

WASTE STREAM	9E324	BCD LLW
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SITE Oldbury
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m ³
Future arisings -	1.4.2096 - 31.3.2101.....	114.9 m ³
Total future arisings:		114.9 m ³
Total waste volume:		114.9 m ³

Comment on volumes: This waste has been deferred from C&M Prep Waste stream 9E959 to FSC. Final Dismantling & Site Clearance is assumed to commence in 2091 with reactor dismantling commencing in 2096 and lasting for 5 years. The volumes and radioactivity have been calculated for 85 years after reactor shutdown, i.e. 2097.

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

WASTE SOURCE Waste arising from areas associated with BCDs.

PHYSICAL CHARACTERISTICS

General description: Mixed trash. Large items do occasionally arise. This happens infrequently and it is therefore difficult to include specific details.
 Physical components (%wt): Metal (81% wt), soft organic (10% wt), plastics/rubber (3% wt), soil/rubble (1% wt), wood (4% wt)
 Sealed sources: The waste does not contain sealed sources.
 Bulk density (t/m³): 0.4
 Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): The waste comprises metal, various plastics including polythene, paper, wood and rubber. The metals will include steel, copper and aluminium.
 Chemical state: Neutral
 Chemical form of radionuclides: H-3: Tritium is present as surface contamination of waste by tritiated liquor.
 C-14: Carbon 14 may be contamination in the form of graphite dust.
 Cl-36: Chlorine 36 may be present as a contaminant of graphite dust.
 Se-79: The selenium 79 content is insignificant.
 Tc-99: The technetium 99 content is insignificant.
 Ra: The radium isotope content is insignificant.
 Th: The thorium content is insignificant.
 U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
 Np: The neptunium isotope content is insignificant.
 Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.
 Metals and alloys (%wt): Thicknesses of metal may vary from 1 mm to 30 mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~35.0		
Other ferrous metals.....	~45.0		
Iron.....			
Aluminium.....	TR		
Beryllium.....	0		

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Cobalt.....	
Copper.....	TR
Lead.....	0
Magnox/Magnesium.....	TR
Nickel.....	
Titanium.....	
Uranium.....	NE
Zinc.....	0
Zircaloy/Zirconium.....	TR
Other metals.....	<1.0 Chromium may be present.

Organics (%wt): The waste contains plastics/rubber (3% wt), wood (4% wt) and soft organic (10% wt).
Halogenated plastics and rubbers are present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	14.0		
Paper, cotton.....	10.0		
Wood.....	4.0		
Halogenated plastics	~1.0		
Total non-halogenated plastics.....	~~2.0		
Condensation polymers.....	~~1.0		
Others.....	~~1.0		
Organic ion exchange materials....	0		
Total rubber.....	~1.0		
Halogenated rubber	~~0.50		
Non-halogenated rubber.....	~~0.50		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	TR		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	~0.50		
Brick/Stone/Rubble.....	~0.50		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	TR		

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Desiccants/Catalysts.....	
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): None present.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	0	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for Trace of Magnox may be present but will not constitute a hazard.
waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	0	
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.....	0	
Reacting with water.....	0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

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Hazardous substances / None expected
 non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....		
Boron (in Boral).....		
Boron (non-Boral).....		
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

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....		

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Potential for the waste to contain discrete items:

Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; All stainless items assumed DIs. NB if recycled then DI Limits n/a

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 Recycling / reuse Other / various None		39.0
		61.0

Comment on planned treatments:

39% of this waste stream is expected to be sent for Metal Recycle.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
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	61.0 39.0	

Classification codes for waste expected to be consigned to a landfill facility: -

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
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			

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

Waste Packaging for Disposal:

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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	61.0	10	8

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: -

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: Principal constituents are activation products arising from dry fuel routes. Waste also contains fission products and actinides.

Uncertainty: Specific activity is a function of Station 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 estimated from the equivalent operational waste stream and decayed to 85 years after shutdown i.e. at 2097.

Other information: -

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			1.88E-05	CC 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			9.9E-04	CC 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			2E-04	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	Pb 210				8
Co 60			7.29E-10	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			2.24E-05	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			5.45E-06	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			8.97E-06	CC 2	Th 234		1E-09	CC 2	8
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233		5.28E-10	CC 2	8
Tc 99				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			6.97E-06	CC 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238		1E-09	CC 2	8
Cd 113m				8	Np 237		5.29E-10	CC 2	8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238		1.56E-07	CC 2	8
Sn 123				8	Pu 239		1E-07	CC 2	8
Sn 126				8	Pu 240		1.25E-07	CC 2	8
Sb 125				8	Pu 241		7.36E-07	CC 2	8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241		1.87E-05	CC 2	8
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243		7.35E-08	CC 2	8
Cs 137			5.94E-06	CC 2	Cm 244		4.16E-07	CC 2	8
Ba 133			3.47E-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				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				8
Eu 152			2.84E-07	CC 2	Other b/g				8
Eu 154			2.47E-08	CC 2	Total a	0	1.96E-05	CC 2	8
Eu 155			1.4E-10	CC 2	Total b/g	0	1.26E-03	CC 2	8

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