WASTE STREAM 7A41 Cemented Sludges

SITE AWE Aldermaston

SITE OWNER Ministry of Defence

WASTE CUSTODIAN AWE plc

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	164.8 m³
Future arisings -	1.4.2019 - 31.3.2080.....	0 m³
Total future arisings:		0 m³
Total waste volume:		164.8 m³

Comment on volumes: This code contains AWE's cemented sludges. It had previously agreed that these would be disposed as LLW under 7A27 (agreement with LLWR), but LLWR has not accepted these items since the introduction of "discreet items" in LLWR WAC. Stock volumes are recorded in a database, and are therefore considered to be accurate. The total volume of arisings will depend on the BAT route for dealing with sludge arisings, which is subject to change.

Uncertainty factors on volumes:

Stock (upper):	x 1.0	Arisings (upper)	x
Stock (lower):	x 1.0	Arisings (lower)	x

WASTE SOURCE Effluent treatment using a ferric floc precipitation process to remove radioactivity from aqueous streams, which have originated from uranium and plutonium operations, cemented.

PHYSICAL CHARACTERISTICS

General description: The waste consists of uranium and plutonium bearing sludges resulting from operations. The waste contains no items that require special handling. Solid component of the sludge has been concentrated by aqueous waste treatment processes. The sludge has been mixed with cement to solidify inside a 205l steel drum.

Physical components (%wt): The solid content is 100%

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 1.9

Comment on density: Density was reviewed for the 2019 UK RWI. This is an average of all "in stock" containers and identical to the figure quoted in the 2016 UK RWI.

CHEMICAL COMPOSITION

General description and components (%wt): Contains trace metals, stainless steel (6%) other-ferrous metal (6%) and cemented flocculant sludge (88%). This is an accurate description (2019) taken from analysis report. The last RWI also identified the waste as being made up of uranium and plutonium bearing ferric hydroxide sludges. The waste contains silica as SiO2 (1.2%), Iron as Fe2O3 (1.6%), Calcium as CaO (2.4%), Sodium as Na2O (0.2%), Carbonate as CO2 (1.9%), Chloride as Cl (0.1%), Plutonium as oxide (<0.1%), Uranium as oxide (<0.1%), Heavy metals as oxides (<0.1%), Potassium as sulphate (<0.1%), Magnesium as hydroxide (<0.1%). As in the 2016 RWI, this data has been assumed to be correct and not reviewed for this RWI.

Chemical state: Alkali

Chemical form of radionuclides:
H-3: Oxide.
U: Oxide form.
Pu: Oxide

Metals and alloys (%wt): No sheet metal.

Stainless steel.....	6.0	Sludges were cemented into a steel drum.
Other ferrous metals.....	6.0	Sacrificial stirring paddle.
Iron.....		
Aluminium.....		
Beryllium.....	TR	
Cobalt.....	TR	

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	Copper	TR	
	Lead	TR	
	Magnox/Magnesium	TR	
	Nickel	TR	
	Titanium	TR	
	Uranium		
	Zinc	TR	
	Zircaloy/Zirconium	TR	
	Other metals	TR	
Organics (%wt):	There are no organic materials (other than traces of complexing agents).		
	Total cellulosics		
	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):	This waste stream is a sludge.		
	Inorganic ion exchange materials.	TR	
	Inorganic sludges and flocs	63.0	Uranium oxide (0.1%wt).
	Soil		
	Brick/Stone/Rubble		
	Cementitious material	25.0	Cement.
	Sand		
	Glass/Ceramics		
	Graphite		
	Desiccants/Catalysts		
	Asbestos		
	Non/low friable		
	Moderately friable		
	Highly friable		

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Free aqueous liquids.....

Free non-aqueous liquids.....

Powder/Ash.....

Inorganic anions (%wt): The waste contains sulphates, chlorides, carbonates and phosphates with traces of nitrate, fluoride and sulphide. Chloride is estimated as 350 to 1100 ppm of total sludge.

Fluoride.....	TR	
Chloride.....	0.10	350 to 1100 ppm.
Iodide.....		
Cyanide.....		
Carbonate.....	1.2	
Nitrate.....	TR	
Nitrite.....		
Phosphate.....	TR	
Sulphate.....	<0.10	
Sulphide.....	TR	

Materials of interest for waste acceptance criteria: There are no hazardous materials present in the waste.

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.....	0
Reacting with water.....	0
Active particles.....	0
Soluble solids as bulk chemical compounds.....	0

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.....	0	
Arsenic.....	P	0.34ppm.
Barium.....	0	
Boron.....	P	0.84ppm.
Cadmium.....	P	0.51ppm.
Caesium.....	TR	
Selenium.....	P	0.51ppm.
Chromium.....	P	4.21ppm.
Molybdenum.....	P	0.25ppm.
Thallium.....	0	
Tin.....	P	0.93ppm.
Vanadium.....	P	0.34ppm.
Mercury compounds.....	0	
Others.....	P	
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		
Recyling / reuse		
Other / various		
None	Off-site	100.0

Comment on planned treatments:

AWE is awaiting confirmation from LLWR that this waste cannot be accepted on a variation as it was acceptable up until June 2014. Average alpha activity is 3800Bq/g; it is LLW but doesn't meet discrete items limit.

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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 m³	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: Will only go into a HHISO if it's accepted at the LLWR. Some voidage will be filled with small packages from 7A27 code, there will be no inaccessible voidage.

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: -

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RADIOACTIVITY

Source:	Plutonium, uranium, tritium, with traces of Cs-137, Fe-55 and Co-60.
Uncertainty:	Accurate data based on assay of sludge from water treatment tanks (minimal variation).
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 sludge is determined by sampling and 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/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3	2.20E-04	A A 1			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	8.51E-07	A A 1			Pb 210				
Co 60	2.56E-06	A A 1			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					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234	5.25E-05	A A 1		
Ag 108m					U 235	2.57E-04	A A 1		
Ag 110m					U 236	4.39E-07	A A 1		
Cd 109					U 238	1.46E-05	A A 1		
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.14E-04	A A 1		
Sn 123					Pu 239	2.01E-03	A A 1		
Sn 126					Pu 240	4.71E-04	A A 1		
Sb 125					Pu 241	4.09E-03	A A 1		
Sb 126					Pu 242	5.47E-09	A A 1		
Te 125m					Am 241	4.42E-03	A A 1		
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	6.71E-05	A A 1			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**	**7.34E-03**	**A A 1**	**0**	
Eu 155					**Total b/g**	**4.38E-03**	**A A 1**	**0**	

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