

WASTE STREAM**7A28****Operational LLW - Miscellaneous Radionuclides****SITE** AWE Aldermaston**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** AWE plc**WASTE TYPE** LLW**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2022.....	30.3 m ³
	1.4.2022 - 31.3.2025.....	2.7 m ³
	1.4.2025 - 31.3.2028.....	1.5 m ³
	1.4.2028 - 31.3.2031.....	1.3 m ³
	1.4.2031 - 31.3.2080.....	0 m ³
Total future arisings:		35.8 m ³
Total waste volume:		35.8 m ³

Comment on volumes: The stock volume has remained at zero since the last inventory. The waste arising rate has increased, based on facility predictions. The total volume of arisings in this category is small and likely to arise in drums / small packages and will be disposed alongside wastes in other streams therefore maybe recategorised into one of those streams prior to disposal (i.e. 7A27).

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 5.0
 Stock (lower): x Arisings (lower) x 0.2

WASTE SOURCE Waste arising from operations where the fingerprint is predominantly beta / gamma emitting radionuclides.

PHYSICAL CHARACTERISTICS

General description: The waste contains plastic/rubber, cellulose, metal and other materials.

Physical components (%wt): Plastics (29%), cellulose (19%), metal (44%), soil (4%) and rubble (4%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.21

Comment on density: Density calculated from disposals for 2013 RWI, not updated as no change.

CHEMICAL COMPOSITION

General description and components (%wt): Plastics (29%), cellulose (19%), metal (44%), soil (4%) and rubble (4%). The composition has been reviewed for the 2016 RWI and is now based on predictions from waste producing facilities.

Chemical state: Neutral

Chemical form of radionuclides: U: Chloride, nitrate or oxide.
 Pu: Chloride, nitrate or oxide.

Metals and alloys (%wt): Small volumes of metal, likely to be placed into drums differentiating between ferrous and non-ferrous metals. Very little present as bulk items. Metal type breakdown is vague because it is likely to be mixed metal that is presented to service providers.

Stainless steel.....	13.0
Other ferrous metals.....	6.0
Iron.....	
Aluminium.....	7.0
Beryllium.....	
Cobalt.....	
Copper.....	1.0
Lead.....	
Magnesium.....	

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	Nickel.....		
	Titanium.....		
	Uranium.....	NE	Present as a contaminant only.
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....	17.0	Undifferentiated metals.
Organics (%wt):	PVC.		
	Total cellulose.....	19.0	
	Paper, cotton.....	5.0	
	Wood.....	14.0	
	Halogenated plastics	19.0	PVC.
	Total non-halogenated plastics.....	10.0	
	Condensation polymers.....	10.0	
	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):	Filters specified as glass		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....	3.8	
	Brick/Stone/Rubble.....	4.0	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....		
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....	0.20	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		
	Powder/Ash.....		

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Inorganic anions (%wt):

-		
Fluoride.....		
Chloride.....		
Iodide.....		
Cyanide.....		
Carbonate.....	2.1	Not reviewed since 2013 RWI.
Nitrate.....	2.1	Not reviewed since 2013 RWI.
Nitrite.....		
Phosphate.....		
Sulphate.....		
Sulphide.....		

Materials of interest for waste acceptance criteria:

No		
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	P	
Putrescible wastes.....	0	
Non-putrescible wastes.....	P	Paper, cotton and wood are present.
Corrosive materials.....	0.20	Not reviewed since 2013 RWI.
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Active particles.....	0	
Soluble solids as bulk chemical compounds.....	NE	

Hazardous substances / non hazardous pollutants:

-		
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	P	PVC.
Arsenic.....	0	

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Barium..... 0
 Boron..... 0
 Cadmium..... 0
 Caesium..... 0
 Selenium..... 0
 Chromium..... 0
 Molybdenum..... 0
 Thallium..... 0
 Tin..... 0
 Vanadium..... 0
 Mercury compounds..... 0
 Others..... 0

Electronic Electrical Equipment (EEE)

EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt):

No
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents.....

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC)	Off-site	~5.0
Incineration Solidification Decontamination Metal treatment	Off-site	~21.0
Size reduction Decay storage Recycling / reuse Other / various None		~74.0

Comment on planned treatments:

Treatment routes for these wastes have been estimated based on the recently issued corporate BAT, it assumes the radionuclide breakdown is predominantly beta / gamma.

WASTE STREAM**7A28****Operational LLW - Miscellaneous Radionuclides****Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	~79.0
Expected to be consigned to a Landfill Facility	
Expected to be consigned to an On-Site Disposal Facility	~21.0
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	

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: (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: -

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**7A28****Operational LLW - Miscellaneous Radionuclides**

Source:	Miscellaneous operations generating a multitude of radionuclides.
Uncertainty:	The activity of the waste arisings has been estimated from the facility declared fingerprints and expected activities.
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:	Typically these wastes are measured using gamma spectrometry with the use of a fingerprint.
Other information:	Decay nuclides with a half life of less than 3 months have been omitted.

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Operational LLW - Miscellaneous Radionuclides

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			7.12E-07	DD 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			3.61E-07	DD 2	Pb 210				
Co 60			2.91E-06	DD 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			1.1E-06	DD 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232		8.66E-10	DD 2	
Ru 106					U 233				
Pd 107					U 234			NE	
Ag 108m					U 235			NE	
Ag 110m					U 236			NE	
Cd 109					U 238			NE	
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239		1.20E-06	DD 2	
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242		1.02E-09	DD 2	
Te 125m					Am 241		5.28E-08	DD 2	
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			1.14E-06	DD 2	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	0	1.25E-06	DD 2	
Eu 155					Total b/g	0	6.22E-06	DD 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