

<b>WASTE STREAM</b>	<b>3L09</b>	<b>Miscellaneous Activated Components - Debris Vault 1</b>
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**SITE** Heysham 1

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** ILW; SPD3

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

	Reported
Stocks: At 1.4.2022.....	10.7 m <sup>3</sup>
Future arisings - 1.4.2022 - 31.3.2023.....	0.4 m <sup>3</sup>
1.4.2023 - 31.3.2024.....	0.4 m <sup>3</sup>
1.4.2024 - 31.3.2025.....	2.1 m <sup>3</sup>
1.4.2025 - 31.3.2026.....	2.1 m <sup>3</sup>
Total future arisings:	4.9 m <sup>3</sup>
Total waste volume:	15.6 m <sup>3</sup>

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

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper) x 1.5  
 Stock (lower): x 0.75 Arisings (lower) x 0.5

**WASTE SOURCE** Irradiated reactor components (excluding principal fuel element stringer components and control rods).

**PHYSICAL CHARACTERISTICS**

General description: Redundant or defective components such as control rod chains, neutron shield plugs, neutron flux detectors and graphite/steel items originating from fuel plug unit refurbishment. The possibility of large items which may need special handling is not assessed.

Physical components (%vol): Not assessed.

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): Principally steel. Other materials not assessed.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Diffused into materials  
 C-14: As activated graphite  
 Cl-36: Not assessed  
 Se-79: Not assessed  
 Tc-99: Not assessed  
 I-129: Not assessed  
 Ra: Not assessed  
 Th: Not assessed  
 U: Not assessed  
 Np: Not assessed  
 Pu: Not assessed

Metals and alloys (%wt): -

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

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Beryllium.....	NE
Cobalt.....	NE
Copper.....	TR
Lead.....	TR
Magnox/Magnesium.....	0
Nickel.....	NE
Titanium.....	NE
Uranium.....	NE
Zinc.....	TR
Zircaloy/Zirconium.....	0
Other metals.....	NE

Organics (%wt): To be further assessed following further operating experience.

	(%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.....	NE		
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.....			

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

Inorganic anions (%wt):            Only trace quantities anticipated.

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

Materials of interest for waste acceptance criteria:            No materials that might give rise to a fire or other non-radioactive hazard have been identified.

	(%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	

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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	May be present in trace quantities.
Total complexing agents.....	TR	

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Potential for the waste to contain discrete items: Yes.

**PACKAGING AND CONDITIONING**

Conditioning method: 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.

Plant Name: None.

Location: Heysham 1 Power Station.

Plant startup date: ~2105.

Total capacity (m<sup>3</sup>/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m<sup>3</sup>/y incoming waste): -

Other information: All of the waste is expected to be retrieved and conditioned when a conditioning campaign is undertaken. The total plant process rate is not estimated.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	4m box (100mm concrete shielding)	100.0	~12.2	~14.3	2

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/m<sup>3</sup>): ~3.0

Conditioned density comment: The density of the encapsulated waste is expected to be approximately 3 t/m<sup>3</sup>.

Other information on 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.

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

**RADIOACTIVITY**

Source: Irradiated components removed from the reactor. Activated material removed from the reactor core is likely to be of high specific activity.

Uncertainty: Specific activity is a function of station operating history. The values quoted are indicative of the activities that might be expected.

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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:

Theoretical estimates.

Other information:

Estimates are based upon theoretical assessments. Other beta/gamma nuclides will include Fe59. Other beta/gamma nuclides (in TBq/m<sup>3</sup>) in arisings and stocks include: - Cr51 (4E+2, 2E-2); Co58 (1E+2, 7E-2); Nb95 (3E-1, 3E-5) and Ru103 (2E-4, 3E-8).

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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-08	CC 2	2E-08	CC 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	5E-02	CC 2	5E-02	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36		6		6	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41		8		8	Pt 193				
Mn 53					Tl 204				
Mn 54	3E-01	CC 2	1E+01	CC 2	Pb 205				
Fe 55	4E+01	CC 2	3E+02	CC 2	Pb 210		8		8
Co 60	3E+01	CC 2	1E+02	CC 2	Bi 208				
Ni 59	2E-01	CC 2	2E-01	CC 2	Bi 210m				
Ni 63	1E+01	CC 2	1E+01	CC 2	Po 210		8		8
Zn 65	8E-07	CC 2	3E-05	CC 2	Ra 223				
Se 79		8		8	Ra 225				
Kr 81					Ra 226		8		8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		8		8	Th 227				
Zr 93		8		8	Th 228				
Nb 91					Th 229		8		8
Nb 92					Th 230		8		8
Nb 93m	4E-05	CC 2	5E-05	CC 2	Th 232		8		8
Nb 94	1E-03	CC 2	1E-03	CC 2	Th 234				
Mo 93	5E-04	CC 2	5E-04	CC 2	Pa 231		8		8
Tc 97					Pa 233				
Tc 99		8		8	U 232				
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m	4E-03	CC 2	4E-03	CC 2	U 235		8		8
Ag 110m					U 236		8		8
Cd 109					U 238		8		8
Cd 113m					Np 237		8		8
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238		8		8
Sn 123					Pu 239		8		8
Sn 126		8		8	Pu 240		8		8
Sb 125					Pu 241		8		8
Sb 126					Pu 242		8		8
Te 125m					Am 241		8		8
Te 127m					Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134		6		6	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137		6		6	Cm 244		8		8
Ba 133					Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144		8		8	Cf 249				
Pm 145					Cf 250				
Pm 147		8		8	Cf 251				
Sm 147					Cf 252				
Sm 151		8		8	Other a		8		8
Eu 152		8		8	Other b/g	8E-02	CC 2	5E+02	CC 2
Eu 154		8		8	<b>Total a</b>	<b>&lt;1E-09</b>	<b>8</b>	<b>&lt;1E-09</b>	<b>8</b>
Eu 155		8		8	<b>Total b/g</b>	<b>8.06E+01</b>	<b>CC 2</b>	<b>9.20E+02</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