WASTE STREAM 3J313 Decommissioning Stage 3: Graphite ILW

SITE Dungeness B

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2019 - 31.3.2115.....	0 m³
	1.4.2115 - 31.3.2116.....	5.1 m³
	1.4.2116 - 31.3.2117.....	733.3 m³
	1.4.2117 - 31.3.2118.....	730.5 m³
	1.4.2118 - 31.3.2119.....	491.0 m³
Total future arisings:		1959.8 m³
Total waste volume:		1959.8 m³

Comment on volumes: Waste volumes will be variable depending on station operating conditions.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.25
Stock (lower):	x	Arisings (lower)	x 0.75

WASTE SOURCE Moderator and reflector graphite from reactor dismantling.

PHYSICAL CHARACTERISTICS

General description: Graphite blocks and other graphite components. Waste can be packaged in standard NDA packages.

Physical components (%vol): Graphite (~100%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.28

Comment on density: Future arisings based on envelope volume, density calculated on this basis.

CHEMICAL COMPOSITION

General description and components (%wt): Graphite and possible traces of ferrous metals.

Chemical state: -

Chemical form of radionuclides:
H-3: Diffused into matrix
C-14: Incorporated in the graphite
Cl-36: Incorporated in the graphite
Se-79: Not significant
Tc-99: Not determined
I-129: Not significant
Ra: Radium content is insignificant
Th: Thorium content is Insignificant
U: Uraniumcontent is insignificant
Np: Neptunium content is insignificant
Pu: Plutonium content is insignificant

Metals and alloys (%wt): -

Stainless steel.....	NE
Other ferrous metals.....	NE
Iron.....	0
Aluminium.....	0
Beryllium.....	0
Cobalt.....	0
Copper.....	0
Lead.....	0

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	Magnox/Magnesium	0
	Nickel	0
	Titanium	0
	Uranium	0
	Zinc	0
	Zircaloy/Zirconium	0
	Other metals	0
Organics (%wt):	None expected.	
	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	0
	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	0
	Glass/Ceramics	0
	Graphite	100.0
	Desiccants/Catalysts	0
	Asbestos	0
	Non/low friable	
	Moderately friable	
	Highly friable	
	Free aqueous liquids	0
	Free non-aqueous liquids	0

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	Powder/Ash	0	
Inorganic anions (%wt):	None likely to be present.		
	Fluoride	0	
	Chloride	0	
	Iodide	0	
	Cyanide	0	
	Carbonate	0	
	Nitrate	0	
	Nitrite	0	
	Phosphate	0	
	Sulphate	0	
	Sulphide	0	
Materials of interest for waste acceptance criteria:	No materials likely to pose a fire or other non-radiological hazard have been identified. Graphite presents a low fire risk; it is difficult but not impossible to ignite.		
	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	0	
	Corrosive materials	0	
	Pyrophoric materials	0	
	Generating toxic gases	0	
	Reacting with water	0	
	Active particles	P	May be present.
	Soluble solids as bulk chemical compounds	0	
Hazardous substances / non hazardous pollutants:	-		
	Acrylamide	NE	
	Benzene	NE	
	Chlorinated solvents	NE	
	Formaldehyde	NE	
	Organometallics	NE	
	Phenol	NE	
	Styrene	NE	
	Tri-butyl phosphate	NE	
	Other organophosphates	NE	
	Vinyl chloride	NE	
	Arsenic	NE	

Barium	NE	
Boron	NE	
Cadmium	NE	
Caesium	NE	
Selenium	NE	
Chromium	NE	
Molybdenum	NE	
Thallium	NE	
Tin	NE	
Vanadium	NE	
Mercury compounds	NE	
Others	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1	0	
EEE Type 2	0	
EEE Type 3	0	
EEE Type 4	0	
EEE Type 5	0	
Complexing agents (%wt):	Not yet determined	
EDTA	NE	
DPTA	NE	
NTA	NE	
Polycarboxylic acids	NE	
Other organic complexants	NE	Only trace quantities, if any.
Total complexing agents	NE	

