

WASTE STREAM	7A37	Contaminated Mercury
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SITE AWE Aldermaston

SITE OWNER Ministry of Defence

WASTE CUSTODIAN AWE plc

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	2.7 m ³
Future arisings -	1.4.2019 - 31.3.2022.....	1.9 m ³
	1.4.2022 - 31.3.2080.....	0 m ³
Total future arisings:		1.9 m ³
Total waste volume:		4.6 m ³

Comment on volumes: AWE predicts that a small volume of mercury contaminated waste will arise from decommissioning facilities. Future arisings have been predicted by a particular decommissioning facility.

Uncertainty factors on volumes:	Stock (upper):	x 3.0	Arisings (upper)	x 5.0
	Stock (lower):	x 0.3	Arisings (lower)	x 0.5

WASTE SOURCE Elemental mercury used in electrical switches, vacuum pumps, thermometers and general experimental work. The contamination is physically associated with the waste not chemically bound.

PHYSICAL CHARACTERISTICS

General description: The waste is principally contaminated mercury, some impurities may be present.

Physical components (%vol): Mercury

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.44

Comment on density: The density was revised in 2016 and is now based on the nett weight of Hg in its container (there is a lot of free space). The 2019 RWI stock waste has been reviewed and adjusted accordingly.

CHEMICAL COMPOSITION

General description and components (%wt): Mercury.

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): -

- Stainless steel.....
- Other ferrous metals.....
- Iron.....
- Aluminium.....
- Beryllium.....
- Cobalt.....
- Copper.....
- Lead.....
- Magnox/Magnesium.....
- Nickel.....
- Titanium.....
- Uranium.....
- Zinc.....

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	Zircaloy/Zirconium.....		
	Other metals.....	100.0	Mercury.
Organics (%wt):	-		
	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):	-		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....		
	Brick/Stone/Rubble.....		
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....		
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....		
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		
	Powder/Ash.....		
Inorganic anions (%wt):	-		

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Fluoride.....
 Chloride.....
 Iodide.....
 Cyanide.....
 Carbonate.....
 Nitrate.....
 Nitrite.....
 Phosphate.....
 Sulphate.....
 Sulphide.....

Materials of interest for
 waste acceptance criteria:

-
 Combustible metals..... 0
 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..... 0
 Corrosive materials..... 0
 Pyrophoric materials..... 0
 Generating toxic gases..... P
 Reacting with water..... 0
 Active particles..... 0
 Soluble solids as bulk chemical
 compounds..... 0

Mercury.

Hazardous substances /
 non hazardous pollutants:

This waste is composed of contaminated mercury.

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

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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) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None	Off-site Off-site	NE NE

Comment on planned treatments:

AWE is investigating further treatments for alpha contaminated mercury, but has not identified a solution at this time.

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Disposal Routes:

Disposal Route	Stream volume %
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

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

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Source:	Plutonium, enriched uranium and depleted uranium.
Uncertainty:	The stock total alpha and beta/gamma specific activity was taken from the volume and activity of waste in stock. Radionuclide breakdown was estimated based on likely fingerprints.
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 activity of the contaminated mercury is determined by radiometric assay.
Other information:	-

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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				6	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				
Co 60	1.02E-06	CC 2		6	Bi 208				
Ni 59					Bi 210m				
Ni 63					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	2.65E-07	CC 2		6	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234	3.92E-09	CC 2	3.92E-09	DD
Ag 108m	8.22E-08	CC 2		6	U 235	1.54E-10	CC 2	1.54E-10	DD
Ag 110m					U 236	1.36E-11	CC 2	1.36E-11	DD
Cd 109					U 238	7.03E-09	CC 2	7.03E-09	DD
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	2.45E-05	CC 2	2.45E-05	DD
Sn 123					Pu 239	7.96E-04	CC 2	7.96E-04	DD
Sn 126					Pu 240	1.82E-04	CC 2	1.82E-04	DD
Sb 125					Pu 241	8.23E-05	CC 2	8.23E-05	DD
Sb 126					Pu 242	2.16E-08	CC 2	2.16E-08	DD
Te 125m					Am 241	1.17E-04	CC 2	1.17E-04	DD
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	2.69E-06	CC 2		6	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	1.12E-03	CC 2	1.12E-03	DD 2
Eu 155					Total b/g	8.64E-05	CC 2	8.23E-05	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