

WASTE STREAM**4B320****Stage 3 Decommissioning: Secondary Wastes LLW****SITE** Hunterston B**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**WASTE TYPE** LLW**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2110.....	0 m ³
	1.4.2110 - 31.3.2111.....	55.3 m ³
	1.4.2111 - 31.3.2112.....	538.1 m ³
	1.4.2112 - 31.3.2113.....	538.1 m ³
	1.4.2113 - 31.3.2114.....	351.0 m ³
	1.4.2114 - 31.3.2115.....	158.1 m ³
	1.4.2115 - 31.3.2116.....	141.8 m ³
	1.4.2116 - 31.3.2117.....	163.0 m ³
Total future arisings:		1945.4 m ³
Total waste volume:		1945.4 m ³

Comment on volumes: Waste volumes will be variable depending on station operating conditions.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.5
 Stock (lower): x Arisings (lower) x 0.5

WASTE SOURCE Wastes arising from contamination control procedures during plant dismantling.**PHYSICAL CHARACTERISTICS**

General description: A variety of combustible and non combustible materials. No large items are present in the waste.

Physical components (%vol): The waste is expected to contain metallic items (~80% vol), plastic items (~4%vol), cloth items (<1% vol). Other organics include incenerator ash (~15%). Percentages of constituents are very uncertain.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1

Comment on density: The density is likely to lie between 0.5 and 1.5 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is expected to contain metallic items (~80% vol), plastic items (~4%vol), cloth items (<1% vol). Other organics include incenerator ash (~15%). Percentages of constituents are very uncertain.

Chemical state: -

Chemical form of radionuclides: H-3: Diffused into materials
 C-14: There may be some surface contamination as graphite.
 Cl-36: Not Determined
 Se-79: Selenium content not expected to be significant
 Tc-99: Not determined
 I-129: Not determined
 Ra: Radium content is insignificant
 Th: Thorium content is Insignificant
 U: Not determined
 Np: The neptunium content is insignificant
 Pu: Not determined

Metals and alloys (%wt): Metal thicknesses will probably be typically 1-3 mm.

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Stainless steel.....	~5.0
Other ferrous metals.....	~70.0
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.....	~5.0

Miscellaneous metals with composition not assessed.

Organics (%wt):

A wide variety of materials may be present. Other organics represents incinerator ash.

Total cellulose.....	<1.0
Paper, cotton.....	<1.0
Wood.....	NE
Halogenated plastics	~4.0
Total non-halogenated plastics.....	NE
Condensation polymers.....	NE
Others.....	NE
Organic ion exchange materials....	NE
Total rubber.....	NE
Halogenated rubber	NE
Non-halogenated rubber.....	NE
Hydrocarbons.....	NE
Oil or grease	
Fuel.....	
Asphalt/Tarmac (cont.coal tar)...	
Asphalt/Tarmac (no coal tar)....	
Bitumen.....	
Others.....	
Other organics.....	~15.0

Other materials (%wt):

-	
Inorganic ion exchange materials.	0
Inorganic sludges and flocs.....	0
Soil.....	0
Brick/Stone/Rubble.....	0
Cementitious material.....	0
Sand.....	0

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	Glass/Ceramics.....	0	
	Graphite.....	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):	Only likely to be present in trace quantities.		
	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 likely to pose a fire or other non-radiological hazard have been identified.		
	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.....	0	Not expected.
	Soluble solids as bulk chemical compounds.....	0	
Hazardous substances / non hazardous pollutants:	-		
	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.....	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.....	NE
EEE Type 2.....	NE
EEE Type 3.....	NE
EEE Type 4.....	NE
EEE Type 5.....	NE
Complexing agents (%wt):	Not yet determined
EDTA.....	NE
DPTA.....	NE
NTA.....	NE
Polycarboxylic acids.....	NE
Other organic complexants.....	NE
Total complexing agents.....	NE

Only trace quantities, if any.

TREATMENT, PACKAGING AND DISPOSAL

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Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	Off-site	~15.0
Incineration	Off-site	~5.0
Solidification		
Decontamination		
Metal treatment	Off-site	~64.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		~16.0

Comment on planned treatments:

Incinerator ash will be supercompacted. Approximately 80% of the metal waste is assumed to be recyclable with 95% suitable for re-use. Waste will be grouted into containers if necessary. Supercompaction assumes x5 volume reduction. Incineration assumes 99% volume reduction.

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	~34.0
Expected to be consigned to a Landfill Facility	
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	~5.0
Expected to be consigned to a Metal Treatment Facility	~61.0
Expected to be consigned as Out of Scope	
Expected to be recycled / reused	
Disposal route not known	

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m ³	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO			
1/2 Height IP-2 Disposal/Re-usable ISO	34.3	22.7	30
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information:

Waste stream volume includes residue from incineration. Loading is representative of the raw waste following planned treatments.

Waste Planned for Disposal at the LLW Repository:

Container voidage:

-

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Waste Characterisation Form (WCH):

It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).

Waste consigned for disposal to LLWR in year of generation:

Yes.

Potential for the waste to contain discrete items:

Yes

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%):

-

Waste stream variation:

-

Bounding cuboidal volume:

Inaccessible voidage:

-

Other information:

-

RADIOACTIVITY

Source:

Contamination by activation products from the reactor structure.

Uncertainty:

Only very approximate estimates have been made of the total specific activities.

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:

Activation/decay calculations based on neutron flux and operating history.

Other information:

No nuclides other than those listed are expected to be significant.

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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			2.16E-04	CC 2	Gd 153				
Be 10			1.36E-12	CC 2	Ho 163				
C 14			7.89E-05	CC 2	Ho 166m		5.55E-08	CC 2	
Na 22				4	Tm 170				
Al 26				4	Tm 171				
Cl 36			8.60E-06	CC 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41			1.09E-04	CC 2	Pt 193				
Mn 53					Tl 204				
Mn 54				8	Pb 205				
Fe 55			5.99E-11	CC 2	Pb 210				8
Co 60			2.22E-07	CC 2	Bi 208				
Ni 59			1.51E-06	CC 2	Bi 210m				
Ni 63			8.20E-05	CC 2	Po 210				8
Zn 65				8	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			5.09E-08	CC 2	Th 232				8
Nb 94			1.54E-07	CC 2	Th 234				
Mo 93			7.11E-07	CC 2	Pa 231				8
Tc 97					Pa 233				
Tc 99			1.51E-07	CC 2	U 232				
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			5.95E-08	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			8.06E-10	CC 2	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				5	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137				6	Cm 244				8
Ba 133			9.05E-09	CC 2	Cm 245				8
La 137					Cm 246				8
La 138					Cm 248				
Ce 144				8	Cf 249				
Pm 145			2.18E-08	CC 2	Cf 250				
Pm 147				8	Cf 251				
Sm 147					Cf 252				
Sm 151			1.50E-05	CC 2	Other a				8
Eu 152			4.36E-05	CC 2	Other b/g				5
Eu 154			1.90E-07	CC 2	Total a	0	<1E-09		8
Eu 155			2.21E-10	CC 2	Total b/g	0	5.56E-04	CC 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