

WASTE STREAM**1A01****LLW Compactable Drummable**

SITE Amersham
SITE OWNER GE Healthcare Limited
WASTE CUSTODIAN GE Healthcare Limited
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	1.6 m ³
Future arisings -	1.4.2019 - 31.3.2020.....	15.0 m ³
	1.4.2020 - 31.3.2021.....	15.0 m ³
	1.4.2021 - 31.3.2022.....	15.0 m ³
	1.4.2022 - 31.3.2023.....	15.0 m ³
	1.4.2023 - 31.3.2030.....	15.0 m ³
Total future arisings:		75.0 m ³
Total waste volume:		76.6 m ³

Comment on volumes: Waste arisings now only from decommissioning over next 5-10 years. Small quantity of stock manufacturing waste. Waste treatment: in-drum low force compaction only. Waste uncertainty factor is low due to understanding of operational waste volumes and predictions for decommissioning operations based on previous work.

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 arise in the future from decommissioning of these redundant facilities.

PHYSICAL CHARACTERISTICS

General description: General laboratory refuse and decayed manufacturing solid waste. The waste is subject to insepection, shredding and low force compaction within 200l drums. No items require special handling. The waste has undergone low force compaction.

Physical components (%wt): Metal (27wt%), soft organics (40 wt%), plastics/rubber (28wt%), glass (5 wt%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.5

Comment on density: The waste density is 0.5 t/m³ after compaction.

CHEMICAL COMPOSITION

General description and components (%wt): The waste comprising mainly cellulose, plastics and rubber. Metal (27%), soft organics - paper / cotton wool / wood / cardboard (40%), PVC (14%), polyethylene (4%), polystyrene (5%), latex (5%), neoprene/hypalon (<1%), glass (5%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Organic - trace only
 C-14: Organic - trace only
 Cl-36: Trace quantity only
 Tc-99: Trace quantity only - sodium pertechnatate
 Ra: Radium sulphate - Trace only

Metals and alloys (%wt): ~100% of metal present is as sheet in form of mild steel drum. Typical thickness 1mm. Metal component of waste excluding drum <0.1%.

Stainless steel.....	<0.10	
Other ferrous metals.....	~26.1	Mild steel drum to BS1449 Part 1
Iron.....		
Aluminium.....	<0.10	
Beryllium.....	0	
Cobalt.....	0	
Copper.....	<0.20	

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	Lead.....	0	
	Magnox/Magnesium.....	0	
	Nickel.....	0	
	Titanium.....	0	
	Uranium.....	0	
	Zinc.....	<0.10	
	Zircaloy/Zirconium.....	0	
	Other metals.....	<0.10	
Organics (%wt):	The waste contains cellulosic materials, plastics and rubber. Polyvinyl chloride.		
	Total cellulosics.....	~40.0	
	Paper, cotton.....	~39.0	
	Wood.....	<1.0	
	Halogenated plastics	~14.0	PVC sheeting / gaitors
	Total non-halogenated plastics.....	~9.0	Polyethylene / Polystyrene
	Condensation polymers.....	<0.10	
	Others.....	~9.0	
	Organic ion exchange materials....	0	
	Total rubber.....	~5.0	
	Halogenated rubber	<1.0	Hypalon/neoprene gloves/gaitors
	Non-halogenated rubber.....	5.0	Latex gloves
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	<0.20	
Other materials (%wt):	Glass ~5%.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	0	
	Brick/Stone/Rubble.....	0	
	Cementitious material.....	0	
	Sand.....	0	
	Glass/Ceramics.....	5.0	
	Graphite.....	0	
	Desiccants/Catalysts.....	0	
	Asbestos.....	<0.10	
	Non/low friable.....	0.05	
	Moderately friable.....	0.05	
	Highly friable.....	<0.01	
	Free aqueous liquids.....	0	

