

WASTE STREAM**9B87/C****Miscellaneous Contaminated Items**

SITE Bradwell
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2022.....	0.5 m ³	2.6 m ³
Total future arisings:		0 m ³	0 m ³
Total waste volume:		0.5 m ³	2.6 m ³
Number of waste packages in stock:	At 1.4.2022.....	2 package(s)	

Comment on volumes: All waste is packaged and there will be no future arisings. Volume from WD/CALC/4107 Issue 3.

Uncertainty factors on volumes:

Stock (upper):	x 1.1	Arisings (upper)	x
Stock (lower):	x 0.9	Arisings (lower)	x

WASTE SOURCE Waste produced from various care and maintenance activities for Bradwell site packaged into 2 packages. Consists of various miscellaneous contaminated items (MCI) and redundant equipment and material mostly from equipment associated with the fuel handling route and the reactor primary gas circuits.

PHYSICAL CHARACTERISTICS

General description: The waste is miscellaneous contaminated items such as FED and ADAP sludge co-packaged together.

Physical components (%vol): This waste stream primarily consists of 8B FED (60%) and ADAP sludge (40%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.75

Comment on density: Density calculated using total wastestream mass (402kg) and total wastestream volume (0.54m³).

CHEMICAL COMPOSITION

General description and components (%wt): This waste stream consists of 8B FED (60%) and ADAP sludge (40%).

Chemical state: Neutral

Chemical form of radionuclides:

H-3: Any tritium is expected to be present as water but some may be in the form of other inorganic compounds or organic compounds.
 C-14: Chemical form of carbon 14 is not determined.
 Cl-36: Chemical form of chlorine 36 is not determined.
 U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
 Np: The chemical form of neptunium has not been determined.
 Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....			
Other ferrous metals.....	0		
Iron.....			
Aluminium.....	NE		
Beryllium.....	NE		

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Cobalt.....			
Copper.....	NE		
Lead.....	NE		
Magnox/Magnesium.....	60.0	Magnox AL80 and ZR85.	Proportions not known.
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....	NE		
Zircaloy/Zirconium.....	NE		
Other metals.....	NE		

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	NE		
Paper, cotton.....	NE		
Wood.....	NE		
Halogenated plastics	NE		
Total non-halogenated plastics.....	NE		
Condensation polymers.....	NE		
Others.....	NE		
Organic ion exchange materials....	0		
Total rubber.....	NE		
Halogenated rubber	NE		
Non-halogenated rubber.....	NE		
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..	0		
Inorganic sludges and flocs.....	40.0	ADAP sludge	
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	0		
Graphite.....	NE		

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Desiccants/Catalysts.....	
Asbestos.....	NE
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	P

Inorganic anions (%wt): None of the listed inorganic anions are expected to be present at greater than 1%.

	(%wt)	Type(s) and comment
Fluoride.....	<1.0	
Chloride.....	<1.0	
Iodide.....	<1.0	
Cyanide.....	0	
Carbonate.....	<1.0	
Nitrate.....	<1.0	
Nitrite.....	<1.0	
Phosphate.....	<1.0	
Sulphate.....	<1.0	
Sulphide.....	<1.0	

Materials of interest for waste acceptance criteria: No materials likely to pose a fire or other non-radiological hazard have been identified.

	(%wt)	Type(s) and comment
Combustible metals.....	NE	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	NE	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....		
Corrosive materials.....	NE	
Pyrophoric materials.....	0	
Generating toxic gases.....	NE	
Reacting with water.....	NE	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

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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.....		
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	

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Potential for the waste to contain discrete items:

Not yet determined. FED - In & of itself not a DI; Will likely contain "rogue" items (HDRIs) that will be (see Nimonic/Others). Sludge - In & of itself not a DI; assumed not likely to contain any "rogue" items that could be.

PACKAGING AND CONDITIONING

Container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l RS drum (0mm Pb)	100.0	0.27	0.27	2

Container type comment:

Waste has been packaged into 2 MOSAIK T ISAR IP-2 containers.

Range in container waste volume:

-

Other information on containers:

The container material is cast iron.

Conditioned density (t/m³):

0.75

Conditioned density comment:

Density calculated using total wastestream mass (402kg) and total wastestream volume (0.53m³).

