

WASTE STREAM**4B20****Miscellaneous Activated Components - Debris Vault 3****SITE** Hunterston B**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**WASTE TYPE** ILW; SPD3**WASTE VOLUMES**Stocks: At 1.4.2019..... Reported 9.1 m³Total future arisings: 0 m³Total waste volume: 9.1 m³

Comment on volumes: No future arisings anticipated

Uncertainty factors on Stock (upper): x 1.25 Arisings (upper) x

volumes: 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): Percentage breakdown not assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.3Comment on density: Estimated as 0.3 t/m³**CHEMICAL COMPOSITION**

General description and components (%wt): The waste is predominantly stainless steel. The material breakdown is not currently assessed.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Diffused into materials
C-14: Incorporated into metal components and activated graphite
Cl-36: Not Assessed
Se-79: Not Assessed
Tc-99: Not Assessed
I-129: Not Assessed
Ra: Not Expected to be significant
Th: Not Assessed
U: Not Assessed
Np: Not Assessed
Pu: Not Assessed

Metals and alloys (%wt): -

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

WASTE STREAM**4B20****Miscellaneous Activated Components - Debris Vault 3**

	Uranium.....	NE
	Zinc.....	NE
	Zircaloy/Zirconium.....	NE
	Other metals.....	NE
Organics (%wt):	Further assessment is required.	
	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	NE
	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):	This waste is not expected to contain any inorganic anions.	

WASTE STREAM**4B20****Miscellaneous Activated Components - Debris Vault 3**

Fluoride.....	0
Chloride.....	0
Iodide.....	0
Cyanide.....	0
Carbonate.....	0
Nitrate.....	0
Nitrite.....	0
Phosphate.....	0
Sulphate.....	0
Sulphide.....	0

Materials of interest for waste acceptance criteria:

There are no hazardous materials in the waste.

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

Hazardous substances / non hazardous pollutants:

This waste is not expected to contain any listed substances.

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

WASTE STREAM

4B20

Miscellaneous Activated Components - Debris Vault 3

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..... NE
 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

There may be traces of complexing agents (decontamination chemicals)

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: -

Location: Hunterston B Power Station

Plant startup date: ~2108

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m³/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 (m³)	Payload (m³)	Number of packages
4m box (100mm concrete shielding)	100.0	~12.2	~14.3	< 1

WASTE STREAM**4B20****Miscellaneous Activated Components - Debris Vault 3**

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/m³): ~3.0

Conditioned density comment: The density of the encapsulated waste is expected to be approximately 3 t/m³.

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: Source of activity is activation with possible contamination by fission products and actinides.

Uncertainty: Needs further assessment.

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 of stocks (in TBq/m³) include Cr51 (2E-2) and Co58 (2E-1).

WASTE STREAM

4B20

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	1.5E-01	DD 2			Gd 153				
Be 10	1.7E-11	DD 2			Ho 163				
C 14	2.5E-02	DD 2			Ho 166m				
Na 22		4			Tm 170				
Al 26		4			Tm 171				
Cl 36	2E-05	DD 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54	1.4E-01	DD 2			Pb 205				
Fe 55	3.7E+01	DD 2			Pb 210				
Co 60	7.3E+01	DD 2			Bi 208				
Ni 59	3.7E-01	DD 2			Bi 210m				
Ni 63	4.3E+01	DD 2			Po 210				
Zn 65					Ra 223				
Se 79	7.24E-07	DD 2			Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.4E-02	DE 2			Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232	1.9E-09	DE 2		
Nb 94	8.9E-03	DD 2			Th 234				
Mo 93	4.9E-03	DD 2			Pa 231	4.2E-08	DE 2		
Tc 97					Pa 233				
Tc 99	2.2E-04	DD 2			U 232				
Ru 106					U 233	3E-06	DE 2		
Pd 107					U 234	1.6E-07	DE 2		
Ag 108m					U 235	6.1E-11	DE 2		
Ag 110m					U 236	1.2E-09	DE 2		
Cd 109					U 238	5.8E-09	DE 2		
Cd 113m					Np 237	1.3E-09	DE 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	3.8E-06	DE 2		
Sn 123					Pu 239	2.3E-05	DE 2		
Sn 126					Pu 240	2E-05	DE 2		
Sb 125					Pu 241	1E-03	DE 2		
Sb 126					Pu 242	5.5E-08	DE 2		
Te 125m					Am 241	1E-04	DE 2		
Te 127m					Am 242m	4.8E-07	DE 2		
I 129	1.4E-09	DE 2			Am 243	1.9E-07	DE 2		
Cs 134					Cm 242				
Cs 135	4.7E-08	DE 2			Cm 243				
Cs 137	2.8E-03	DE 2			Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a		6		
Eu 152					Other b/g	2.2E-01	DD 2		
Eu 154					Total a	1.50E-04	DE 2		0
Eu 155					Total b/g	1.54E+02	DD 2		0

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