PACKAGING AND CONDITIONING

Conditioning method:	The waste is not expected to be supercompacted. It will be placed in "baskets" in the waste packages, and is assumed to be encapsulated.
Plant Name:	-
Location:	-
Plant startup date:	85 years after reactor shut-down.
Total capacity (m^3/y incoming waste):	~5000.0
Target start date for packaging this stream:	-
Throughput for this stream (m^3/y incoming waste):	-
Other information:	Waste will be conditioned when removed from the reactor.

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
4m box (100mm concrete shielding)	100.0	~10.67	14.3	184

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Likely container type comment:	-
Range in container waste volume:	-
Other information on containers:	Stainless Steel.
Likely conditioning matrix:	BFS/OPC
Other information:	-
Conditioned density (t/m³):	~1.86
Conditioned density comment:	Assumes waste will be encapsulated, matrix would be likely to be BFS/OPC.
Other information on conditioning:	The waste will be in baskets placed in the waste packages. Baskets of different Stage 3 ILW wastes may be in the same waste package.
Opportunities for alternative disposal routing:	No

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	Activation of the graphite and impurities, Contamination by other activated materials.
Uncertainty:	The values quoted were derived by calculation from available material specification and are indicative of the activities that are expected. The major source of uncertainty is the impurity levels.
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:	Activation/decay calculations based on neutron flux and projected operating history.
Other information:	There may be some contamination by Cs137. The activities quoted are for the time at which this waste will arise (i.e. ~85 years after end of generation).

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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			1.07E-03	C C 2	Gd 153				
Be 10				8	Ho 163				
C 14			1.3E-01	C C 2	Ho 166m			4E-07	C C 2
Na 22				4	Tm 170				
Al 26				4	Tm 171				
Cl 36			7.58E-04	C C 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41			1.41E-05	C C 2	Pt 193				
Mn 53					Tl 204				
Mn 54				8	Pb 205				
Fe 55				8	Pb 210				8
Co 60			1.92E-07	C C 2	Bi 208				
Ni 59			8.69E-06	C C 2	Bi 210m				
Ni 63			5.55E-04	C C 2	Po 210				8
Zn 65				8	Ra 223				
Se 79				8	Ra 225				
Kr 81					Ra 226				8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90				8	Th 227				
Zr 93				8	Th 228				
Nb 91					Th 229				8
Nb 92					Th 230				8
Nb 93m			3.47E-08	C C 2	Th 232				8
Nb 94			4.94E-08	C C 2	Th 234				
Mo 93			6.25E-06	C C 2	Pa 231				8
Tc 97					Pa 233				
Tc 99			1.23E-06	C C 2	U 232				
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			4.2E-07	C C 2	U 235				8
Ag 110m					U 236				8
Cd 109					U 238				8
Cd 113m					Np 237				8
Sn 119m					Pu 236				
Sn 121m			8.66E-07	C C 2	Pu 238				8
Sn 123					Pu 239				8
Sn 126				8	Pu 240				8
Sb 125					Pu 241				8
Sb 126					Pu 242				8
Te 125m					Am 241				8
Te 127m					Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137				8	Cm 244				8
Ba 133			1.38E-08	C C 2	Cm 245				8
La 137					Cm 246				8
La 138					Cm 248				
Ce 144				8	Cf 249				
Pm 145			3.3E-08	C C 2	Cf 250				
Pm 147				8	Cf 251				
Sm 147					Cf 252				
Sm 151			3.41E-07	C C 2	Other a				8
Eu 152			2.85E-08	C C 2	Other b/g				8
Eu 154			7.72E-07	C C 2	**Total a**		**0**	**<1E-09**	**8**
Eu 155				6	**Total b/g**		**0**	**1.32E-01**	**C C 2**

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