

WASTE STREAM	8A32	UCP Metallic LLW
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SITE Capenhurst
SITE OWNER Urenco
WASTE CUSTODIAN URENCO Chemplants Ltd
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2049.....	~~30.0 m ³
	1.4.2050 - 31.3.2055.....	~~400.0 m ³
	1.4.2056 - 31.3.2114.....	~~1.0 m ³
	1.4.2115 - 31.3.2119.....	~~12.0 m ³
Total future arisings:		443.0 m ³
Total waste volume:		443.0 m ³

Comment on volumes: 2019-2049 relates to deconversion operations and the following five years to decommissioning of the main plant. The period between 2056 and 2114 relates to maintenance of the Uranium Oxide Store and the final five years to uranium oxide export from the store and its decommissioning. At time of initial inventory production the TMF is not yet operational and all future arising estimates are approximations. During operations, annual arisings will vary depending outage needs. Decommissioning needs are not yet underpinned.

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

WASTE SOURCE Metallic operational plant items from the TMF (kiln tubes and crinoline ribbon, flanges, pipes, sintered metal filters, valves, flexible metal hoses etc) that have been decontaminated, but can't be reused & decommissioning plant work.

PHYSICAL CHARACTERISTICS

General description: Plant components particularly from the deconversion area, Cylinder Wash Facility and Uranium Oxide Powder Handling System. Includes redundant 48Y cylinder valves and plugs. Excludes redundant 48Y cylinders. Dry decontamination to remove bulk contamination followed by water washing and acid decontamination (nitric acid for Stainless Steel and Nickel Alloy and Phosphoric Acid for Carbon Steel) of operational plant work.

Physical components (%wt): Plant components (kiln tubes and crinoline ribbon, flanges, pipes, sintered metal filters, valves, flexible metal hoses etc) = 63%. Cylinder valves and plugs = 37%. All values are estimates.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~4

Comment on density: Assumes mean metal density of 8 t/m³ with 50% voidage to give a working density of 4 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Metallic waste stream: Nickel Alloy = 47%; Stainless Steel = 16%; Carbon Steel = 1%; and, Bronze Alloy = 37%. All values are estimates.

Chemical state: Neutral

Chemical form of radionuclides: H-3: N/A
 C-14: N/A
 Cl-36: N/A
 Se-79: N/A
 Tc-99: Trace quantities present as Tc(IV) as TcO₂ and Tc(VII) as pertechnetate.
 I-129: N/A
 Ra: N/A
 Th: Thorium nitrate
 U: U3O8, UO₂F₂ and uranyl nitrate
 Np: Trace quantities potentially in nitrate form
 Pu: Trace quantities potentially in nitrate form

Metals and alloys (%wt): 5% ducting and 95% other fabricated items. Plate metals very limited or absent. Majority of

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items of the order of 10 to 10s cm in dimension. Larger items (up to 10m in length) will be sized reduced for chemical decontamination and waste management.

	Stainless steel.....	~16.0	316L (96%) 304L (2%) and Duplex (2%)
	Other ferrous metals.....	~1.0	Mostly Carbon Steel, but some Cast Iron
	Iron.....		
	Aluminium.....		
	Beryllium.....		
	Cobalt.....		
	Copper.....		
	Lead.....		
	Magnox/Magnesium.....		
	Nickel.....	~47.0	Allow 600 (50%) and C4 (50%)
	Titanium.....		
	Uranium.....		
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....	~36.0	Bronze Alloy cylinder plugs
Organics (%wt):	None		
	Total cellulosics.....	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.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	0	
Other materials (%wt):	None		

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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

Inorganic anions (%wt):

Trace quantities may be present.
 Fluoride..... <0.01 Traces of uranyl fluoride
 Chloride..... 0
 Iodide..... 0
 Cyanide..... 0
 Carbonate..... <0.01 Traces of uranyl carbonate
 Nitrate..... <0.01 Traces of uranyl nitrate
 Nitrite..... 0
 Phosphate..... <0.01 Traces of uranyl phosphate
 Sulphate..... 0
 Sulphide..... 0

Materials of interest for waste acceptance criteria:

This waste stream is specific to metals that have been decontaminated and dried.

