WASTE STREAM 9B81/C FED Magnox - Secondary Ion Exchange Resin (Co-Treat)

SITE Bradwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2019.....	0.7 m³	2.6 m³
Total future arisings:		0 m³	0 m³
Total waste volume:		0.7 m³	2.6 m³
Number of waste packages in stock:	At 1.4.2019.....	2 package(s)	
Comment on volumes:	-		
Uncertainty factors on volumes:	Stock (upper): x 1.1	Arisings (upper) x	
	Stock (lower): x 0.9	Arisings (lower) x	

WASTE SOURCE The secondary Ion exchange resin originates in the ADAP from the abatement of FED dissolution discharges. The ADAP plant used Co-Treat and Cs-Treat proprietary Ion Exchange (IX) resins to remove soluble radioactive components from the effluent, minimising the activity discharged to the environment. This waste stream refers to the Co-Treat.

PHYSICAL CHARACTERISTICS

General description:	Spent CoTreat (100%) resin from the FED effluent activity abatement. There are no large items which may cause special handling
Physical components (%wt):	100 wt% Co-Treat resin, with some bound water (~35 wt%)
Sealed sources:	-
Bulk density (t/m³):	~1.1
Comment on density:	The bulk density of the waste ranges from 1.05 to 1.15 t/m³ and includes absorbed water. The average is 1.1 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt):	Ion Exchange material ~100% wt (of which 35% wt is absorbed water). Other minor items/components ~1% wt are not assessed.
Chemical state:	Alkali
Chemical form of radionuclides:	H-3: Likely present as water. Cl-36: The chemical form of chlorine 36 may be inorganic chloride. U: The chemical form of uranium isotopes has not been determined but will probably be uranium oxides. Pu: The chemical form of plutonium isotopes has not been determined but will probably be plutonium oxides.
Metals and alloys (%wt):	No bulk or sheet metal items.

Stainless steel.....	NE
Other ferrous metals.....	NE
Iron.....	
Aluminium.....	NE
Beryllium.....	TR
Cobalt.....	
Copper.....	NE
Lead.....	TR
Magnox/Magnesium.....	<1.0
Nickel.....	

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	Titanium		
	Uranium		
	Zinc	NE	
	Zircaloy/Zirconium	NE	
	Other metals	NE	The "other" metal content has not been fully assessed.
Organics (%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	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	0	
Other materials (%wt):	100% inorganic Co-Treat resin.There are no halogenated plastics or rubbers present.		
	Inorganic ion exchange materials.	~100.0	Co-Treat
	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		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	0	
	Free non-aqueous liquids	TR	
	Powder/Ash	0	

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Inorganic anions (%wt): Not fully assessed. Carbonates are expected to be present.

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: -

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	NE
Reacting with water	0
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):

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... TR

PACKAGING AND CONDITIONING

Container type:

Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
500 l RS drum (0mm Pb)	100.0	0.355	0.355	2

Container type comment: -

Range in container waste volume: Single resin bed per MOSAIK

Other information on containers: -

Conditioned density (t/m³): -

Conditioned density comment: -

Other information on conditioning: -

RADIOACTIVITY

Source: The activity originates from Magnox FED which has been dissovled in the dissolution process and the resulting effluent abated within ADAP. Co-Treat is one of the abatement steps in ADAP specifically to target Co-60. The activity arises from activation products, fission products and fuel route.

Uncertainty: The fingerprints are conservative upper limits based upon the mass and activity of FED

	processed through ADAP.
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:	Cs-137 and Co-60 both measured using in-situ gamma spectroscopy.
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	<8.34E+00	E 3			Gd 153		8		
Be 10	<2.69E-05	D 3			Ho 163	<2.95E-06	D 3		
C 14	<1.1E-01	D 3			Ho 166m	<3.73E-09	D 3		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171	<4.57E-05	D 3		
Cl 36	<1.07E-02	D 3			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41	<3.3E-02	D 3			Pt 193		8		
Mn 53		8			Tl 204	<3.02E-03	D 3		
Mn 54	<1E-06	D 3			Pb 205		8		
Fe 55	<2.58E-02	D 3			Pb 210	<4.72E-08	D 8		
Co 60	4.85E-03	B B 1			Bi 208		8		
Ni 59	<1.42E-03	D 3			Bi 210m		8		
Ni 63	<9.25E-02	D 3			Po 210	<4.29E-08	D 3		
Zn 65	<2.71E-07	D 3			Ra 223		8		
Se 79	<2.25E-06	D 3			Ra 225	<2.03E-08	D 3		
Kr 81		8			Ra 226	<2.81E-07	D 3		
Kr 85	<2.09E-02	D 3			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	<2.92E-02	D 3			Th 227		8		
Zr 93	<1.24E-05	D 3			Th 228	<4.89E-06	D 3		
Nb 91		8			Th 229	<2.05E-08	D 3		
Nb 92		8			Th 230	<2.39E-09	D 3		
Nb 93m	<8.39E-06	D 3			Th 232		8		
Nb 94	<1.33E-04	D 3			Th 234	<4.99E-06	D 3		
Mo 93	<1.54E-06	D 3			Pa 231		8		
Tc 97		8			Pa 233	<7.03E-07	D 3		
Tc 99	<9.76E-05	D 3			U 232	<5.41E-06	D 3		
Ru 106	<2.77E-05	D 3			U 233	<3.62E-05	D 3		
Pd 107	<1.1E-06	D 3			U 234	<4.99E-06	D 3		
Ag 108m	<1.51E-02	D 3			U 235	<1.02E-07	D 3		
Ag 110m	<1.33E-07	D 3			U 236	<9.32E-07	D 3		
Cd 109	<8.16E-07	D 3			U 238	<4.99E-06	D 3		
Cd 113m	<3.84E-02	D 3			Np 237	<7.04E-07	D 3		
Sn 119m	<1.26E-08	D 3			Pu 236	<3.69E-09	D 3		
Sn 121m	<2.66E-03	D 3			Pu 238	<9.21E-04	D 3		
Sn 123		8			Pu 239	<3.28E-03	D 3		
Sn 126	<4.88E-06	D 3			Pu 240	<3.28E-03	D 3		
Sb 125	<1.39E-03	D 3			Pu 241	<1.72E-02	D 3		
Sb 126	<6.83E-07	D 3			Pu 242	<4.34E-06	D 3		
Te 125m	<3.47E-04	D 3			Am 241	<4.84E-03	D 3		
Te 127m		8			Am 242m	<4.45E-05	D 3		
I 129	<2.09E-07	D 3			Am 243	<1.06E-05	D 3		
Cs 134	<2.03E-03	D 3			Cm 242	<3.19E-05	D 3		
Cs 135	<5.83E-06	D 3			Cm 243	<7.80E-05	D 3		
Cs 137	6.36E-03	B B 1			Cm 244	<7.12E-05	D 3		
Ba 133	<7.15E-04	D 3			Cm 245	<7.01E-09	D 3		
La 137	<3.17E-07	D 3			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144	<2.09E-06	D 3			Cf 249		8		
Pm 145	<3.93E-04	D 3			Cf 250		8		
Pm 147	<3.16E-03	D 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	<1.87E-03	D 3			Other a				
Eu 152	<7.04E-04	D 3			Other b/g				
Eu 154	<1.63E-03	D 3			**Total a**	**<1.26E-02**	**D 3**	**0**	
Eu 155	<5.35E-04	D 3			**Total b/g**	**<8.76E+00**	**D 3**	**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