

<b>WASTE STREAM</b>	<b>3K15</b>	<b>Dry Fuel Route LLW</b>
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**SITE** Hartlepool

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** LLW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	18.4 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2023.....	80.6 m <sup>3</sup>
	1.4.2023 - 31.3.2024.....	3.5 m <sup>3</sup>
	1.4.2024 - 31.3.2025.....	13.8 m <sup>3</sup>
	1.4.2025 - 31.3.2026.....	15.8 m <sup>3</sup>
	1.4.2026 - 31.3.2027.....	20.3 m <sup>3</sup>
	1.4.2027 - 31.3.2028.....	8.9 m <sup>3</sup>
Total future arisings:		142.8 m <sup>3</sup>
Total waste volume:		161.2 m <sup>3</sup>

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** Hard trash arising from fuel route areas.

**PHYSICAL CHARACTERISTICS**

General description: Hard trash from the fuel route areas. Non-drummable items may be transported and disposed at the LLWR in half height ISO containers.

Physical components (%wt): Metal (46%), Concrete (17%), Organics (1%), Plastics (6%), Rubber (4%), Wood (16%) and other material such as non asbestos lagging and ash (10%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~0.28

Comment on density: Density as in WCF

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (46%), Concrete (17%), Organics (1%), Plastics (6%), Rubber (4%), Wood (16%) and other material such as non asbestos lagging and ash (10%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: To be Determined  
 C-14: To be Determined  
 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):

Stainless steel.....	~1.0
Other ferrous metals.....	~42.0
Iron.....	NE
Aluminium.....	~1.0
Beryllium.....	NE
Cobalt.....	NE
Copper.....	~2.0

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Lead..... 0  
 Magnox/Magnesium..... NE  
 Nickel..... NE  
 Titanium..... NE  
 Uranium..... NE  
 Zinc..... NE  
 Zircaloy/Zirconium..... NE  
 Other metals..... NE

## Organics (%wt):

The waste contains cellulose as paper, halogenated and non-halogenated plastic and small quantities of rubber. Traces of oil may be present. The waste contains halogenated plastic.

Total cellulosics..... ~17.0  
     Paper, cotton..... ~1.0  
     Wood..... ~16.0  
 Halogenated plastics ..... ~1.0  
 Total non-halogenated plastics..... ~5.0  
     Condensation polymers..... ~0  
     Others..... ~5.0  
 Organic ion exchange materials.... ~0  
 Total rubber..... ~4.0  
     Halogenated rubber ..... ~3.0  
     Non-halogenated rubber..... ~1.0  
 Hydrocarbons..... NE  
     Oil or grease .....  
     Fuel.....  
     Asphalt/Tarmac (cont.coal tar)...  
     Asphalt/Tarmac (no coal tar)....  
     Bitumen.....  
     Others.....  
 Other organics..... ~10.0

## Other materials (%wt):

-  
 Inorganic ion exchange materials. 0  
 Inorganic sludges and flocs..... 0  
 Soil..... 0  
 Brick/Stone/Rubble..... ~17.0  
 Cementitious material..... 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 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:	No hazardous materials expected.	
	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:	Listed substances are not expected in significant quantity.	
	Acrylamide.....	NE
	Benzene.....	NE
	Chlorinated solvents.....	NE
	Formaldehyde.....	NE
	Organometallics.....	NE
	Phenol.....	NE
	Styrene.....	NE
	Tri-butyl phosphate.....	NE

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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

Trace quantities may be present.

**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 <sup>3</sup>	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	6
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. Routinely sent 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:	Mainly activation products.
Uncertainty:	Specific activity is a function of station operating history. The values quoted are indicative of the activities that would be expected.
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 values are based on fingerprint of wastestream.
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	4.86E-05	CC 2	4.86E-05	CC 2	Gd 153				
Be 10					Ho 163				
C 14	8.72E-06	CC 2	8.72E-06	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	6.16E-08	CC 2	6.16E-08	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	7.31E-05	CC 2	7.31E-05	CC 2	Pb 205				
Fe 55	5.62E-04	CC 2	5.62E-04	CC 2	Pb 210				
Co 60	7.52E-05	CC 2	7.52E-05	CC 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	3.10E-05	CC 2	3.10E-05	CC 2	Po 210				
Zn 65	2.72E-06	CC 2	2.72E-06	CC 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.31E-07		1.31E-07		Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	3.14E-08	CC 2	3.14E-08	CC 2	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106	2.29E-07	CC 2	2.29E-07	CC 2	U 233				
Pd 107					U 234	2.82E-12	CC 2	2.82E-12	CC 2
Ag 108m	2.60E-08	CC 2	2.60E-08	CC 2	U 235	4.53E-14	CC 2	4.53E-14	CC 2
Ag 110m	2.21E-07	CC 2	2.21E-07	CC 2	U 236	7.23E-13	CC 2	7.23E-13	CC 2
Cd 109					U 238	8.44E-13	CC 2	8.44E-13	CC 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	2.56E-09	CC 2	2.56E-09	CC 2
Sn 123					Pu 239	9.50E-10	CC 2	9.50E-10	CC 2
Sn 126					Pu 240	2.26E-09	CC 2	2.26E-09	CC 2
Sb 125	7.04E-08	CC 2	7.04E-08	CC 2	Pu 241	1.45E-06	CC 2	1.45E-06	CC 2
Sb 126					Pu 242				
Te 125m					Am 241	9.93E-09	CC 2	9.93E-09	CC 2
Te 127m					Am 242m				
I 129	6.55E-14	CC 2	6.55E-14	CC 2	Am 243				
Cs 134	5.43E-07	CC 2	5.43E-07	CC 2	Cm 242	2.87E-09	CC 2	2.87E-09	CC 2
Cs 135					Cm 243	4.56E-12	CC 2	4.56E-12	CC 2
Cs 137	2.46E-07	CC 2	2.46E-07	CC 2	Cm 244	3.17E-10	CC 2	3.17E-10	CC 2
Ba 133		CC 2		CC 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	3.89E-07	CC 2	3.89E-07	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	4.97E-07	CC 2	4.97E-07	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a		6		6
Eu 152	5.92E-08	CC 2	5.92E-08	CC 2	Other b/g	1.30E-05	CC 2	1.30E-05	CC 2
Eu 154	5.72E-08	CC 2	5.72E-08	CC 2	<b>Total a</b>	<b>1.89E-08</b>	<b>CC 2</b>	<b>1.89E-08</b>	<b>CC 2</b>
Eu 155	3.82E-08	CC 2	3.82E-08	CC 2	<b>Total b/g</b>	<b>8.23E-04</b>	<b>CC 2</b>	<b>8.23E-04</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