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

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	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	No hazardous substances / non-hazardous pollutants	
	Acrylamide.....	
	Benzene.....	0
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	0
	Styrene.....	
	Tri-butyl phosphate.....	0
	Other organophosphates.....	
	Vinyl chloride.....	0
	Arsenic.....	0
	Barium.....	
	Boron.....	0
	Cadmium.....	0
	Caesium.....	
	Selenium.....	0
	Chromium.....	0
	Molybdenum.....	0
	Thallium.....	
	Tin.....	0
	Vanadium.....	0
	Mercury compounds.....	
	Others.....	0
	Electronic Electrical Equipment (EEE)	
	EEE Type 1.....	
	EEE Type 2.....	
	EEE Type 3.....	
	EEE Type 4.....	
	EEE Type 5.....	
Complexing agents (%wt):	No	
	EDTA.....	
	DPTA.....	
	NTA.....	
	Polycarboxylic acids.....	
	Other organic complexants.....	
	Total complexing agents.....	

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	100.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction	Off-site	100.0
Decay storage		
Recycling / reuse		
Other / various		
None		

Comment on planned treatments:

Metallic LLW which can't be demonstrated to be Out of Scope of RSR will be recycled via a LLW route. Waste that can be demonstrated as Out of Scope of RSR will be recycled via the Facility Management Contractor.

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	~25.0 ~75.0
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	
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: (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:

Metallic LLW will be package for transfer to a LLW metal recycling facility

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

Container voidage:

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Waste Characterisation Form (WCH): -

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

Potential for the waste to contain discrete items: -

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: UF6 deconversion and associated dry U308 powder management and cylinder washing and residue recovery.

Uncertainty: Decontaminated metal where it cannot be demonstrated as out of scope of RSR. Decontamination efficiency is not yet confirmed by operational experience. Arisings during decommissioning not yet underpinned.

Definition of total alpha and total beta/gamma: Initial decay chain and short-lived (i.e. less than three month) decay products of U-238 not listed and expected to be in equilibrium with U-238.

Measurement of radioactivities: Currently theoretical estimate (TMF not yet operational).

Other information: Other Uranium series decay products not present as the source is chemically purified Uranium.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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					Gd 153				
Be 10					Ho 163				
C 14					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				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228		~~1.39E-07	BB	2
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99			~~1.69E-10	BB	2		~~2.66E-07	BB	2
Ru 106			~~9.61E-19	BB	2				
Pd 107					U 232		~~1.73E-05	BB	2
Ag 108m					U 233		~~3.76E-07	BB	2
Ag 110m					U 234		~~3.49E-06	BB	2
Cd 109					U 235		~~1.84E-05	BB	2
Cd 113m					U 236		~~6.34E-11	BB	2
Sn 119m					U 238		~~3.83E-16	BB	2
Sn 121m					Np 237		~~3.83E-16	BB	2
Sn 123					Pu 236		~~3.83E-16	BB	2
Sn 126					Pu 238		~~6.4E-13	BB	2
Sb 125					Pu 239		~~3.83E-16	BB	2
Sb 126					Pu 240		~~3.83E-16	BB	2
Te 125m					Pu 241		~~3.83E-16	BB	2
Te 127m					Pu 242				
I 129					Am 241				
Cs 134					Am 242m				
Cs 135					Am 243				
Cs 137					Cm 242				
Ba 133					Cm 243				
La 137					Cm 244				
La 138					Cm 245				
Ce 144					Cm 246				
Pm 145					Cm 248				
Pm 147					Cf 249				
Sm 147					Cf 250				
Sm 151					Cf 251				
Eu 152					Cf 252				
Eu 154					Other a				
Eu 155					Other b/g				
					Total a	0	~~4E-05	BB	2
					Total b/g	0	~~1.7E-10	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