WASTE STREAM 1A10 ILW Containing Radium

SITE Amersham

SITE OWNER GE Healthcare Limited

WASTE CUSTODIAN GE Healthcare Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	~~2.0 m³
Future arisings -	1.4.2019 - 31.3.2030.....	9.0 m³
Total future arisings:		9.0 m³
Total waste volume:		11.0 m³

Comment on volumes: This waste stream represents legacy waste. A full detailed analysis of all packaged radium was carried out for the 2013 inventory with no changes for 2016 or 2019. A radium strategy and project has been initiated which will improve the understanding of this waste stream.

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 Sealed and closed source production.

PHYSICAL CHARACTERISTICS

General description: The waste consists of solid and absorbed liquid wastes within steel cans or fibreboard drums as primary containment, all contained in sealed PVC bags. (Wastes arising from 1990 are dry). Solids include glassware, rubber gloves, paper tissue, and small items of redundant laboratory equipment such as hotplates, retort stands, etc. Liquids comprise aqueous solutions.

Physical components (%vol): The waste is believed to consist mainly of glass (10.5%) metals (17%) plastics (33%) cellulosics (31%) others (8.5%).

Sealed sources: The waste contains sealed sources. Present as closed sources (not leak tested and defined as a sealed source). Number not yet estimated.

Bulk density (t/m³): NE

Comment on density: NE

CHEMICAL COMPOSITION

General description and components (%wt): The waste is believed to consist mainly of glass, plastics, cellulosics and some metal.

Chemical state: Neutral

Chemical form of radionuclides: Ra: Radium sulphate, radium bromide, radium carbonate.

Metals and alloys (%wt): Not estimated

Stainless steel.....	~5.0	316L used for sealed sources.
Other ferrous metals.....	~7.0	Mild steel tins.
Iron.....	0	
Aluminium.....	<1.0	
Beryllium.....	0.10	
Cobalt.....	0	
Copper.....	<1.0	
Lead.....	<2.0	
Magnox/Magnesium.....	0	
Nickel.....	0	
Titanium.....	0	
Uranium.....	0	

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	Zinc	<1.0	
	Zircaloy/Zirconium	0	
	Other metals	NE	The waste may contain platinium, rhodium, iridium and gold.
Organics (%wt):	-		
	Total cellulosics	~31.0	
	Paper, cotton	~30.0	
	Wood	~1.0	
	Halogenated plastics	~17.0	PVC bags / sheeting.
	Total non-halogenated plastics	~16.0	
	Condensation polymers	~9.5	
	Others	~6.5	
	Organic ion exchange materials	TR	
	Total rubber	~4.0	
	Halogenated rubber	~2.0	Hypalon/neoprene gloves.
	Non-halogenated rubber	<2.0	Latex gloves.
	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):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand	0	
	Glass/Ceramics	~~14.8	
	Graphite	0	
	Desiccants/Catalysts	0	
	Asbestos	<0.10	
	Non/low friable	<0.05	
	Moderately friable	<0.05	
	Highly friable	0	
	Free aqueous liquids	0	
	Free non-aqueous liquids	0	
	Powder/Ash	NE	
Inorganic anions (%wt):	No details available at present.		

Fluoride	NE	Not thought to be present
Chloride	NE	Not thought to be present
Iodide	NE	Not thought to be present
Cyanide	NE	Not thought to be present
Carbonate	NE	Not thought to be present
Nitrate	NE	Not thought to be present
Nitrite	NE	Not thought to be present
Phosphate	NE	Not thought to be present
Sulphate	NE	Not thought to be present
Sulphide	NE	Not thought to be present

Materials of interest for waste acceptance criteria: A very small fraction of the inventory is in a mixture of hydrochloric acid and nitric acid, but this will be neutralised prior to final storage or disposal arrangements.

Combustible metals		
Low flash point liquids		
Explosive materials		
Phosphorus		
Hydrides		
Biological etc. materials		
Biodegradable materials		
Putrescible wastes		
Non-putrescible wastes		
Corrosive materials	<1.0	Aqua Regia (mixture of hydrochloric acid and nitric acid).
Pyrophoric materials		
Generating toxic gases		
Reacting with water		
Active particles		
Soluble solids as bulk chemical compounds		

Hazardous substances / non hazardous pollutants: Not yet fully determined

Acrylamide	0	
Benzene	0	
Chlorinated solvents	0	
Formaldehyde	0	
Organometallics	0	
Phenol	0	
Styrene	0	
Tri-butyl phosphate	0	
Other organophosphates	0	
Vinyl chloride	~17.0	17% PVC bags.
Arsenic	0	
Barium	0	
Boron	0	

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Cadmium	0	
Caesium	0	
Selenium	0	
Chromium	0	
Molybdenum	0	
Thallium	0	
Tin	0	
Vanadium	0	
Mercury compounds	0	
Others	NE	
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): Not yet determined

EDTA	NE	No details available at present.
DPTA	NE	No details available at present.
NTA	NE	No details available at present.
Polycarboxylic acids	NE	No details available at present.
Other organic complexants	NE	No details available at present.
Total complexing agents	NE	

PACKAGING AND CONDITIONING

Conditioning method: GE Healthcare IWS is not to condition at this time. Radium project currently defining proof of principle for long term storage on site prior to third party transfer (as yet unidentified), subject to BAT. Principle likely to be multibarrier containment of raw waste (no conditioning).

Plant Name: -

Location: -

Plant startup date: -

Total capacity (m^3/y incoming waste): -

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

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Likely container type comment:	Container likely to be 500l DEVA drum (may or may not be lead lined - dose rate depending), this has yet to be determined.
Range in container waste volume:	Not specified
Other information on containers:	Not Specified
Likely conditioning matrix:	Not specified
Other information:	-
Conditioned density (t/m³):	NE
Conditioned density comment:	NE
Other information on conditioning:	-
Opportunities for alternative disposal routing:	Yes

Treatment	Stream volume (%)	Comment
Recycling	<1.0	Closed sources being investigated for transfer for recycling, low % by vol (<1) but significant % by activity of the waste stream (~90).

RADIOACTIVITY

Source:	This waste was generated from sealed source production.
Uncertainty:	Details of waste holdings are estimated using pessimistic assumptions.
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:	Specific activity data has been calculated from records of waste holdings.
Other information:	No account has been made for radium decay daughters.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3					Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					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				
Mn 54					Pb 205				
Fe 55					Pb 210				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	~3.97E+00	A A 2	~3.23E-02	A A 2
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					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					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					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					Other b/g				
Eu 154					**Total a**	**~3.97E+00**	**A A 2**	**~3.23E-02**	**A A 2**
Eu 155					**Total b/g**	**NE**		**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