WASTE STREAM 4B19 Miscellaneous Activated Components - Debris Vault 2

SITE	Hunterston B
SITE OWNER	EDFE NGL
WASTE CUSTODIAN	EDFE NGL
WASTE TYPE	ILW; SPD3

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	123.9 m³
Future arisings -	1.4.2019 - 31.3.2023.....	5.4 m³
	1.4.2023 - 31.3.2025.....	7.4 m³
Total future arisings:		12.9 m³
Total waste volume:		136.8 m³

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 The waste is primarily produced as a result of dismantling plant components. Some additional high activity components, in steel tins, may also be present.

PHYSICAL CHARACTERISTICS

General description: The waste includes fuel plug unit components, control rod actuators, flux measuring detectors, dummy fuel elements and miscellaneous small items in tins.

Physical components (%vol): Percentage breakdown not assessed.

Sealed sources: Not yet determined.

Bulk density (t/m³): ~0.3

Comment on density: Estimated as 0.3 t/m³

CHEMICAL COMPOSITION

General description and components (%wt): 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
	Uranium	NE
	Zinc	NE
	Zircaloy/Zirconium	NE
	Other metals	NE
Organics (%wt):	No organic material is expected other than trace amounts of oil. Further assessment is required.	
	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	
	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

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Inorganic anions (%wt): This waste is not expected to contain any inorganic anions.

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

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	Boron	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	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	There may be traces of complexing agents (decontamination chemicals)
	Total complexing agents	NE	

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 (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.

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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	12

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

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 arisings and stocks (in TBq/m^3) include Cr51 (1E+2, 2E-2) and Co58 (5E+1, 2E-1).

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3	1.5E-01	D D 2	2.3E-01	D D 2	Gd 153				
Be 10	1.7E-11	D D 2	2.4E-13	D D 2	Ho 163				
C 14	2.5E-02	D D 2	1.6E-02	D D 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	2E-05	D D 2	1.2E-05	D D 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	D D 2	1E+01	D D 2	Pb 205				
Fe 55	3.7E+01	D D 2	4.4E+02	D D 2	Pb 210				
Co 60	7.3E+01	D D 2	2.9E+02	D D 2	Bi 208				
Ni 59	3.7E-01	D D 2	2.3E-01	D D 2	Bi 210m				
Ni 63	4.3E+01	D D 2	3E+01	D D 2	Po 210				
Zn 65					Ra 223				
Se 79	7.24E-07	D D 2	4.48E-07	D D 2	Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.4E-02	D E 2	1.2E-03	D E 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232	1.9E-09	D E 2	1.1E-09	D E 2
Nb 94	8.9E-03	D D 2	5.6E-03	D D 2	Th 234				
Mo 93	4.9E-03	D D 2	3.1E-03	D D 2	Pa 231	4.2E-08	D E 2	2.5E-08	D E 2
Tc 97					Pa 233				
Tc 99	2.2E-04	D D 2	1.4E-04	D D 2	U 232				
Ru 106					U 233	3E-06	D E 2	1.8E-06	D E 2
Pd 107					U 234	1.6E-07	D E 2	9.4E-08	D E 2
Ag 108m					U 235	6.1E-11	D E 2	3.6E-11	D E 2
Ag 110m					U 236	1.2E-09	D E 2	6.6E-10	D E 2
Cd 109					U 238	5.8E-09	D E 2	3.4E-09	D E 2
Cd 113m					Np 237	1.3E-09	D E 2	6.3E-10	D E 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	3.8E-06	D E 2	2.4E-06	D E 2
Sn 123					Pu 239	2.3E-05	D E 2	1.4E-05	D E 2
Sn 126					Pu 240	2E-05	D E 2	1.2E-05	D E 2
Sb 125					Pu 241	1E-03	D E 2	9.7E-04	D E 2
Sb 126					Pu 242	5.5E-08	D E 2	3.3E-08	D E 2
Te 125m					Am 241	1E-04	D E 2	5.8E-05	D E 2
Te 127m					Am 242m	4.8E-07	D E 2	3E-07	D E 2
I 129	1.4E-09	D E 2	7.8E-10	D E 2	Am 243	1.9E-07	D E 2	1.1E-07	D E 2
Cs 134					Cm 242				
Cs 135	4.7E-08	D E 2	2.8E-08	D E 2	Cm 243				
Cs 137	2.8E-03	D E 2	2.1E-03	D E 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		6
Eu 152					Other b/g	2.2E-01	D D 2	1.5E+02	D D 2
Eu 154					**Total a**	**1.50E-04**	**D E 2**	**8.85E-05**	**D E 2**
Eu 155					**Total b/g**	**1.54E+02**	**D D 2**	**9.21E+02**	**D D 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