

WASTE STREAM	9B105	Care and Maintenance LLW
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SITE Bradwell
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 - 31.3.2020.....	2.8 m ³
	1.4.2020 - 31.3.2030.....	28.0 m ³
	1.4.2030 - 31.3.2040.....	28.0 m ³
	1.4.2040 - 31.3.2070.....	84.0 m ³
	1.4.2070 - 31.3.2087.....	47.6 m ³
Total future arisings:		190.4 m ³
Total waste volume:		190.4 m ³
Comment on volumes:	Bradwell entered C&M during 2018 however this stream is not due to arise until 2019.	
Uncertainty factors on volumes:	Stock (upper): x	Arisings (upper) x 1.2
	Stock (lower): x	Arisings (lower) x 0.8

WASTE SOURCE Wastes from the safe store and Interim Storage Facility (ISF) during the Care and Maintenance period.

PHYSICAL CHARACTERISTICS

General description: Principally secondary waste arisings, including mixed plastic sheeting, wipes, and protective clothing. There will be some secondary waste arisings potentially contaminated with asbestos or drain sludge.

Physical components (%wt): Principally plastic and cloth (95%wt), others (5%wt).

Sealed sources: -

Bulk density (t/m³): ~0.188

Comment on density: The density is an estimate based on 1 x bag weighing 15kg and holding 80 litres of waste.

CHEMICAL COMPOSITION

General description and components (%wt): Principally plastic and cloth (95 %wt), others (5 %wt).

Chemical state: Neutral

Chemical form of radionuclides:
 H-3: Tritium present as surface contamination of waste by tritiated liquor.
 C-14: Contamination in the form of graphite dust.
 Cl-36: Chlorine 36 may be present as a contaminant of graphite dust.
 Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): -

Stainless steel.....	0
Other ferrous metals.....	5.0
Iron.....	
Aluminium.....	0
Beryllium.....	0
Cobalt.....	
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	
Titanium.....	

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	Uranium.....	
	Zinc.....	0
	Zircaloy/Zirconium.....	0
	Other metals.....	0
Organics (%wt):	-	
	Total cellulose.....	~25.0
	Paper, cotton.....	~24.0
	Wood.....	~1.0
	Halogenated plastics	~24.0
	Total non-halogenated plastics.....	~46.0
	Condensation polymers.....	0
	Others.....	~46.0
	Organic ion exchange materials....	0
	Total rubber.....	0
	Halogenated rubber	0
	Non-halogenated rubber.....	0
	Hydrocarbons.....	
	Oil or grease	
	Fuel.....	
	Asphalt/Tarmac (cont.coal tar)...	
	Asphalt/Tarmac (no coal tar)....	
	Bitumen.....	
	Others.....	
	Other organics.....	0
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	0
	Glass/Ceramics.....	0
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	-	

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Fluoride.....	0
Chloride.....	0
Iodide.....	0
Cyanide.....	0
Carbonate.....	0
Nitrate.....	0
Nitrite.....	0
Phosphate.....	0
Sulphate.....	0
Sulphide.....	0

Materials of interest for
waste acceptance criteria:

No materials likely to pose a fire or other non-radiological hazard have been identified.

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:

None expected.

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

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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):

EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents..... NE

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-Site	~99.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		

Comment on planned treatments:

Waste will be transferred to Sizewell A Site for streaming, processing and packaging for disposal

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Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	~99.0
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	<1.0

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:

Container	Stream volume %	Waste loading m ³	Number of packages
1/3 Height IP-1 ISO	<1.0	~10	< 1
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:

Container voidage: -

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste does not have a current WCH.

Waste consigned for disposal to LLWR in year of generation: Yes. The timing of the consignment of waste for disposal is not known. Disposal to the LLWR at the start of Care & Maintenance is expected, later disposal route to be established.

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:	Contamination of materials.
Uncertainty:	Activity values are current best estimates. Specific activity is a function of site operating history. The values quoted are indicative of the activities that would be expected.
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 specific activities have been developed using 9B910 and 9B951 as the basis with a suitable decay period to the beginning of Care and Maintenance.
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			7.06E-07	CC 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			9.8E-07	CC 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			2.78E-07	CC 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41				8	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55			8.78E-06	CC 2	Pb 210				8
Co 60			7.49E-06	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			1.62E-06	CC 2	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226				8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			1.95E-05	CC 2	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232				8
Nb 94			4.82E-08	CC 2	Th 234				8
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234		6.54E-09	CC 2	8
Ag 108m			3.91E-08	CC 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238		1.46E-08	CC 2	8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238		9.84E-06	CC 2	8
Sn 123				8	Pu 239		1.47E-06	CC 2	8
Sn 126				8	Pu 240		1.92E-06	CC 2	8
Sb 125			1.2E-08	CC 2	Pu 241		3.23E-05	CC 2	8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241		7.65E-06	CC 2	8
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			1.69E-08	CC 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			3.29E-05	CC 2	Cm 244		1.2E-08	CC 2	8
Ba 133			3.2E-08	CC 2	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144				8	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147			1.15E-07	CC 2	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152			8.53E-08	CC 2	Other b/g				
Eu 154			2.37E-07	CC 2	Total a	0	2.09E-05	CC 2	
Eu 155			5.2E-08	CC 2	Total b/g	0	1.05E-04	CC 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