPOSITION

General description and components (%wt): Ferrous metals (~86%), other metals (0.5%), Lead (~3%), Cellulosics (~3%) and plastics (~2%). There may be some cementitious material.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Unknown
 C-14: Unknown
 Tc-99: Unknown
 Ra: Unknown
 Th: The chemical form of Thorium is unknown but probably comprises of mainly oxide with small amounts of nitrates.
 U: Unknown, probably present as metal and oxide.
 Np: Unknown
 Pu: Unknown, probably present as metal and oxide, with possibly traces of nitrate.

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

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	P		
Other ferrous metals.....	~86.0	The identity of steels/other alloys is not known.	
Iron.....			
Aluminium.....	~0.10		
Beryllium.....			
Cobalt.....			

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Copper.....	~0.40	
Lead.....	~3.0	
Magnox/Magnesium.....	TR	
Nickel.....		
Titanium.....		
Uranium.....		
Zinc.....	TR	
Zircaloy/Zirconium.....	TR	
Other metals.....	TR	Other metals comprise uranium.

Organics (%wt): Cellulose comprises wood and paper. The halogenated plastics which are present in the waste are PVC and PTFE, and the rubbers are neoprene and hypalon.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	3.0		
Paper, cotton.....	~1.5		
Wood.....	~1.5		
Halogenated plastics	~1.0	PVC and PTFE	
Total non-halogenated plastics.....	<2.0		
Condensation polymers.....	<1.0		
Others.....	<1.0		
Organic ion exchange materials....	0		
Total rubber.....	P		
Halogenated rubber	P	Neoprene and hypalon.	
Non-halogenated rubber.....	NE		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		

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.....	~~5.0		
Sand.....			
Glass/Ceramics.....	NE		
Graphite.....	NE		
Desiccants/Catalysts.....			

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Asbestos.....	TR
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	TR

Inorganic anions (%wt): None 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: Trace levels of asbestos are present. Combustible metals may comprise uranium and finely divided material. Some powders may be generated by size reduction/ decontamination operations, depending on methodologies adopted.

	(%wt)	Type(s) and comment
Combustible metals.....	TR	
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.....		
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances /
non hazardous pollutants:

Lead is present as a metal. Antimony (not estimated), and asbestos.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		
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	

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Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs

PACKAGING AND CONDITIONING

Conditioning method: Waste will be treated by packing and encapsulation into 6m3 boxes for transfer to the Harwell ILW store pending disposal to the GDF.

Plant Name: Radiochemical Laboratory CHILW Treatment Plant

Location: Harwell

Plant startup date: 2022

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: 2022

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

Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	6m ³ concrete box (SD)	100.0	1.725	5.8	20

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Stainless steel and concrete

Likely conditioning matrix: Pulverised Fly Ash / Ordinary Portland Cement

Other information: -

Conditioned density (t/m³): <3.0

Conditioned density comment: Estimated range 2-3 t/m³.

Other information on conditioning: -

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

RADIOACTIVITY

Source: The activity is contamination arising from a wide variety of work carried out in the facility, including fuels examination, radium recovery operations, thoria processing, experiments with beta/gamma isotopes.

Uncertainty: Fingerprint will vary from laboratory location and reflect historical processes performed. At this stage an assumed radioactivity is stated as the average specific activity; it will change based on the waste activity assessments performed during decommissioning work.

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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:

The specific activities for the future arisings have been calculated based upon fingerprints derived from sampling and analysis.

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				8	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.24E-04	CC 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			4.38E-05	CC 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41				8	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54			1.24E-09	CC 2	Pb 205				8
Fe 55			7.67E-05	CC 2	Pb 210		5.56E-05	CC 2	
Co 60			5.22E-04	CC 2	Bi 208			8	
Ni 59				8	Bi 210m			8	
Ni 63			1.17E-03	CC 2	Po 210		5.58E-05	CC 2	
Zn 65				8	Ra 223		1.38E-05	CC 2	
Se 79				8	Ra 225		7.8E-06	CC 2	
Kr 81				8	Ra 226		4.81E-05	CC 2	
Kr 85				8	Ra 228		7.62E-06	CC 2	
Rb 87				8	Ac 227		1.4E-05	CC 2	
Sr 90			1.68E-03	CC 2	Th 227		1.36E-05	CC 2	
Zr 93				8	Th 228		6.1E-06	CC 2	
Nb 91				8	Th 229		7.8E-06	CC 2	
Nb 92				8	Th 230		2.26E-07	CC 2	
Nb 93m				8	Th 232		1.48E-05	CC 2	
Nb 94			5.56E-07	CC 2	Th 234		6.42E-05	CC 2	
Mo 93				8	Pa 231		6.97E-05	CC 2	
Tc 97				8	Pa 233		7.90E-04	CC 2	
Tc 99			2.86E-05	CC 2	U 232			8	
Ru 106			1.55E-07	CC 2	U 233		8.01E-05	CC 2	
Pd 107				8	U 234		1.46E-04	CC 2	
Ag 108m				8	U 235		4.66E-06	CC 2	
Ag 110m				8	U 236		3.75E-07	CC 2	
Cd 109				8	U 238		6.42E-05	CC 2	
Cd 113m				8	Np 237		7.90E-04	CC 2	
Sn 119m				8	Pu 236			8	
Sn 121m				8	Pu 238		5.72E-02	CC 2	
Sn 123				8	Pu 239		1.44E-02	CC 2	
Sn 126				8	Pu 240		1.08E-02	CC 2	
Sb 125			5.04E-08	CC 2	Pu 241		5.01E-01	CC 2	
Sb 126				8	Pu 242		6.27E-06	CC 2	
Te 125m			1.26E-08	CC 2	Am 241		9.43E-02	CC 2	
Te 127m				8	Am 242m			8	
I 129				8	Am 243		2.72E-06	CC 2	
Cs 134			1.75E-07	CC 2	Cm 242			8	
Cs 135				8	Cm 243			8	
Cs 137			2.57E-03	CC 2	Cm 244		1.11E-04	CC 2	
Ba 133				8	Cm 245			8	
La 137				8	Cm 246			8	
La 138				8	Cm 248			8	
Ce 144				8	Cf 249			8	
Pm 145				8	Cf 250			8	
Pm 147			4.36E-08	CC 2	Cf 251			8	
Sm 147				8	Cf 252			8	
Sm 151			5.19E-06	CC 2	Other a				
Eu 152			2.75E-06	CC 2	Other b/g				
Eu 154			1.34E-06	CC 2	Total a	0	1.78E-01	CC 2	
Eu 155				8	Total b/g	0	5.08E-01	CC 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