

WASTE STREAM	1A07	ILW
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SITE Amersham
SITE OWNER GE Healthcare Limited
WASTE CUSTODIAN GE Healthcare Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	172.0 m ³
Future arisings -	1.4.2022 - 31.3.2030.....	-50.5 m ³
Total future arisings:		50.5 m ³
Total waste volume:		222.5 m ³

Comment on volumes: The rate of arisings are due to an ongoing decommissioning programme as well as changes in the processes designed to reduce ILW production. All manufacturing processes have ceased on site, and a number of decommissioning programmes have been completed. Stock volume increased since 2019 due to completion of a number of decommissioning programmes. Volume is total volume of ILW containers in our Materials Handling Centre. Future volumes increased due to Annual review of liabilities and assessment of volume of ILW from decommissioning programme - however activity associated with this waste has not been determined.

Uncertainty factors on volumes: Stock (upper): x 1.5 Arisings (upper) x 1.5
Stock (lower): x 0.5 Arisings (lower) x 0.5

WASTE SOURCE Decommissioning of small scale radiopharmaceutical and radiochemical preparations and radiation source production facilities.

PHYSICAL CHARACTERISTICS

General description: The waste consists of solid and absorbed liquid wastes within steel cans or fibreboard drums as primary containment, all contained in sealed PVC bags. (Wastes arising from 1990 onwards are dry). Solids include metals, glassware, rubber gloves, paper tissue, chromatography papers and small items of redundant laboratory equipment. Absorbed liquids comprise aqueous solutions, very little tritiated water and small quantities of a wide range of organic and inorganic chemical salts. The waste will have undergone radioactive decay.

Physical components (%wt): Glassware (10%) cellulose (21%), rubber (3%), plastics (33%), metals (27%), absorbed liquids (5%), minor components (<1%).

Sealed sources: The waste contains sealed sources. NE - likely to be present, assessment to be completed as part of project strategy

Bulk density (t/m³): ~0.35

Comment on density: The mean density is 0.35 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The waste consists mainly of glass, plastics, cellulose, some metal and a wide range of principally inorganic chemicals. Glassware (10%), cellulose (21%), absorbed liquids (5%), metals (27%), rubber (3%), plastics (33%), minor components (<1%)

Chemical state: Neutral

Chemical form of radionuclides: H-3: Organic
C-14: Organic
Cl-36: Impurity from S35 production
I-129: sodium iodide
Th: not yet determined
U: Oxide
Np: not yet determined
Pu: Oxide, nitrates

Metals and alloys (%wt): Sheet metal: 20 wt% typical thickness 1 mm. Bulk items: 80 wt% typical size 0.1 litre.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~10.0		5.0
Other ferrous metals.....	~12.0		
Iron.....			
Aluminium.....	<1.0		
Beryllium.....	0		
Cobalt.....	0		
Copper.....	<1.0		
Lead.....	<2.0		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....	0		
Uranium.....	0		
Zinc.....	<1.0		
Zircaloy/Zirconium.....	0		
Other metals.....	0		

Organics (%wt): The waste contains a large amount of cellulosics comprising paper (13%), cotton wool (7%) and wood (1%). There are amounts of plastics and rubber including glassfibre/polyester (4%) and water expanded polystyrene (<1%), Polyvinyl chloride and neoprene.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	~21.0		
Paper, cotton.....	~20.0		
Wood.....	~1.0		
Halogenated plastics	~17.0	PVC	20.0
Total non-halogenated plastics.....	~16.0	Polyethylene / Polystyrene	20.0
Condensation polymers.....	~9.5		
Others.....	~6.5		
Organic ion exchange materials....	TR		
Total rubber.....	~3.0		20.0
Halogenated rubber	~2.0	Hypalon/neoprene gloves/gaitors	
Non-halogenated rubber.....	<1.0	Latex gloves	
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar).....			
Bitumen.....			
Others.....			
Other organics.....	0		

Other materials (%wt): Waste contains glass and ceramics, ion exchange materials, and traces of asbestos.

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	~~5.0	Absorbed liquid on vermiculite	
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	~~11.0		35.0
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	TR		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Inorganic anions are present only as surface contamination. No details available at present.

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

Materials of interest for waste acceptance criteria: The waste contains hazardous materials.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	20.0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	20.0	Paper / cotton.

