

WASTE STREAM	1A09	Incinerated Waste
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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.....	1.7 m ³
Future arisings -	1.4.2022 - 31.3.2030.....	~5.0 m ³
Total future arisings:		5.0 m ³
Total waste volume:		6.7 m ³

Comment on volumes: Future arising predictions for this stream have stayed the same as the 2019 inventory due to cessation of manufacturing operations in 2019. Low uncertainty on stock volumes due to accountancy accuracy on site and wastetrak computer system for tracking and consigning waste between producer and waste operations.

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper) x 1.5
 Stock (lower): x 0.25 Arisings (lower) x 0.5

WASTE SOURCE This waste was generated as a result of manufacturing and developing radio-pharmaceuticals and bio-science products.

PHYSICAL CHARACTERISTICS

General description: The waste typically consists of light weight laboratory items that are typically made of glass, plastic and cellulose as well as some liquids such as scintillation samples, standard solutions, and aqueous liquids in vials (medical product manufacturing rejections). Also ZnBr₂ from the Senior Caves facility decommissioning. This waste has not undergone any physical or chemical changes.

Physical components (%wt): Mild steel drums (5%), paper and cardboard (20%), glass (5%), plastics (40%), cork (4%), rubber (2%) and others liquid (24%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.5

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Mild steel drums (5%), paper and cardboard (20%), glass (5%), plastics (40%), cork (4%), rubber (2%) and others liquid (24%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Aqueous and organic
 C-14: Aqueous and organic
 Cl-36: Sodium chloride
 Tc-99: Potassium Perchnetate
 I-129: Potassium iodide
 Ra: sulphate

Metals and alloys (%wt): Only metal present is mild steel drums.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	~5.0	Mild steel drum to BS1449 Part 1	
Iron.....			
Aluminium.....	0		
Beryllium.....	0		
Cobalt.....	0		

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Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	0
Titanium.....	0
Uranium.....	0
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): 66%wt Organic component as paper / cotton and non-halogenated plastics.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~24.0		
Paper, cotton.....	~20.0		
Wood.....	~4.0		
Halogenated plastics	~9.0	PVC sheeting / gaitors	
Total non-halogenated plastics.....	~31.0	Polyethylene	
Condensation polymers.....	~30.0		
Others.....	~1.0		
Organic ion exchange materials....	0		
Total rubber.....	~2.0	Hypalon/neoprene gloves	
Halogenated rubber	~2.0		
Non-halogenated rubber.....			
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	TR		

Other materials (%wt): 29%wt glass and ZnBr2

	(%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.....	~5.0		
Graphite.....	0		
Desiccants/Catalysts.....	0		

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Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	~20.0
Free non-aqueous liquids.....	~4.0
Powder/Ash.....	0

Inorganic anions (%wt): Not present - maybe trace - see table.

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

Materials of interest for waste acceptance criteria: 24% paper wood cotton.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	P	Autoclaved biomedica in petri dishes
Biodegradable materials.....	~24.0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	~24.0	24%wt paper cotton wood.
Corrosive materials.....	P	Small quantities of acids
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: Boron in borosilicate glass (10% of glass estimated to be borosilicate with a concentration of 8% boron)

	(%wt)	Type(s) and comment
Acrylamide.....	0	

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Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	~9.0	9%wt PVC bags / sheet / gloves
Arsenic.....	0	
Barium.....	0	
Boron.....	~-0.04	
Boron (in Boral).....		
Boron (non-Boral).....	~-0.04	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.....	0	
EEE Type 2.....	0	
EEE Type 3.....	0	
EEE Type 4.....	0	
EEE Type 5.....	0	

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....	TR	There may be minute amounts of EDTA present on swabs.
Total complexing agents.....	TR	

Potential for the waste to contain discrete items: No.

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TREATMENT, PACKAGING AND DISPOSAL

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	Off-site	100.0

Comment on planned treatments:

Incineration is carried out by specialist companies at their location.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
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	100.0	-0.50

Classification codes for waste expected to be consigned to a landfill facility: -

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: (Not applicable to this waste stream)

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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			

Other information: -

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

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: The waste has become contaminated as a result of handling radionuclides in order to manufacture a range of healthcare products. The Cs-137 figure is from the incineration of contaminated zinc bromide drained from shielding windows and substantially decontaminated using ion exchange. The activity is in 0.2m³ @ 20MBq/l. Changes in nuclide values also linked to decommissioning of standard solution safes - number of very small volume liquid in vials for incineration.

Uncertainty: The specific activity data have been calculated from data for waste in stock.

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 activity data have been calculated from data for waste in stock, measured using high resolution gamma spec or accountancy for certain nuclides.

Other information: The waste is typically contaminated with low energy short half life beta emitting radionuclides.

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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	3.16E-05	AA 1		5	Gd 153				
Be 10					Ho 163				
C 14	8.98E-06	AA 1		5	Ho 166m				
Na 22	1.29E-08	AA 1			Tm 170				
Al 26					Tm 171				
Cl 36	7.63E-07	AA 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40	9.04E-09	AA 2			Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54	2.2E-10	AA 1		5	Pb 205				
Fe 55	3.52E-06	AA 1			Pb 210				
Co 60	2.78E-06	AA 1		5	Bi 208				
Ni 59					Bi 210m				
Ni 63	2.83E-05	AA 1			Po 210				
Zn 65	1.26E-11	AA 1			Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	6.23E-05	AA 1		5
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	6.26E-06	AA 1		5	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	3.78E-06	AA 2			U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m	1.86E-09	AA 1			U 235				
Ag 110m		5		5	U 236				
Cd 109	5.43E-08	AA 1		5	U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	5.33E-10	AA 1		
Sn 123					Pu 239	7.17E-08	AA 1		
Sn 126					Pu 240				
Sb 125	2.44E-08	AA 1		5	Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241	1.29E-06	AA 1		5
Te 127m					Am 242m				
I 129	3.97E-07	AA 2			Am 243				
Cs 134	4.25E-09	AA 1		5	Cm 242				
Cs 135					Cm 243				
Cs 137	2.47E-03	AA 1	~2E-02	AA 2	Cm 244	3.78E-10	AA 1		
Ba 133	1.67E-08	AA 1		5	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	9.98E-07	AA 2			Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g	2.61E-11	AA 1		5
Eu 154					Total a	6.37E-05	AA 1	0	5
Eu 155					Total b/g	2.56E-03	AA 1	-2E-02	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