

WASTE STREAM	1A02	LLW Non-Compactable Drummable
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SITE Amersham
SITE OWNER GE Healthcare Limited
WASTE CUSTODIAN GE Healthcare Limited

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	28.0 m ³
Future arisings -	1.4.2022 - 31.3.2030.....	~350.0 m ³
Total future arisings:		350.0 m ³
Total waste volume:		378.0 m ³
Comment on volumes:	Waste arisings will be only from decommissioning over the next 5-10 years.	
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 This waste was generated as a result of manufacturing and developing radio-pharmaceuticals and bio-science products. Waste will now only arise from decommissioning of redundant facilities.

PHYSICAL CHARACTERISTICS

General description: The waste generated is typically small laboratory equipment and consumables. The waste comprises glassware, plastic and metal items. No items require special handling. None

Physical components (%wt): Metals (54wt%), soft organics (2wt%), plastic / rubber (16wt%), wood (1wt%), glass (25 wt%) and other (2wt%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.35

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

CHEMICAL COMPOSITION

General description and components (%wt): Metals (54wt%), soft organics (2wt%), plastic / rubber (16wt%), wood (1wt%), glass (25 wt%) and other (2wt%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Organic - trace only
C-14: Organic - trace only
Tc-99: Trace quantity only - Potassium Pertechnetate
Ra: Radium sulphate

Metals and alloys (%wt): Sheet metal: 20 wt% with typical thickness 1mm. Bulk items: 80 wt% with typical size 0.04m³.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~4.8	304/316	
Other ferrous metals.....	~35.5	Mild steel drum to BS1449 Part 1	
Iron.....			
Aluminium.....	<1.0		
Beryllium.....	0		
Cobalt.....	0		
Copper.....	<1.1		
Lead.....	~10.5		
Magnox/Magnesium.....	0		

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Nickel.....	TR	
Titanium.....	0	
Uranium.....	0	
Zinc.....	<0.10	
Zircaloy/Zirconium.....	0	
Other metals.....	~1.0	Tin, molybdenum may be present

Organics (%wt): The waste contains cellulose, various plastics and rubber. Polyvinyl chloride and neoprene.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~3.0		
Paper, cotton.....	~2.0		
Wood.....	~1.0		
Halogenated plastics	~3.9	PVC sheeting / gaitors	
Total non-halogenated plastics.....	~6.0	Polyethylene / Polystyrene	
Condensation polymers.....	<0.10		
Others.....	~6.0		
Organic ion exchange materials....	0		
Total rubber.....	~6.0		
Halogenated rubber	~3.0	Hypalon/neoprene gloves/gaitors	
Non-halogenated rubber.....	~3.0	Latex gloves	
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	<0.10		

Other materials (%wt): glass (26 wt%) and other (1wt%).

	(%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.....	0		
Sand.....	0		
Glass/Ceramics.....	~26.0		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	<1.0		
Non/low friable.....	<1.0	Floor / ceiling tiles	
Moderately friable.....			

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Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): The inorganic anion content of the waste is <0.5%, probably <0.1%.

	(%wt)	Type(s) and comment
Fluoride.....	<0.10	
Chloride.....	<0.10	
Iodide.....	<0.10	
Cyanide.....	0	
Carbonate.....	<0.10	
Nitrate.....	<0.10	
Nitrite.....	0	
Phosphate.....	<0.10	
Sulphate.....	<0.10	
Sulphide.....	<0.10	

Materials of interest for waste acceptance criteria: -

	(%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.....	2.0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	2.0	paper / cotton.
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: Lead is present as a metal. Boron present in borosilicate glass (10% of glass is borosilicate with a boron concentration of 8%)

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	

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Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	3.9	PVC
Arsenic.....	0	
Barium.....	0	
Boron.....	0.20	
Boron (in Boral).....		
Boron (non-Boral).....	0.20	
Cadmium.....	0	
Caesium.....	0	
Selenium.....	0	
Chromium.....	0	
Molybdenum.....	0	
Thallium.....	0	
Tin.....	P	<1%wt
Vanadium.....	0	
Mercury compounds.....	0	
Others.....	0	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	<1.0	<100 items - Stripped down circuit boards
EEE Type 2.....		
EEE Type 3.....	<1.0	<100 items - tools
EEE Type 4.....		
EEE Type 5.....		

