WASTE STREAM 1A11 Sealed Sources

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.....	<< 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/m^3):	~~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):	No sheet metal present in this waste.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
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		

WASTE STREAM 1A11 Sealed Sources

Uranium	0
Zinc	0
Zircaloy/Zirconium	0
Other metals	0

Organics (%wt): None

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	0		
Paper, cotton	0		
Wood	0		
Halogenated plastics	0		
Total non-halogenated plastics	0		
Condensation polymers	0		
Others	0		
Organic ion exchange materials	0		
Total rubber	0		
Halogenated rubber	0		
Non-halogenated rubber	0		
Hydrocarbons	0		
Oil or grease	0		
Fuel	0		
Asphalt/Tarmac (cont.coal tar)	0		
Asphalt/Tarmac (no coal tar)	0		
Bitumen	0		
Others	0		
Other organics	0		

Other materials (%wt): Ceramics.

	(%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	50.0		
Graphite	0		
Desiccants/Catalysts	0		
Asbestos	0		
Non/low friable	0		
Moderately friable	0		
Highly friable	0		
Free aqueous liquids	0		

WASTE STREAM 1A11 Sealed Sources

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

Inorganic anions (%wt): -

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

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.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	0	
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: -

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

WASTE STREAM 1A11 Sealed Sources

Styrene	0
Tri-butyl phosphate	0
Other organophosphates	0
Vinyl chloride	0
Arsenic	0
Barium	0
Boron	0
Boron (in Boral)	0
Boron (non-Boral)	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

	(%wt)	Type(s) and comment
EDTA		
DPTA		
NTA		
Polycarboxylic acids		
Other organic complexants		
Total complexing agents		

Potential for the waste to contain discrete items: Yes. Sealed sources

PACKAGING AND CONDITIONING

Conditioning method:	Not yet determined.
Plant Name:	-
Location:	-
Plant startup date:	-
Total capacity (m^3/y incoming waste):	-

WASTE STREAM 1A11 Sealed Sources

Target start date for packaging this stream: -

Throughput for this stream (m^3/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

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/m^3): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at a Geological Disposal Facility	Reuse/Recycling	NE	-	Medium	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.

WASTE STREAM 1A11 Sealed Sources

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	7.09E-02	A A 1			Gd 153				
Be 10					Ho 163				
C 14	3.72E+01	A A 1			Ho 166m				
Na 22	2.58E-01	A A 1			Tm 170				
Al 26					Tm 171				
Cl 36	5.52E-03	A A 1			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204	3.78E+00	A A 1		
Mn 54					Pb 205				
Fe 55	1.76E+02	A A 1			Pb 210	3.74E+03	A A 1		
Co 60	1.42E+02	A A 1			Bi 208				
Ni 59					Bi 210m				
Ni 63	4.89E+02	A A 1			Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	1.92E+03	A A 1		
Kr 85	2.37E+00	A A 1			Ra 228				
Rb 87					Ac 227				
Sr 90	2.08E+03	A A 1			Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m	1.2E+00	A A 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	1.05E-02	A A 1			U 238	1.25E+02	A A 1		
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	5.41E+04	A A 1		
Sn 123					Pu 239	6.04E-03			
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241	1.65E+05	A A 1		
Te 127m					Am 242m				
I 129	2.16E-01	A A 1			Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	9.49E+03	A A 1			Cm 244				
Ba 133	2.53E+01	A A 1			Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	7.11E+00	A A 1			Cf 251				
Sm 147					Cf 252				
Sm 151	4.51E+04	A A 1			Other a				
Eu 152	2.08E-01	A A 1			Other b/g	1.92E-01	A A 1		
Eu 154					**Total a**	**2.21E+05**	**A A 1**	**0**	
Eu 155					**Total b/g**	**6.13E+04**	**A A 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