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

Hazardous substances / non hazardous pollutants: Plastic (vinyl chloride) sheeting. Borosilicate glass is estimated as 10% of all glassware, with borosilicate glass having 8% boron component by weight.

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	17.0	sheeting
Arsenic.....	0	
Barium.....	0	
Boron.....	~~0.08	
Boron (in Boral).....		
Boron (non-Boral).....	~~0.08	Borosilicate glass
Cadmium.....	0	
Caesium.....	0	
Selenium.....	0	
Chromium.....	0	
Molybdenum.....	0	
Thallium.....	0	
Tin.....	0	
Vanadium.....	0	
Mercury compounds.....	0	
Others.....	0	
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.....	<0.01	There may be minute amounts of EDTA present on swabs.
Total complexing agents.....	<<0.01	

Potential for the waste to contain discrete items: Yes. hand tools, lab equipment

PACKAGING AND CONDITIONING

Conditioning method: GE Healthcare IWS is not to condition at this time.

Plant Name: -

Location: -

Plant startup date: -

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
	Not specified	100.0	NE	NE	NE

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Not Specified

Likely conditioning matrix: Not specified

Other information: -

Conditioned density (t/m³): NE

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source:	This waste was generated as a result of manufacturing and developing radio-pharmaceuticals, bio-science products, and sealed sources and will be generated from the site decommissioning programme. All manufacturing processes have ceased on site with longer lived nuclides only being present in the decommissioning waste. A number of manufacturing operations with shorter lived nuclides have also ceased on site resulting in a number of these nuclides no longer being present in this waste stream.
Uncertainty:	The accuracy of the data is from +10% to -50% (i.e. generally overestimated).
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:	Specific activity data has been calculated from records of waste holdings.
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	~2.38E-01	AA 2			Gd 153				
Be 10					Ho 163				
C 14	~7.45E-02	AA 2			Ho 166m				
Na 22	~1.1E-06	AA 2			Tm 170				
Al 26					Tm 171				
Cl 36	~1.44E-03	AA 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204	~2.86E-06	AA 2		
Mn 54	~2.99E-09	AA 2		5	Pb 205				
Fe 55	~1.85E-04	AA 2			Pb 210	~1.43E-05	AA 2		
Co 60	~1.15E-03	AA 2			Bi 208				
Ni 59					Bi 210m				
Ni 63	~1.75E-01	AA 2			Po 210				
Zn 65	~1.26E-07	AA 2		5	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85	~6.3E-05	AA 2			Ra 228				
Rb 87					Ac 227	~2.06E-03	AA 2		
Sr 90	~2.42E+00	AA 2		7	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232	~1.13E-04	AA 2		
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99	~3.24E-05	AA 2			U 232	~8.25E-09	AA 2		
Ru 106					U 233				
Pd 107					U 234				
Ag 108m	~1.14E-07	AA 2			U 235	~1.94E-06	AA 2		
Ag 110m					U 236				
Cd 109	~2.81E-07	AA 2			U 238	~5.82E-05	AA 2		
Cd 113m					Np 237	~3.32E-06	AA 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	~3.56E-03	AA 2		5
Sn 123					Pu 239	~2.75E-07	AA 2		
Sn 126					Pu 240				5
Sb 125	~1.27E-06	AA 2			Pu 241	~7.75E-09	AA 2		
Sb 126					Pu 242				
Te 125m					Am 241	~6.24E-01	AA 2		7
Te 127m					Am 242m				
I 129	~2.72E-05	AA 2			Am 243				
Cs 134	~7.42E-08	AA 2		5	Cm 242				
Cs 135					Cm 243				
Cs 137	~2.34E+01	AA 2		7	Cm 244	~1.24E-02	AA 2	~5.3E-02	AA
Ba 133	~9.62E-06	AA 2		5	Cm 245				
La 137					Cm 246				
La 138					Cm 248	~1.87E-07	AA 2		
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	~6.81E-05	AA 2			Cf 251				
Sm 147					Cf 252	~6.71E-07	AA 2		
Sm 151	~2.43E-02	AA 2			Other a				
Eu 152	~1.5E-04	AA 2			Other b/g	~7.69E-07	AA 2		5
Eu 154	~3.45E-08	AA 2			Total a	~6.43E-01	AA 2	~5.3E-02	AA 7
Eu 155					Total b/g	~2.64E+01	AA 2	0	7

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