

WASTE STREAM	9A930	Active Waste Vault Retrieval Decommissioning.
---------------------	--------------	--

SITE Berkeley

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2023.....	~211.8 m ³
Total future arisings:		211.8 m ³
Total waste volume:		211.8 m ³

Comment on volumes: The dates above are under review. The demolition will not start until all the vaults have been emptied. Arisings are predicted by quantity estimates.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.2
 Stock (lower): x Arisings (lower) x 0.8

WASTE SOURCE Plant arisings from Active Waste Vault Retrieval building. Steel components from dismantling plant and pipework in the Retrieval Building.

PHYSICAL CHARACTERISTICS

General description: Consists of soft and hard trash resulting from Active Waste Vault Retrievals (AWVR), as well as the eventual deplant and demolition of the building in readiness for the sites entry into the Care & Maintenance (C&M) phase. This waste will include varied quantities of steel, deplanting materials, general waste, ventilation plant ducting and cable trays, other scrap and concrete. The secondary waste arisings (used PPE, plastic sheeting, tackys and wipealls) from vault retrievals will constitute majority of the LLW generated until the vaults have been emptied (c.2021). The volume of waste will then increase significantly with the Post Operational Clean Out (POCO) deplanting and demolition of the Active Waste Vaults (AWV) facility.

Physical components (%vol): Varied quantities of steels, deplanting materials, general waste, Light Iron Duct Work (Ventilation Plant ducting and cable trays), general scrap (Ventilation equipment etc), cabling, fibre insulation and concrete. % Breakdown by volume, ~32% metals, ~25% concrete, ~12% plastics (non-halogenated), ~24% Cellulosics, 2% rubber, and ~5% glass.

Sealed sources: -

Bulk density (t/m³): ~1.31

Comment on density: Density has been calculated using published densities for the material components.

CHEMICAL COMPOSITION

General description and components (%wt): 55% Metal, 29% concrete, 4% plastic, 1% rubber, 8% cellulosic, 3% glass.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Any tritium is expected to be present as water.
 C-14: Carbon-14 maybe present as graphite.
 Cl-36: The chlorine 36 content is insignificant.
 U: Chemical form of uranium has not been determined but may be uranium oxides.
 Pu: Chemical form of plutonium has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Items will have been cut for packaging. Thicknesses are likely to vary from a few mm to about 25 mm.

Stainless steel.....	NE	
Other ferrous metals.....	~24.3	Ventilation equipment, deplanting materials
Iron.....		
Aluminium.....	NE	
Beryllium.....	0	
Cobalt.....		

WASTE STREAM**9A930****Active Waste Vault Retrieval Decommissioning.**

	Copper.....	~29.9	Cabling
	Lead.....	NE	
	Magnox/Magnesium.....	TR	
	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....	0.80	Galvanised vent ducting
	Zircaloy/Zirconium.....	NE	
	Other metals.....	NE	"Other" metals not identified
Organics (%wt):	Trace amounts of ion exchange resin could be present.		
	Total cellulosics.....	~8.0	
	Paper, cotton.....	~4.0	
	Wood.....	~4.0	
	Halogenated plastics	NE	
	Total non-halogenated plastics.....	4.0	
	Condensation polymers.....	NE	
	Others.....	~4.0	
	Organic ion exchange materials....	NE	
	Total rubber.....	~1.0	
	Halogenated rubber	NE	
	Non-halogenated rubber.....	~1.0	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	NE	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	NE	
	Inorganic sludges and flocs.....	NE	
	Soil.....	NE	
	Brick/Stone/Rubble.....	NE	
	Cementitious material.....	~29.0	
	Sand.....		
	Glass/Ceramics.....	~3.0	
	Graphite.....	NE	
	Desiccants/Catalysts.....		
	Asbestos.....	0	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		

WASTE STREAM**9A930 Active Waste Vault Retrieval Decommissioning.**

	Free aqueous liquids.....	TR
	Free non-aqueous liquids.....	
	Powder/Ash.....	NE
Inorganic anions (%wt):	-	
	Fluoride.....	NE
	Chloride.....	NE
	Iodide.....	NE
	Cyanide.....	0
	Carbonate.....	NE
	Nitrate.....	NE
	Nitrite.....	NE
	Phosphate.....	NE
	Sulphate.....	NE
	Sulphide.....	NE
Materials of interest for waste acceptance criteria:	-	
	Combustible metals.....	NE
	Low flash point liquids.....	0
	Explosive materials.....	0
	Phosphorus.....	0
	Hydrides.....	0
	Biological etc. materials.....	0
	Biodegradable materials.....	
	Putrescible wastes.....	0
	Non-putrescible wastes.....	
	Corrosive materials.....	0
	Pyrophoric materials.....	0
	Generating toxic gases.....	NE
	Reacting with water.....	0
	Active particles.....	
	Soluble solids as bulk chemical compounds.....	
Hazardous substances / non hazardous pollutants:	None expected.	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	
	Other organophosphates.....	

