WASTE STREAM 2X21/3 LLW from Magnox Flask Maintenance Facility

SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2019 - 31.3.2020.....	32.3 m³
	1.4.2020 - 31.3.2021.....	32.3 m³
	1.4.2021 - 31.3.2022.....	32.3 m³
	1.4.2022 - 31.3.2023.....	32.3 m³
	1.4.2023 - 31.3.2024.....	32.3 m³
	1.4.2024 - 31.3.2025.....	32.3 m³
	1.4.2025 - 31.3.2026.....	32.3 m³
	1.4.2026 - 31.3.2027.....	32.3 m³
	1.4.2027 - 31.3.2028.....	32.3 m³
	1.4.2028 - 31.3.2029.....	32.3 m³
	1.4.2029 - 31.3.2030.....	32.3 m³
Total future arisings:		355.3 m³
Total waste volume:		355.3 m³

Comment on volumes: Arisings are sourced from DEC-0828A and are based on the latest five-year forecasts from the Waste Forecasting database. The overall timescale for waste arising are informed by the Sellafield Site Master Timeline. Uncertainty information is notional.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.5
Stock (lower):	x	Arisings (lower)	x 0.5

WASTE SOURCE The waste arises as a result of routine operations and maintenance within the Magnox Flask Maintenance Facility.

PHYSICAL CHARACTERISTICS

General description: The waste is mostly metallic waste associated with redundant flask components. Quantities of secondary compactable wastes plus hard wastes associated with building modifications will also arise. The waste has not undergone any changes since it was generated.

Physical components (%wt): Metals (59.8%), Concrete/Rubble (4.2%), Soil (1%), Wood (1%), Rubber (1%), Halogenated Plastics (7%), Non-Halogenated Plastics (7%), Hydrocarbons (0.7%), Other Organics (16%), Asbestos (2.3%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.280

Comment on density: The total Bulk density is derived from DEC-0828A and is based on the five-year forecast from the Waste Forecasting database.

CHEMICAL COMPOSITION

General description and components (%wt): Metals (59.8%), Concrete/Rubble (4.2%), Soil (1%), Wood (1%), Rubber (1%), Halogenated Plastics (7%), Non-Halogenated Plastics (7%), Hydrocarbons (0.7%), Other Organics (16%), Asbestos (2.3%).

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): -

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	Stainless steel	18.2
	Other ferrous metals	~31.4
	Iron	4.9
	Aluminium	~1.0
	Beryllium	0
	Cobalt	0
	Copper	~1.0
	Lead	~3.2
	Magnox/Magnesium	0
	Nickel	0
	Titanium	0
	Uranium	0
	Zinc	0
	Zircaloy/Zirconium	0
	Other metals	~0
Organics (%wt):	-	
	Total cellulosics	1.0
	Paper, cotton	0
	Wood	1.0
	Halogenated plastics	7.0
	Total non-halogenated plastics	7.0
	Condensation polymers	0
	Others	0
	Organic ion exchange materials	0
	Total rubber	1.0
	Halogenated rubber	0
	Non-halogenated rubber	0
	Hydrocarbons	0.70
	Oil or grease	0
	Fuel	0
	Asphalt/Tarmac (cont.coal tar)	0.35
	Asphalt/Tarmac (no coal tar)	0.35
	Bitumen	0
	Others	0
	Other organics	16.1
Other materials (%wt):	-	
	Inorganic ion exchange materials	0
	Inorganic sludges and flocs	0
	Soil	1.0
	Brick/Stone/Rubble	4.2
	Cementitious material	0
	Sand	0
	Glass/Ceramics	0

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	Graphite	0	
	Desiccants/Catalysts	0	
	Asbestos	2.3	
	Non/low friable	1.0	
	Moderately friable	1.0	
	Highly friable	0.16	
	Free aqueous liquids	0	
	Free non-aqueous liquids	0	
	Powder/Ash	0	
Inorganic anions (%wt):	-		
	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	15.0	
	Putrescible wastes	TR	Trace amounts associated with moss on building fabric.
	Non-putrescible wastes	15.0	
	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:	-		
	Acrylamide	0	
	Benzene	0	
	Chlorinated solvents	0	

