WASTE STREAM	9B85/C	FED Magnox - Secondary Ion Exchange Resin (Cs-Treat)

SITE Bradwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m^3)	OR	Conditioned (m^3)	Packaged (m^3)
Stocks:	At 1.4.2025		= 0.4	1.3
Future arisings:				0.0
				0.0
Total future arisings:			**0.0**	**0.0**
Total waste volume:			**0.4**	**1.3**

Number of waste packages in stock: At 1.4.2025…… 1 packages

Comment on arising rates: -

Additional information on quantities: Volume obtained from voidage calculations

Uncertainty factors on volumes:
Stock (upper): x 1.00 Arisings (upper): x -
Stock (lower): x 1.00 Arisings (lower): x -

WASTE SOURCE The secondary ion exchange resin originates in the ADAP from the abatement of FED dissolution discharges. The ADAP plant will use 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 Cs-Treat.

PHYSICAL CHARACTERISTICS

General description: Spent CsTreat resin from the FED effluent activity abatement.

Changes since waste generated: -

Bulk density (t/m³): = 0.11

Comment on density: The bulk density of the waste is calculated using the total waste mass and volume of the wastestream.

CHEMICAL COMPOSITION

General description and components (%wt): Ion exchange material (100 wt%) of which 35% wt is absorbed water.

Chemical state: Alkali

Sheet metal proportion / thickness: No bulk or sheet metal items.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel……	NE	-	
Other ferrous metals……	NE	-	
Iron……		-	
Aluminium……	NE	-	
Beryllium……		-	
Cobalt……		-	
Copper……	NE	-	
Lead……	TR	-	
Magnox/Magnesium……	NE	-	
Nickel……		-	
Titanium……		-	
Uranium……		-	
Zinc……	NE	-	
Zircaloy/Zirconium……	NE	-	
Other metals……	NE	-	

Organics (%wt):

	(%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		-	
Oil or grease		-	
Fuel		-	
Asphalt/Tarmac (cont.coal tar)		-	
Asphalt/Tarmac (no coal tar)		-	
Bitumen		-	
Others		-	
Other organics	0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	~ 100.0	Cs-treat - Potassium hexacyanocobalt (II)-ferrate (II) granules	100.0
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		-	
Moderately friable		-	
Highly friable		-	
Free aqueous liquids		-	
Free non-aqueous liquids	TR	-	
Powder/Ash	= 0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%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:

	(%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	NE	-
Reacting with water	0	-
Higher activity particles		-
Soluble solids as bulk chemical compounds		-

Hazardous substances / non hazardous pollutants: -

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

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA		-
DPTA		-
NTA		-
Polycarboxylic acids		-
Other organic complexants		-
Total complexing agents	= 0	-

Physical components:

	Number	Type(s) and comment
Sources		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1		-
EEE Type 2		-
EEE Type 3		-
EEE Type 4		-
EEE Type 5		-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction		
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments: -

Conditioning method: The Ion Exchange material has been conditioned using thermal vacuum in vessel drying.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix: -

Further information on the conditioning matrix: -

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
500 l RS drum (0mm Pb)	100.0	0.36	0.36	1	-

Range in container waste loading: -

Other information on packaging and conditioning: -

Conditioned density (t/m^3): = 0.11
Conditioned density comment: The bulk density of the waste is calculated using the total waste mass and volume of the wastestream.

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility	100.0		
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: The activity originates from Magnox FED which has been dissolved in the dissolution process and the resulting effluent abated within ADAP. Cs-Treat is one of the abatement steps in ADAP specifically to target Caesium. 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.

Measurement of radioactivities: Cs-137 and Co-60 both measured using in-situ gamma spectroscopy. Other radionuclides are taken from the specific activity of one package, as the inventory was calculated assuming all activity of FED was present in one package. Decayed to 01/04/2025.

Chemical form of radionuclides:

H-3: Likely present as water.
C-14: -
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: The chemical form of uranium isotopes has not been determined but will probably be uranium oxides.
Np: -
Pu: The chemical form of plutonium isotopes has not been determined but will probably be plutonium oxides.

