WASTE STREAM 5C304 Radiochemical Laboratory Decommissioning CHILW

SITE Harwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2019 - 31.3.2021.....	34.0 m³
Total future arisings:		34.0 m³
Total waste volume:		34.0 m³

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: -

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.

Stainless steel.....	P	
Other ferrous metals.....	~86.0	The identity of steels/other alloys is not known.
Iron.....		
Aluminium.....	~0.10	
Beryllium.....		
Cobalt.....		
Copper.....	~0.40	
Lead.....	~3.0	
Magnox/Magnesium.....	TR	

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	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.		
	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):	-		
	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		
	Asbestos	TR	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	0	
	Free non-aqueous liquids	0	

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	Powder/Ash	TR
Inorganic anions (%wt):	None present.	
	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.	
	Combustible metals	TR
	Low flash point liquids	0
	Explosive materials	0
	Phosphorus	0
	Hydrides	0
	Biological etc. materials	0
	Biodegradable materials	
	Putrescible wastes	0
	Non-putrescible wastes	
	Corrosive materials	0
	Pyrophoric materials	0
	Generating toxic gases	0
	Reacting with water	0
	Active particles	
	Soluble solids as bulk chemical compounds	
Hazardous substances / non hazardous pollutants:	Lead is present as a metal. Antimony (not estimated), and asbestos.	
	Acrylamide	
	Benzene	
	Chlorinated solvents	
	Formaldehyde	
	Organometallics	
	Phenol	
	Styrene	
	Tri-butyl phosphate	
	Other organophosphates	
	Vinyl chloride	
	Arsenic	

Barium.....

Boron.....

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

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... 0

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: 2019

Total capacity (m^3/y incoming waste): -

Target start date for packaging this stream: 2019

Throughput for this stream (m^3/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

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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:	

Treatment	Stream volume (%)	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.
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/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	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	C C 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			4.38E-05	C C 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			1.41E-08	C C 2	Pb 205				8
Fe 55			1.64E-04	C C 2	Pb 210			5.64E-05	C C 2
Co 60			7.75E-04	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			1.19E-03	C C 2	Po 210			5.66E-05	C C 2
Zn 65				8	Ra 223			8.15E-06	C C 2
Se 79				8	Ra 225			7.78E-06	C C 2
Kr 81				8	Ra 226			4.82E-05	C C 2
Kr 85				8	Ra 228			4.49E-06	C C 2
Rb 87				8	Ac 227			8.38E-06	C C 2
Sr 90			1.81E-03	C C 2	Th 227			8.13E-06	C C 2
Zr 93				8	Th 228			5.48E-06	C C 2
Nb 91				8	Th 229			7.78E-06	C C 2
Nb 92				8	Th 230			2.22E-07	C C 2
Nb 93m				8	Th 232			1.48E-05	C C 2
Nb 94			5.56E-07	C C 2	Th 234			6.42E-05	C C 2
Mo 93				8	Pa 231			6.97E-05	C C 2
Tc 97				8	Pa 233			7.9E-04	C C 2
Tc 99			2.86E-05	C C 2	U 232				8
Ru 106			1.22E-06	C C 2	U 233			8.01E-05	C C 2
Pd 107				8	U 234			1.45E-04	C C 2
Ag 108m				8	U 235			4.66E-06	C C 2
Ag 110m				8	U 236			3.74E-07	C C 2
Cd 109				8	U 238			6.42E-05	C C 2
Cd 113m				8	Np 237			7.9E-04	C C 2
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			5.86E-02	C C 2
Sn 123				8	Pu 239			1.44E-02	C C 2
Sn 126				8	Pu 240			1.08E-02	C C 2
Sb 125			1.07E-07	C C 2	Pu 241			5.79E-01	C C 2
Sb 126				8	Pu 242			6.27E-06	C C 2
Te 125m			2.69E-08	C C 2	Am 241			9.22E-02	C C 2
Te 127m				8	Am 242m				8
I 129				8	Am 243			2.72E-06	C C 2
Cs 134			4.79E-07	C C 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			2.75E-03	C C 2	Cm 244			1.24E-04	C C 2
Ba 133				8	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144			1.05E-08	C C 2	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147			9.64E-08	C C 2	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151			5.31E-06	C C 2	Other a				
Eu 152			3.21E-06	C C 2	Other b/g				
Eu 154			1.7E-06	C C 2	**Total a**	**0**		**1.77E-01**	**C C 2**
Eu 155				8	**Total b/g**	**0**		**5.87E-01**	**C C 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