WASTE STREAM 9B83/C Graphite Filter Dust Pots

SITE Bradwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2019.....	1.7 m³	9.2 m³
Total future arisings:		0 m³	0 m³
Total waste volume:		1.7 m³	9.2 m³
Number of waste packages in stock:	At 1.4.2019.....	7 package(s)	

Comment on volumes: Volume calculated based on each package being 55% full.

Uncertainty factors on volumes:

Stock (upper):	x 1.2	Arisings (upper)	x
Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE The waste was produced in the by-pass filters, located on the reactor gas circuits. The graphite dust (and rust fragments) in the gas circuit were deposited into the by-pass filter catch pots, which were in-turn decanted into plastic bags within the interim storage filter dust pots, which were constructed from 8 inch nominal bore carbon steel pipe fittings. Sand arose from filter units in the Pond Water Treatment Plant (PWTP) - formerly known as 9B65.

PHYSICAL CHARACTERISTICS

General description: Graphite dust originates from the by-pass filter units, where graphite dust was removed from the reactor primary gas circuits. The dust also contains fragments of rust from the reactor pressure vessel internals. This was co-packaged with sand from filter units in the Pond Water Treatment Plant (PWTP) into 7 MOSAIKs.

Physical components (%vol): Graphite dust, contained in carbon steel fabricated interim storage pots, and sand.

Sealed sources: -

Bulk density (t/m³): ~1.5

Comment on density: Density is based on an engineering estimate given the approximate size and weight of the filter dust pot (assuming an overall weight of 70kg and an external volume of 50 litres). The mass and density of the dust within the filter dust pot has not been determined but the contribution to the overall mass and density will be insignificant. The pots have an approximate 14 litre capacity and are estimated to be 75% full (and assuming a bulk density for the graphite dust of 0.56 t/m3). Therefore, the mass of the graphite dust per filter dust pot is estimated to be 6kg.

CHEMICAL COMPOSITION

General description and components (%wt): Graphite dust (2%), contained in carbon steel fabricated interim storage pots (24 wt%), and sand (74 wt%) co-packaged in 7 MOSAIKs.

Chemical state: -

Chemical form of radionuclides: -

Metals and alloys (%wt): -

Stainless steel.....	0	
Other ferrous metals.....	24.0	Carbon steel fabricated interim storage pots
Iron.....		
Aluminium.....	0	
Beryllium.....		
Cobalt.....		
Copper.....	0	

WASTE STREAM 9B83/C Graphite Filter Dust Pots

	Lead	0
	Magnox/Magnesium	0
	Nickel	
	Titanium	
	Uranium	
	Zinc	0
	Zircaloy/Zirconium	0
	Other metals	0
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):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs	0
	Soil	0
	Brick/Stone/Rubble	0
	Cementitious material	0
	Sand	74.0
	Glass/Ceramics	0
	Graphite	2.0
	Desiccants/Catalysts	
	Asbestos	0
	Non/low friable	
	Moderately friable	
	Highly friable	
	Free aqueous liquids	0

WASTE STREAM 9B83/C Graphite Filter Dust Pots

	Free non-aqueous liquids	0
	Powder/Ash	TR
Inorganic anions (%wt):	-	
	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	0
	Reacting with water	0
	Active particles	
	Soluble solids as bulk chemical compounds	
Hazardous substances / non hazardous pollutants:	-	
	Acrylamide	
	Benzene	
	Chlorinated solvents	
	Formaldehyde	
	Organometallics	
	Phenol	
	Styrene	
	Tri-butyl phosphate	
	Other organophosphates	
	Vinyl chloride	

WASTE STREAM 9B83/C Graphite Filter Dust Pots

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): No

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... 0

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	0.239	0.2385	8

Container type comment: -

Range in container waste volume: -

Other information on containers: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: -

RADIOACTIVITY

Source: Contamination by graphite from primary circuit and the filtering of active material from pond water using sand filters.

