

**WASTE STREAM****8A19****Solid Waste from B36 and Legacy Cylinder Facility (LCF)****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.....	2.4 m <sup>3</sup>
Future arisings -	1.4.2028 - 31.3.2053.....	~612.0 m <sup>3</sup>
Total future arisings:		612.0 m <sup>3</sup>
Total waste volume:		614.4 m <sup>3</sup>

Comment on volumes: Arisings from the future container handling facility have been estimated but cannot be confirmed until design is finalised. Timescales for arisings are assumed to be the same as for the cylinders in 8A05 so will occur over the period 2028-2053.

Uncertainty factors on volumes: Stock (upper): x 1.0 Arisings (upper) x 2.0  
 Stock (lower): x 1.0 Arisings (lower) x 0.5

**WASTE SOURCE** This waste arises from the processes to wash out cylinders which have previously contained UF6.**PHYSICAL CHARACTERISTICS**

General description: All materials will be contaminated on the surfaces with UO2F2/UF4. The current stocks consist of used PPE, paint and rust from cylinder exteriors, wipes etc. used during the process, tools, used drill bits etc. Future arisings will include used PPE, blanking plates, swarf, cylinder plugs, o-rings, cylinder valves, re-inforced hoses, sealing gaskets, HEPA filters. Other materials not yet identified. Mixed solid wastes.

Physical components (%wt): Blanking plates 5.93%, Swarf 1.02%, Cylinder Plugs 1.17%, O-rings 0.02%, Cylinder valves 0.34%, Re-inforced Hoses 1.64%, Sealing Gaskets 0.29%, HEPA Filters 56.23%, Pre-Filters 25.56%, Used PPE 7.67%, Tanks 0.1%

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~3.03

Comment on density: Average of estimated densities for all materials.

**CHEMICAL COMPOSITION**

General description and components (%wt): Steel 12%, Aluminium 11%, Rubber 1%, PTFE 0.5%, Fibreglass 42.4%, Plastics 8%, Paper/Card 25%, Uranium <0.1% (all estimated).

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: NpO2, NpO2F2.

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	~12.0	mild steel, grade unknown	70.0
Iron.....	0		
Aluminium.....	~11.0		10.0
Beryllium.....	0		

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Cobalt.....	0
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	0
Titanium.....	0
Uranium.....	<<0.10 Present as UO2F2 and UF4
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt):                      Organic materials are present in hoses, filters and used PPE. PTFE 0.5%, Rubber hoses 1%.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~25.0		10.0
Paper, cotton.....	~25.0		
Wood.....	0		
Halogenated plastics .....	~0.50		
Total non-halogenated plastics.....	~50.4		10.0
Condensation polymers.....	~0		
Others.....	~50.4		
Organic ion exchange materials....	0		
Total rubber.....	~1.0		
Halogenated rubber .....	0		
Non-halogenated rubber.....	~1.0		
Hydrocarbons.....	0		
Oil or grease .....	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar)....	0		
Bitumen.....	0		
Others.....	0		
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.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....			
Graphite.....	0		

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Desiccants/Catalysts.....	
Asbestos.....	0
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 will be present. Other inorganic anions may be present in trace quantities.

	(%wt)	Type(s) and comment
Fluoride.....	<0.10	
Chloride.....	<0.01	
Iodide.....	<0.01	
Cyanide.....	NE	
Carbonate.....	<0.01	
Nitrate.....	<0.01	
Nitrite.....	NE	
Phosphate.....	<0.01	
Sulphate.....	<0.01	
Sulphide.....	<0.01	

Materials of interest for waste acceptance criteria:      Fluorides are present in the waste as stored, processing of some waste types may remove this material.

	(%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.....	<1.0	<1%
Reacting with water.....	0	
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	0	

**WASTE STREAM****8A19****Solid Waste from B36 and Legacy Cylinder Facility (LCF)**Hazardous substances /  
non hazardous pollutants:

UO2F2 and UF4 &lt;0.1wt%.

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	0	
Arsenic.....	0	
Barium.....	0	
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....	0	
Caesium.....	0	
Selenium.....	0	
Chromium.....	0	
Molybdenum.....	0	
Thallium.....	0	
Tin.....	0	
Vanadium.....	0	
Mercury compounds.....	0	
Others.....	0	
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.....	0	
DPTA.....	0	
NTA.....	0	
Polycarboxylic acids.....	0	
Other organic complexants.....	0	
Total complexing agents.....	0	

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Potential for the waste to contain discrete items:

Not yet determined.

**TREATMENT, PACKAGING AND DISPOSAL**

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

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination	Off-site	~71.0
Metal treatment Size reduction Decay storage Recycling / reuse Other / various	On-site	~23.0
None	Off-site	~6.0

Comment on planned treatments:

Current stocks are expected to be sent for disposal as LLW to landfill or for incineration. Some future arisings may be suitable for metals recycling or decontamination, some may be incinerated or sent for compaction - routes not yet determined for material arising from LCF (2028-2053).

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository		
Expected to be consigned to a Landfill Facility	~6.0	~0.90
Expected to be consigned to an On-Site Disposal Facility	~23.0	~7.8
Expected to be consigned to an Incineration Facility	~71.0	~1.2
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		

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

VLLW that is not suitable for other treatment, such as O rings.

**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 <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			

Other information: Final disposal routes will be determined when design of LCF finalised.

**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 and daughters, with some Tc-99 and Np-237.

Uncertainty: Accuracy is good for measured data.

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: Some analysis has been carried out for existing stocks. For future arisings, activity has been estimated using current data for similar materials.

Other information: -

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	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	~2.17E-09	BB 2	~7.94E-10	CC 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	~1.27E-05	BB 2	~9.53E-09	CC 2
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228	~1.73E-07	BB 2	~1.35E-08	CC 2
Nb 91					Th 229				
Nb 92					Th 230	~8.15E-07	BB 2	~1.23E-07	CC 2
Nb 93m					Th 232	~1.36E-09	BB 2	~1.59E-09	CC 2
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99	~1.71E-07	BB 2	~4.75E-07	CC 2	U 232	~6.23E-08	BB 2	~3.89E-08	CC 2
Ru 106					U 233	~4.58E-07	BB 2	~2.24E-07	CC 2
Pd 107					U 234	~1.55E-04	BB 2	~1.29E-05	CC 2
Ag 108m					U 235	~5.82E-06	BB 2	~5.48E-07	CC 2
Ag 110m					U 236	~1.75E-06	BB 2	~1.76E-07	CC 2
Cd 109					U 238	~4.07E-05	BB 2	~4.18E-06	CC 2
Cd 113m					Np 237	~3.64E-08	BB 2	~2.3E-08	CC 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	~1.47E-07	BB 2	~4.54E-07	CC 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					<b>Total a</b>	<b>2.17E-04</b>	<b>CB 2</b>	<b>1.82E-05</b>	<b>CC 2</b>
Eu 155					<b>Total b/g</b>	<b>3.2E-07</b>	<b>CB 2</b>	<b>9.30E-07</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