WASTE STREAM 5G307 Minor Facilities Decommissioning LLW

SITE	Winfrith
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	LLW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m³
Future arisings -	1.4.2022 - 31.3.2027.....	2344.8 m³
Total future arisings:		2344.8 m³
Total waste volume:		2344.8 m³

Comment on volumes: LLW arises as and when various facilities on the Winfrith site are decommissioned. The waste arising volumes are more uncertain because they relate to facilities (i.e. buildings, sea pipeline) which have not yet been decommissioned and require further characterisation.

Uncertainty factors on volumes:

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

WASTE SOURCE The waste consists of all arisings from the decommissioning of facilities encompassed within Winfrith Plant and Structures Programme.

PHYSICAL CHARACTERISTICS

General description:	The waste is primarily formed of metallics wastes, concrete and demolition rubble, grout, soft wastes such as PPE, rubber and wood. Decommissioning wastes- size reduction.
Physical components (%wt):	Metal (20%), concrete/rubble (67%), plastic (2%), soil/tarmac (8%), others (3%).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m³):	2.44
Comment on density:	Mean bulk density of waste arisings is 2.44 t/m3, derived from total mass divided by total volume in the WCH.

CHEMICAL COMPOSITION

General description and components (%wt):	Metal (20%), concrete/rubble (67%), plastic (2%), soil/tarmac (8%), others (3%).
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: Tritium present in the waste. C-14: C-14 present in steel and concrete. I-129: Some iodine contamination, probably as iodide Th: Some thorium contamination present U: Some uranium contamination present Pu: Some plutonium contamination present
Metals and alloys (%wt):	Various size reduced decommissioning wastes.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~2.0	Stainless sheeting	
Other ferrous metals.....	~17.3	Mild steel Miscellaneous/pipework & delay tank walls	
Iron.....			
Aluminium.....	~0.20	Miscellaneous sheeting some handrails.	
Beryllium.....	TR		
Cobalt.....			
Copper.....	~0.20	Small and medium bore pipework	

WASTE STREAM 5G307 Minor Facilities Decommissioning LLW

Lead	~0.30	Shield Blocks and lead sheeting
Magnox/Magnesium		
Nickel		
Titanium		
Uranium		
Zinc		
Zircaloy/Zirconium	0	
Other metals	NE	

Organics (%wt): Organic ion exchange resins may be present in residues on sludge tank walls.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	~1.0		
Paper, cotton	0		
Wood	~1.0		
Halogenated plastics	~0.50	Solid misc waste	
Total non-halogenated plastics	~0.50	Solid misc waste	
Condensation polymers	~0.25		
Others	~0.25		
Organic ion exchange materials	NE		
Total rubber	~1.0		
Halogenated rubber	~0.50	Neoprene	
Non-halogenated rubber	~0.50		
Hydrocarbons	~7.5		
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)	~7.5	Tarmac from roadways - post 1983	
Bitumen			
Others			
Other organics			

Other materials (%wt): Sludge may be present as an adherent layer on tanks, depending on clean-out methodology.

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	NE		
Inorganic sludges and flocs	NE		
Soil			
Brick/Stone/Rubble	~67.0		
Cementitious material			
Sand			
Glass/Ceramics	0.01	Man Made Mineral Fibre	
Graphite	0		
Desiccants/Catalysts			

WASTE STREAM 5G307 Minor Facilities Decommissioning LLW

Asbestos	NE	Not known at present
Non/low friable	NE	
Moderately friable	NE	
Highly friable	NE	
Free aqueous liquids	NE	
Free non-aqueous liquids	NE	
Powder/Ash	TR	

Inorganic anions (%wt): Anions only expected to be present as components of cement.

	(%wt)	Type(s) and comment
Fluoride	NE	
Chloride	NE	
Iodide	NE	
Cyanide	NE	
Carbonate	P	
Nitrate	NE	
Nitrite	NE	
Phosphate	NE	
Sulphate	NE	
Sulphide	NE	

Materials of interest for waste acceptance criteria: No hazardous materials are expected to be present except contamination by asbestos, beryillium & mercury. Some lead is also present. Additionally, powders (e.g. scabbled concrete).

	(%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		
Corrosive materials		
Pyrophoric materials	0	
Generating toxic gases	0	
Reacting with water	P	20m2
Higher activity particles		
Soluble solids as bulk chemical compounds		

WASTE STREAM 5G307 Minor Facilities Decommissioning LLW

Hazardous substances / non hazardous pollutants: Beryllium contaminated waste- 6 x 220 litre drums (stocks), possible in decommissioning former chemical plant hall(arisings). 12 x 220 litre drums (stock) containing mercury waste need processing to remove mercury prior to shipment to LLWR. Lead flask (stock)weighing 3570kg, also lead shielding in other redundant transport packages (arisings).

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		
Mercury compounds.....		
Others.....	1.0	Plasterboard
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids……		
Other organic complexants.....	TR	Some complexing agents may be present in the SGHWR sludge tanks.

WASTE STREAM 5G307 Minor Facilities Decommissioning LLW

Total complexing agents..... TR

Potential for the waste to contain discrete items: Not yet determined. In & of itself not a DI; waste stream may include DIs (notably any stainless steel components). Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration	Off-site	15.0
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		85.0

Comment on planned treatments: 84.5% of this stream is expected to be disposed of as VLLW to landfill

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	0.50	2.4
Expected to be consigned to a Landfill Facility	84.5	2.4
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	15.0	0.40
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: 17 04 05, 17 05 03*/04

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 STREAM 5G307 Minor Facilities Decommissioning LLW

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m³	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	0.50	10	2

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: Inaccessible voidage will be <10%.

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste has a current WCH.
Inventory information is consistent with the current WCH.

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

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: Activity will principally be due to contamination from historic operations on the site, including activation and fission products.

Uncertainty: No data available for specific activities for the majority of the waste.

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: Data taken from WCH 1MXN-2WIN-0-WCH-0-4354 V1 and decayed by five years to date of first arising.

Other information: A more detailed assessment of the wastes will be performed prior to decommissioning.

WASTE STREAM 5G307 Minor Facilities Decommissioning LLW

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			3.67E-05	2	Gd 153				8
Be 10				8	Ho 163				8
C 14			3.34E-06	C C 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			4.88E-08	C C 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41				8	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55			3.1E-05	C C 2	Pb 210				8
Co 60			2.45E-06	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			5.58E-06	C C 2	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226				8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			1.86E-05	C C 2	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232				8
Nb 94				8	Th 234			4.92E-07	C C 2
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234			5.9E-07	C C 2
Ag 108m				8	U 235			4.88E-08	C C 2
Ag 110m				8	U 236			4.88E-08	C C 2
Cd 109				8	U 238			4.92E-07	C C 2
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			6.83E-06	C C 2
Sn 123				8	Pu 239			1.9E-05	C C 2
Sn 126				8	Pu 240			1.55E-05	C C 2
Sb 125				8	Pu 241			1.33E-04	C C 2
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			4.39E-05	C C 2
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			9.11E-09	C C 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			3.5E-05	C C 2	Cm 244			5.04E-07	C C 2
Ba 133				8	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144				8	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152			3.78E-08	C C 2	Other b/g				
Eu 154			3.26E-08	C C 2	**Total a**	**0**		**8.69E-05**	**C C 2**
Eu 155				8	**Total b/g**	**0**		**2.66E-04**	**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