

WASTE STREAM	5G307	Minor Facilities Decommissioning LLW
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SITE Winfrith
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2023.....	2445.6 m ³
Total future arisings:		2445.6 m ³
Total waste volume:		2445.6 m ³

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 Decommissioning waste from redundant facilities.

PHYSICAL CHARACTERISTICS

General description: Concrete, pipework and redundant plant. Tanks and pipework will be size-reduced where necessary to enable containerisation for disposal. Decommissioning wastes- size reduction.

Physical components (%vol): Pipework (~ 6%), building structures (~71%), plant items (~14%). soil (~9%).

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 weight divided by total volume.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (20%), concrete/rubble (67%), plastic (2%), soil (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.

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
Lead.....	~0.30	Shield Blocks and lead sheeting
Magnox/Magnesium.....		

WASTE STREAM

5G307

Minor Facilities Decommissioning LLW

Nickel.....

Titanium.....

Uranium..... TR

Zinc..... NE

Zircaloy/Zirconium..... 0

Other metals..... NE

Chromium, nickel may be present. Mercury present (majority believed to be clean) and requires removal before shipment of parent wastes to LLWR.

Organics (%wt):

Organic ion exchange resins may be present in residues on sludge tank walls.

Total cellulose..... ~1.0

 Paper, cotton..... 0

 Wood..... ~1.0

Halogenated plastics ~0.50

Halogenated plastics - PVC

Total non-halogenated plastics..... <0.50

 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..... <1.0

Other materials (%wt):

Sludge may be present as an adherent layer on tanks, depending on clean-out methodology.

Inorganic ion exchange materials. <1.0

Inorganic sludges and flocs..... NE

Soil..... ~8.0

Brick/Stone/Rubble..... ~59.5

Cementitious material.....

Sand.....

Glass/Ceramics..... TR

Man Made Mineral Fibre

Graphite..... 0

Desiccants/Catalysts.....

Asbestos..... NE

Not known at present

 Non/low friable.....

 Moderately friable.....

WASTE STREAM

5G307 Minor Facilities Decommissioning LLW

- Tri-butyl phosphate.....
- Other organophosphates.....
- Vinyl chloride.....
- Arsenic.....
- 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): Yes
 - EDTA.....
 - DPTA.....
 - NTA.....
 - Polycarboxylic acids.....
 - Other organic complexants..... TR
- Total complexing agents..... TR

Some complexing agents may be present in the SGHWR sludge tanks.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	15.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / 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.

WASTE STREAM**5G307****Minor Facilities Decommissioning LLW****Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	0.50
Expected to be consigned to a Landfill Facility	84.5
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	15.0
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	0.50	10	2
2m box (no shielding)			
4m box (no shielding)			
Other			

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.

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

WASTE STREAM**5G307****Minor Facilities Decommissioning LLW**

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 1RSR-2WIN-0-WCH-0-4037 and decayed by two years to date of first arising.
Other information:	A more detailed assessment of the wastes will be performed prior to decommissioning. The LLW sources will be assessed and added to the stocks in the future, but are low volume and unlikely to have significant impact.

WASTE STREAM

5G307

Minor Facilities Decommissioning LLW

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			4.34E-05	CC 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			3.34E-06	CC 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			4.88E-08	CC 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			6.63E-05	CC 2	Pb 210				8
Co 60			3.64E-06	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			5.7E-06	CC 2	Po 210				8
Zn 65			6.14E-09	CC 2	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			2E-05	CC 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	CC 2	8
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	CC 2	8
Ag 108m				8	U 235		4.88E-08	CC 2	8
Ag 110m				8	U 236		4.88E-08	CC 2	8
Cd 109				8	U 238		4.92E-07	CC 2	8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238		6.99E-06	CC 2	8
Sn 123				8	Pu 239		1.9E-05	CC 2	8
Sn 126				8	Pu 240		1.55E-05	CC 2	8
Sb 125				8	Pu 241		1.54E-04	CC 2	8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241		4.34E-05	CC 2	8
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			2.49E-08	CC 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			3.75E-05	CC 2	Cm 244		5.65E-07	CC 2	8
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				8
Eu 152			4.41E-08	CC 2	Other b/g				8
Eu 154			4.15E-08	CC 2	Total a	0	8.66E-05	CC 2	8
Eu 155				8	Total b/g	0	3.34E-04	CC 2	8

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