WASTE STREAM 9B83/C Graphite Filter Dust Pots

Uncertainty:	Specific activities of all 7 waste packages were determined using gamma spectroscopy and fingerprints. The above values (Tbq/m3) 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 7 waste packages were measured and derived using gamma spectroscopy and the application of fingerprints. Decayed from 2013 by six years to 01/04/2019.
Other information:	Specific activity is a function of operating history. Activities given are based on the graphite dust (without accounting for the mass of the carbon steel pot).

WASTE STREAM 9B83/C Graphite Filter Dust Pots

Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	4.03E-03	C C 2			Gd 153		8		
Be 10	3.67E-09	C C 2			Ho 163	7.84E-07	C C 2		
C 14	7.87E-03	C C 2			Ho 166m	2.41E-06	C C 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	3.65E-04	C C 2			Lu 174		8		
Ar 39	2.39E-06	C C 2			Lu 176		8		
Ar 42		8			Hf 178n	3.49E-06	C C 2		
K 40	6.99E-08	C C 2			Hf 182		8		
Ca 41	4.15E-04	C C 2			Pt 193	1.61E-03	C C 2		
Mn 53		8			Tl 204	4.11E-07	C C 2		
Mn 54		8			Pb 205		8		
Fe 55	1.13E-02	C C 2			Pb 210		8		
Co 60	2.10E-02	B B 1			Bi 208		8		
Ni 59	2.88E-04	C C 2			Bi 210m		8		
Ni 63	2.07E-02	C C 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	8.18E-09	C C 2			Ra 225		8		
Kr 81	1.69E-08	C C 2			Ra 226		8		
Kr 85	1.98E-04	C C 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	5.98E-04	C C 2			Th 227		8		
Zr 93	3.2E-06	C C 2			Th 228	1.13E-09	C C 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	4.92E-06	C C 2			Th 232		8		
Nb 94	1.38E-05	C C 2			Th 234	6.83E-07	C C 2		
Mo 93	1.82E-05	C C 2			Pa 231		8		
Tc 97		8			Pa 233	2.72E-08	C C 2		
Tc 99	2.71E-04	C C 2			U 232	1.10E-09	C C 2		
Ru 106		8			U 233	4.11E-09	C C 2		
Pd 107	2E-08	C C 2			U 234	5.28E-07	C C 2		
Ag 108m	2.10E-03	C C 2			U 235	1.54E-08	C C 2		
Ag 110m		8			U 236	5.66E-08	C C 2		
Cd 109		8			U 238	6.83E-07	C C 2		
Cd 113m	7.20E-07	C C 2			Np 237	2.72E-08	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m	8.26E-06	C C 2			Pu 238	6.89E-05	C C 2		
Sn 123		8			Pu 239	1.19E-04	C C 2		
Sn 126	7.42E-08	C C 2			Pu 240	1.17E-04	C C 2		
Sb 125	1.78E-07	C C 2			Pu 241	2.24E-03	C C 2		
Sb 126	1.04E-08	C C 2			Pu 242	1.02E-07	C C 2		
Te 125m	4.46E-08	C C 2			Am 241	5.36E-04	C C 2		
Te 127m		8			Am 242m	6.13E-07	C C 2		
I 129	2.81E-05	C C 2			Am 243	1.92E-07	C C 2		
Cs 134	5.99E-06	C C 2			Cm 242	5.06E-07	C C 2		
Cs 135	1.49E-07	C C 2			Cm 243	4.41E-07	C C 2		
Cs 137	1.20E-02	C C 2			Cm 244	5.60E-06	C C 2		
Ba 133	1.72E-04	C C 2			Cm 245		8		
La 137	8.48E-08	C C 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	7.02E-09	C C 2			Cf 250		8		
Pm 147	1.04E-06	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	8.03E-04	C C 2			Other a				
Eu 152	8.60E-05	C C 2			Other b/g				
Eu 154	7.21E-05	C C 2			**Total a**	**8.49E-04**	**C C 2**	**0**	
Eu 155	2.69E-04	C C 2			**Total b/g**	**8.65E-02**	**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