WASTE STREAM 9A82 Ion Exchange Material in Drums

SITE	Berkeley
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	3.0 m³
Total future arisings:		0 m³
Total waste volume:		3.0 m³

Comment on volumes: Station operation ceased in March 1989. The waste was used as an infill for drums containing Miscellaneous Contaminated Items (streams 9A66-70) that arose at Berkeley Technology Centre. Approximately 175 drums were used in this way between 1975 and 1987.

Uncertainty factors on volumes:

Stock (upper):	x 1.1	Arisings (upper)	x
Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE Spent ion exchange materials arising from the treatment of pond waters. The material was packaged in modified '45 gallon' mild steel drums.

PHYSICAL CHARACTERISTICS

General description: The Ion Exchange Material was used for removing caesium from the Berkeley Technology Centre pond. The material is believed to be Lewatit DN/KR, which is a bead form organic ion exchange material. The waste was dried and used as an infill for approximately 175 drums containing Miscellaneous contaminated items (streams 9A66-70), prior to transfer to the Berkeley Power Station for storage in the vaults. There are no large items in the ion exchange material which may require special handling. This waste has not previously been included separately in the UK inventories, but it was originally included in the Miscellaneous Contaminated Item waste streams.

Physical components (%vol): The waste is expected to be 100% organic material (Lewatit DN/KR).

Sealed sources: -

Bulk density (t/m³): ~1

Comment on density: The assumption of 1 t/m³ as the average bulk density may be subject to revision.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is expected to be organic ion exchange material. It is most likely to be loaded with caesium.

Chemical state: Alkali

Chemical form of radionuclides:
H-3: Most tritium is expected to be present as water but some may be in the form of other inorganic compounds or as organic compounds.
C-14: Carbon 14 will probably be present as graphite.
Cl-36: Chlorine 36 will probably be present as inorganic chloride.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
Ra: The radium isotope content is insignificant.
Th: The thorium isotope content is insignificant.
U: The chemical form of uranium isotopes has not been determined but probably will be uranium oxides.
Np: The neptunium content is insignificant.
Pu: The chemical form of plutonium isotopes has not been determined but probably will be plutonium oxides.

Metals and alloys (%wt): No sheet or bulk metal items present.

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	Stainless steel	NE	The waste will be contaminated with stainless and mild steel as it was used as an infill for drums containing Miscellaneous Contaminated Items.
	Other ferrous metals	NE	
	Iron		
	Aluminium	0	
	Beryllium	<0.01	
	Cobalt		
	Copper	0	
	Lead	0	
	Magnox/Magnesium	TR	
	Nickel		
	Titanium		
	Uranium		
	Zinc	0	
	Zircaloy/Zirconium	TR	
	Other metals	0	No "other" metals present.
Organics (%wt):	Organic ion exchange material are present (Lewatit DN/KR 100%wt)		
	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	~100.0	Lewatit DN/KR
	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	0	
Other materials (%wt):	Traces of graphite may be present.		

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Inorganic ion exchange materials.	~0
Inorganic sludges and flocs.....	0
Soil.....	0
Brick/Stone/Rubble.....	0
Cementitious material.....	0
Sand.....	
Glass/Ceramics.....	0
Graphite.....	TR
Desiccants/Catalysts.....	
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): The presence of inorganic anions shown in the table has not been fully assessed.

Fluoride.....	<<0.01
Chloride.....	<0.01
Iodide.....	<<0.01
Cyanide.....	0
Carbonate.....	~2.0
Nitrate.....	NE
Nitrite.....	NE
Phosphate.....	NE
Sulphate.....	<0.01
Sulphide.....	NE

Materials of interest for waste acceptance criteria: Organic ion exchange material swells in water. If it is not fully saturated prior to being encapsulated in the ILW drum, it is likely to swell in the grout, potentially causing problems with cracking of the wasteform.

Combustible metals.....	0
Low flash point liquids.....	0
Explosive materials.....	0
Phosphorus.....	0
Hydrides.....	0
Biological etc. materials.....	0
Biodegradable materials.....	
Putrescible wastes.....	0
Non-putrescible wastes.....	
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0

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Active particles.....

Soluble solids as bulk chemical compounds.....

Hazardous substances / non hazardous pollutants: None expected.

Acrylamide.....

Benzene.....

Chlorinated solvents.....

Formaldehyde.....

Organometallics.....

Phenol.....

Styrene.....

Tri-butyl phosphate.....

Other organophosphates.....

Vinyl chloride.....

Arsenic.....

Barium.....

Boron.....

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

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... TR

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PACKAGING AND CONDITIONING

Conditioning method:	This stream is to be co-packaged with 9A37, 9A38, 9A57, 9A58, 9A59, 9A65, 9A68, 9A69, 9A70, 9A71, 9A72, 9A75, 9A77, 9A78. Packages are assigned to 9A68, 9A71 & 9A75.
Plant Name:	-
Location:	Berkeley Site
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:	

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	Spent ion exchange materials arising from the treatment of pond water. There is expected to be contamination by fission products and activation products including actinides. Caesium-137 is expected to be a dominant nuclide.
Uncertainty:	Specific activity is a function of perating history. The values quoted are indicative of the activities that are 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'.

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Measurement of radioactivities:	Values were derived by extrapolation from available data. based on 9R10 and decayed 22 years
Other information:	-

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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		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	2.97E-07	C C 2			Pb 210		8		
Co 60	1.70E-04	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	7.92E-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	4.71E-05	C C 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	8.79E-06	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	1.33E-09	C C 2			Cm 242		8		
Cs 135		8			Cm 243	3.52E-09	C C 2		
Cs 137	2.01E-03	C C 2			Cm 244	1.27E-07	C C 2		
Ba 133	4.11E-06	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**	**1.26E-05**	**C C 2**	**0**	
Eu 155	1.19E-07	C C 2			**Total b/g**	**2.23E-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