WASTE STREAM 5C317 Harwell Contact Handled ILW Drums

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.....	94.4 m^3
Total future arisings:		0 m^3
Total waste volume:		94.4 m^3

Comment on volumes: Volume in stock has been updated to reflect drums that have been transferred from Harwell to Sellafield. Volume in stock at 2013 UKRWI was 915m3 however this was based on a volume of 0.227m3 per drum not the agreed 0.2m3 per drum used by SL. Revised volumes are therefore: Total original volume = 799.8m3, Volume transferred from 1/4/13 to 1/4/16 = 490.8m3 therefore volume left in stock was 309m3. Shipments since 01/04/2016 have been deducted as and when they occur.

Uncertainty factors on volumes:

Stock (upper):	x 1.2	Arisings (upper)	x
Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE Operational and decommissioning solid wastes from gloveboxes and other alpha-handling facilities.

PHYSICAL CHARACTERISTICS

General description: Laboratory waste and HEPA filters. Miscellaneous items from decommissioning of laboratories, glove boxes and shop window. Small volumes of ionium sludge CHILW and NDS CHILW are mixed with this waste.

Physical components (%vol): Metal 39.9%; Soil/Rubble 5.0%; Soft Organics 3.1%; Plastic/Rubber 35.8%; Paper/Wood 7.0%; Absorbed Liquid 0.2%; Others 9.0%. Others includes Filters 2.6%; Glass 1.9%; Sources 0.7%; Ion exchange resin 0.2%; Miscellaneous balance.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): 0.6

Comment on density: Mass of wastes in stock divided by volume.

CHEMICAL COMPOSITION

General description and components (%wt): Approximate densities have been assumed to derive this from the inventory information which is in volume format. Metals 81.8%; Soil/Rubble 2.5%; Soft Organics 0.6%; Plastic/Rubber 10.1%; Paper/Wood 1.3%; Absorbed Liquid 0.1%; Others 3.6%.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Tritium may be present as gaseous sources, but is expected to be absorbed in metal targets.
C-14: Present as labelled organic materials.
Se-79: Unknown.
Tc-99: Unknown.
Ra: Variable, comprising mainly oxide plus small amounts of salts.
Th: Present as a metal or oxide and in irradiated fuel.
U: Variable, comprising mainly oxide and metal plus small amounts of nitrates.
Np: Unknown.
Pu: Variable comprising mainly oxide plus small amounts of salts eg nitrates.

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	~43.0		
Other ferrous metals	~16.0	The identity of steels/other alloys is not known.	
Iron			
Aluminium	~3.0		
Beryllium	~~2.0		
Cobalt			
Copper	~3.4		
Lead	~2.0		
Magnox/Magnesium	TR		
Nickel			
Titanium			
Uranium	TR		
Zinc	TR		
Zircaloy/Zirconium	TR		
Other metals	~14.0	Other metals consist of cadmium, uranium, gold, iron, magnesium, molybdenum, nickel, palladium, silver, tantallum, thorium, tin, titanium, tungsten, zinc and zirconium.	

Organics (%wt): Cellulosics comprise of paper, rope, muslin, cotton cloth. All unidentified plastic is assumed to be halogenated (e.g. PVC).

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	~2.0		
Paper, cotton	~1.5		
Wood	~0.50		
Halogenated plastics	~8.0	PVC and PTFE	
Total non-halogenated plastics	~1.2		
Condensation polymers	TR		
Others	<1.2		
Organic ion exchange materials	TR		
Total rubber	~1.2		
Halogenated rubber	<1.2	Neoprene and hypalon.	
Non-halogenated rubber	TR		
Hydrocarbons			
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics	TR		

Other materials (%wt): Clinoptilolite present <<0.1%.

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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.....	0.70		
Cementitious material.....	1.7		
Sand.....			
Glass/Ceramics.....	0.70		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	TR		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	TR		
Free non-aqueous liquids.....	NE		
Powder/Ash.....	~0.20		

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

	(%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: Combustible metals mainly comprise uranium and small amounts of finely divided metals. Free liquids will be immobilised prior to conditioning. Powder from dust, hoover bags, grindings etc.

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

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Corrosive materials.....	TR
Pyrophoric materials.....	TR
Generating toxic gases.....	TR
Reacting with water.....	TR
Higher activity particles.....	
Soluble solids as bulk chemical compounds.....	

Hazardous substances / non hazardous pollutants: The waste contains beryillium and cadmium in trace quantities. Lead is present (~2%). The waste contains vermiculite (<<0.1%), (this may possibly be contaminated with 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.....		

