

**WASTE STREAM****3M14****Gas Circulator Maintenance - Low Level Waste****SITE** Heysham 2**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**WASTE TYPE** LLW**WASTE VOLUMES**

Reported

Stocks: At 1.4.2019..... 5.0 m<sup>3</sup>Future arisings - 1.4.2019 - 31.3.2031..... 7.8 m<sup>3</sup>1.4.2031 - 31.3.2033..... 2.6 m<sup>3</sup>Total future arisings: 10.4 m<sup>3</sup>Total waste volume: 15.4 m<sup>3</sup>

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

Uncertainty factors on Stock (upper): x 1.25 Arisings (upper) x 1.75

volumes: Stock (lower): x 0.75 Arisings (lower) x 0.25

**WASTE SOURCE** Waste arising from gas circulator maintenance.**PHYSICAL CHARACTERISTICS**

General description: The waste is expected to be solids such as plastic, paper, rubber, metals and clothing that is slightly contaminated. There may also be filters and redundant equipment.

Physical components (%wt): Metal (15%wt), concrete (1%wt), Soft organics (50%wt), plastics/rubber (30%wt), wood (4%wt).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 1.18

Comment on density: Density is based on conditioned volume in WCF.

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (15%wt), concrete (1%wt), Soft organics (50%wt), plastics/rubber (30%wt), wood (4%wt).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritiated water  
C-14: Contamination by activated graphite and metallic particulate  
Cl-36: To be determined  
Se-79: Not expected to be significant  
Tc-99: Not expected to be significant  
I-129: To be determined  
Ra: Not expected to be significant  
Th: To be determined  
U: To be determined  
Np: Not expected to be significant  
Pu: To be determined

Metals and alloys (%wt): -

Stainless steel..... ~10.0

Other ferrous metals..... ~5.0

Iron..... NE

Aluminium..... NE

Beryllium..... NE

Cobalt..... NE

Copper..... NE

Lead..... 0

Magneox/Magnesium..... NE

Nickel..... NE

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	Titanium.....	NE
	Uranium.....	NE
	Zinc.....	NE
	Zircaloy/Zirconium.....	NE
	Other metals.....	NE
Organics (%wt):	To be further assessed.	
	Total cellulose.....	~54.0
	Paper, cotton.....	~50.0
	Wood.....	~4.0
	Halogenated plastics .....	TR
	Total non-halogenated plastics.....	~20.0
	Condensation polymers.....	~0
	Others.....	~20.0
	Organic ion exchange materials....	0
	Total rubber.....	~10.0
	Halogenated rubber .....	~7.0
	Non-halogenated rubber.....	~3.0
	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.....	1.0
	Sand.....	0
	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):	Inorganic anions likely to be below 1% but not estimated.	

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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:

Some of the materials in the waste would burn under appropriate conditions and plastics and rubber could generate toxic fumes. The waste might include some asbestos occasionally.

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

Not expected

Hazardous substances / non hazardous pollutants:

-	
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

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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):

No	
EDTA.....	NE
DPTA.....	NE
NTA.....	NE
Polycarboxylic acids.....	NE
Other organic complexants.....	NE
Total complexing agents.....	0

**TREATMENT, PACKAGING AND DISPOSAL**

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.

**WASTE STREAM****3M14****Gas Circulator Maintenance - Low Level Waste****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	50.0
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	5.0
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 <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO	45.0	~13.55	< 1
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO			
1/2 Height IP-2 Disposal/Re-usable ISO			
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.

**Waste Planned for Disposal at the LLW Repository:**

Container voidage: -

Waste Characterisation Form (WCH):

The waste meets the LLWR's Waste Acceptance Criteria (WAC).  
The waste has a current WCH.  
Inventory information is consistent with the current WCH.

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: -

**WASTE STREAM****3M14****Gas Circulator Maintenance - Low Level Waste****RADIOACTIVITY**

Source:	Principally activation products.
Uncertainty:	Activity estimates have been made from drum dose rate measurements and some limited fingerprint data.
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:	-
Other information:	-

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	2.88E-04	CC 2	2.88E-04	CC 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	2.72E-05	CC 2	2.72E-05	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	3.84E-06	CC 2	3.84E-06	CC 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41		8		8	Pt 193				
Mn 53					Tl 204				
Mn 54	2.72E-05	CC 2	2.72E-05	CC 2	Pb 205				
Fe 55	1.01E-03	CC 2	1.01E-03	CC 2	Pb 210	8			8
Co 60	1.38E-04	CC 2	1.38E-04	CC 2	Bi 208				
Ni 59		8		8	Bi 210m				
Ni 63	8.8E-05	CC 2	8.8E-05	CC 2	Po 210	8			8
Zn 65	1.49E-06	CC 2	1.49E-06	CC 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	6.4E-07	CC 2	6.4E-07	CC 2	Th 227				
Zr 93		8		8	Th 228				
Nb 91					Th 229	8			8
Nb 92					Th 230	8			8
Nb 93m		8		8	Th 232	8			8
Nb 94	3.84E-08	CC 2	3.84E-08	CC 2	Th 234				
Mo 93		8		8	Pa 231	8			8
Tc 97					Pa 233				
Tc 99		8		8	U 232				
Ru 106	8.8E-07	CC 2	8.8E-07	CC 2	U 233				8
Pd 107		8		8	U 234	1.09E-08	CC 2	1.09E-08	CC 2
Ag 108m	4.32E-08	CC 2	4.32E-08	CC 2	U 235	3.68E-10	CC 2	3.68E-10	CC 2
Ag 110m	3.2E-07	CC 2	3.2E-07	CC 2	U 236	5.76E-09	CC 2	5.76E-09	CC 2
Cd 109					U 238	1.09E-08	CC 2	1.09E-08	CC 2
Cd 113m					Np 237		8		8
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	7.2E-09	CC 2	7.2E-09	CC 2
Sn 123					Pu 239	4.64E-09	CC 2	4.64E-09	CC 2
Sn 126		8		8	Pu 240	1.10E-08	CC 2	1.10E-08	CC 2
Sb 125	5.6E-07	CC 2	5.6E-07	CC 2	Pu 241	5.6E-07	CC 2	5.6E-07	CC 2
Sb 126					Pu 242		8		8
Te 125m					Am 241	2.08E-08	CC 2	2.08E-08	CC 2
Te 127m					Am 242m		8		8
I 129	6.08E-13	CC 2	6.08E-13	CC 2	Am 243		8		8
Cs 134	6.88E-07	CC 2	6.88E-07	CC 2	Cm 242	2.72E-08	CC 2	2.72E-08	CC 2
Cs 135		8		8	Cm 243	2.24E-10	CC 2	2.24E-10	CC 2
Cs 137	2.24E-06	CC 2	2.24E-06	CC 2	Cm 244	1.50E-08	CC 2	1.50E-08	CC 2
Ba 133	2.24E-07	CC 2	2.24E-07	CC 2	Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	2.88E-07	CC 2	2.88E-07	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	4.32E-07	CC 2	4.32E-07	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a		6		6
Eu 152	9.92E-08	CC 2	9.92E-08	CC 2	Other b/g	2.05E-05	CC 2	2.05E-05	CC 2
Eu 154	1.04E-07	CC 2	1.04E-07	CC 2	<b>Total a</b>	<b>1.14E-07</b>	<b>CC 2</b>	<b>1.14E-07</b>	<b>CC 2</b>
Eu 155	5.28E-08	CC 2	5.28E-08	CC 2	<b>Total b/g</b>	<b>1.61E-03</b>	<b>CC 2</b>	<b>1.61E-03</b>	<b>CC 2</b>

**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