

WASTE STREAM	4C16	Dry Fuel Route LLW
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SITE Torness

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	18.3m ³
Future arisings -	1.4.2022 - 31.3.2027.....	213.0m ³
	1.4.2027 - 31.3.2028.....	3.0m ³
	1.4.2028 - 31.3.2029.....	13.0m ³
	1.4.2029 - 31.3.2030.....	14.0m ³
	1.4.2030 - 31.3.2031.....	17.0m ³
	1.4.2031 - 31.3.2032.....	15.0m ³
Total future arisings:		275.0m ³
Total waste volume:		293.3m 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 generated from the dry fuel route areas. This includes the following areas: Gas Circulators, Pile Cap Area, Irradiated Fuel Disposal Facility, Fuel Plug Unit area, High Active Debris Vault, and SDM area.

PHYSICAL CHARACTERISTICS

General description: The wastes generated in these areas can be metal, redundant plant items both small and large, cabling. They can be shreddable/compactable including general bagged waste, paper, polythene, clothing, wood, rubber, lagging, vacuum bags etc. Some small amounts of contaminated asbestos may be generated during plant maintenance activities Items that are considered suitable will be shredded and compacted into the standard 180 – litre drum. Waste compaction on site is carried out for volume minimisation.

Physical components (%wt): Metal (~63%), Plastic/Rubber (~15%), Wood (~8%), Biodegradable- non putrescibles (~12%) and Other (~2%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.21

Comment on density: Density based on raw volume and weight at arising as provided in WCH

CHEMICAL COMPOSITION

General description and components (%wt): Metal (~63%), Plastic/Rubber (~15%), Wood (~8%), Biodegradable- non putrescibles (~12%) and Other (~2%).

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 is variable and may contain some bulk items which will be volume reduced by cutting, proportion of bulk items unknown.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~9.0	Solid - miscellaneous plant items, typically from maintenance and overhaul of gas circulators or replacement of effluent pipework in reactor building, support structure, redundant fuel handling equipment. Also Solid - miscellaneous plant items and scrap generated during plant modifications and maintenance. Hand tools, nuts, bolts, valves, pipework, stainless steel sintered metal cylindrical HEPA filters etc.	
Other ferrous metals.....	~54.0	Mild steel-Solid - miscellaneous plant items and scrap generated during plant modifications and maintenance. Locations will be primarily from Decontam workshop areas. E.g. support structure, pipework, redundant fuel handling equipment, mild steel rectangular HEPA filters.	
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.....	NE		
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.		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~20.0		
Paper, cotton.....	~12.0	Biodegradable-non putrescibles	
Wood.....	~8.0		
Halogenated plastics	NE		
Total non-halogenated plastics.....	~12.0	General shredded plastic wastes e.g. plastic bags, sheeting, PPE	
Condensation polymers.....	NE		
Others.....	NE		
Organic ion exchange materials....	0		
Total rubber.....	~3.0		

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Halogenated rubber	NE		
Non-halogenated rubber.....	~3.0		
Hydrocarbons.....	~0	A small amount may be present	
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....		Epoxy polyester paint-Coating adhered to mild steel rectangular HEPA filters.	
Other organics.....	~0		
Other materials (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	1.8		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	NE		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	~0.20	Man Made Mineral Fibres	
Non/low friable.....	~0.10	CAF joints - WHITE Chrysotile asbestos, with a small quantity of BROWN Amosite asbestos	
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.		

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	(%wt)	Type(s) and comment
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: -

	(%wt)	Type(s) and comment
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.....	12.0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	NE	
Benzene.....	0	
Chlorinated solvents.....	NE	
Formaldehyde.....	NE	
Organometallics.....	NE	
Phenol.....	NE	
Styrene.....	NE	
Tri-butyl phosphate.....	0	
Other organophosphates.....	NE	

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Vinyl chloride.....	0
Arsenic.....	0
Barium.....	NE
Boron.....	0
Boron (in Boral).....	0
Boron (non-Boral).....	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):

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	
Total complexing agents.....	0	

Potential for the waste to contain discrete items: Yes.

