

**WASTE STREAM****3K23****Miscellaneous Activated Components - Debris Vault 3****SITE** Hartlepool**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.....	0.5 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		0.5 m <sup>3</sup>

Comment on volumes: Future arisings unpredictable depending on operational failures.

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

**WASTE SOURCE** Irradiated reactor control rods, control rod chains and graphite specimen assemblies.**PHYSICAL CHARACTERISTICS**

General description: Redundant or defective control rods and control rod chains and graphite specimen assemblies. 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): Irradiated components principally steel (&gt;50% wt) removed from the reactor. Other materials not assessed.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Diffused into components  
C-14: Activated graphite contamination, activation of carbon within components  
Cl-36: Not Accessed  
Se-79: Not Accessed  
Tc-99: Not Accessed  
I-129: Not Accessed  
Ra: Not Accessed  
Th: Not Accessed  
U: Not Accessed  
Np: Not Accessed  
Pu: Not Accessed

Metals and alloys (%wt): Majority of the waste is stainless steel cylinders, of varying thickness

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	P	321, 316 and boronated stainless steel.	
Other ferrous metals.....	P		
Iron.....	NE		
Aluminium.....	NE		
Beryllium.....	NE		
Cobalt.....	NE		
Copper.....	NE		

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Lead.....	NE
Magnox/Magnesium.....	NE
Nickel.....	NE
Titanium.....	NE
Uranium.....	NE
Zinc.....	NE
Zircaloy/Zirconium.....	NE
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.....	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.....	NE		
Desiccants/Catalysts.....	0		
Asbestos.....	0		

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Non/low friable.....

Moderately friable.....

Highly friable.....

Free aqueous liquids..... 0

Free non-aqueous liquids..... 0

Powder/Ash..... 0

Inorganic anions (%wt): Not assessed.

(%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: No materials that might give rise to a fire or other non-radioactive hazard has 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

Hazardous substances / non hazardous pollutants: -

(%wt) Type(s) and comment

Acrylamide..... NE

Benzene..... NE

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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.....	P	as Boronated Stainless Steel
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	
Total complexing agents.....	NE	

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.

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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	< 1

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.  
 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: -  
 Other information: Estimates are based upon theoretical assessments.

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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		6			Gd 153				
Be 10		8			Ho 163				
C 14	5E-02	CC 2			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	7.04E-03	CC 2			Pb 205				
Fe 55	2.31E+01	CC 2			Pb 210		8		
Co 60	3.37E+01	CC 2			Bi 208				
Ni 59	2E-01	CC 2			Bi 210m				
Ni 63	9.79E+00	CC 2			Po 210		8		
Zn 65	1.79E-09	CC 2			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	3.25E-05	CC 2			Th 232		8		
Nb 94	1E-03	CC 2			Th 234				
Mo 93	5E-04	CC 2			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	3.98E-03	CC 2			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		6			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	4.37E-08	CC 2		
Eu 154		8			<b>Total a</b>	<b>0</b>	<b>8</b>		<b>0</b>
Eu 155		8			<b>Total b/g</b>	<b>6.69E+01</b>	<b>CC 2</b>		<b>0</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