Other information on conditioning:

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RADIOACTIVITY

Source:

The waste usually arises from the irradiated fuel handling, active filtration systems and pond operations. Components that have been associated with fuel pond operations and waste from the primary gas circuits are likely to be of high activity.

Uncertainty:

Specific activities of both waste packages were determined using gamma spectroscopy and fingerprints.

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 activities of both waste packages were measured and derived using gamma spectroscopy and the application of fingerprints. Due to the presence of ADAP sludge, the specific activity of the packages could not be derived prior to 2025. The inventory must be accepted as a best estimate. For further information on the method used to derive fingerprints, see WD/REP/0153/18 Issue 2.

Other information:

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	2.02E-02	CC 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	5.80E-04	CC 2			Ho 166m	2.6E-07	CC 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171	3.67E-08	CC 2		
Cl 36	4.61E-09	CC 2			Lu 174		8		
Ar 39	3.41E-05	CC 2			Lu 176		8		
Ar 42	1.03E-09	CC 2			Hf 178n	5.46E-07	CC 2		
K 40		8			Hf 182		8		
Ca 41	1.24E-05	CC 2			Pt 193	2.15E-05	CC 2		
Mn 53		8			Tl 204	5.87E-07	CC 2		
Mn 54	1.65E-09	CC 2			Pb 205		8		
Fe 55	2.2E-03	CC 2			Pb 210		8		
Co 60	1.97E-03	CC 2			Bi 208		8		
Ni 59	8.9E-06	CC 2			Bi 210m		8		
Ni 63	5.39E-03	CC 2			Po 210		8		
Zn 65	1.05E-09	CC 2			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85	6.35E-05	CC 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	6.87E-04	CC 2			Th 227		8		
Zr 93	5.87E-07	CC 2			Th 228	6.21E-08	CC 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230	6.21E-09	CC 2		
Nb 93m	9.57E-07	CC 2			Th 232		8		
Nb 94	5.89E-08	CC 2			Th 234	1E-05	CC 2		
Mo 93	1.7E-09	CC 2			Pa 231		8		
Tc 97		8			Pa 233	1.22E-06	CC 2		
Tc 99	1.79E-09	CC 2			U 232	6.06E-08	CC 2		
Ru 106	4.25E-08	CC 2			U 233	1.17E-07	CC 2		
Pd 107	2.13E-09	CC 2			U 234	2.85E-05	CC 2		
Ag 108m	6.73E-06	CC 2			U 235	7.54E-07	CC 2		
Ag 110m		8			U 236	2.78E-06	CC 2		
Cd 109	9.84E-09	CC 2			U 238	1E-05	CC 2		
Cd 113m	1.79E-07	CC 2			Np 237	1.22E-06	CC 2		
Sn 119m		8			Pu 236	3.48E-09	CC 2		
Sn 121m	2.74E-08	CC 2			Pu 238	2.11E-03	CC 2		
Sn 123		8			Pu 239	3.82E-03	CC 2		
Sn 126	7.93E-09	CC 2			Pu 240	3.79E-03	CC 2		
Sb 125	2.26E-06	CC 2			Pu 241	5.02E-02	CC 2		
Sb 126	1.11E-09	CC 2			Pu 242	5.03E-06	CC 2		
Te 125m	5.66E-07	CC 2			Am 241	2.75E-04	CC 2		
Te 127m		8			Am 242m	3.25E-05	CC 2		
I 129		8			Am 243	9.45E-06	CC 2		
Cs 134	5.82E-07	CC 2			Cm 242	2.66E-05	CC 2		
Cs 135	1.59E-08	CC 2			Cm 243	3.7E-06	CC 2		
Cs 137	1.45E-03	CC 2			Cm 244	6.07E-05	CC 2		
Ba 133	1.23E-05	CC 2			Cm 245	4.02E-09	CC 2		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144	3.43E-09	CC 2			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	1.65E-05	CC 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	2.28E-05	CC 2			Other a				
Eu 152	5.63E-07	CC 2			Other b/g				
Eu 154	2.05E-05	CC 2			Total a	1.01E-02	CC 2	0	
Eu 155	3.31E-06	CC 2			Total b/g	8.29E-02	CC 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