

WASTE STREAM	2D114	Uranium Plants Initial/Interim Decommissioning: Stores
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SITE Sellafield
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Sellafield Limited
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2061.....	0 m ³
	1.4.2061 - 31.3.2067.....	78.9 m ³
	1.4.2067 - 31.3.2120.....	0 m ³
Total future arisings:		78.9 m ³
Total waste volume:		78.9 m ³

Comment on volumes: Arisings are in line with current decommissioning programmes and strategy. Waste within this waste stream is generated from a decommissioning project which will commence at a future date. As a result of this, minimal characterisation of waste volumes and fingerprints has been carried out and hence there is a large uncertainty in the potential arisings. Preliminary assessments indicate that the volumes may vary from -50% to +300% for LLW.

Uncertainty factors on volumes:
 Stock (upper): x Arisings (upper) x 4.0
 Stock (lower): x Arisings (lower) x 0.5

WASTE SOURCE Dismantling of uranium product stores.

PHYSICAL CHARACTERISTICS

General description: Plant and equipment, instruments and fittings, internal building fabric, soft waste i.e. rubber, PVC, paper. Most items size reduced in-situ. Some large items may be present.
Physical components (%vol): Plant and equipment (14%), ducting (66%), electrical cabling, hardware and instruments (6%), internal fabric and furniture (1%), secondary steelwork (3%), soft waste (10%).
Sealed sources: The waste does not contain sealed sources.
Bulk density (t/m³): ~0.5
Comment on density: Density stated is average for LLW.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (6%), mild steel (77%), copper (3%), aluminium (0.5%), plastic (10%), rubber (2%), cellulose (1%), glass (0.5%). Percentages are by volume.

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): Some sheet metal present (~30%), bulk metal (70%).

Stainless steel.....	6.0	The most commonly used stainless steel is 304L.
Other ferrous metals.....	77.0	
Iron.....		
Aluminium.....	0.50	
Beryllium.....		
Cobalt.....	0	
Copper.....	3.0	
Lead.....	TR	
Magnox/Magnesium.....	0	
Nickel.....	0	
Titanium.....		

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	Uranium.....	
	Zinc.....	0
	Zircaloy/Zirconium.....	0
	Other metals.....	0
Organics (%wt):	The waste contains PVC and other plastics, small amounts of rubber and cellulose. Percentages are by volume. PVC oversuits, Windscale suits, waste bags, rubber gloves.	
	Total cellulose.....	1.0
	Paper, cotton.....	TR
	Wood.....	~1.0
	Halogenated plastics	7.5
	Total non-halogenated plastics.....	2.5
	Condensation polymers.....	1.3
	Others.....	1.3
	Organic ion exchange materials....	0
	Total rubber.....	2.0
	Halogenated rubber	P
	Non-halogenated rubber.....	P
	Hydrocarbons.....	
	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.....	TR
	Cementitious material.....	TR
	Sand.....	0
	Glass/Ceramics.....	~0.50
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	P
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0

Asbestos is likely to be present but the specific types and proportions have not been determined.

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	Powder/Ash.....	0
Inorganic anions (%wt):	Inorganic anions are not expected 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:

	-
	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
	Soluble solids as bulk chemical compounds..... 0

Hazardous substances / non hazardous pollutants:

	Lead is present in trace quantities. Asbestos.
	Acrylamide.....
	Benzene.....
	Chlorinated solvents.....
	Formaldehyde.....
	Organometallics.....
	Phenol.....
	Styrene.....
	Tri-butyl phosphate.....
	Other organophosphates.....
	Vinyl chloride.....
	Arsenic.....

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Barium.....
 Boron.....
 Cadmium.....
 Caesium.....
 Selenium.....
 Chromium.....
 Molybdenum.....
 Thallium.....
 Tin.....
 Vanadium.....
 Mercury compounds.....
 Others.....
 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..... 0

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC)	On-site	10.0
Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various	Off-site	72.0
None		18.0

Comment on planned treatments:

Although there are no firm plans in place, based on current experience we have assumed the treatment methods set out in the table for the purposes of the 2019 UK Inventory. For Inventory purposes, it is assumed that supercompaction will continue after the closure of WAMAC in 2028.

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Disposal Routes:	Disposal Route	Stream volume %
	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	

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 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	10.0 18.0	50.8 15.7	< 1 < 1

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: Voidage will be variable due to the different range of materials consigned from the facility in the future.

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

This waste stream covers a future decommissioning project. Waste from future projects will require WCHs prior to acceptance for disposal.

Waste consigned for disposal to LLWR in year of generation: Yes.

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:

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Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: The main sources of activity are uranium isotopes.

Uncertainty: Activity levels will depend on degree of decontamination achieved.

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: Future arisings activities are based on actual activities of recent disposals.

Other information: Other alpha not specified. Other beta/gamma includes Co58 3.64E-12 TBq/m³, Sr89 2.78E-13 TBq/m³, Zr95 4.62E-10 TBq/m³, Nb95 4.13E-10 TBq/m³ and Ru103 1.61E-10 TBq/m³. Nuclides making up remaining "other beta/gamma" not specified.

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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			1.97E-10	CC 2	Gd 153				
Be 10					Ho 163				
C 14			1.12E-11	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			4.16E-11	CC 2	Pb 205				
Fe 55			4.10E-11	CC 2	Pb 210				
Co 60			5.11E-10	CC 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			1.60E-12	CC 2	Po 210				
Zn 65			1.52E-11	CC 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226		7.96E-13	CC 2	
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			1.87E-08	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232		8.28E-10	CC 2	
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99			1.66E-10	CC 2	U 232				
Ru 106			2.46E-09	CC 2	U 233				
Pd 107					U 234		2.57E-09	CC 2	
Ag 108m					U 235		1.08E-09	CC 2	
Ag 110m					U 236		2.32E-10	CC 2	
Cd 109					U 238		6.63E-09	CC 2	
Cd 113m					Np 237		6.48E-10	CC 2	
Sn 119m					Pu 236				
Sn 121m					Pu 238		8.02E-10	CC 2	
Sn 123					Pu 239		1.39E-09	CC 2	
Sn 126					Pu 240		1.17E-09	CC 2	
Sb 125					Pu 241		6.48E-08	CC 2	
Sb 126					Pu 242				
Te 125m					Am 241		1.27E-09	CC 2	
Te 127m					Am 242m				
I 129					Am 243				
Cs 134			9.71E-10	CC 2	Cm 242		3.98E-13	CC 2	
Cs 135					Cm 243				
Cs 137			1.78E-08	CC 2	Cm 244		2.55E-12	CC 2	
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144			1.02E-09	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147			2.37E-10	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151			1.27E-12	CC 2	Other a		6.81E-12	CC 2	
Eu 152					Other b/g		1.08E-09	CC 2	
Eu 154			2.43E-11	CC 2	Total a	0	1.66E-08	CC 2	
Eu 155			1.30E-11	CC 2	Total b/g	0	1.08E-07	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