

WASTE STREAM	4B317	Decommissioning Stage 3: Graphite LLW
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SITE Hunterston B

SITE OWNER EDF Energy Nuclear Generation Ltd (EDFE NGL)

WASTE CUSTODIAN EDF Energy Nuclear Generation Ltd (EDFE NGL)

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025 = 0			
Future arisings:	1.4.2025 - 31.3.2109 = 0			
	1.4.2109 - 31.3.2110 = 18.3			
	1.4.2110 - 31.3.2111 = 178.6			
	1.4.2111 - 31.3.2112 = 178.6			
	1.4.2112 - 31.3.2113 = 90.9			
Total future arisings:	466.5			
Total waste volume:	466.5			

Number of waste packages in stock: At 1.4.2025..... - packages

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

Additional information on quantities: Volumes based on Back to Bio Shield strategy. Work is ongoing looking at optimising the strategy which could lead to a change in volume and timings of arisings across Final Site Clearance wastes (300s) and Pre C&M wastes (100s), in future submissions.

Uncertainty factors on volumes: Stock (upper): x - Arisings (upper): x 1.50
Stock (lower): x - Arisings (lower): x 0.50

WASTE SOURCE Reflector and shield graphite from reactor dismantling.

PHYSICAL CHARACTERISTICS

General description: Graphite blocks and other graphite components (100%). Waste can be packaged in standard NDA packages.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.3

Comment on density: Assumes 10% of graphite will arise in rubble form with a worse packing factor than blocks.

CHEMICAL COMPOSITION

General description and components (%wt): Graphite (100%) and possible traces of ferrous metals.

Chemical state: -

Sheet metal proportion / thickness: Waste expected to be placed in metal 'baskets' before being placed in waste packages.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	NE	-	
Other ferrous metals.....	NE	-	
Iron.....	= 0	-	
Aluminium.....	= 0	-	
Beryllium.....	= 0	-	
Cobalt.....	= 0	-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	= 0	-	
Uranium.....	= 0	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose...	= 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):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials...	= 0	-	100.0
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	-	
Powder/Ash...	= 0	-	

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

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
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:

	(%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...	= 0	-
Corrosive materials...	= 0	-
Pyrophoric materials...	= 0	-
Generating toxic gases...	= 0	-
Reacting with water...	= 0	-
Higher activity particles...	P	May be present.
Soluble solids as bulk chemical compounds...	= 0	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
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	-
Boron (in Boral).....	NE	-
Boron (non-Boral).....	NE	-
Cadmium.....	NE	-
Caesium.....	NE	-
Selenium.....	NE	-
Chromium.....	NE	-
Molybdenum.....	NE	-
Thallium.....	NE	-
Tin.....	NE	-
Vanadium.....	NE	-
Mercury compounds.....	NE	-
Others.....	NE	-

Complexing agents (%wt):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....	NE	-
NTA.....	NE	-
Polycarboxylic acids.....	NE	-
Other organic complexants.....	NE	Only trace quantities, if any.
Total complexing agents.....	NE	-

Physical components:

	Number	Type(s) and comment
Sources.....	= 0	-
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		= 100.0

Comments on planned treatments:

-

Conditioning method:

-

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 (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	4 m box (LLW)	100.0	15.0	16.2	32	-

Range in container waste loading:

Other information on packaging and conditioning: -

Conditioned density (t/m³): -

Conditioned density comment: -

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)	= 100.0	~ 1.3	
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			
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: Activation of the graphite and impurities.

Uncertainty: The values quoted were derived by calculation from available material specification and are indicative of the activities that are expected. A major source of uncertainty is the impurity levels.

Measurement of radioactivities: Activation/decay calculations based on neutron flux and operating history. The activities quoted are for the time at which this waste will arise (i.e. ~85 years after end of generation). There may be some contamination by Cs137.

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: Uranium content is insignificant.
- Np: Neptunium content is insignificant.
- Pu: Plutonium content is insignificant.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3			2.39E-04	C C 2	Gd 153				
Be 10			1.51E-11	C C 2	Ho 163				
C 14			8.08E-04	C C 2	Ho 166m			5.99E-08	C C 2
Na 22				4	Tm 170				
Al 26				4	Tm 171				
Cl 36			9.24E-05	C C 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41			1.71E-06	C C 2	Pt 193				
Mn 53					Ti 204				
Mn 54				8	Pb 205				
Fe 55			5.16E-12	C C 2	Pb 210				8
Co 60			2.89E-08	C C 2	Bi 208				
Ni 59			1.02E-06	C C 2	Bi 210m				
Ni 63			6.18E-05	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			3.66E-09	C C 2	Th 232				8
Nb 94			6.58E-09	C C 2	Th 234				
Mo 93			9.38E-07	C C 2	Pa 231				8
Tc 97					Pa 233				
Tc 99			1.87E-07	C C 2	U 232				
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			5.10E-08	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			6.99E-09	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			1.32E-08	C C 2	Cm 245				8
La 137					Cm 246				8
La 138					Cm 248				
Ce 144				8	Cf 249				
Pm 145			8.75E-09	C C 2	Cf 250				
Pm 147				8	Cf 251				
Sm 147					Cf 252				
Sm 151			1.52E-06	C C 2	Unsp a				8
Eu 152			4.80E-06	C C 2	Unsp b/g				8
Eu 154			2.37E-07	C C 2	Total a	0	*	2.45E-17	*
Eu 155			3.72E-11	C C 2	Total b/g	0	*	1.21E-03	*

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