WASTE STREAM 3K25 Miscellaneous Activated Components - Debris Vault 4

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.....	168.0 m³
Future arisings -	1.4.2022 - 31.3.2023.....	12.0 m³
	1.4.2023 - 31.3.2024.....	12.0 m³
	1.4.2024 - 31.3.2025.....	17.8 m³
	1.4.2025 - 31.3.2026.....	17.8 m³
Total future arisings:		59.6 m³
Total waste volume:		227.6 m³

Comment on volumes: Waste volumes will be variable depending on station operating conditions. Reported volume unchanged from 2016. Previous estimates now considered overly pessimistic regarding packing factor within the vault.

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 Components resulting from the dismantling of fuel stringers. Some additional high activity components in steel tins, may also be present.

PHYSICAL CHARACTERISTICS

General description: Graphite sleeves, associated metal components and other components may be present. The possibility of large items which may need special handling is not assessed.

Physical components (%vol): Stocks are graphite vacancy blocks , vacancy top assemblies, top reflectors, bottom reflectors, Central Inertial Collector assemblies. Percentage breakdown is not currently assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.5

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Graphite and steels. Stocks are estimated to be 65% wt graphite, 35% wt stainless steel. Arisings will be about 3% wt graphite, 97% wt stainless steel.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Diffused into components
C-14: Graphite and activation of trace elements in metallic components.
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): -

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	~90.0	316, 321	
Other ferrous metals	NE		
Iron	NE		
Aluminium	0		
Beryllium	0		
Cobalt	0		
Copper	0		
Lead	0		
Magnox/Magnesium	0		
Nickel	0		
Titanium	0		
Uranium	0		
Zinc	0		
Zircaloy/Zirconium	0		
Other metals	0		

Organics (%wt): To be further assessed.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	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	TR		
Oil or grease	TR		
Fuel	0		
Asphalt/Tarmac (cont.coal tar)	0		
Asphalt/Tarmac (no coal tar)	0		
Bitumen	0		
Others			
Other organics	NE		

Other materials (%wt): -

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	(%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.....	~10.0		
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): None of the listed inorganic anions are expected to be present at greater than 1% wt.

	(%wt)	Type(s) and comment
Fluoride.....	<1.0	
Chloride.....	<1.0	
Iodide.....	<1.0	
Cyanide.....	0	
Carbonate.....	<1.0	
Nitrate.....	<1.0	
Nitrite.....	NE	
Phosphate.....	<1.0	
Sulphate.....	<1.0	
Sulphide.....	<1.0	

Materials of interest for waste acceptance criteria: Whilst it is difficult to ignite, graphite will eventually burn in air.

	(%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	

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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: None expected.

	(%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	

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Complexing agents (%wt): Not yet determined

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids…….	NE	
Other organic complexants.....	NE	Expect only trace quantities, if any.
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.

Plant Name: None.

Location: Hartlepool Power Station.

Plant startup date: ~ 2109

Total capacity (m^3/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m^3/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^3)	Payload (m^3)	Number of packages
4m box (100mm concrete shielding)	100.0	~12.2	~14.3	19

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^3): ~3.0

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

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

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

RADIOACTIVITY

Source:	Components resulting from the dismantling of fuel stringers. Activation of metallic components 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.
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:	Other beta/gamma nuclides in arisings and stocks include (in TBq/m^3) S35 (6E-2, 7E-4); Ca45 (6E-5, 2E-6); Cr51 (9E+2, 4E-1); Co58 (1E+2, 8E-1); Sr89 (2E-6, 7E-9); Zr95 (3E-7, 2E-9); Nb95 (1E+0, 1E-3); Ta182 (1E-3, 2E-5); Sc46 (3E-4, 3E-6); Fe59 (2E+1, 5E-2); Sr85 (1E-6, 6E-9); Sn113 (8E-6, 1E-7); Sb124 (6E-8, 3E-10); Sm145 (5E-7, 1E-7) and W181 (3E-7, 6E-9).

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	5E-02	C C 2	9E-03	C C 2	Gd 153				
Be 10	8E-07	C C 2	1E-07	C C 2	Ho 163				
C 14	2E-02	C C 2	7E-02	C C 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	2E-05	C C 2	2E-05	C C 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41	3E-07	C C 2	4E-08	C C 2	Pt 193				
Mn 53					Tl 204				
Mn 54	4E+00	C C 2	7E+01	C C 2	Pb 205				
Fe 55	7E+01	C C 2	5E+02	C C 2	Pb 210		8		8
Co 60	4E+01	C C 2	2E+02	C C 2	Bi 208				
Ni 59	3E-02	C C 2	9E-02	C C 2	Bi 210m				
Ni 63	3E+00	C C 2	1E+01	C C 2	Po 210		8		8
Zn 65	4E-07	C C 2	8E-06	C C 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	6E-04	C C 2	2E-04	C C 2	Th 232		8		8
Nb 94	1E-02	C C 2	4E-02	C C 2	Th 234				
Mo 93	3E-04	C C 2	1E-03	C C 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-04	C C 2	3E-03	C C 2	U 235		8		8
Ag 110m	1E-01	C C 2	3E+00	C C 2	U 236		8		8
Cd 109	3E-04	C C 2	4E-03	C C 2	U 238		8		8
Cd 113m	5E-09	C C 2	1E-09	C C 2	Np 237		8		8
Sn 119m					Pu 236				
Sn 121m	2E-05	C C 2	2E-06	C C 2	Pu 238		8		8
Sn 123	1E-07	C C 2	6E-06	C C 2	Pu 239		8		8
Sn 126		8		8	Pu 240		8		8
Sb 125	5E-05	C C 2	6E-05	C C 2	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	2E-10	C C 2		8	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137		8		8	Cm 244		8		8
Ba 133	5E-07	C C 2	9E-08	C C 2	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	8E-06	C C 2	9E-07	C C 2	Other a		8		8
Eu 152	1E-02	C C 2	2E-03	C C 2	Other b/g	1E+00	C C 2	1E+03	C C 2
Eu 154	4E-03	C C 2	8E-04	C C 2	**Total a**	**0**	**8**	**0**	**8**
Eu 155	6E-04	C C 2	3E-04	C C 2	**Total b/g**	**1.18E+02**	**C C 2**	**1.78E+03**	**C C 2**

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