

WASTE STREAM	3M22	Miscellaneous Activated Components & Fuel Stringer Debris
--------------	------	---

SITE Heysham 2

SITE OWNER EDF Energy Nuclear Generation Ltd (EDFE NGL)

WASTE CUSTODIAN EDF Energy Nuclear Generation Ltd (EDFE NGL)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 222.0		
Future arisings:	1.4.2025 - 31.3.2030	= 40.0		
	1.4.2030 - 31.3.2033	= 90.0		
Total future arisings:		130.0		
Total waste volume:		352.0		

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

Comment on arising rates: Stock volume updated to 222 m3 following station assessment. Waste volumes will be variable depending on station operating conditions. 8 m3/yr estimated until end of life at Mar 2030 and 30 m3/yr estimated during the defueling period until 2033. Total future arising increased compared to 2022 value due to lifetime extension and end of defueling at 2033

Additional information on quantities: -

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper): x 1.50
Stock (lower): x 0.75 Arisings (lower): x 0.50

WASTE SOURCE The waste is primarily produced as a result of dismantling fuel stringers.

PHYSICAL CHARACTERISTICS

General description: The waste includes tiebar sections, top reflectors, central inertial collectors, anti-gapping units, piston seals and cartridge assemblies, stabilising brushes, other miscellaneous components, control rods and parts of control rod chains, neutron shield plugs and flux measuring detectors. Some additional high activity components, in steel tins, may also be present. Some large items may be present in the waste. "Graphite sleeves/vacancy stringers will also be present. Percentage breakdown of components is not currently assessed. The waste is largely composed of steel (~85%) and graphite (~10%) items, with some nimonic (~5%)."

Changes since waste generated: -

Bulk density (t/m³): ~ 0.50

Comment on density: Estimated average density of the waste.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is predominantly stainless steel and graphite. There will be traces of organic materials (e.g. oil) and complexing agents (e.g. decontamination chemicals). Stainless steel (~85%), graphite (~10%), nimonic (~5%).

Chemical state: Neutral

Sheet metal proportion / thickness: Some large items may be present in the waste.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 85.0	-	
Other ferrous metals.....	NE	-	
Iron.....	NE	-	
Aluminium.....	NE	-	
Beryllium.....	NE	-	
Cobalt.....	NE	-	
Copper.....	NE	-	
Lead.....	NE	-	
Magnox/Magnesium.....	NE	-	
Nickel.....	~ 5.0	-	
Titanium.....	NE	-	
Uranium.....	NE	-	
Zinc.....	NE	-	
Zircaloy/Zirconium.....	NE	-	
Other metals.....	NE	-	

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.....	NE	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
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.....	= 10.0	-	
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.....	NE	-
Chloride.....	NE	-
Iodide.....	NE	-
Cyanide.....	NE	-
Carbonate.....	NE	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	NE	-
Sulphate.....	NE	-
Sulphide.....	NE	-

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	-
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	If present there will only be trace quantities.
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	On-site	= 100.0
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		

Comments on planned treatments:

-

The waste will be conditioned to satisfy the disposal requirements which are effective at the time of retrieval/conditioning. It is currently assumed that the waste will be placed in 'baskets' in the waste packages and will be encapsulated.

Conditioning plants:

Plant Name	Location
Heysham 2 Waste Management Centre	Heysham 2

Likely conditioning matrix:

-

Further information on the conditioning matrix:

Conditioning matrix will be BFS/OPC. Mix ratios are yet to be established

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 (100 mm concrete shielding)	100.0	12.2	14.3	29	-

Range in container waste loading:

Other information on packaging and conditioning:

Waste will be retained on site pending Final Site Clearance, to let nuclides such as Co-60 undergo considerable radioactive decay. Baskets of different Final Site Clearance ILW wastes may be in the same waste package.

