

<b>WASTE STREAM</b>	<b>3K24</b>	<b>Miscellaneous Activated Components - Spalled Oxide &amp; Dust</b>
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**SITE** Hartlepool

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** ILW; SPD3

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	10.1 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2024.....	2.0 m <sup>3</sup>
	1.4.2024 - 31.3.2026.....	0.8 m <sup>3</sup>
Total future arisings:		2.8 m <sup>3</sup>
Total waste volume:		12.9 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 1.5  
 Stock (lower): x 0.75 Arisings (lower) x 0.5

**WASTE SOURCE** Irradiated dusts and spalled oxide.

**PHYSICAL CHARACTERISTICS**

General description: Active Dusts. No large items are expected.

Physical components (%vol): Not assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~2.5

Comment on density: -

**CHEMICAL COMPOSITION**

General description and components (%wt): Irradiated dust in dust tanks could include spalled fuel can oxide and graphite dust, and abraded drier desiccant. Principally iron oxide with graphite. Other materials not assessed.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Not Assessed  
 C-14: As graphite dust  
 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): -

Stainless steel.....	P
Other ferrous metals.....	P
Iron.....	P
Aluminium.....	NE
Beryllium.....	NE
Cobalt.....	NE
Copper.....	NE
Lead.....	NE
Magnox/Magnesium.....	0
Nickel.....	NE
Titanium.....	NE

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	Uranium.....	NE
	Zinc.....	NE
	Zircaloy/Zirconium.....	0
	Other metals.....	NE
Organics (%wt):	To be further assessed following further operating experience.	
	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):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	0
	Glass/Ceramics.....	
	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):	Not assessed.	

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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:

There may be finely divided metals present in the dust tanks.

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
Active particles.....	P
Soluble solids as bulk chemical compounds.....	0

May be present

Hazardous substances / non hazardous pollutants:

-	
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

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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

EDTA..... NE  
 DPTA..... NE  
 NTA..... NE  
 Polycarboxylic acids..... NE  
 Other organic complexants..... NE  
 Total complexing agents..... NE

May be present in trace quantities.

**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	2

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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

Treatment	Stream volume (%)	Comment
-	-	-

### RADIOACTIVITY

Source: Irradiated dust and spalled oxide collected in appropriate tanks. 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: Theoretical estimates.

Other information: Estimates are based upon theoretical assessments. Other beta/gamma nuclides in arisings and stocks include (in TBq/m<sup>3</sup>) Cr51 (8E+2, 1E-9); Co58 (2E+2, 5E-4); Nb95 (6E-1, 1E-10) and Ru103 (4E-4, 6E-13). Other beta/gamma nuclides will also include Fe59.

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3		6		6	Gd 153				
Be 10		8		8	Ho 163				
C 14	1E-01	CD 2	1E-01	CD 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	1E+00	CD 2	2E+01	CD 2	Pb 205				
Fe 55	1E+02	CD 2	6E+02	CD 2	Pb 210		8		8
Co 60	7E+01	CD 2	2E+02	CD 2	Bi 208				
Ni 59	4E-01	CD 2	4E-01	CD 2	Bi 210m				
Ni 63	2E+01	CD 2	2E+01	CD 2	Po 210		8		8
Zn 65	3E-06	CD 2	6E-05	CD 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	7E-05	CD 2	1E-04	CD 2	Th 232		8		8
Nb 94	2E-03	CD 2	2E-03	CD 2	Th 234				
Mo 93	1E-03	CD 2	1E-03	CD 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	8E-03	CD 2	8E-03	CD 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	5E-04	CD 2	1E+03	CD 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>1.92E+02</b>	<b>CD 2</b>	<b>1.84E+03</b>	<b>CD 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