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	Free non-aqueous liquids.....	0	
	Powder/Ash.....	0	
Inorganic anions (%wt):	The inorganic anion content is <0.5%, probably <0.1%.		
	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:	There are only very small quantities of hazardous materials in the waste.		
	Combustible metals.....	0	
	Low flash point liquids.....	0	
	Explosive materials.....	0	
	Phosphorus.....	0	
	Hydrides.....	0	
	Biological etc. materials.....	<0.01	
	Biodegradable materials.....	~39.0	
	Putrescible wastes.....	<0.01	
	Non-putrescible wastes.....	39.0	39% Paper and cotton.
	Corrosive materials.....	0	
	Pyrophoric materials.....	0	
	Generating toxic gases.....	0	
	Reacting with water.....	0	
	Active particles.....	0	
	Soluble solids as bulk chemical compounds.....	0	
Hazardous substances / non hazardous pollutants:	There are no heavy metals present in the waste.		
	Acrylamide.....	0	
	Benzene.....	0	
	Chlorinated solvents.....	0	
	Formaldehyde.....	0	
	Organometallics.....	0	
	Phenol.....	0	
	Styrene.....	0	
	Tri-butyl phosphate.....	0	
	Other organophosphates.....	0	
	Vinyl chloride.....	14.0	PVC plastic sheeting / bags /

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overshoes

Arsenic..... 0
 Barium..... 0
 Boron..... 0
 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..... 0
 EEE Type 2..... 0
 EEE Type 3..... 0
 EEE Type 4..... 0
 EEE Type 5..... 0

Complexing agents (%wt):

No
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents..... 0

No complexing agents are present in this waste.

TREATMENT, PACKAGING AND DISPOSAL

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

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

Comment on planned treatments:

None

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Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	30.0
Expected to be consigned to a Landfill Facility	70.0
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	

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m ³	Number of packages
1/3 Height IP-1 ISO	30.0	~15.6	2
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			

Other information: Majority 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.

Potential for the waste to contain discrete items: No

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

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Source:	This waste was generated as a result of manufacturing radio-pharmaceuticals and bio-science products. The waste consists of general laboratory refuse collected in paper sacks, including clothing, plastics, light metal items and paper, and decayed waste from manufacturing enclosures including glassware, gloves, soft wastes. Similar waste will be generated from decommissioning of pharmaceutical manufacturing areas and redundant manufacturing areas for the production of radioactive sources and bio-science products. The waste is subject to on-site low force compaction within 200l drums. No items require special handling.
Uncertainty:	All waste is 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:	All waste is measured individually by gamma spectroscopy using hyperpure germanium detectors, which are calibrated using traceable radioactive standards in reference drums. The process follows that in the NPL good practice guide number 34 "Radiometric non-destructive assay".
Other information:	Total activity values represent the likely activity of waste arisings but nuclide breakdown depends upon commercial activity within a particular product sector. Activity estimates are derived from known levels of surface contamination, dose rate measurements and laboratory practice.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3			~2.1E-07	AA 2	Gd 153				
Be 10					Ho 163				
C 14			~2E-07	AA 2	Ho 166m				
Na 22	1.56E-10	AA 1	~6.67E-08	AA 2	Tm 170				
Al 26					Tm 171				
Cl 36			~6.67E-08	AA 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54			~8E-08	AA 2	Pb 205				
Fe 55			~6.67E-08	AA 2	Pb 210	1.15E-08	AA 1	~6.67E-08	AA 2
Co 60			~4E-07	AA 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			~6.67E-08	AA 2	Po 210	1.33E-14	AA 1	~6.67E-08	AA 2
Zn 65	4.48E-12	AA 1	~6.67E-08	AA 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	4.99E-09	AA 1	~6.67E-08	AA 2
Kr 85			~6.67E-08	AA 2	Ra 228				
Rb 87					Ac 227				
Sr 90	5.42E-08	AA 1	~6.67E-07	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			~6.67E-08	AA 2	U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m			~6.67E-08	AA 2	U 235				
Ag 110m			~6.67E-08	AA 2	U 236				
Cd 109	4.85E-11	AA 1	~3.6E-07	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			~6.67E-08	AA 2	Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241	6.99E-08	AA 1	~8E-07	AA 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134			~6.67E-08	AA 2	Cm 242				
Cs 135					Cm 243				
Cs 137	6.79E-07	AA 1	~2E-06	AA 2	Cm 244			~6.67E-08	AA 2
Ba 133			~6.67E-08	AA 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152			~6.67E-08	AA 2	Other b/g	2.48E-09	AA 1	~5.2E-07	AA 2
Eu 154			~6.67E-08	AA 2	Total a	7.49E-08	AA 1	~1E-06	AA 2
Eu 155					Total b/g	7.47E-07	AA 1	~5.44E-06	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