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	~10.0
Incineration	Off-site	~40.0
Solidification		
Decontamination		
Metal treatment	Off-Site	~40.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None	Off-site	~10.0

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, Cyclife, Tradebe Inutec.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~20.0	
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	~40.0	
Expected to be consigned to a Metal Treatment Facility	~40.0	
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: -

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
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			

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

Waste Packaging for Disposal:

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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 2m box (no shielding) 4m box (no shielding) Other	20.0	~30.4	2

Other information: Waste loading is representative of the raw waste following further planned treatments. Supercompaction assumed to reduce volume to 20% of original. Solidification assumed to increase volume to 300% of original. No treatment results in the same volume.

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: No. Efforts are made to dispose of waste during year of arising, but this is dependent on rate of arising throughout the year. This is also dependent on consignment of waste to third parties

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: Contamination will be main source of activity with possibly some activation of certain reactor or fuel route components.

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 beta/gamma emitting radionuclides plus 'other beta/gamma' not listed on the datasheet

Measurement of radioactivities: Results for the analysis of area bulk samples were calculated as ratios to Co-60 and Cs-137. These ratios are referred to as individual area fingerprints. For these fingerprints 'less than' values were quoted where a result falls below the Minimum Detectable Activity (MDA). Waste mapping data was provided by Torness in the form of volume of bags/drums (m3) and associated dose rates (µSv/h) from plant areas. The waste mapping data covers the period between June 2011 and February 2015. This allowed NNL to calculate activity based percentage contributions to the waste stream for each area sampled.

Other information: The specific activity will vary at various times in the history of the plant.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	2.03E-05	CC 2	2.03E-05	CC 2	Gd 153				
Be 10					Ho 163				
C 14	2.67E-06	CC 2	2.67E-06	CC 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	4.26E-06	CC 2	4.26E-06	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	1.34E-05	CC 2	1.34E-05	CC 2	Pb 205				
Fe 55	3.55E-04	CC 2	3.55E-04	CC 2	Pb 210				
Co 60	5.87E-05	CC 2	5.87E-05	CC 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	3.85E-05	CC 2	3.85E-05	CC 2	Po 210				
Zn 65	8.74E-07	CC 2	8.74E-07	CC 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.84E-07	CC 2	1.84E-07	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	3.70E-08	CC 2	3.70E-08	CC 2	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106	4.63E-07	CC 2	4.63E-07	CC 2	U 233				
Pd 107					U 234				
Ag 108m	3.57E-08	CC 2	3.57E-08	CC 2	U 235				
Ag 110m	2.09E-07	CC 2	2.09E-07	CC 2	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	4.99E-10	CC 2	4.99E-10	CC 2
Sn 123					Pu 239	1.47E-10	CC 2	1.47E-10	CC 2
Sn 126					Pu 240	3.81E-10	CC 2	3.81E-10	CC 2
Sb 125	3.31E-08	CC 2	3.31E-08	CC 2	Pu 241	1.33E-07	CC 2	1.33E-07	CC 2
Sb 126					Pu 242				
Te 125m					Am 241	9.97E-10	CC 2	9.97E-10	CC 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	8.50E-08	CC 2	8.50E-08	CC 2	Cm 242	6.16E-10	CC 2	6.16E-10	CC 2
Cs 135					Cm 243				
Cs 137	8.80E-07	CC 2	8.80E-07	CC 2	Cm 244	2.35E-10	CC 2	2.35E-10	CC 2
Ba 133	1.51E-08	CC 2	1.51E-08	CC 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	1.76E-07	CC 2	1.76E-07	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	8.91E-08	CC 2	8.91E-08	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152	4.72E-08	CC 2	4.72E-08	CC 2	Other b/g	1.02E-05	CC 2	1.02E-05	CC 2
Eu 154	7.27E-08	CC 2	7.27E-08	CC 2	Total a	2.87E-09	CC 2	2.87E-09	CC 2
Eu 155	3.77E-08	CC 2	3.77E-08	CC 2	Total b/g	5.06E-04	CC 2	5.06E-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