

WASTE STREAM	8A103	Capenhurst Decommissioning Waste
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SITE Capenhurst
SITE OWNER Urenco
WASTE CUSTODIAN Urenco Nuclear Stewardship

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	50.0 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	~56.0 m ³
	1.4.2023 - 31.3.2024.....	~56.0 m ³
	1.4.2024 - 31.3.2025.....	~56.0 m ³
	1.4.2025 - 31.3.2050.....	~1236.0 m ³
Total future arisings:		1404.0 m ³
Total waste volume:		1454.0 m ³

Comment on volumes: Arisings have been estimated based on current programmes which have not yet been confirmed. Also characterisation of some of the materials has not been completed so volumes may change when this work is carried out. Wastes will be size reduced where appropriate, packaged as required by transport regulations and disposed of as LLW and VLLW via LLWR. Volumes currently stored may have been estimated due to containers not being full. Some wastes are not fully characterised and hence volume for disposal may be reduced.

Uncertainty factors on volumes: Stock (upper): x 2.0 Arisings (upper) x 5.0
 Stock (lower): x 1.0 Arisings (lower) x 0.2

WASTE SOURCE General plant decommissioning and building demolition.

PHYSICAL CHARACTERISTICS

General description: Contaminated material associated with decommissioning of diffusion plant and associated facilities on Capenhurst Site. Some materials have been size reduced.
 Physical components (%wt): Various metals (42.31%), Organics (43.21%), asbestos (14.42%).
 Sealed sources: The waste does not contain sealed sources.
 Bulk density (t/m³): ~0.56
 Comment on density: Density is an average for the whole waste stream.

CHEMICAL COMPOSITION

General description and components (%wt): Various metals (42.31%), Organics (43.21%), asbestos (14.42%).
 Chemical state: Neutral
 Chemical form of radionuclides: C-14: Unknown.
 Tc-99: TcO₂.
 I-129: Unknown.
 Ra: Unknown.
 Th: ThO₂, ThO₂F₂, ThF₄.
 U: UO₂F₂, UF₄.
 Np: NpO₂F₂, NpO₂.
 Metals and alloys (%wt): The average thickness of sheet metal pipes components is 10mm. Most of the waste is made up of various components e.g. valves, pipes.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	TR		
Other ferrous metals.....	~39.5		
Iron.....	0		
Aluminium.....	~2.6		

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Beryllium.....	0
Cobalt.....	0
Copper.....	~0.10
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	0
Titanium.....	0
Uranium.....	<<0.10
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): The waste contains cellulose as paper and wood, and small quantities of plastics and rubber. PVC, neoprene.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	~18.0		100.0
Paper, cotton.....	~8.0		45.0
Wood.....	~10.0		55.0
Halogenated plastics	~7.2		
Total non-halogenated plastics.....	~0.09		
Condensation polymers.....	P		
Others.....	P		
Organic ion exchange materials....	0		
Total rubber.....	P		
Halogenated rubber	P		
Non-halogenated rubber.....	P		
Hydrocarbons.....	~2.0		
Oil or grease	~2.0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar)....	0		
Bitumen.....	0		
Others.....	0		
Other organics.....	~16.0		

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.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	0		

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Graphite.....	0	
Desiccants/Catalysts.....	0	
Asbestos.....	~14.4	Type not determined
Non/low friable.....	0	
Moderately friable.....	0	
Highly friable.....	0	
Free aqueous liquids.....	0	
Free non-aqueous liquids.....	0	
Powder/Ash.....	0	

Inorganic anions (%wt): Fluorides and chlorides are present.

	(%wt)	Type(s) and comment
Fluoride.....	0.02	
Chloride.....	TR	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	0	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

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.....	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	

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Hazardous substances / Not yet determined
non hazardous pollutants:

	(%wt)	Type(s) and comment
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	
Boron.....	NE	
Boron (in Boral).....	NE	
Boron (non-Boral).....	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): No

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

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Potential for the waste to contain discrete items: Yes. RSJs potential for hand tools

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	~20.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination	On-site	~20.0
Metal treatment		
Size reduction	On-site	~2.0
Decay storage		
Recycling / reuse		
Other / various		
None		~58.0

Comment on planned treatments:

This stream will be sent for incineration, metals recycling or disposal as LLW or VLLW to landfill sites. Treatment and repackaging are carried out to meet transport regulations. There are no limitations on volumes to be sent for treatment or disposal. Some materials will be cut up for repackaging. This will not significantly reduce the volume for disposal. Some material may be suitable for metals recycling. Containers used for disposal to landfill are standard 210 litre UN approved drums (approx. dimensions 880mm high x 600mm diameter); may also use Bulk bags (approx 1 te weight capacity).

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~60.0	~1.6
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility	~20.0	~1.0
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility	~20.0	~7.8
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:

Mixed wastes - soil, concrete, metals, wood, lagging (asbestos contaminated).

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: (Not applicable to this waste stream)

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			

Other information: -

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

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 by uranium isotopes and their daughters and technetium.

Uncertainty: The accuracy is good for the measured data. Overall accuracy to within a factor of 10.

Definition of total alpha and total beta/gamma: Total activity is the sum of the listed nuclides plus other alpha and other beta/gamma.

Measurement of radioactivities: Chemical analysis of some materials and calculation of weighted average for whole stream.

Other information: -

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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					Gd 153				
Be 10					Ho 163				
C 14	~1.21E-08	BB 2	~1.21E-08	BB 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	~2.33E-08	BB 2	~2.33E-08	BB 2
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228	~4.5E-07	BB 2	~4.5E-07	BB 2
Nb 91					Th 229				
Nb 92					Th 230	~4.27E-07	BB 2	~4.27E-07	BB 2
Nb 93m					Th 232	~2.36E-09	BB 2	~2.36E-09	BB 2
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99	~4.34E-05	BB 2	~4.34E-05	BB 2	U 232	~2.99E-08	BB 2	~2.99E-08	BB 2
Ru 106					U 233	~8.97E-08	BB 2	~8.97E-08	BB 2
Pd 107					U 234	~1.37E-04	BB 2	~1.37E-04	BB 2
Ag 108m					U 235	~5.1E-06	BB 2	~5.1E-06	BB 2
Ag 110m					U 236	~6.81E-07	BB 2	~6.81E-07	BB 2
Cd 109					U 238	~1.76E-05	BB 2	~1.76E-05	BB 2
Cd 113m					Np 237	~4.14E-07	BB 2	~4.14E-07	BB 2
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129	~1.75E-08	BB 2	~1.75E-08	BB 2	Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g				
Eu 154					Total a	~1.61E-04	BB 2	~1.61E-04	BB 2
Eu 155					Total b/g	~4.35E-05	BB 2	~4.35E-05	BB 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