

WASTE STREAM	1A11	Sealed Sources
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SITE Amersham
SITE OWNER GE Healthcare Limited
WASTE CUSTODIAN GE Healthcare Limited
WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	<< 0.1 m ³
Total future arisings:		0 m ³
Total waste volume:		<< 0.1 m ³
Comment on volumes:	No further arisings anticipated. Volume indicated is volume of raw waste i.e. unshielded sources, as they do not reside in a transport or storage container - they are in a shielded plant.	
Uncertainty factors on volumes:	Stock (upper): x 1.5	Arisings (upper) x
	Stock (lower): x 0.5	Arisings (lower) x

WASTE SOURCE Returned sealed radioactive sources.

PHYSICAL CHARACTERISTICS

General description: The waste consists of returned sealed sources. These sources are normally encapsulated in welded stainless steel capsules. Waste will have undergone radioactive decay.

Physical components (%wt): Metals (50 wt%), ceramics (50 wt%).

Sealed sources: The waste contains sealed sources. 1,649 currently in stock.

Bulk density (t/m³): ~-1.5

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Metals (50 wt%), ceramics (50 wt%).

Chemical state: Neutral

Chemical form of radionuclides: C-14: Carbon 14 will be present in a resin matrix.
I-129: Organic ion exchange resin bead (styrene based).
Ra: Sulphate.
U: Oxide.
Pu: Ceramic.

Metals and alloys (%wt):

Stainless steel.....	~-50.0	316l stainless steel.
Other ferrous metals.....	0	
Iron.....	0	
Aluminium.....	0	
Beryllium.....	TR	AmBe neutron sources.
Cobalt.....	0	
Copper.....	0	
Lead.....	0	
Magnox/Magnesium.....	0	
Nickel.....	0	
Titanium.....	0	
Uranium.....	0	
Zinc.....	0	
Zircaloy/Zirconium.....	0	

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	Other metals.....	0
Organics (%wt):	None	
	Total cellulose.....	
	Paper, cotton.....	
	Wood.....	
	Halogenated plastics	
	Total non-halogenated plastics.....	
	Condensation polymers.....	
	Others.....	
	Organic ion exchange materials....	
	Total rubber.....	
	Halogenated rubber	
	Non-halogenated rubber.....	
	Hydrocarbons.....	
	Oil or grease	
	Fuel.....	
	Asphalt/Tarmac (cont.coal tar)...	
	Asphalt/Tarmac (no coal tar)....	
	Bitumen.....	
	Others.....	
	Other organics.....	
Other materials (%wt):	Ceramics.	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	0
	Glass/Ceramics.....	50.0
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	0
	Non/low friable.....	0
	Moderately friable.....	0
	Highly friable.....	0
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	-	

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Fluoride.....
 Chloride.....
 Iodide.....
 Cyanide.....
 Carbonate.....
 Nitrate.....
 Nitrite.....
 Phosphate.....
 Sulphate.....
 Sulphide.....

Materials of interest for
 waste acceptance criteria:

-
 Combustible metals.....
 Low flash point liquids.....
 Explosive materials.....
 Phosphorus.....
 Hydrides.....
 Biological etc. materials.....
 Biodegradable materials.....
 Putrescible wastes.....
 Non-putrescible wastes.....
 Corrosive materials.....
 Pyrophoric materials.....
 Generating toxic gases.....
 Reacting with water.....
 Active particles.....
 Soluble solids as bulk chemical
 compounds.....

Hazardous substances /
 non hazardous pollutants:

-
 Acrylamide.....
 Benzene.....
 Chlorinated solvents.....
 Formaldehyde.....
 Organometallics.....
 Phenol.....
 Styrene.....
 Tri-butyl phosphate.....
 Other organophosphates.....
 Vinyl chloride.....
 Arsenic.....
 Barium.....
 Boron.....

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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.....

Complexing agents (%wt): No
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents.....

PACKAGING AND CONDITIONING

Conditioning method: Not yet determined.
 Plant Name: -
 Location: -
 Plant startup date: -
 Total capacity (m³/y incoming waste): -
 Target start date for packaging this stream: -
 Throughput for this stream (m³/y incoming waste): -
 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

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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): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: Yes

Treatment	Stream volume (%)	Comment
Reuse/Recycling	NE	Investigating opportunities for recycling and reuse of the sources with third parties

RADIOACTIVITY

Source: The waste is made up of returned radioactive sources.

Uncertainty: The accuracy of the data is based on records. Allowance has been made for decay.

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: Activity data has been derived from processing records. Radionuclide concentration is based on raw source waste - i.e. unshielded sources not in any transport or storage containers.

Other information: Reuse and recycling routes will be assessed for the sources prior to HAW packaging and conditioning for disposal to GDF.

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Sealed Sources

Nuclide	Mean radioactivity, TBq/m ³		Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m ³		Future arisings	Bands and Code
	Waste at 1.4.2019	Bands and Code				Waste at 1.4.2019	Bands and Code		
H 3	8.39E-02	AA 1			Gd 153				
Be 10					Ho 163				
C 14	3.73E+01	AA 1			Ho 166m				
Na 22	5.73E-01	AA 1			Tm 170				
Al 26					Tm 171				
Cl 36	5.52E-03	AA 1			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204	6.56E+00	AA 1		
Mn 54					Pb 205				
Fe 55	3.81E+02	AA 1			Pb 210	4.10E+03	AA 1		
Co 60	2.11E+02	AA 1			Bi 208				
Ni 59					Bi 210m				
Ni 63	4.99E+02	AA 1			Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	1.93E+03	AA 1		
Kr 85	2.90E+00	AA 1			Ra 228				
Rb 87					Ac 227				
Sr 90	2.23E+03	AA 1			Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m	1.24E+00	AA 1			Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109	5.44E-02	AA 1			U 238	1.25E+02	AA 1		
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	5.54E+04	AA 1		
Sn 123					Pu 239	6.04E-03			
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241	1.74E+05	AA 1		
Te 127m					Am 242m				
I 129	2.17E-01	AA 1			Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	9.85E+03	AA 1			Cm 244				
Ba 133	3.09E+01	AA 1			Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	1.57E+01	AA 1			Cf 251				
Sm 147					Cf 252				
Sm 151	4.62E+04	AA 1			Other a				
Eu 152	2.44E-01	AA 1			Other b/g	2.35E-01	AA 1		
Eu 154					Total a	2.30E+05	AA 1		0
Eu 155					Total b/g	6.36E+04	AA 1		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