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....	<<0.01	The waste may contain minute quantities of EDTA on swabs.
Total complexing agents.....	<<0.01	

Potential for the waste to contain discrete items: Yes. Might contain hand tools

TREATMENT, PACKAGING AND DISPOSAL

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Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None		100.0

Comment on planned treatments:

No treatments planned

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	10.0	~0.35
Expected to be consigned to a Landfill Facility	90.0	~0.35
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: 20 01 01; 20 01 02; 20 01 38; 20 01 39; 20 01 40; 20 01 35*; 16 02 13*; 16 02 14

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Opportunities for alternative disposal routing: -

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

Waste Packaging for Disposal:

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Container	Stream volume %	Waste loading m ³	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	~10.0	~15.6	3

Other information: Majority will be diverted from repository to LALLW

Waste Planned for Disposal at the LLW Repository:

Container voidage: Not yet determined

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste has a current WCH.
Inventory information is consistent with the current WCH.

Waste consigned for disposal to LLWR in year of generation: Yes.

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: This waste was generated as a result of manufacturing and developing radio-pharmaceuticals and bio-science products. Radioactivity is present as low level contamination of general laboratory refuse and exists as a wide mixture of nuclides. The business mixture has changed and as a consequence fewer long lived nuclides are being generated. Waste will be generated from decommissioning of pharmaceutical manufacturing areas and redundant manufacturing areas for the production of radioactive sources and bio-science products.

Uncertainty: All waste drums are measured individually by gamma spectroscopy using hyperpure germanium detectors, giving high confidence in declared activity.

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: Radioactivity in waste is assessed by either direct measurement or from processing records.

Other information: Total activity values represent the likely activity of waste arisings but nuclide breakdown depends upon commercial activity within a particular product sector.

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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	9.22E-06	AA 1	~1.43E-08	AA 2	Gd 153				
Be 10					Ho 163				
C 14	6.08E-06	AA 1	~1.43E-08	AA 2	Ho 166m				
Na 22	2.98E-08	AA 1	~7.14E-08	AA 2	Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204			~1.43E-08	AA 2
Mn 54	1.48E-09	AA 1	~1.43E-08	AA 2	Pb 205				
Fe 55	1.28E-07	AA 1			Pb 210	2.24E-07	AA 1	~3.43E-07	AA 2
Co 60	9.39E-06	AA 1	~1.67E-06	AA 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	1.1E-07	AA 1	~1.86E-07	AA 2	Po 210	6.47E-13	AA 1	~3.43E-07	AA 2
Zn 65	1.37E-08	AA 1	~2.86E-07	AA 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	3.62E-07	AA 1	~3.43E-07	AA 2
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	5.59E-06	AA 1	~6.57E-06	AA 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99			~1.43E-08	AA 2	U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m	1.28E-07	AA 1	~3.14E-08	AA 2	U 235				
Ag 110m	6.62E-09	AA 1	~1E-07	AA 2	U 236				
Cd 109	1.29E-10	AA 1	~1E-06	AA 2	U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125	3.91E-07	AA 1	~1.43E-06	AA 2	Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241	6.04E-05	AA 1	~4.19E-05	AA 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	1.5E-09	AA 1	~3.14E-08	AA 2	Cm 242				
Cs 135					Cm 243				
Cs 137	1.4E-04	AA 1	~1.11E-05	AA 2	Cm 244				
Ba 133	1.37E-07	AA 1	~3.73E-07	AA 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248	1.15E-06	AA 1		
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			~1.43E-08	AA 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152	2.17E-07	AA 1	~5.71E-07	AA 2	Other b/g	1.13E-07	AA 1	~1.64E-07	AA 2
Eu 154	1.89E-09	AA 1	~5.4E-07	AA 2	Total a	6.19E-05	AA 1	~4.26E-05	AA 2
Eu 155	4.14E-09	AA 1	~1.43E-08	AA 2	Total b/g	1.72E-04	AA 1	~2.46E-05	AA 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