WASTE STREAM**9A930****Active Waste Vault Retrieval Decommissioning.**

Vinyl chloride.....
 Arsenic.....
 Barium.....
 Boron.....
 Cadmium.....
 Caesium.....
 Selenium.....
 Chromium.....
 Molybdenum.....
 Thallium.....
 Tin.....
 Vanadium.....
 Mercury compounds.....
 Others.....
 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

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	37.4
Supercompaction (HFC)		
Incineration	Off-site	32.2
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various	30.4	
None		

Comment on planned treatments:

30.4% by volume of the waste stream is expected to be disposed of as VLLW to landfill.

WASTE STREAM**9A930****Active Waste Vault Retrieval Decommissioning.****Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	30.4
Expected to be consigned to a Landfill Facility	
Expected to be consigned to an On-Site Disposal Facility	37.4
Expected to be consigned to an Incineration Facility	
Expected to be consigned to a Metal Treatment Facility	32.2
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):

Future waste stream, WCF yet to be written.

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: -

WASTE STREAM**9A930****Active Waste Vault Retrieval Decommissioning.****RADIOACTIVITY**

Source:	Contamination of steelwork, equipment and structure materials.
Uncertainty:	-
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 sampling plan was based on the ILW (FED) stored in the vaults as opposed to the secondary LLW arisings that have arisen with the recent retrieved operations. The FED that was initially retrieved was subjected to a number of gamma spectrometry measurements using a High Resolution Gamma Spectrometer (HRGS) in order to determine the concentration of gamma emitting radionuclides in the waste. Each item of FED retrieved was subjected to HRGS measurements and radiochemical analyses. This has been used to determine the fingerprint for 9A930, whereby:- historic data from past LLW disposals (VLLW, Combustible, Supercompaction, Metallic Treatment and Direct) have been used in estimating the total activity in the stocks and arisings for this waste stream and the resulting nuclide fractions used to determine the nuclide activities for this waste stream.
Other information:	-

WASTE STREAM

9A930

Active Waste Vault Retrieval Decommissioning.

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			8.34E-05	BB 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			2.21E-05	BB 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			6.58E-09	BB 1	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41			3.53E-08	BB 2	Pt 193		2.17E-07	BB 2	
Mn 53				8	Tl 204		1.39E-08	BB 2	
Mn 54				8	Pb 205				8
Fe 55			5.69E-08	BB 1	Pb 210				8
Co 60			1.18E-06	BB 1	Bi 208				8
Ni 59			1.78E-08	BB 2	Bi 210m				8
Ni 63			1.31E-07	BB 1	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226				8
Kr 85			3.89E-08	BB 2	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			1.53E-06	BB 1	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m			6.51E-09	BB 2	Th 232				8
Nb 94			2.48E-08	BB 2	Th 234				8
Mo 93			3.59E-09	BB 2	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106				8	U 233		4.19E-09	BB 1	
Pd 107				8	U 234				8
Ag 108m			1.92E-08	BB 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238		7.5E-08	BB 1	
Sn 123				8	Pu 239		9.65E-08	BB 1	
Sn 126				8	Pu 240		9.76E-08	BB 1	
Sb 125				8	Pu 241		4.75E-06	BB 2	
Sb 126				8	Pu 242		2.51E-09	BB 1	
Te 125m				8	Am 241		3.87E-07	BB 1	
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			6.59E-09	BB 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			4.87E-07	BB 1	Cm 244		5.66E-09	BB 1	
Ba 133			1.61E-08	BB 2	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144				8	Cf 249				8
Pm 145			1.07E-09	BB 2	Cf 250				8
Pm 147			1.06E-09	BB 1	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151			1.53E-07	BB 1	Other a				
Eu 152			2.08E-07	BB 2	Other b/g				
Eu 154			3.29E-07	BB 2	Total a	0	6.69E-07	BB 2	
Eu 155			2.24E-08	BB 2	Total b/g	0	1.15E-04	BB 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