

WASTE STREAM	3M13	Wet Fuel Route - Low Level Waste
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SITE Heysham 2

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	1.6 m ³
Future arisings -	1.4.2019 - 31.3.2030.....	13.4 m ³
	1.4.2030 - 31.3.2032.....	2.4 m ³
	1.4.2032 - 31.3.2033.....	23.3 m ³
	1.4.2033 - 31.3.2034.....	58.0 m ³
	1.4.2034 - 31.3.2035.....	106.3 m ³
	1.4.2035 - 31.3.2036.....	111.3 m ³
	1.4.2036 - 31.3.2040.....	9.5 m ³
	1.4.2040 - 31.3.2041.....	15.7 m ³
Total future arisings:		340.0 m ³
Total waste volume:		341.6 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 General trash from wet fuel route areas.

PHYSICAL CHARACTERISTICS

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

Physical components (%wt): Mainly organics (~59%) and plastic/rubber (~32%). A small amount of metal and concrete is also present.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.3

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

CHEMICAL COMPOSITION

General description and components (%wt): Mainly organics (~59%) and plastic/rubber (~32%). A small amount of metal and concrete is also present.

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: To be determined
 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..... ~4.0
 Other ferrous metals..... ~4.0
 Iron..... NE
 Aluminium..... NE
 Beryllium..... NE

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	Cobalt.....	NE
	Copper.....	NE
	Lead.....	0
	Magnox/Magnesium.....	NE
	Nickel.....	NE
	Titanium.....	NE
	Uranium.....	NE
	Zinc.....	NE
	Zircaloy/Zirconium.....	NE
	Other metals.....	NE
Organics (%wt):	To be further assessed.	
	Total cellulose.....	~59.0
	Paper, cotton.....	~55.0
	Wood.....	~4.0
	Halogenated plastics	~7.0
	Total non-halogenated plastics.....	~15.0
	Condensation polymers.....	~15.0
	Others.....	NE
	Organic ion exchange materials....	0
	Total rubber.....	~10.0
	Halogenated rubber	NE
	Non-halogenated rubber.....	~10.0
	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.....	
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	

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	Highly friable.....	
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	Not assessed.	
	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 then generate toxic fumes.	
	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
	Chlorinated solvents.....	NE
	Formaldehyde.....	NE
	Organometallics.....	NE
	Phenol.....	NE
	Styrene.....	NE
	Tri-butyl phosphate.....	NE

Not expected

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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):	Not yet determined
EDTA.....	NE
DPTA.....	NE
NTA.....	NE
Polycarboxylic acids.....	NE
Other organic complexants.....	NE
Total complexing agents.....	TR

May be present in trace quantities.

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	12
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 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:	-

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:	Activity estimates are based on fingerprint of waste stream and on dose rate measurements of drummed waste.
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	6.55E-06	CC 2	6.55E-06	CC 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	5.27E-07	CC 2	5.27E-07	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	1.11E-07	CC 2	1.11E-07	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	5.53E-06	CC 2	5.53E-06	CC 2	Pb 205				
Fe 55	1.55E-04	CC 2	1.55E-04	CC 2	Pb 210		8		8
Co 60	1.85E-05	CC 2	1.85E-05	CC 2	Bi 208				
Ni 59		8		8	Bi 210m				
Ni 63	3.31E-05	CC 2	3.31E-05	CC 2	Po 210		8		8
Zn 65	3.71E-07	CC 2	3.71E-07	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	6.11E-05	CC 2	6.11E-05	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	1.10E-08	CC 2	1.10E-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	1.13E-06	CC 2	1.13E-06	CC 2	U 233		8		8
Pd 107		8		8	U 234	2.78E-08	CC 2	2.78E-08	CC 2
Ag 108m	1.36E-08	CC 2	1.36E-08	CC 2	U 235	<4.52E-10	C 3	<4.52E-10	C 3
Ag 110m	2.59E-07	CC 2	2.59E-07	CC 2	U 236	7.22E-09	CC 2	7.22E-09	CC 2
Cd 109					U 238	8.59E-09	CC 2	8.59E-09	CC 2
Cd 113m					Np 237		8		8
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	5.57E-06	CC 2	5.57E-06	CC 2
Sn 123					Pu 239	2.91E-06	CC 2	2.91E-06	CC 2
Sn 126		8		8	Pu 240	6.90E-06	CC 2	6.90E-06	CC 2
Sb 125	1.83E-07	CC 2	1.83E-07	CC 2	Pu 241	3.92E-04	CC 2	3.92E-04	CC 2
Sb 126					Pu 242		8		8
Te 125m					Am 241	1.35E-05	CC 2	1.35E-05	CC 2
Te 127m					Am 242m		8		8
I 129	7.34E-11	CC 2	7.34E-11	CC 2	Am 243		8		8
Cs 134	4.39E-06	CC 2	4.39E-06	CC 2	Cm 242	9.62E-08	CC 2	9.62E-08	CC 2
Cs 135		8		8	Cm 243	1.31E-08	CC 2	1.31E-08	CC 2
Cs 137	2.14E-04	CC 2	2.14E-04	CC 2	Cm 244	7.52E-07	CC 2	7.52E-07	CC 2
Ba 133	1.24E-07	CC 2	1.24E-07	CC 2	Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	5.08E-07	CC 2	5.08E-07	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	2.70E-05	CC 2	2.70E-05	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a		6		6
Eu 152	2.68E-07	CC 2	2.68E-07	CC 2	Other b/g	2.13E-06	CC 2	2.13E-06	CC 2
Eu 154	7.84E-06	CC 2	7.84E-06	CC 2	Total a	2.98E-05	CC 2	2.98E-05	CC 2
Eu 155	2.87E-06	CC 2	2.87E-06	CC 2	Total b/g	9.34E-04	CC 2	9.34E-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