WASTE STREAM 7A33 Radioactive Contaminated Land

SITE	AWE Aldermaston
SITE OWNER	Ministry of Defence
WASTE CUSTODIAN	AWE plc
WASTE TYPE	LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	216.0 m³
Future arisings -	1.4.2019 - 31.3.2077.....	3786.0 m³
Total future arisings:		3786.0 m³
Total waste volume:		4002.0 m³

Comment on volumes: Future arisings are based on the figures calculated for the Annual Review of Nuclear Liabilities, which have been reviewed for this RWI. This waste stream represent two waste types, A) existing stockpiled contaminated soil awaiting disposal and B) areas of known radiologically contaminated soil that will be encountered either during ongoing re-development of the site or dealt with during the works to achieve the site end state. The expected volume of future radiologically 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 of the 1176m3 of the 3786m3 currently accounted for could be OOS when full waste characterisation is undertaken, rather than the initial land quality hazard identification information currently available (further investigation required).

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 and building foundations 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 m 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 has been calculated by AWE's Contaminated Land Technical Authority in 2019.

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 the NDA.

Chemical state: Neutral

Chemical form of radionuclides: U: Oxide form.
Pu: Oxide form.

Metals and alloys (%wt): -

Stainless steel.....

Other ferrous metals.....

Iron.....

Aluminium.....

Beryllium.....

Cobalt.....

Copper.....

Lead..... TR

WASTE STREAM	7A33	Radioactive Contaminated Land	

	Magnox/Magnesium.....		
	Nickel.....		
	Titanium.....		
	Uranium.....	TR	Present as a contaminant only.
	Zinc.....	TR	
	Zircaloy/Zirconium.....		
	Other metals.....		
Organics (%wt):	-		
	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):	-		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....	100.0	
	Brick/Stone/Rubble.....	NE	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....		
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....		
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		

WASTE STREAM	7A33	Radioactive Contaminated Land

Powder/Ash.....

Inorganic anions (%wt): -

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

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.....	NE
Arsenic.....	NE

Barium..... 0

Boron..... NE

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.....

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		~100.0

Comment on planned treatments: Analysis of this waste indicates that it is suitable for landfill disposal.

WASTE STREAM 7A33 Radioactive Contaminated Land

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: Most practicable container will be determined at time of disposal.

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 7A33 Radioactive Contaminated Land

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:	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:	Measurement has been by destructive analysis. Decay nuclides with a half life of less than 3 months have been omitted.
Other information:	-

WASTE STREAM 7A33 Radioactive Contaminated Land

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					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					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	6.32E-08	B B 2	1.09E-07	C C 2
Ag 108m					U 235	2.24E-09	B B 2	3.88E-09	C C 2
Ag 110m					U 236	1.28E-09	B B 2	2.23E-09	C C 2
Cd 109					U 238	2.39E-08	B B 2	4.65E-08	C C 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	7.37E-09	B B 2	1.60E-07	C C 2
Sn 123					Pu 239	4.36E-07	B B 2	3.10E-06	C C 2
Sn 126					Pu 240	1.36E-07	B B 2	7.12E-07	C C 2
Sb 125					Pu 241	5.80E-07	B B 2	5.47E-06	C C 2
Sb 126					Pu 242	1.06E-11	B B 2	2.86E-11	C C 2
Te 125m					Am 241	7.51E-08	B B 2	6.29E-06	C C 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**	**7.45E-07**	**B B 2**	**1.04E-05**	**C C 2**
Eu 155					**Total b/g**	**5.80E-07**	**B B 2**	**5.47E-06**	**C C 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