

WASTE STREAM	4B13	General Reactor LLW
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SITE Hunterston B

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	48.2 m ³
Future arisings -	1.4.2019 - 31.3.2023.....	160.0 m ³
	1.4.2023 - 31.3.2024.....	30.6 m ³
	1.4.2024 - 31.3.2025.....	122.2 m ³
	1.4.2025 - 31.3.2026.....	123.8 m ³
	1.4.2026 - 31.3.2027.....	247.4 m ³
	1.4.2027 - 31.3.2028.....	119.6 m ³
	1.4.2028 - 31.3.2029.....	18.8 m ³
	1.4.2029 - 31.3.2030.....	0 m ³
	1.4.2030 - 31.3.2031.....	0 m ³
	1.4.2031 - 31.3.2032.....	0 m ³
	1.4.2032 - 31.3.2033.....	4.3 m ³
Total future arisings:		826.6 m ³
Total waste volume:		874.8 m ³

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 Waste arises from maintenance and operations in the reactor areas.

PHYSICAL CHARACTERISTICS

General description: The waste is general rubbish and comprises disposable items including paper, plastic, cloth, wood and redundant metal components. Large items may be present in the waste which will not fit in 200 litre drums. This waste will be volume reduced by cutting, etc. prior to disposal.

Physical components (%wt): Metal (~25%), Soil/Rubble (~2%), Soft Organics (~45%), Plastics/Rubber (~15%), Wood (~10%), Charcoal (~3%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.5

Comment on density: Density based on % compactable waste in WSCD.

CHEMICAL COMPOSITION

General description and components (%wt): The waste comprises paper, wood, metal, cloth and plastic. The drum material is mild steel.

Chemical state: Neutral

Chemical form of radionuclides: H-3: tritiated water
 C-14: Activated graphite and metallic components and particulate
 Cl-36: Not assessed
 Se-79: Not expected to be significant
 Tc-99: Not expected to be significant
 I-129: Not expected to be significant
 Ra: Not expected to be significant
 Th: Not expected to be significant
 U: Not assessed
 Np: Not expected to be significant
 Pu: Not assessed

Metals and alloys (%wt): Waste stream may contain some large items which will be volume reduced by cutting, etc.

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Stainless steel.....	~10.0
Other ferrous metals.....	~15.0
Iron.....	NE
Aluminium.....	P
Beryllium.....	NE
Cobalt.....	NE
Copper.....	NE
Lead.....	NE
Magnox/Magnesium.....	0
Nickel.....	NE
Titanium.....	NE
Uranium.....	NE
Zinc.....	NE
Zircaloy/Zirconium.....	0
Other metals.....	NE

Percentage variable with station operations.

Organics (%wt):

The waste is known to contain organic materials in the form of paper, wood and plastic (polythene). Other organics represents charcoal waste. Not currently assessed.

Total cellulosics.....	~55.0
Paper, cotton.....	~45.0
Wood.....	~10.0
Halogenated plastics	NE
Total non-halogenated plastics.....	~10.0
Condensation polymers.....	NE
Others.....	~10.0
Organic ion exchange materials....	0
Total rubber.....	~5.0
Halogenated rubber	NE
Non-halogenated rubber.....	~5.0
Hydrocarbons.....	NE
Oil or grease	NE
Fuel.....	
Asphalt/Tarmac (cont.coal tar)...	
Asphalt/Tarmac (no coal tar)....	
Bitumen.....	
Others.....	
Other organics.....	~3.0

Other materials (%wt):

-	
Inorganic ion exchange materials.	0
Inorganic sludges and flocs.....	0
Soil.....	~1.0
Brick/Stone/Rubble.....	~1.0
Cementitious material.....	0
Sand.....	0

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	Glass/Ceramics.....	
	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):	Inorganic anion content is not estimated.	
	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:	None expected, efforts are made to remove all hazardous materials during sorting and compaction.	
	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
	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	-	
	Acrylamide.....	NE
	Benzene.....	NE

Not expected

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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.....	0
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): Yes	
EDTA.....	NE
DPTA.....	NE
NTA.....	NE
Polycarboxylic acids.....	NE
Other organic complexants.....	NE
Total complexing agents.....	NE

Complexing agents are not estimated.