WASTE STREAM **9B85/C** **FED Magnox - Secondary Ion Exchange Resin (Cs-Treat)**

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	1.18E+01	C C 2			Gd 153		8		
Be 10	5.34E-05	C C 2			Ho 163	5.86E-06	C C 2		
C 14	2.19E-01	C C 2			Ho 166m	7.39E-09	C C 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171	1.04E-05	C C 2		
Cl 36	2.12E-02	C C 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41	6.55E-02	C C 2			Pt 193		8		
Mn 53		8			Tl 204	2.01E-03	C C 2		
Mn 54	1.53E-08	C C 2			Pb 205		8		
Fe 55	1.12E-02	C C 2			Pb 210	1.71E-07	C C 2		
Co 60	2.87E-03	C C 2			Bi 208		8		
Ni 59	2.82E-03	C C 2			Bi 210m		8		
Ni 63	1.76E-01	C C 2			Po 210	1.64E-07	C C 2		
Zn 65	1.07E-09	C C 2			Ra 223		8		
Se 79	4.46E-06	C C 2			Ra 225	8.09E-08	C C 2		
Kr 81		8			Ra 226	5.56E-07	C C 2		
Kr 85	2.82E-02	C C 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	5.03E-02	C C 2			Th 227		8		
Zr 93	2.46E-05	C C 2			Th 228	1.03E-05	C C 2		
Nb 91		8			Th 229	8.13E-08	C C 2		
Nb 92		8			Th 230	5.28E-09	C C 2		
Nb 93m	1.90E-05	C C 2			Th 232		8		
Nb 94	2.63E-04	C C 2			Th 234	9.91E-06	C C 2		
Mo 93	3.05E-06	C C 2			Pa 231		8		
Tc 97		8			Pa 233	1.42E-06	C C 2		
Tc 99	1.94E-04	C C 2			U 232	1.01E-05	C C 2		
Ru 106	8.88E-07	C C 2			U 233	7.18E-05	C C 2		
Pd 107	2.20E-06	C C 2			U 234	9.94E-06	C C 2		
Ag 108m	2.97E-02	C C 2			U 235	2.02E-07	C C 2		
Ag 110m		8			U 236	1.85E-06	C C 2		
Cd 109	6.08E-08	C C 2			U 238	9.91E-06	C C 2		
Cd 113m	5.63E-02	C C 2			Np 237	1.42E-06	C C 2		
Sn 119m		8			Pu 236	1.74E-09	C C 2		
Sn 121m	4.88E-03	C C 2			Pu 238	1.75E-03	C C 2		
Sn 123		8			Pu 239	6.51E-03	C C 2		
Sn 126	9.68E-06	C C 2			Pu 240	6.51E-03	C C 2		
Sb 125	6.12E-04	C C 2			Pu 241	2.55E-02	C C 2		
Sb 126	1.36E-06	C C 2			Pu 242	8.62E-06	C C 2		
Te 125m	1.53E-04	C C 2			Am 241	9.81E-03	C C 2		
Te 127m		8			Am 242m	8.58E-05	C C 2		
I 129	4.15E-07	C C 2			Am 243	2.09E-05	C C 2		
Cs 134	5.37E-04	C C 2			Cm 242	7.08E-05	C C 2		
Cs 135	1.16E-05	C C 2			Cm 243	1.34E-04	C C 2		
Cs 137	3.92E-03	C C 2			Cm 244	1.12E-04	C C 2		
Ba 133	9.53E-04	C C 2			Cm 245	1.39E-08	C C 2		
La 137	6.29E-07	C C 2			Cm 246	1.04E-09	C C 2		
La 138		8			Cm 248		8		
Ce 144	2.00E-08	C C 2			Cf 249		8		
Pm 145	6.17E-04	C C 2			Cf 250		8		
Pm 147	1.29E-03	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	3.53E-03	C C 2			Unsp a				
Eu 152	1.03E-03	C C 2			Unsp b/g				
Eu 154	2.00E-03	C C 2			**Total a**	**2.50E-02**	*	**0**	*
Eu 155	4.50E-04	C C 2			**Total b/g**	**1.25E+01**	*	**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 the 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
* Total calculated from the 114 declared radionuclides