WASTE STREAM 4C17 Wet Fuel Route LLW

SITE Torness

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0.4 m³
Future arisings -	1.4.2019 - 31.3.2032.....	22.4 m³
	1.4.2032 - 31.3.2033.....	95.6 m³
	1.4.2033 - 31.3.2034.....	67.4 m³
	1.4.2034 - 31.3.2035.....	149.7 m³
	1.4.2035 - 31.3.2036.....	2.1 m³
	1.4.2036 - 31.3.2037.....	2.1 m³
	1.4.2037 - 31.3.2038.....	2.1 m³
	1.4.2038 - 31.3.2039.....	2.1 m³
	1.4.2039 - 31.3.2040.....	9.0 m³
	1.4.2040 - 31.3.2041.....	8.1 m³
Total future arisings:		360.3 m³
Total waste volume:		360.7 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 1.5
Stock (lower):	x 0.75	Arisings (lower)	x 0.5

WASTE SOURCE Waste arises from operation and maintenance of fuel route areas.

PHYSICAL CHARACTERISTICS

General description: The waste includes disposable items such as paper, plastic and metal tools. These waste items will be cut, punctured, etc. prior to disposal directly in HHISO containers.

Physical components (%wt): Metal (~2%), Plastic/Rubber (~50%), Wood (~3%), Soft Organics (~44%), Other (~1%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.61

Comment on density: Waste density is an estimate based on average of current arisings.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (~2%), Plastic/Rubber (~50%), Wood (~3%), Soft Organics (~44%), Other (~1%). The drum material is mild steel.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Contamination from tritiated water
C-14: Graphite
Cl-36: To Be determined
Se-79: To Be determined
Tc-99: To Be determined
I-129: To Be determined
Ra: To Be determined
Th: To Be determined
U: To Be determined
Np: To Be determined
Pu: To Be determined

Metals and alloys (%wt): This waste stream will contain some large uncompactable items, which will be volume reduced and placed in HHISO containers for disposal.

WASTE STREAM	4C17	Wet Fuel Route LLW

	Stainless steel	~1.0	
	Other ferrous metals	~1.0	
	Iron	0	
	Aluminium	0	
	Beryllium	0	
	Cobalt	0	
	Copper	0	
	Lead	0	
	Magnox/Magnesium	0	
	Nickel	0	
	Titanium	0	
	Uranium	0	
	Zinc	~0	
	Zircaloy/Zirconium	0	
	Other metals	NE	
Organics (%wt):	The waste is known to contain organic materials in the form of paper, cloth and plastic (polythene).Mass fractions are indicative and will vary significantly with station operation. Not currently estimated.		
	Total cellulosics	~47.0	
	Paper, cotton	~44.0	
	Wood	~3.0	
	Halogenated plastics	NE	
	Total non-halogenated plastics	~49.0	
	Condensation polymers	NE	
	Others	~49.0	Polythene
	Organic ion exchange materials	0	
	Total rubber	~1.0	
	Halogenated rubber	NE	
	Non-halogenated rubber	~1.0	
	Hydrocarbons	~0	A small amount may be present
	Oil or grease		
	Fuel		
	Asphalt/Tarmac (cont.coal tar)		
	Asphalt/Tarmac (no coal tar)		
	Bitumen		
	Others		
	Other organics	~1.0	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	

WASTE STREAM	4C17	Wet Fuel Route LLW

	Sand	0	
	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 anions are not estimated but may be present in trace quantities.		
	Fluoride	0	
	Chloride	NE	
	Iodide	NE	
	Cyanide	0	
	Carbonate	NE	
	Nitrate	NE	
	Nitrite	NE	
	Phosphate	0	
	Sulphate	NE	
	Sulphide	NE	
Materials of interest for waste acceptance criteria:	Efforts are made to remove all hazardous materials from the waste 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	Not expected
	Soluble solids as bulk chemical compounds	0	

