

<b>WASTE STREAM</b>	<b>4C315</b>	<b>Decommissioning Stage 3: Mild Steel (Reactor) LLW</b>
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**SITE** Torness

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** LLW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2118.....	0 m <sup>3</sup>
	1.4.2118 - 31.3.2119.....	1063.4 m <sup>3</sup>
	1.4.2119 - 31.3.2120.....	1176.6 m <sup>3</sup>
	1.4.2120 - 31.3.2121.....	1038.0 m <sup>3</sup>
Total future arisings:		3278.0 m <sup>3</sup>
Total waste volume:		3278.0 m <sup>3</sup>

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

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.5  
 Stock (lower): x Arisings (lower) x 0.5

**WASTE SOURCE** Mild steel items from the reactor structure.

**PHYSICAL CHARACTERISTICS**

General description: A variety of mild steel items. Waste can be packaged in standard NDA packages.

Physical components (%wt): Mild steel items (100%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1.4

Comment on density: The density is of the waste as cut for packaging.

**CHEMICAL COMPOSITION**

General description and components (%wt): A variety of mild steels (100%) with possible traces of other metals.

Chemical state: -

Chemical form of radionuclides: H-3: Diffused into matrix  
 C-14: Incorporated in the steel. There may be some surface contamination as graphite.  
 Cl-36: The chlorine will be incorporated in the steel  
 Se-79: Selenium content not expected to be significant  
 Tc-99: Not determined  
 I-129: Not significant  
 Ra: Radium content is insignificant  
 Th: Thorium content is Insignificant  
 U: Uranium content is Insignificant  
 Np: The neptunium content is insignificant  
 Pu: Plutonium content is insignificant

Metals and alloys (%wt): The waste will be bulk metal items which have been cut for packaging. Metal thicknesses will range from a few mm to about 50mm.

Stainless steel.....	0
Other ferrous metals.....	100.0
Iron.....	0
Aluminium.....	0
Beryllium.....	0
Cobalt.....	0
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0

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	Nickel.....	0
	Titanium.....	0
	Uranium.....	0
	Zinc.....	0
	Zircaloy/Zirconium.....	0
	Other metals.....	0
Organics (%wt):	None expected.	
	Total cellulose.....	0
	Paper, cotton.....	0
	Wood.....	0
	Halogenated plastics .....	0
	Total non-halogenated plastics.....	0
	Condensation polymers.....	0
	Others.....	0
	Organic ion exchange materials....	0
	Total rubber.....	0
	Halogenated rubber .....	0
	Non-halogenated rubber.....	0
	Hydrocarbons.....	0
	Oil or grease .....	
	Fuel.....	
	Asphalt/Tarmac (cont.coal tar)...	
	Asphalt/Tarmac (no coal tar)....	
	Bitumen.....	
	Others.....	
	Other organics.....	0
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	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

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Inorganic anions (%wt):

None likely to be present.

Fluoride.....	0
Chloride.....	0
Iodide.....	0
Cyanide.....	0
Carbonate.....	0
Nitrate.....	0
Nitrite.....	0
Phosphate.....	0
Sulphate.....	0
Sulphide.....	0

Materials of interest for waste acceptance criteria:

No materials likely to pose a fire or other non-radiological hazard have been identified.

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.....	P
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

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Boron.....	NE
Cadmium.....	NE
Caesium.....	NE
Selenium.....	NE
Chromium.....	NE
Molybdenum.....	NE
Thallium.....	NE
Tin.....	NE
Vanadium.....	NE
Mercury compounds.....	NE
Others.....	NE
Electronic Electrical Equipment (EEE)	
EEE Type 1.....	0
EEE Type 2.....	0
EEE Type 3.....	0
EEE Type 4.....	0
EEE Type 5.....	0

Complexing agents (%wt):

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

Only trace quantities, if any.

**TREATMENT, PACKAGING AND DISPOSAL**

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	~80.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		
		~20.0

Comment on planned treatments:

Approximately 80% of the waste will be suitable for decontamination and melting and 95% is expected to be suitable for re-use.

**WASTE STREAM****4C315****Decommissioning Stage 3: Mild Steel (Reactor) LLW****Disposal Routes:**

Disposal Route	Stream volume %	
Expected to be consigned to the LLW Repository	~24.0	
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		
Expected to be consigned to a Metal Treatment Facility		~76.0
Expected to be consigned as Out of Scope		
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 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	24.0	14.75	54

Other information: Change to HHISO.

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

Container voidage: -

Waste Characterisation Form (WCH): It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).

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:	Activation of the mild steel and its impurities.
Uncertainty:	The values quoted were derived by calculation from available material specifications and are indicative of the activities that are to be expected. A major source of uncertainty is the impurity levels.
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:	Activation/decay calculations based on neutron flux and operating history.
Other information:	There may be some contamination by Cs137. The activities quoted are for the time at which this waste will arise (i.e. ~85 years after end of generation).

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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				8	Gd 153				
Be 10				8	Ho 163				
C 14			5.45E-06	C C 2	Ho 166m				
Na 22				4	Tm 170				
Al 26				4	Tm 171				
Cl 36				8	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41				8	Pt 193				
Mn 53					Tl 204				
Mn 54				8	Pb 205				
Fe 55			4.62E-11	C C 2	Pb 210				8
Co 60			6.55E-08	C C 2	Bi 208				
Ni 59			9.71E-07	C C 2	Bi 210m				
Ni 63			5.53E-05	C C 2	Po 210				8
Zn 65				6	Ra 223				
Se 79				8	Ra 225				
Kr 81					Ra 226				8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90				8	Th 227				
Zr 93				8	Th 228				
Nb 91					Th 229				8
Nb 92					Th 230				8
Nb 93m			2.8E-09	C C 2	Th 232				8
Nb 94			2.06E-08	C C 2	Th 234				
Mo 93			2.44E-08	C C 2	Pa 231				8
Tc 97					Pa 233				
Tc 99			4.81E-09	C C 2	U 232				
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			3.88E-09	C C 2	U 235				8
Ag 110m					U 236				8
Cd 109					U 238				8
Cd 113m					Np 237				8
Sn 119m					Pu 236				
Sn 121m				8	Pu 238				8
Sn 123					Pu 239				8
Sn 126				8	Pu 240				8
Sb 125					Pu 241				8
Sb 126					Pu 242				8
Te 125m					Am 241				8
Te 127m					Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137				8	Cm 244				8
Ba 133					Cm 245				8
La 137					Cm 246				8
La 138					Cm 248				
Ce 144				8	Cf 249				
Pm 145					Cf 250				
Pm 147				8	Cf 251				
Sm 147					Cf 252				
Sm 151				8	Other a				8
Eu 152				8	Other b/g				8
Eu 154				8	<b>Total a</b>	<b>0</b>	<b>&lt;1E-09</b>		<b>8</b>
Eu 155				8	<b>Total b/g</b>	<b>0</b>	<b>6.18E-05</b>	<b>C C 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