

WASTE STREAM	5C334	Replacement Effluent Treatment Plant LLW
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SITE Harwell

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.....	4.2 m ³
Future arisings - 1.4.2022 - 31.3.2026.....	~20.8 m ³
Total future arisings:	20.8 m ³
Total waste volume:	25.0 m ³

Comment on volumes: Arisings result from decommissioning operations on the site. Volumes updated for 2016 RWI to reflect SMART Inventory Review.

Uncertainty factors on volumes:

Stock (upper): x 1.3	Arisings (upper) x 1.3
Stock (lower): x 0.7	Arisings (lower) x 0.7

WASTE SOURCE Waste arising from the treatment of active effluent from site decommissioning. Waste will be processed through evaporators and encapsulated in Disposable Settling Tanks.

PHYSICAL CHARACTERISTICS

General description: Waste arising from the treatment of active effluent from site decommissioning. Waste will be processed through evaporators and encapsulated in Disposable Settling Tanks. Active effluent in Disposable Settling Tanks.

Physical components (%vol): Active effluent in Disposable Settling Tanks.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~2

Comment on density: Based on density of similar waste stream.

CHEMICAL COMPOSITION

General description and components (%wt): Active effluent

Chemical state: -

Chemical form of radionuclides: Ra: Present as a decay product of fuel.
U: Present as a metal or an oxide.
Pu: Present as metal, oxide or nitrate

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	P		
Other ferrous metals.....	~30.0		
Iron.....			
Aluminium.....	P		
Beryllium.....			
Cobalt.....			
Copper.....	P		
Lead.....	P		
Magnox/Magnesium.....	TR		
Nickel.....			
Titanium.....			

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Free non-aqueous liquids..... 0

Powder/Ash..... 0

Inorganic anions (%wt): Carbonates present in concrete.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	P	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: Trace amounts of uranium metal may be present.

	(%wt)	Type(s) and comment
Combustible metals.....	TR	
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.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		

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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.....
 Electronic Electrical Equipment (EEE)
 EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt):

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....	NE	

Potential for the waste to contain discrete items: Not yet determined. Large Concrete Items (LCIs) may be DIs; drummed (ungROUTED)/"rubbleised" wastes assumed not DIs Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs

TREATMENT, PACKAGING AND DISPOSAL

WASTE STREAM

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

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None		100.0

Comment on planned treatments:

-

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 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	100.0	2.0

Classification codes for waste expected to be consigned to a landfill facility:

-

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:

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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 (Disposal Settling Tanks inside ISO container)	100.0	10	3

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: No. Waste will be held in Disposal Settling Tanks until such time that the tank is full. At this point the DST will be disposed of to LLWR.

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 in waste has arisen from the treatment of liquid effluent.

Uncertainty: No data available for specific activities for the majority of the facility. Expected radionuclides listed above.

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: The radionuclide fingerprint for this waste stream has been updated using data from waste stream 5C39.

Other information: -

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	3.26E-06	CC 2	3.26E-06	CC 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14		8		8	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36		8		8	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54	1.05E-09	CC 2	1.05E-09	CC 2	Pb 205		8		8
Fe 55		8		8	Pb 210	1.25E-09	CC 2	1.25E-09	CC 2
Co 60	1.5E-05	CC 2	1.5E-05	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63		8		8	Po 210	1.03E-09	CC 2	1.03E-09	CC 2
Zn 65	1.09E-09	CC 2	1.09E-09	CC 2	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226	1.42E-08	CC 2	1.42E-08	CC 2
Kr 85		8		8	Ra 228	1.69E-07	CC 2	1.69E-07	CC 2
Rb 87		8		8	Ac 227		8		8
Sr 90	3.08E-05	CC 2	3.08E-05	CC 2	Th 227		8		8
Zr 93		8		8	Th 228	1.08E-07	CC 2	1.08E-07	CC 2
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232	3.29E-07	CC 2	3.29E-07	CC 2
Nb 94		8		8	Th 234	3.14E-07	CC 2	3.14E-07	CC 2
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99		8		8	U 232		8		8
Ru 106	1.64E-08	CC 2	1.64E-08	CC 2	U 233		8		8
Pd 107		8		8	U 234	9.71E-08	CC 2	9.71E-08	CC 2
Ag 108m		8		8	U 235	2.37E-08	CC 2	2.37E-08	CC 2
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238	3.14E-07	CC 2	3.14E-07	CC 2
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	5.53E-07	CC 2	5.53E-07	CC 2
Sn 123		8		8	Pu 239	3.29E-06	CC 2	3.29E-06	CC 2
Sn 126		8		8	Pu 240	3E-07	CC 2	3E-07	CC 2
Sb 125		8		8	Pu 241	4.1E-05	CC 2	4.1E-05	CC 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	5.79E-06	CC 2	5.79E-06	CC 2
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	6.36E-08	CC 2	6.36E-08	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	4.85E-05	CC 2	4.85E-05	CC 2	Cm 244	1.36E-07	CC 2	1.36E-07	CC 2
Ba 133		8		8	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147		8		8	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152		8		8	Other b/g				
Eu 154	1.02E-06	CC 2	1.02E-06	CC 2	Total a	1.10E-05	CC 2	1.10E-05	CC 2
Eu 155	3.52E-07	CC 2	3.52E-07	CC 2	Total b/g	1.40E-04	CC 2	1.40E-04	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