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	Formaldehyde	0	
	Organometallics	0	
	Phenol	0	
	Styrene	0	
	Tri-butyl phosphate	0	
	Other organophosphates	0	
	Vinyl chloride	0	
	Arsenic	0	
	Barium	0	
	Boron	0	
	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	P	50 units.
	EEE Type 2	P	100 units.
	EEE Type 3	P	100 units.
	EEE Type 4		No units
	EEE Type 5	P	100 units.
Complexing agents (%wt):	Yes		
	EDTA	<0.01	
	DPTA	0	
	NTA	0	
	Polycarboxylic acids	0	
	Other organic complexants	0	
	Total complexing agents	<0.01	

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	On-site	25.2
Incineration	Off-site	63.2
Solidification		
Decontamination		
Metal treatment	Off-site	3.9
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		7.7

Comment on planned treatments: All high force compaction takes place in WAMAC. For Inventory purposes, it is assumed that Supercompaction will continue after the closure of WAMAC in 2028. Waste not requiring treatment is out of scope metal, VLLW or direct disposal to LLWR.

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	28.5
Expected to be consigned to a Landfill Facility	
Expected to be consigned to an On-Site Disposal Facility	4.5
Expected to be consigned to an Incineration Facility	63.2
Expected to be consigned to a Metal Treatment Facility	3.9
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	25.2	59.28	2
1/2 Height IP-2 Disposal/Re-usable ISO	3.3	10	2
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

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Waste Characterisation Form (WCH):	The waste meets the LLWR's Waste Acceptance Criteria (WAC). The waste has a current WCH. Differences exist between Inventory information and current WCH. Materials and radioactivity data has been taken from the current WCH, but data on waste volumes and waste routes is based on the Waste Forecasting database as this information is more recent.
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:	
Inaccessible voidage:	-
Other information:	-

RADIOACTIVITY

Source:	The activity arises as a result of operations to decontaminate flasks and originates from the fuels these flasks were used to transport.
Uncertainty:	The uncertainty associated with the fingerprinting analysis is likely to be low, however the volumes and total activity information (and possibly some other assumptions) are likely to be more notional and thus more uncertain.
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:	Specific activity data is based on data in the corresponding WCH, which in turn maps an estimated total activity to an analytically derived radionuclide fingerprint.
Other information:	The radionuclides have been taken from DEC-0828A and are based on the current WCH (LLWR Ref: IS-IS-0-WCH-0-4556).

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ 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			2.50E-06	C C 2	Pb 205				
Fe 55			1.71E-05	C C 2	Pb 210				
Co 60			3.36E-06	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			6.85E-06	C C 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			1.09E-05	C C 2	Th 227				
Zr 93					Th 228				
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					U 232				
Ru 106					U 233				
Pd 107					U 234			2.43E-07	C C 2
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238			2.84E-07	C C 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238			5.37E-07	C C 2
Sn 123					Pu 239			5.47E-07	C C 2
Sn 126					Pu 240			5.47E-07	C C 2
Sb 125					Pu 241			2.74E-05	C C 2
Sb 126					Pu 242			9.97E-09	C C 2
Te 125m					Am 241			1.65E-06	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134			1.11E-07	C C 2	Cm 242			1.01E-08	C C 2
Cs 135					Cm 243				
Cs 137			2.65E-05	C C 2	Cm 244			8.10E-08	C C 2
Ba 133					Cm 245			2.02E-08	C C 2
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			1.97E-06	C C 2	Cf 251				
Sm 147					Cf 252				
Sm 151			1.22E-07	C C 2	Other a				
Eu 152					Other b/g				
Eu 154			3.44E-07	C C 2	**Total a**	**0**		**3.93E-06**	**C C 2**
Eu 155			1.82E-07	C C 2	**Total b/g**	**0**		**9.73E-05**	**C C 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