WASTE STREAM 9R10 ILW Ion Exchange Material

SITE	Berkeley
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0.7 m^3
Total future arisings:		0 m^3
Total waste volume:		0.7 m^3

Comment on volumes: The volumes quoted are raw waste volumes.

Uncertainty factors on volumes:

Stock (upper):	x 1.2	Arisings (upper)	x
Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE Spent ion exchange materials arising from the treatment of pond water.

PHYSICAL CHARACTERISTICS

General description: The waste is a mixture of Duolite C3, IRN150 and AW500 ion exchange materials. Composition appropriate to proprietary ion exchange materials, most of which are organic in nature. There are no large items which may require special handling.

Physical components (%wt): Ion exchange material (>99 %wt) and cloth bags (<1%wt).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): 1.1

Comment on density: The bulk density is estimated to be 1.1 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): Organic ion exchange materials constitute ~90%, inorganic ion exchange materials ~9 % and cloth bags <1%.

Chemical state: Alkali

Chemical form of radionuclides:
H-3: Tritium content is expected to be insignificant.
C-14: Carbon 14 content is expected to be insignificant.
Cl-36: The chemical form of chlorine 36 has not been determined.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
Ra: Radium isotope content is expected to be insignificant.
Th: The thorium content is insignificant.
U: Uranium isotope content is expected to be insignificant.
Np: The neptunium content is insignificant.
Pu: Plutonium isotope content is expected to be insignificant.

Metals and alloys (%wt): No sheet or bulk metal present in this waste stream.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	TR		
Other ferrous metals.....	TR		
Iron.....			
Aluminium.....	TR		
Beryllium.....	TR		
Cobalt.....	TR		
Copper.....	TR		
Lead.....	TR		

WASTE STREAM 9R10 ILW Ion Exchange Material

Magnox/Magnesium	TR	
Nickel	TR	
Titanium		
Uranium		
Zinc	TR	
Zircaloy/Zirconium	TR	
Other metals	TR	Not fully assessed but only trace quantities anticipated, if any.

Organics (%wt): Proprietary organic ion exchange resins will be present. These are contained in cloth bags.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	<1.0		
Paper, cotton	<1.0		
Wood	0		
Halogenated plastics	0		
Total non-halogenated plastics	0		
Condensation polymers	0		
Others	0		
Organic ion exchange materials	~90.0		
Total rubber	0		
Halogenated rubber	0		
Non-halogenated rubber	0		
Hydrocarbons			
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics	NE		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	~9.0		
Inorganic sludges and flocs	0		
Soil	0		
Brick/Stone/Rubble	0		
Cementitious material	0		
Sand			
Glass/Ceramics	0		
Graphite	0		
Desiccants/Catalysts			
Asbestos	0		
Non/low friable			

WASTE STREAM 9R10 ILW Ion Exchange Material

Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	TR
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): Not fully assessed.

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

Materials of interest for waste acceptance criteria: Hazardous materials are not expected but ion exchange materials may be combustible when dry.

	(%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.....		
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: May be present in trace quantities.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		

WASTE STREAM 9R10 ILW Ion Exchange Material

Formaldehyde.....	
Organometallics.....	
Phenol.....	
Styrene.....	
Tri-butyl phosphate.....	
Other organophosphates.....	
Vinyl chloride.....	
Arsenic.....	
Barium.....	
Boron.....	0
Boron (in Boral).....	
Boron (non-Boral).....	
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): Yes

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

Potential for the waste to contain discrete items: No. In & of itself not a DI; assumed not likely to contain any "rogue" items that could be.

PACKAGING AND CONDITIONING

Conditioning method: To be co-packaged with 9R02, 9R13, 9R17, 9R19, 9R101, 9R112, 9R118. Packages are assigned to 9R02 & 9R101.

Plant Name: -

Location: -

WASTE STREAM 9R10 ILW Ion Exchange Material

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

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

RADIOACTIVITY

Source: Contamination by activation and fission products will be the main source of activity.

Uncertainty: The values are indicative of the activities that might be expected.

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 arisings activities have been normalised and the stocks activities have been derived from measurements of the packages.

Other information: Specific activity is a function of operating history.

WASTE STREAM 9R10 ILW Ion Exchange Material

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		8			Gd 153		8		
Be 10		8			Ho 163		8		
C 14		8			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36		8			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54		8			Pb 205		8		
Fe 55	4.68E-05	C C 2			Pb 210		8		
Co 60	2.06E-03	C C 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63		8			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90		8			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232		8		
Nb 94		8			Th 234		8		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99		8			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234		8		
Ag 108m		8			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238		8		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	9.10E-07	C C 2		
Sn 123		8			Pu 239	9.00E-07	C C 2		
Sn 126		8			Pu 240	2.00E-06	C C 2		
Sb 125		8			Pu 241	1.13E-04	C C 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	9.76E-06	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	1.24E-06	C C 2			Cm 242		8		
Cs 135		8			Cm 243	5.3E-09	C C 2		
Cs 137	3.03E-03	C C 2			Cm 244	2.52E-07	C C 2		
Ba 133	1.36E-05	C C 2			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147		8			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		8			Other a				
Eu 152		8			Other b/g				
Eu 154		8			**Total a**	**1.38E-05**	**C C 2**	**0**	
Eu 155	1.83E-06	C C 2			**Total b/g**	**5.27E-03**	**C C 2**	**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