WASTE STREAM 4C17 Wet Fuel Route LLW

Hazardous substances / non hazardous pollutants: -

Acrylamide	NE	
Benzene	0	
Chlorinated solvents	NE	
Formaldehyde	NE	
Organometallics	NE	
Phenol	NE	
Styrene	NE	
Tri-butyl phosphate	0	
Other organophosphates	NE	
Vinyl chloride	0	
Arsenic	0	
Barium	NE	
Boron	0	
Cadmium	0	
Caesium	0	
Selenium	0	
Chromium	0	
Molybdenum	0	
Thallium	NE	
Tin	0	
Vanadium	0	
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	Not expected to be present.
Total complexing agents	0	

WASTE STREAM 4C17 Wet Fuel Route LLW

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		
Recyling / reuse		
Other / various		
None		~15.0

Comment on planned treatments:

IIn 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.

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. Waste will usually be disposed of in the year of arising, however this will be dependent upon rate of arising of LLW throughout the year for LLWR disposal.
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:	The waste is contaminated with fission products, actinides and activation products.
Uncertainty:	Activity expected to be within 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:	-
Other information:	The specific activity will vary at various time in the history of the plant.

WASTE STREAM 4C17 Wet Fuel Route LLW

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	9.41E-07	C C 2	9.41E-07	C C 2	Gd 153				
Be 10					Ho 163				
C 14	4.14E-08	C C 2	4.14E-08	C C 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	4.5E-08	C C 2	4.5E-08	C C 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	4.06E-07	C C 2	4.06E-07	C C 2	Pb 205				
Fe 55	1.26E-05	C C 2	1.26E-05	C C 2	Pb 210				
Co 60	1.04E-06	C C 2	1.04E-06	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	1.41E-06	C C 2	1.41E-06	C C 2	Po 210				
Zn 65	1.32E-08	C C 2	1.32E-08	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	3.49E-07	C C 2	3.49E-07	C C 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	4.55E-09	C C 2	4.55E-09	C C 2	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106	3.82E-08	C C 2	3.82E-08	C C 2	U 233				
Pd 107					U 234	1.46E-10	C C 2	1.46E-10	C C 2
Ag 108m	5.91E-09	C C 2	5.91E-09	C C 2	U 235	2.36E-12	C C 2	2.36E-12	C C 2
Ag 110m	6E-08	C C 2	6E-08	C C 2	U 236	3.82E-11	C C 2	3.82E-11	C C 2
Cd 109					U 238	4.27E-11	C C 2	4.27E-11	C C 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	5.59E-08	C C 2	5.59E-08	C C 2
Sn 123					Pu 239	2.86E-08	C C 2	2.86E-08	C C 2
Sn 126					Pu 240	6.77E-08	C C 2	6.77E-08	C C 2
Sb 125	2.36E-08	C C 2	2.36E-08	C C 2	Pu 241	3.40E-06	C C 2	3.40E-06	C C 2
Sb 126					Pu 242				
Te 125m					Am 241	1.62E-07	C C 2	1.62E-07	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	2.16E-07	C C 2	2.16E-07	C C 2	Cm 242	9.09E-10	C C 2	9.09E-10	C C 2
Cs 135					Cm 243	7.73E-11	C C 2	7.73E-11	C C 2
Cs 137	1.46E-05	C C 2	1.46E-05	C C 2	Cm 244	1E-08	C C 2	1E-08	C C 2
Ba 133	9.09E-09	C C 2	9.09E-09	C C 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	1.14E-08	C C 2	1.14E-08	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147	1E-07	C C 2	1E-07	C C 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a		6		6
Eu 152	1.73E-08	C C 2	1.73E-08	C C 2	Other b/g				
Eu 154	2.73E-08	C C 2	2.73E-08	C C 2	**Total a**	**3.25E-07**	**C C 2**	**3.25E-07**	**C C 2**
Eu 155	2.55E-08	C C 2	2.55E-08	C C 2	**Total b/g**	**3.54E-05**	**C C 2**	**3.54E-05**	**C C 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