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	~20.0
Incineration	Off-site	~50.0
Solidification	On-site	<10.0
Decontamination	On-site	~5.0
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		~15.0

Comment on planned treatments:

In line with the waste hierarchy, wastes will be treated preferentially by incineration, metal decontamination/melting, supercompaction, optimal packaging in HHISOs or immobilisation by encapsulation where necessary, prior to ultimate disposal at the LLW Repository. These treatments will be carried out off-site under contract with companies such as LLWR Ltd, EDF Cyclife, Tradebe and Inutec. The percentages are based on the history of consignments across the fleet of EDF Energy Nuclear Generation stations.

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	45.0
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	50.0
Expected to be consigned to a Metal Treatment Facility	
Expected to be consigned as Out of Scope	
Expected to be recycled / reused	5.0
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	~45.0	~13.55	30
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information:

Waste loading is representative of the raw waste following further planned treatments. The waste will be reduced to 50% of its original waste volume after further planned treatments.

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Container voidage:

-

Waste Characterisation
Form (WCH):The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste does not have a current WCH.

Wastestream characterisation document is still currently valid.

Waste consigned for
disposal to LLWR in
year of generation:Yes. Waste will normally be disposed of during year of arising, but this is dependent
on rate of arising throughout the year.Potential for the waste
to contain discrete
items:

-

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:

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RADIOACTIVITY

Source:

Activity source is variable, but mainly activation products.

Uncertainty:

The estimate of specific activity is correct to a factor of 10.

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:

Estimated based on arisings and data in WSCD.

Other information:

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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	4.34E-04	CC 2	4.34E-04	CC 2	Gd 153				
Be 10					Ho 163				
C 14	5.56E-06	CC 2	5.56E-06	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	9.16E-05	CC 2	9.16E-05	CC 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	5.01E-06	CC 2	5.01E-06	CC 2	Pb 205				
Fe 55	1.30E-04	CC 2	1.30E-04	CC 2	Pb 210				
Co 60	4.56E-05	CC 2	4.56E-05	CC 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	2.33E-05	CC 2	2.33E-05	CC 2	Po 210				
Zn 65	2.84E-06	CC 2	2.84E-06	CC 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.48E-06	CC 2	1.48E-06	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	4.83E-07	CC 2	4.83E-07	CC 2	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106	5.09E-06	CC 2	5.09E-06	CC 2	U 233				
Pd 107					U 234	3.14E-08	CC 2	3.14E-08	CC 2
Ag 108m	5.79E-07	CC 2	5.79E-07	CC 2	U 235	5.2E-09	CC 2	5.2E-09	CC 2
Ag 110m	2.41E-06	CC 2	2.41E-06	CC 2	U 236	8.3E-08	CC 2	8.3E-08	CC 2
Cd 109					U 238	1.1E-08	CC 2	1.1E-08	CC 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	2.64E-08	CC 2	2.64E-08	CC 2
Sn 123					Pu 239	3.96E-08	CC 2	3.96E-08	CC 2
Sn 126					Pu 240	9.42E-08	CC 2	9.42E-08	CC 2
Sb 125	1.39E-06	CC 2	1.39E-06	CC 2	Pu 241	4.92E-06	CC 2	4.92E-06	CC 2
Sb 126					Pu 242				
Te 125m					Am 241	7.24E-08	CC 2	7.24E-08	CC 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	5.80E-07	CC 2	5.80E-07	CC 2	Cm 242	1E-07	CC 2	1E-07	CC 2
Cs 135					Cm 243	1.6E-09		1.6E-09	
Cs 137	3.41E-06	CC 2	3.41E-06	CC 2	Cm 244	1.03E-07	CC 2	1.03E-07	CC 2
Ba 133	6.06E-07	CC 2	6.06E-07	CC 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	2.62E-06	CC 2	2.62E-06	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	3.76E-07	CC 2	3.76E-07	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a		6		6
Eu 152	1.31E-06	CC 2	1.31E-06	CC 2	Other b/g	4.59E-04	CC 2	4.59E-04	CC 2
Eu 154	1.25E-06	CC 2	1.25E-06	CC 2	Total a	5.68E-07	CC 2	5.68E-07	CC 2
Eu 155	4.78E-08	CC 2	4.78E-08	CC 2	Total b/g	1.22E-03	CC 2	1.22E-03	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