

<b>WASTE STREAM</b>	<b>3M17 Catalysts</b>
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**SITE** Heysham 2

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** ILW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	0 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2028.....	0 m <sup>3</sup>
	1.4.2028 - 31.3.2030.....	0 m <sup>3</sup>
	1.4.2030 - 31.3.2031.....	13.0 m <sup>3</sup>
Total future arisings:		13.0 m <sup>3</sup>
Total waste volume:		13.0 m <sup>3</sup>

Comment on volumes: Waste volumes will be variable depending on station operating conditions. The volume of catalyst in the recombination units is known and so future arising volumes are predictable.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.75  
 Stock (lower): x Arisings (lower) x 0.25

**WASTE SOURCE** Exhausted catalysts that have been used for the recombination of carbon monoxide within carbon dioxide reactor coolant.

**PHYSICAL CHARACTERISTICS**

General description: Exhausted catalysts that have been used for the recombination of carbon dioxide coolant. There will also be ceramic and mild steel shielding balls. There are no large items in the waste which may require special handling.

Physical components (%vol): Catalyst (77% vol), Ceramic and mild steel balls (23% vol). No other components anticipated.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1

Comment on density: -

**CHEMICAL COMPOSITION**

General description and components (%wt): Catalyst - Platinum (0.3-0.5% wt) on alumina spheres or cylinders. Ceramic and mild steel shielding balls. Mild steel drums with polythene liners containing the waste.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Incorporated into material  
 C-14: May be present as Graphite contamination  
 Cl-36: Not expected to be present in significant quantities  
 Se-79: Not expected to be present in significant quantities  
 Tc-99: Not expected to be present in significant quantities  
 I-129: Not expected to be present in significant quantities  
 Ra: Not expected to be present in significant quantities  
 Th: Not expected to be present in significant quantities  
 U: Not expected to be present in significant quantities  
 Np: Not expected to be present in significant quantities  
 Pu: Not expected to be present in significant quantities

Metals and alloys (%wt): Not expected to be present

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	TR		
Other ferrous metals.....	P		
Iron.....	0		
Aluminium.....	TR		

<b>WASTE STREAM</b>	<b>3M17</b>	<b>Catalysts</b>
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Beryllium.....	0
Cobalt.....	0
Copper.....	TR
Lead.....	TR
Magnox/Magnesium.....	0
Nickel.....	0
Titanium.....	0
Uranium.....	TR
Zinc.....	TR
Zircaloy/Zirconium.....	0
Other metals.....	<0.50

Platinum (0.3-0.5% wt) on alumina spheres or cylinders

Organics (%wt): To be further assessed following further operational experience. Polythene drum liners are present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics .....	0		
Total non-halogenated plastics.....	P		
Condensation polymers.....	0		
Others.....	P		
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): Approximately 80wt% alumina base granule.

	(%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		

<b>WASTE STREAM</b>	<b>3M17</b>	<b>Catalysts</b>
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Glass/Ceramics.....	P
Graphite.....	0
Desiccants/Catalysts.....	99.5
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt):           None of the listed inorganic anions are expected to be present at greater than 10%.

	(%wt)	Type(s) and comment
Fluoride.....	<10.0	
Chloride.....	<10.0	
Iodide.....	<10.0	
Cyanide.....	NE	
Carbonate.....	<10.0	
Nitrate.....	<10.0	
Nitrite.....	NE	
Phosphate.....	<10.0	
Sulphate.....	<10.0	
Sulphide.....	<10.0	

Materials of interest for waste acceptance criteria:           There are no materials identified in the waste likely to present a fire or other non-radiological hazard.

	(%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.....	0	Not expected
Soluble solids as bulk chemical compounds.....	0	

**WASTE STREAM****3M17 Catalysts**

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	
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

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	Expect only trace quantities, if any.
Total complexing agents.....	TR	

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Potential for the waste to contain discrete items: No.

**TREATMENT, PACKAGING AND DISPOSAL**

**Waste that is currently ILW:** This waste is ILW at the time of arising. The waste is stored temporarily to allow decay of short lived radionuclides. Following this, the waste is sent for decontamination to LLW.

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification	Off-site	100.0
Decontamination	Off-site	100.0
Metal treatment		
Size reduction		
Decay storage	On-site	100.0
Recycling / reuse		
Other / various		
None		

Comment on planned treatments:

Current waste treatment is to decontaminated to LLW and then encapsulated. However, trials are ongoing to consider a change in strategy to wash and incinerate.

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	100.0	NE
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: -

**Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):**

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

**Opportunities for alternative disposal routing:** Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at LLWR	Incineration	-	-	Medium	-



**WASTE STREAM 3M17 Catalysts**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			2E-01	CC 2	Gd 153				
Be 10				8	Ho 163				
C 14				8	Ho 166m				
Na 22				4	Tm 170				
Al 26				4	Tm 171				
Cl 36				6	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41				8	Pt 193				
Mn 53					Tl 204				
Mn 54			4E-07	CC 2	Pb 205				
Fe 55			2E-06	CC 2	Pb 210				8
Co 60			3E-07	CC 2	Bi 208				
Ni 59				6	Bi 210m				
Ni 63			3E-07	CC 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				8	Th 232				8
Nb 94				8	Th 234				
Mo 93				8	Pa 231				8
Tc 97					Pa 233				
Tc 99				8	U 232				
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m				8	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	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				6	Cm 244				8
Ba 133					Cm 245				8
La 137					Cm 246				8
La 138					Cm 248				
Ce 144				8	Cf 249				
Pm 145					Cf 250				
Pm 147				8	Cf 251				
Sm 147					Cf 252				
Sm 151				8	Other a				8
Eu 152				8	Other b/g		5E-01	CC 2	
Eu 154				8	<b>Total a</b>	<b>0</b>	<b>&lt;1E-09</b>	<b>8</b>	
Eu 155				8	<b>Total b/g</b>	<b>0</b>	<b>7E-01</b>	<b>CC 2</b>	

**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