

WASTE STREAM**7A33****Radioactive Contaminated Land****SITE** AWE Aldermaston**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** AWE plc**WASTE TYPE** LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	216.0m ³
Future arisings -	1.4.2022 - 31.3.2080.....	3802.0m ³
Total future arisings:		3802.0m ³
Total waste volume:		4018.0m ³

Comment on volumes: Future arisings are based on the figures calculated for the Annual Review of Nuclear Liabilities, which have been reviewed for the 2022 UKRWI. This waste stream represents two waste types: a). existing stockpiled contaminated soil awaiting disposal and b). areas of known radioactive contaminated soil that will be encountered either during on-going redevelopment of the site or dealt with during the works to achieve the site end state. The expected volume of future radioactive contaminated soil waste arisings has been refined by the adoption of the Annual Review of Nuclear Liabilities reporting process, which has replaced the five yearly QQR submission. It is possible that 1176m³ of the 3802m³ currently accounted could be OOS when full waste characterisation is undertaken, rather than the initial land quality hazard identification information currently available (further investigation required). Only 16m³ of the waste is contaminated with tritium.

Uncertainty factors on volumes: Stock (upper): x 2.0 Arisings (upper) x 30.0
 Stock (lower): x 0.5 Arisings (lower) x 0.5

WASTE SOURCE Processes involved with the production, maintenance and decommissioning of the UK's nuclear deterrent.**PHYSICAL CHARACTERISTICS**

General description: The waste is composed of soil from the decommissioning of AWE sites. Soils are sand and gravel (glacial fluvial deposits together with Clayey Flint gravel with made ground typically 1 to 2 metres deep)

Physical components (%wt): Soil (100%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 1.6

Comment on density: This density quoted was calculated by AWE's Contaminated Land Technical Authority in 2019 and this has not changed for the 2022 UKRWI submission.

CHEMICAL COMPOSITION

General description and components (%wt): Chemicals present are those typically found in sand and gravel. Samples indicate that there are no metals, plastics or complexing agents or contamination above trigger levels of interest to Nuclear Waste Services.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Present in the waste stream as HTO (principally), HT and organically bound solid
 C-14: Not present in Waste Stream
 Cl-36: Not present in Waste Stream
 Se-79: Not present in Waste Stream
 Tc-99: Not present in Waste Stream
 I-129: Not present in Waste Stream
 Ra: Only daughter products present from uranium in this waste stream. Oxide form
 Th: Only daughter products present from uranium in this waste stream. Oxide form
 U: Present in this waste stream. Oxide form
 Np: Np-237 present in waste stream as oxide form from daughter product of Am-241 alpha decay
 Pu: Present in the waste stream in oxide form

Metals and alloys (%wt): -

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	0		
Beryllium.....	0		
Cobalt.....	0		
Copper.....	0		
Lead.....	TR		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....	0		
Uranium.....	TR	Present as a contaminant only	
Zinc.....	TR		
Zircaloy/Zirconium.....	0		
Other metals.....	0		

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....			
Paper, cotton.....			
Wood.....			
Halogenated plastics			
Total non-halogenated plastics.....			
Condensation polymers.....			
Others.....			
Organic ion exchange materials....			
Total rubber.....			
Halogenated rubber			
Non-halogenated rubber.....			
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....			

Other materials (%wt): The material in this waste stream is solely soil

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	100.0		
Brick/Stone/Rubble.....	NE		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....	0		
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): None to report

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

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.....		
Putrescible wastes.....		
Non-putrescible wastes.....		

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Corrosive materials.....
 Pyrophoric materials.....
 Generating toxic gases.....
 Reacting with water.....
 Higher activity particles.....
 Soluble solids as bulk chemical
 compounds.....

Hazardous substances /
 non hazardous pollutants: -

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

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Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....	0	
DPTA.....	0	
NTA.....	0	
Polycarboxylic acids.....	0	
Other organic complexants.....	0	Complexing agents are not present in the waste stream
Total complexing agents.....	0	

Potential for the waste to contain discrete items: No.

TREATMENT, PACKAGING AND DISPOSAL

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	Off-site	~100.0

Comment on planned treatments:

Analysis of this waste indicates that most is suitable for disposal at a LA-LLW Permitted Landfill. A small volume of this waste stream may be treated/disposed of differently.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~99.0	~1.6
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	~1.0	~1.6
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: 170504

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			

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Opportunities for alternative disposal routing: No

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)

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			

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: Radioactivity arises from contamination due to past operations from refining and processing plutonium and uranium.

Uncertainty: Activity measurements have been carried out on discreet samples taken as part of studies into particular areas on site. Hence, the results reflect a range depending on individual samples.

Definition of total alpha and total beta/gamma: The total alpha and total beta/gamma specific activities are sums of the individual radionuclide specific activities.

Measurement of radioactivities: Measurement has been performed using destructive analysis. Decay nuclides with a half-life of less than 3 months have been omitted.

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			7.89E-05	CC 2	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					Pb 205				
Fe 55					Pb 210	3.66E-14	BB 2	4.30E-14	CC 2
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	3.50E-14	BB 2	4.08E-14	CC 2
Zn 65					Ra 223	5.93E-13	BB 2	8.18E-13	CC 2
Se 79					Ra 225	3.74E-23	BB 2	3.21E-18	CC 2
Kr 81					Ra 226	1.36E-13	BB 2	1.78E-13	CC 2
Kr 85					Ra 228	1.57E-18	BB 2	2.30E-18	CC 2
Rb 87					Ac 227	5.97E-13	BB 2	8.23E-13	CC 2
Sr 90					Th 227	5.86E-13	BB 2	8.09E-23	CC 2
Zr 93					Th 228	1.4E-18	BB 2	2.01E-18	CC 2
Nb 91					Th 229	4.08E-23	BB 2	3.34E-18	CC 2
Nb 92					Th 230	1.92E-11	BB 2	2.85E-11	CC 2
Nb 93m					Th 232	2.08E-18	BB 2	3.18E-18	CC 2
Nb 94					Th 234	2.39E-08	BB 2	4.63E-08	CC 2
Mo 93					Pa 231	1.57E-12	BB 2	2.37E-12	CC 2
Tc 97					Pa 233	7.13E-14	BB 2	5.81E-11	CC 2
Tc 99					U 232				
Ru 106					U 233	4.48E-19	BB 2	3.67E-15	CC 2
Pd 107					U 234	6.32E-08	BB 2	1.07E-07	CC 2
Ag 108m					U 235	2.24E-09	BB 2	3.86E-09	CC 2
Ag 110m					U 236	1.28E-09	BB 2	2.22E-09	CC 2
Cd 109					U 238	2.39E-08	BB 2	4.63E-08	CC 2
Cd 113m					Np 237	7.4E-14	BB 2	5.82E-11	CC 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	7.19E-09	BB 2	1.26E-07	CC 2
Sn 123					Pu 239	4.36E-07	BB 2	3.09E-06	CC 2
Sn 126					Pu 240	1.36E-07	BB 2	7.07E-07	CC 2
Sb 125					Pu 241	5.02E-07	BB 2	1.35E-06	CC 2
Sb 126					Pu 242	1.05E-11	BB 2	2.84E-11	CC 2
Te 125m					Am 241	7.72E-08	BB 2	6.12E-06	CC 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g				
Eu 154					Total a	7.47E-07	BB 2	1.02E-05	CC 2
Eu 155					Total b/g	5.26E-07	BB 2	8.03E-05	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