

<b>WASTE STREAM</b>	<b>4C01</b>	<b>Catalyst</b>
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**SITE** Torness

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** ILW

Is the waste subject to Scottish Policy: Yes

**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.....	6.0 m <sup>3</sup>
	1.4.2031 - 31.3.2032.....	3.4 m <sup>3</sup>
Total future arisings:		9.4 m <sup>3</sup>
Total waste volume:		9.4 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** Catalyst used for recombination of carbon dioxide reactor coolant.

**PHYSICAL CHARACTERISTICS**

General description: Exhausted catalyst 0.3 wt% platinum on 2/5mm diameter alumina catalyst cylinders. There are no large items that require special handling.

Physical components (%wt): Catalyst (100%).

Sealed sources: The waste does not contain sealed sources.

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

Comment on density: Waste density is an estimate.

**CHEMICAL COMPOSITION**

General description and components (%wt): The catalyst is granular alumina-platinum. Alumina platinum catalyst (100% wt).

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.....	0		
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	0		
Beryllium.....	0		

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Cobalt.....	0	
Copper.....	0	
Lead.....	0	
Magnox/Magnesium.....	0	
Nickel.....	0	
Titanium.....	0	
Uranium.....	0	
Zinc.....	0	
Zircaloy/Zirconium.....	0	
Other metals.....	~0.30	The waste contains platinum in small amounts.

Organics (%wt):                      There are no organic materials present. This waste is not expected to contain any halogenated plastics and rubbers.

	(%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):                      Approximately 100wt% 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		
Glass/Ceramics.....	0		

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Graphite.....	0
Desiccants/Catalysts.....	99.7
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt):           The waste contains no inorganic anions.

	(%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:           There are no hazardous materials present.

	(%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	

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Hazardous substances /  
non hazardous pollutants:

This waste is not expected to contain any listed substances.

	(%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):      No

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	The waste contains no complexing agents.
Total complexing agents.....	NE	

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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. No date specified.

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	-

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**Waste Packaging for Disposal:**

Container	Stream volume %	Waste loading m <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	100.0	~6.09	2

Other information: Waste loading is based on 18.27m<sup>3</sup> per half-height ISO.

**Waste Planned for Disposal at the LLW Repository:**

Container voidage: -  
The waste does not meet the LLWR's Waste Acceptance Criteria (WAC).

Does not meet WAC until catalyst is decontaminated.

Waste consigned for disposal to LLWR in year of generation: No. Waste is ILW when generated and needs decontaminating to LLW .

**Non-Containerised Waste for In-Vault Grouting:** (Not applicable to this waste stream)

Stream volume (%): -  
Waste stream variation: -  
Bounding cuboidal volume:  
Inaccessible voidage: -  
Other information: -

**RADIOACTIVITY**

Source: Principally activation products Co-60, H-3, S-35.  
Uncertainty: Activity data not yet assessed.  
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: No catalyst waste has been generated previously at TOR and so theoretical estimates have been used.  
Other information: -

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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					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54			4E-07	CC 2	Pb 205				
Fe 55			2E-06	CC 2	Pb 210				
Co 60			3E-07	CC 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			3E-07	CC 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g		5E-01	CC 2	
Eu 154					<b>Total a</b>		<b>&lt;1E-09</b>	<b>8</b>	
Eu 155					<b>Total b/g</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