WASTE STREAM 5C323 LETP Land Remediation VLLW and LA-LLW

SITE Harwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE VLLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	116.6 m³
Total future arisings:		0 m³
Total waste volume:		116.6 m³

Comment on volumes: VLLW and LA-LLW soil and rubble arising from LETP Land remediation. Volumes updated for 2016 RWI to reflect SMART Inventory Review. This waste was originally part of 5C300 but this has been split to provide greater clarity.

Uncertainty factors on volumes:

Stock (upper):	x 1.1	Arisings (upper)	x
Stock (lower):	x 0.9	Arisings (lower)	x

WASTE SOURCE This WCH has been updated to include an additional fingerprint tank 4b hexagonal sump sludge from technical report issue 8 which has been added to the list of LETP Land Remediation fingeprints already approved under this WCH. This Version of the WCH now covers Zones/fingerprints 1, 2, 3, 4,4B Sludge, Tank 4B Hexagonal Sump, 5, 6, 7, 8, 9, 10, 11, 11-A (previously refered to as 11-H336.1), 12, 12-Sludge,13A, 13B, 14, 14A, 15, 16, 17, 18, 19, 19A, 19B, 20, 21, 21A, 22, 23, 25 and the wheelie bin fingerprint. The waste generated consists largely of soil, sand, concrete, plastic pipework, small amounts of rebar metals and residual decommissioning friable wastes. The addition of the fingerprint has not impacted on the volumes of wastes or radiological properties assessment in this WCH. Nuvia report 73550/TR/139 Issue 9 has been updated to include the Tank 4B Hexagonal Sump sludge fingerprint, and the calculations are supported by 73550/CAL/001/Issue 9.xls

PHYSICAL CHARACTERISTICS

General description: Predominantly soil. There should be no large items in this waste stream. Land and buildings on the Harwell site, contaminated as a result of past operations.

Physical components (%wt): Soil ~82%; concrete/rubble, ~15%, plastics ~1%, metal ~1%, Others ~1%

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.35

Comment on density: Average density for soil.

CHEMICAL COMPOSITION

General description and components (%wt): Soil ~82%; concrete/rubble, ~15%, plastics ~1%, metal ~1%, Others ~1%

Chemical state: -

Chemical form of radionuclides: -

Metals and alloys (%wt): There should be no sheet metal or bulk metal items present in the waste stream.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE		
Other ferrous metals.....	TR	Rebar and small pipework	
Iron.....			
Aluminium.....	NE		
Beryllium.....	NE		
Cobalt.....			

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Copper	NE	
Lead	TR	Within the tarmac and bitumen
Magnox/Magnesium	NE	
Nickel		
Titanium		
Uranium	NE	
Zinc	TR	Within the tarmac and bitumen
Zircaloy/Zirconium	NE	
Other metals	~1.0	

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	NE		
Paper, cotton	NE		
Wood	NE		
Halogenated plastics	~1.0	Plastic PPE for incineration route	
Total non-halogenated plastics	NE		
Condensation polymers	NE		
Others	NE		
Organic ion exchange materials	NE		
Total rubber	NE		
Halogenated rubber	NE		
Non-halogenated rubber	NE		
Hydrocarbons	TR		
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)	TR	Road covering (solid)	
Bitumen	TR	Solid bitumous paint and tank liner material	
Others			
Other organics	NE		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	NE		
Inorganic sludges and flocs	NE		
Soil	~~82.0		
Brick/Stone/Rubble	~~15.0		
Cementitious material			
Sand			
Glass/Ceramics	NE		
Graphite	NE		
Desiccants/Catalysts			

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Asbestos	TR	
Non/low friable	TR	Mixed asbestos: amosite, chrysotile within cemented materials. Trace asbestos was discovered across the site (<0.1-0.2%). Most of the asbestos will be disposed via Out Of Scope hazardous waste routes. However, it's recognised that small amounts (<500kg) may be disposed within VLLW/LA-LLW consignments.
Moderately friable		
Highly friable		
Free aqueous liquids		
Free non-aqueous liquids		
Powder/Ash		

Inorganic anions (%wt): -

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

Materials of interest for waste acceptance criteria: -

	(%wt)	Type(s) and comment
Combustible metals		
Low flash point liquids		
Explosive materials		
Phosphorus		
Hydrides		
Biological etc. materials		
Biodegradable materials	0	
Putrescible wastes		
Non-putrescible wastes		
Corrosive materials		
Pyrophoric materials		
Generating toxic gases		
Reacting with water		
Higher activity particles		

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Soluble solids as bulk chemical compounds.....

Hazardous substances / non hazardous pollutants: -

	(%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.....	TR	Within the tarmac and bitumen
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		
Mercury compounds.....	TR	
Others.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		

Total complexing agents..... 0

Potential for the waste to contain discrete items: .

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	~0.13
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		~99.9

Comment on planned treatments: It is intended that the majority of this waste stream will be disposed of via controlled burial to an off-site landfill, therefore no waste containers will be produced.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository		
Expected to be consigned to a Landfill Facility	99.9	1.4
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	0.13	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 05 03*/04, 17 01 01

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 Packaging for Disposal: (Not applicable to this waste stream)

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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			

Other information: -

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

Container voidage: -

Waste Characterisation Form (WCH): -

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

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: Contamination as a result of past operations.

Uncertainty: -

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-2HAR-0-WCH-V-4189 V15 decayed four years for RWI 2022

Other information: -

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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	1.56E-08	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	1.61E-09	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36		8			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	3.3E-09	C C 2			Pb 210		8		
Co 60		8			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	4.98E-09	C C 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226	1.77E-09	C C 2		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	1.73E-08	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	1.36E-09	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	1.29E-09	C C 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234		8		
Ag 108m		8			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	1.36E-09	C C 2		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	1.82E-09	C C 2		
Sn 123		8			Pu 239	5.72E-09	C C 2		
Sn 126		8			Pu 240	5.72E-09	C C 2		
Sb 125		8			Pu 241	5.72E-09	C C 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	5.24E-09	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134		8			Cm 242		8		
Cs 135		8			Cm 243		8		
Cs 137	4.2E-08	C C 2			Cm 244		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				
Eu 152		8			Other b/g				
Eu 154		8			**Total a**	**2.16E-08**	**C C 2**	**0**	
Eu 155		8			**Total b/g**	**9.32E-08**	**C C 2**	**0**	

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