Conditioned density (t/m³):

~ 3.0

Conditioned density comment:

Conditioned density is estimated to be in the region of 2-3t/m³

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		
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 nuclides within the graphite, steel and the Nimonic will be the main sources of activity.

Uncertainty:

-

Measurement of radioactivities:

Theoretical assessment.

Chemical form of radionuclides:

H-3: Diffused into materials
C-14: Graphite
Cl-36: Incorporated into steels
Se-79: Not expected to be significant
Tc-99: Not expected to be significant
I-129: Not expected to be significant
Ra: Not expected to be significant
Th: Not expected to be significant
U: Not expected to be significant
Np: Not expected to be significant
Pu: Not expected to be significant

WASTE STREAM		3M22		Miscellaneous Activated Components & Fuel Stringer Debris					
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	1.28E-01	C C 2	2.59E-01	C C 2	Gd 153				
Be 10	5.77E-07	C C 2	5.77E-07	C C 2	Ho 163				
C 14	2.75E-02	C C 2	2.75E-02	C C 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	7.30E-06	C C 2	7.30E-06	C C 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41	1.99E-05	C C 2	1.99E-05	C C 2	Pt 193				
Mn 53					Tl 204				
Mn 54	9.34E-01	C C 2	1.56E+01	C C 2	Pb 205				
Fe 55	6.45E+01	C C 2	5.29E+02	C C 2	Pb 210	8			8
Co 60	6.40E+01	C C 2	2.41E+02	C C 2	Bi 208				
Ni 59	2.27E-01	C C 2	2.27E-01	C C 2	Bi 210m				
Ni 63	2.84E+01	C C 2	2.84E+01	C C 2	Po 210	8			8
Zn 65	5.03E-06	C C 2	9.80E-05	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	8			8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93	1.55E-07	C C 2	1.55E-07	C C 2	Th 228				
Nb 91					Th 229	8			8
Nb 92					Th 230	8			8
Nb 93m	3.18E-04	C C 2	5.54E-04	C C 2	Th 232	8			8
Nb 94	1.25E-02	C C 2	1.25E-02	C C 2	Th 234				
Mo 93	1.89E-03	C C 2	2.10E-03	C C 2	Pa 231	8			8
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233	8			8
Pd 107					U 234	8			8
Ag 108m	1.44E-03	C C 2	1.44E-03	C C 2	U 235	8			8
Ag 110m	6.20E-02	C C 2	1.18E+00	C C 2	U 236	8			8
Cd 109	1.86E-04	C C 2	2.35E-03	C C 2	U 238	8			8
Cd 113m	2.83E-08	C C 2	5.30E-08	C C 2	Np 237	8			8
Sn 119m	6.41E-09	C C 2	6.41E-09	C C 2	Pu 236				
Sn 121m	4.48E-05	C C 2	5.61E-05	C C 2	Pu 238	8			8
Sn 123	6.41E-07	C C 2	1.66E-05	C C 2	Pu 239	8			8
Sn 126					Pu 240	8			8
Sb 125	1.28E-04	C C 2	8.43E-04	C C 2	Pu 241	8			8
Sb 126					Pu 242	8			8
Te 125m					Am 241				8
Te 127m					Am 242m				8
I 129					Am 243				8
Cs 134	4.48E-09	C C 2	3.84E-08	C C 2	Cm 242	8			8
Cs 135					Cm 243	8			8
Cs 137					Cm 244	8			8
Ba 133	1.37E-06	C C 2	3.05E-06	C C 2	Cm 245	8			8
La 137					Cm 246	8			8
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151	5.08E-06	C C 2	5.64E-06	C C 2	Unsp a	8			8
Eu 152	6.66E-03	C C 2	1.27E-02	C C 2	Unsp b/g				
Eu 154	4.46E-03	C C 2	1.14E-02	C C 2	Total a	0	*	0	*
Eu 155	2.11E-03	C C 2	8.62E-03	C C 2	Total b/g	1.58E+02	*	8.16E+02	*

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