

WASTE STREAM 7A32 Closed Sources**SITE** AWE Aldermaston**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** AWE plc**WASTE TYPE** ILW**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2080.....	92.0 m ³
Total future arisings:		92.0 m ³
Total waste volume:		92.0 m ³

Comment on volumes: AWE ceased cementation in 2005 and now transports sources to a treatment facility. Future arising volumes are based on 2017 and 2018 disposal volumes projected until 2080 i.e. 1.5m³ per year. The volume is similar to that predicted in both the 2013 and 2016 UK RWIs. This stream will include wastes previously reported in deleted waste stream 7A39 (ILW Closed Sources). Stock volumes are recorded in a recently issued database, and are therefore considered to be accurate. The total volume of arisings will depend on the longevity of the AWE site, estimates have been made based on a site closure date of 2080.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 10.0
 Stock (lower): x Arisings (lower) x 0.1

WASTE SOURCE This waste stream comprises miscellaneous ILW closed sources that have been used for the calibration of radiological equipment.**PHYSICAL CHARACTERISTICS**

General description: The closed sources are all solid sources that do not contain any liquid or gas inners.

Physical components (%wt): Metal (18%), Paper/cotton (4%), Plastics (35%), Glass (43%).

Sealed sources: The waste contains sealed sources. 100% sources as per waste stream.

Bulk density (t/m³): ~0.227

Comment on density: The density was reviewed for the 2019 UK RWI and is based on the last 15 disposals.

CHEMICAL COMPOSITION

General description and components (%wt): Other ferrous metals (12%), aluminium (2%), copper (2%), brass (2%), paper/cotton (4%), halogenated plastics (5%), non-halogenated plastics (30%), glass (43%). The components remain unreviewed since the 2013 RWI as the associated processes and experiments have not changed significantly in their scope.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Oxide / chloride / sulphate.
C-14: Oxide / chloride / sulphate.
Ra: Oxide / chloride / sulphate
Th: Oxide / chloride / sulphate
U: Oxide / chloride / sulphate.
Pu: Oxide / chloride / sulphate.

Metals and alloys (%wt): Not relevant, as not appropriate for recycling.

Stainless steel.....	
Other ferrous metals.....	12.0
Iron.....	
Aluminium.....	2.0
Beryllium.....	
Cobalt.....	
Copper.....	4.0
Lead.....	
Magnox/Magnesium.....	

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	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....		
Organics (%wt):	Plastic is present in the form of perspex for shielding of beta radiation, e.g. for Sr-90 sources.		
	Total cellulosics.....	4.0	
	Paper, cotton.....	4.0	
	Wood.....		
	Halogenated plastics	5.0	PVC
	Total non-halogenated plastics.....	30.0	
	Condensation polymers.....	30.0	
	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):	-		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....		
	Brick/Stone/Rubble.....		
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....	43.0	
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....		
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		

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	Powder/Ash.....	
Inorganic anions (%wt):	Present but not totalling more that 1% by weight	
	Fluoride.....	
	Chloride.....	<1.0
	Iodide.....	
	Cyanide.....	
	Carbonate.....	
	Nitrate.....	<1.0
	Nitrite.....	
	Phosphate.....	
	Sulphate.....	<1.0
	Sulphide.....	
Materials of interest for waste acceptance criteria:	-	
	Combustible metals.....	0
	Low flash point liquids.....	0
	Explosive materials.....	0
	Phosphorus.....	0
	Hydrides.....	NE
	Biological etc. materials.....	0
	Biodegradable materials.....	P
	Putrescible wastes.....	0
	Non-putrescible wastes.....	P
	Corrosive materials.....	NE
	Pyrophoric materials.....	NE
	Generating toxic gases.....	NE
	Reacting with water.....	NE
	Active particles.....	P
	Soluble solids as bulk chemical compounds.....	NE
Hazardous substances / non hazardous pollutants:	-	
	Acrylamide.....	0
	Benzene.....	NE
	Chlorinated solvents.....	0
	Formaldehyde.....	0
	Organometallics.....	0
	Phenol.....	NE
	Styrene.....	0
	Tri-butyl phosphate.....	NE
	Other organophosphates.....	0
	Vinyl chloride.....	P
	Arsenic.....	NE

Paper and cotton.

Source

PVC

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

LAW TREATMENT, PACKAGING AND DISPOSAL

Waste that is currently ILW: High activity Am-241 and Co-60 sources are recycled and, therefore, not disposed as waste. In omitting these activities, the total specific activities do not exceed 4.00E-03 TBq/m³ alpha and 1.20E-02 TBq/m³ beta.

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse	Off-site	~5.0
Other / various	Off-site	~95.0
None		

Comment on planned treatments:

The bulk of the sources are consolidated at a contractor's site and then sentenced through a final disposal solution, e.g. LLWR burial, permitted LA-LLW, etc. Re-use or recycle if possible. However, recycling/reuse tends to be available for higher activity sources, so the crux of the waste stream goes to an off-site contractor's facility to be consolidated before final disposal.

WASTE STREAM**7A32 Closed Sources****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	~5.0
Disposal route not known	~95.0

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: Disposal route is none of the above, it will go to Eckert Zeigler or another source disposal provider.

Waste Consigned to the LLW Repository:

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

Source:	The source of activity could be from any number of radionuclides.
Uncertainty:	The activity and radionuclides declared are not accurate, they will vary depending on what requires disposal in any given year.
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 levels are determined from 2017-2018 disposals figures. Decay calculations have not been done as it's assumed that new sources will be bought and eventually disposed.
Other information:	-

WASTE STREAM 7A32 Closed Sources

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			~3.88E-05	DD 2	Gd 153				
Be 10					Ho 163				
C 14			~1.86E-08	DD 2	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			7.55E-02	DD 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			4.89E-06	DD 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226		1.66E-06	DD 2	
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			6.47E-05	DD 2	Th 227				
Zr 93					Th 228		~2.34E-08	DD 2	
Nb 91					Th 229				
Nb 92					Th 230		~2.65E-10	DD 2	
Nb 93m					Th 232		1.32E-09	DD 2	
Nb 94					Th 234				
Mo 93					Pa 231		~5.92E-06	DD 2	
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234		~2.34E-04	DD 2	
Ag 108m					U 235		~7.20E-06	DD 2	
Ag 110m					U 236		~7.99E-07	DD 2	
Cd 109			4.31E-10	DD 2	U 238		~3.04E-04	DD 2	
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239		6.54E-07	DD 2	
Sn 126					Pu 240		1.39E-09	DD 2	
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241		1.68E-02	DD 2	
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			2.05E-04	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			~4.51E-11	DD 2	Cf 251				
Sm 147					Cf 252		~2.18E-07	DD 2	
Sm 151					Other a				
Eu 152			1.86E-07	DD 2	Other b/g		1.42E-06	DD 2	
Eu 154					Total a	0	1.74E-02	DD 2	
Eu 155					Total b/g	0	7.58E-02	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