

**WASTE STREAM****3K30****Miscellaneous Activated Components & Fuel Stringer  
Debris - Debris Vault 2****SITE** Hartlepool**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**WASTE TYPE** ILW; SPD3Is the waste subject to  
Scottish Policy: No**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	81.0 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2023.....	2.8 m <sup>3</sup>
	1.4.2023 - 31.3.2024.....	2.8 m <sup>3</sup>
	1.4.2024 - 31.3.2025.....	9.1 m <sup>3</sup>
	1.4.2025 - 31.3.2026.....	9.1 m <sup>3</sup>
Total future arisings:		23.9 m <sup>3</sup>
Total waste volume:		104.9 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 1.75  
Stock (lower): x 0.75 Arisings (lower) x 0.25**WASTE SOURCE** Metallic components resulting from the dismantling of fuel element stringers.**PHYSICAL CHARACTERISTICS**

General description: Upper and lower tie bar components. Other components may be present. No large items are expected.

Physical components (%vol): Tie Bars (no ends and nuts) ~100%

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~0.5

Comment on density: -

**CHEMICAL COMPOSITION**General description and  
components (%wt): Nimonic alloy with some stainless steel. Percentage breakdown is not yet estimated.

Chemical state: Neutral

Chemical form of  
radionuclides: H-3: Diffused into metals  
C-14: Incorporated in the steel. There may be some surface contamination as graphite.  
Cl-36: The chlorine will be incorporated in the steel  
Se-79: Selenium content not expected to be significant  
Tc-99: Content not expected to be significant  
I-129: Content not expected to be significant  
Ra: Radium not expected to be significant  
Th: Thorium not expected to be significant  
U: Uranium not expected to be significant  
Np: Neptunium not expected to be significant  
Pu: Not determined

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	P	as 321 and 316	
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	0		
Beryllium.....	0		

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Cobalt.....	0	
Copper.....	0	
Lead.....	0	
Magnox/Magnesium.....	0	
Nickel.....	P	As nimonic alloy
Titanium.....	0	
Uranium.....	0	
Zinc.....	0	
Zircaloy/Zirconium.....	0	
Other metals.....	0	

Organics (%wt):                      Other organics to be further assessed.

	(%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.....	0		

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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):            Not estimated but not expected to be present at greater than 1%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            None expected.  
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	

**WASTE STREAM****3K30****Miscellaneous Activated Components & Fuel Stringer  
Debris - Debris Vault 2**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.....	NE	
EEE Type 2.....	NE	
EEE Type 3.....	NE	
EEE Type 4.....	NE	
EEE Type 5.....	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	
Total complexing agents.....	NE	

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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: Hartlepool Power Station

Plant startup date: ~2109

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	9

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>): ~2.5

Conditioned density comment: The density of the encapsulated waste is expected to be approximately 2.5 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: Activation of nuclides within the steel will be the main sources of 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 assessments

Other information:

Estimates have been based on theoretical assessments. Other beta/gamma nuclides (in TBq/m<sup>3</sup>) in arisings and stocks include: - S35 (6E-1, 8E-3); Ca45 (1E+0, 3E-2); Cr51 (2E+4, 1E+1); Co58 (1E+3, 9E+0); Zr95 (6E-1, 5E-3); Nb95 (1E+1, 1E-2); Sc46 (1E-1, 1E-3) and Fe59 (2E+2, 7E-1).

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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	1E-06	CC 2	2E-06	CC 2	Gd 153				
Be 10	1E-09	CC 2	1E-09	CC 2	Ho 163				
C 14	3E-06	CC 2	3E-06	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	7E-05	CC 2	7E-05	CC 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41	7E-04	CC 2	7E-04	CC 2	Pt 193				
Mn 53					Tl 204				
Mn 54	6E+00	CC 2	1E+02	CC 2	Pb 205				
Fe 55	1E+03	CC 2	6E+03	CC 2	Pb 210	8			8
Co 60	2E+03	CC 2	3E+03	CC 2	Bi 208				
Ni 59	8E+00	CC 2	8E+00	CC 2	Bi 210m				
Ni 63	9E+02	CC 2	1E+03	CC 2	Po 210	8			8
Zn 65	2E-04	CC 2	5E-03	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	5E-06	CC 2	5E-06	CC 2	Th 228				
Nb 91					Th 229	8			8
Nb 92					Th 230	8			8
Nb 93m	4E-03	CC 2	5E-03	CC 2	Th 232	8			8
Nb 94	2E-02	CC 2	2E-02	CC 2	Th 234				
Mo 93	6E-02	CC 2	6E-02	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	9E-03	CC 2	9E-03	CC 2	U 235	8			8
Ag 110m	1E-01	CC 2	3E+00	CC 2	U 236	8			8
Cd 109	9E-03	CC 2	1E-01	CC 2	U 238	8			8
Cd 113m	6E-07	CC 2	8E-07	CC 2	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		8		8	Cm 242	8			8
Cs 135		8		8	Cm 243	8			8
Cs 137		8		8	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	2E+01	CC 2	2E+04	CC 2
Eu 154		8		8	<b>Total a</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>8</b>
Eu 155		8		8	<b>Total b/g</b>	<b>3.93E+03</b>	<b>CC 2</b>	<b>3.01E+04</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