

WASTE STREAM**9B17/C****Miscellaneous Contaminated Items**

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

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2019.....	27.4 m ³	65.2 m ³
Total future arisings:		0 m ³	0 m ³
Total waste volume:		27.4 m ³	65.2 m ³
Number of waste packages in stock:	At 1.4.2019.....	12 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 Waste produced from various care and maintenance activities for Bradwell site packaged into 12 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 redundant equipment, filters and miscellaneous contaminated items co-packaged together.

Physical components (%vol): This waste stream primarily consists of metallic waste including from waste BROKs, gravel, interfacial material from vaults, sludge (ponds and ADAP), FED, redundant pumps, vacuum bags, filter media and pots, sand and resin.

Sealed sources: -

Bulk density (t/m³): ~0.34

Comment on density: Taken from waste stream package records mass divided by volume loaded into the 12 containers

CHEMICAL COMPOSITION

General description and components (%wt): Mixed metallic waste including steel (~40%), gravel (~19%), sludge (~13%), FED (~10%), sand (~8%), resin (1%) Other components have not been assessed but plastic will be present. Fission products, actinides and other activation products will be present as contaminants.

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): -

Stainless steel.....		
Other ferrous metals.....	~40.0	Including redundant pumps, filter pots and catch pans.
Iron.....		
Aluminium.....	NE	
Beryllium.....	NE	
Cobalt.....		

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Copper.....	NE
Lead.....	NE
Magnox/Magnesium.....	~10.0
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	NE
Zircaloy/Zirconium.....	NE
Other metals.....	NE

The presence of "other" metals has not been assessed.

Organics (%wt):

The quantities of organic materials have not been assessed but plastics will be present. PVC may be present in trace quantities.

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):

-	
Inorganic ion exchange materials.	1.0
Inorganic sludges and flocs.....	~13.0
Soil.....	0
Brick/Stone/Rubble.....	~19.0
Cementitious material.....	0
Sand.....	~8.0
Glass/Ceramics.....	0
Graphite.....	NE
Desiccants/Catalysts.....	
Asbestos.....	NE
Non/low friable.....	
Moderately friable.....	

Gravel

	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%.	
	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.	
	Combustible metals.....	NE
	Low flash point liquids.....	0
	Explosive materials.....	0
	Phosphorus.....	0
	Hydrides.....	0
	Biological etc. materials.....	NE
	Biodegradable materials.....	
	Putrescible wastes.....	0
	Non-putrescible wastes.....	
	Corrosive materials.....	NE
	Pyrophoric materials.....	0
	Generating toxic gases.....	NE
	Reacting with water.....	NE
	Active particles.....	
	Soluble solids as bulk chemical compounds.....	
Hazardous substances / non hazardous pollutants:	-	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	

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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 (m ³)	Payload (m ³)	Number of packages
	3m ³ RS box	100.0	2.29	2.29	12

Container type comment: -

Range in container waste volume: No significant variability is expected.

Other information on containers: The container material is cast iron.

Conditioned density (t/m³): -

Conditioned density comment: -

Other information on conditioning: -

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 all 12 waste packages were determined using gamma spectroscopy and fingerprints. The above values (Tbq/m ³) are representative of the waste across the packages and each package's specific activity falls within the quoted uncertainty bands.
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 all 12 waste packages were measured and derived using gamma spectroscopy and the application of fingerprints. and decayed for RWI 2019
Other information:	-

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3	5.93E-04	DD 2			Gd 153		8		
Be 10		8			Ho 163	4.09E-08	DD 2		
C 14	8.76E-04	DD 2			Ho 166m	9.28E-07	DD 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171	1.77E-07	DD 2		
Cl 36	6.37E-05	DD 2			Lu 174	1.28E-09	DD 2		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n	1.60E-06	DD 2		
K 40	3.95E-08	DD 2			Hf 182		8		
Ca 41	5.29E-04	DD 2			Pt 193	3.53E-03	DD 2		
Mn 53		8			Tl 204	1.29E-06	DD 2		
Mn 54	6.48E-07	DD 2			Pb 205		8		
Fe 55	4.65E-04	DD 2			Pb 210		8		
Co 60	4.50E-03	CC 1			Bi 208		8		
Ni 59	3.38E-05	DD 2			Bi 210m		8		
Ni 63	2.38E-03	DD 2			Po 210		8		
Zn 65	5.03E-08	DD 2			Ra 223		8		
Se 79	3.13E-09	DD 2			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	2.14E-03	DD 2			Th 227		8		
Zr 93	3.57E-06	DD 2			Th 228	1.77E-09	DD 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	2.30E-03	DD 2			Th 232		8		
Nb 94	1.76E-06	DD 2			Th 234	1.27E-06	DD 2		
Mo 93	1.38E-06	DD 2			Pa 231		8		
Tc 97		8			Pa 233	4.01E-08	DD 2		
Tc 99	3.46E-05	DD 2			U 232	1.73E-09	DD 2		
Ru 106	3.60E-07	DD 2			U 233	3.77E-09	DD 2		
Pd 107	7.64E-09	DD 2			U 234	6.07E-07	DD 2		
Ag 108m	2.37E-04	DD 2			U 235	1.62E-08	DD 2		
Ag 110m	1.48E-08	DD 2			U 236	8.13E-08	DD 2		
Cd 109	1.89E-04	DD 2			U 238	1.27E-06	DD 2		
Cd 113m	4.35E-07	DD 2			Np 237	4.01E-08	DD 2		
Sn 119m		8			Pu 236		8		
Sn 121m	9.99E-06	DD 2			Pu 238	1.02E-04	DD 2		
Sn 123		8			Pu 239	1.50E-04	DD 2		
Sn 126	2.84E-08	DD 2			Pu 240	1.88E-04	DD 2		
Sb 125	2.73E-06	DD 2			Pu 241	3.65E-03	DD 2		
Sb 126	3.98E-09	DD 2			Pu 242	1.56E-07	DD 2		
Te 125m	6.84E-07	DD 2			Am 241	7.28E-04	DD 2		
Te 127m		8			Am 242m	9.67E-07	DD 2		
I 129	3.47E-06	DD 2			Am 243	2.93E-07	DD 2		
Cs 134	2.07E-05	DD 2			Cm 242	8.01E-07	DD 2		
Cs 135	7.55E-08	DD 2			Cm 243	8.87E-08	DD 2		
Cs 137	4.57E-03	CC 2			Cm 244	1.60E-06	DD 2		
Ba 133	4.43E-04	DD 2			Cm 245		8		
La 137	4.22E-08	DD 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144	4.44E-08	DD 2			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	2.11E-06	DD 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	8.63E-05	DD 2			Other a				
Eu 152	1.24E-05	DD 2			Other b/g				
Eu 154	1.02E-05	DD 2			Total a	1.17E-03	DD 2	0	
Eu 155	1.94E-04	DD 2			Total b/g	2.69E-02	DD 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