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Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		Complexing agents are present in a few packages.
Total complexing agents.....	TR	

Potential for the waste to contain discrete items: Not yet determined. In & of itself not a DI; waste stream may include DIs as defined elsewhere (notably any stainless steel components)

PACKAGING AND CONDITIONING

Conditioning method: The waste is contained within, or will be repacked into 200-litre drums. These will be transferred to Sellafield using Nupak, Novapak or Full Height ISOs for treatment alongside similar wastes.

Plant Name: Engineered Drum Store / Waste Treatment Complex 1a or Waste Treatment Complex 2

Location: Sellafield

Plant startup date: -

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

Target start date for packaging this stream: -

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

Likely container type comment: 200-litre drums transferred to Sellafield using Nupak, Novapak or Full Height ISO

Range in container waste volume: -

Other information on containers: Stainless Steel

Likely conditioning matrix: Pulverised Fly Ash / Ordinary Portland Cement

Other information: 3:1 PCA:OPC, w/s 0.42

Conditioned density (t/m^3): ~2.0

Conditioned density comment: The density of the wasteform will vary with the nature of the waste (soft or hard) in individual packages.

Other information on conditioning: -

Opportunities for alternative disposal routing: -

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

RADIOACTIVITY

Source:	Activity is present as alpha and mixed fission product contaminated trash from gloveboxes. The major sources of activity are plutonium isotopes.
Uncertainty:	-
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:	Activities measured/ estimated by a range of methods including sampling/analysis and radiation measurements.
Other information:	Other alpha/ other beta gamma not defined.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	5.65E-02	B B 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.72E-04	B B 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	2.41E-05	B B 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40	1.31E-08	B B 2			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53		8			Tl 204	6.53E-08	B B 2		
Mn 54		8			Pb 205		8		
Fe 55	9.87E-07	B B 2			Pb 210	5.77E-05	B B 2		
Co 60	1.69E-05	B B 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	1.67E-03	B B 2			Po 210	5.54E-05	B B 2		
Zn 65		8			Ra 223	3.24E-05	B B 2		
Se 79		8			Ra 225	2.22E-07	B B 2		
Kr 81		8			Ra 226	1.90E-04	B B 2		
Kr 85	4.52E-05	B B 2			Ra 228	5.03E-06	B B 2		
Rb 87		8			Ac 227	3.27E-05	B B 2		
Sr 90	4.87E-04	B B 2			Th 227	3.21E-05	B B 2		
Zr 93	3.98E-09	B B 2			Th 228	4.53E-06	B B 2		
Nb 91		8			Th 229	2.22E-07	B B 2		
Nb 92		8			Th 230	2.85E-05	B B 2		
Nb 93m	9.19E-07	B B 2			Th 232	6.73E-06	B B 2		
Nb 94	3.07E-07	B B 2			Th 234	7.43E-05	B B 2		
Mo 93	4.61E-06	B B 2			Pa 231	9.53E-05	B B 2		
Tc 97		8			Pa 233	3.57E-05	B B 2		
Tc 99	2.04E-05	B B 2			U 232	3.04E-07	B B 2		
Ru 106		8			U 233	2.14E-05	B B 2		
Pd 107		8			U 234	5.21E-05	B B 2		
Ag 108m	1.83E-09	B B 2			U 235	2.75E-06	B B 2		
Ag 110m		8			U 236	1.27E-07	B B 2		
Cd 109		8			U 238	7.43E-05	B B 2		
Cd 113m		8			Np 237	3.57E-05	B B 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	2.05E-02	B B 2		
Sn 123		8			Pu 239	1.71E-02	B B 2		
Sn 126		8			Pu 240	1.5E-02	B B 2		
Sb 125		8			Pu 241	2.16E-01	B B 2		
Sb 126		8			Pu 242	8.65E-06	B B 2		
Te 125m		8			Am 241	3.13E-02	B B 2		
Te 127m		8			Am 242m		8		
I 129	1.1E-08	B B 2			Am 243	1.67E-06	B B 2		
Cs 134	5.59E-07	B B 2			Cm 242		8		
Cs 135	2.4E-08	B B 2			Cm 243		8		
Cs 137	5.96E-04	B B 2			Cm 244	4.36E-05	B B 2		
Ba 133	1.69E-06	B B 2			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248	4.62E-07	B B 2		
Ce 144		8			Cf 249	4.24E-07	B B 2		
Pm 145		8			Cf 250		8		
Pm 147	4.30E-06	B B 2			Cf 251		8		
Sm 147		8			Cf 252	1.82E-09	B B 2		
Sm 151	1.24E-06	B B 2			Other a				
Eu 152	2.28E-07	B B 2			Other b/g				
Eu 154	1.96E-07	B B 2			**Total a**	**8.46E-02**	**B B 2**	**0**	
Eu 155		8			**Total b/g**	**2.75E-01**	**B B 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