

WASTE STREAM	9E958	Dry Fuel Route (excluding 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.....	2.4 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	5.8 m ³
	1.4.2023 - 31.3.2024.....	22.4 m ³
	1.4.2024 - 31.3.2026.....	50.0 m ³
	1.4.2026 - 31.3.2031.....	70.0 m ³
Total future arisings:		148.2 m ³
Total waste volume:		150.6 m ³

Comment on volumes: -

Uncertainty factors on volumes: Stock (upper): x 1.1 Arisings (upper) x 1.2
 Stock (lower): x 0.9 Arisings (lower) x 0.8

WASTE SOURCE

Waste stream 9E958 captures a large area of Oldbury site, made up of multiple contributing areas surrounding the reactor and boiler systems. The contributing areas can be divided into two main sub-areas, Pile Cap (PC) and Gas Circulators (GC), which both have their own sub-fingerprint. The waste is operational waste from activities carried out in these areas with the majority of the waste being from the Pile cap area.

PHYSICAL CHARACTERISTICS

General description: The waste consigned under waste stream 9E958 mainly comprises metal, concrete and rubble, soil, biodegradable materials, plasterboard, plastics, rubber, wood, glass and other materials. The waste is expected to be in the form of mixed trash, with occasional large items such as pipework, motors and pumps. The material of the waste includes aluminium, asphalt or tarmac, copper, iron, magnesium, mild steel, plastics, stainless steel, zinc, lead, EEE materials, MMMF, asbestos and oil.

Physical components (%wt): Metal (~50%wt), concrete (~6%wt), soil (~3% wt), biodegradables (~6%), plasterboard (~1%), plastic (5%wt), rubber (~4%), wood (~4%), other organic (~1%), others oil and asbestos (~20%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.4

Comment on density: The density is of the waste as cut for packaging. WCH mass divided by volume.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (~50%wt), concrete (~6%wt), soil (~3% wt), biodegradables (~6%), plasterboard (~1%), plastic (5%wt), rubber (~4%), wood (~4%), other organic (~1%), others oil and asbestos (~20%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritium present as surface contamination of waste by tritiated water.
 C-14: Carbon 14 may be present as contamination in the form of graphite dust.
 Cl-36: Chlorine 36 may be present as a contaminant of graphite dust.
 Se-79: The selenium content is insignificant.
 Tc-99: The technetium content is insignificant.
 Ra: The radium isotope content is insignificant.
 Th: The thorium content is insignificant.
 U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.
 Np: The neptunium content is insignificant.
 Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Metal thickness may vary from 1 mm to 30 mm.

WASTE STREAM	9E958	Dry Fuel Route (excluding BCD) LLW
---------------------	--------------	-------------------------------------------

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~5.0	Items such as pipework, flooring plates, brackets, frames.	
Other ferrous metals.....	~22.3	Mild steel - items such as pipework, flooring plates, brackets, frames.	
Iron.....	0.83		
Aluminium.....	1.0	Aluminium in waste items such as ladders and ducting.	
Beryllium.....	0		
Cobalt.....			
Copper.....	~0.25	Trace in waste items such as pipework.	
Lead.....	20.0	Sheet, pipe, block and shot.	
Magnox/Magnesium.....	0.01	Trace in waste items.	
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....	0.50	Galvanised steel in items such as gratings or buckets.	
Zircaloy/Zirconium.....	TR		
Other metals.....	0	"Other" metals have not been identified.	
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~4.0		
Paper, cotton.....	0		
Wood.....	~4.0		
Halogenated plastics	~2.0	PVC, PPE.	
Total non-halogenated plastics.....	3.0		
Condensation polymers.....			
Others.....	3.0	Pipes, poly, ppe, perspex, containers, sheet and hoses.	
Organic ion exchange materials....	0		
Total rubber.....	~4.0		
Halogenated rubber	~4.0	Neoprene.	
Non-halogenated rubber.....			
Hydrocarbons.....	~		
Oil or grease	~15.0	Liquid - (various types) e.g. from pumps, motors and circulator pipework.	
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....	~0.10	Road surface.	
Bitumen.....			
Others.....			
Other organics.....	~1.0	Other organic includes miscellaneous items not covered	

WASTE STREAM	9E958	Dry Fuel Route (excluding BCD) LLW
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in any other category e.g. wipes, absorbent material.

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	3.0		
Brick/Stone/Rubble.....	6.0		
Cementitious material.....			
Sand.....			
Glass/Ceramics.....	0.45	0.05% MMMF Lagging (associated with general plant items), 0.4% glass.	
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	~0.05		
Non/low friable.....	0		
Moderately friable.....	0		
Highly friable.....	~0.05	Lagging / gaskets chrysotile (white).	
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): None expected, but possibly present in trace quantities.

	(%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 waste acceptance criteria: Magnox may be present in trace quantities but will not constitute a hazard. Some Asbestos and MMMF is expected to be present.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	

WASTE STREAM	9E958	Dry Fuel Route (excluding BCD) LLW
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Biological etc. materials.....	TR
Biodegradable materials.....	~6.0
Putrescible wastes.....	~1.0
Non-putrescible wastes.....	~5.0
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Higher activity particles.....	
Soluble solids as bulk chemical compounds.....	

Hazardous substances /
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.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		
Mercury compounds.....		
Others.....	4.0	Others include EEE materials. EEE weight is approx. 800kg or 4%.
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	P	25 off Items with circuit boards.
EEE Type 2.....	P	50 off Plant items containing electrical components e.g. transformers and capacitors,

WASTE STREAM 9E958 Dry Fuel Route (excluding BCD) LLW

pumps and motors.

EEE Type 3.....	P	50 off Electrical tools e.g. saws and drills.
EEE Type 4.....	P	25 off Fluorescent tubes / lamps.
EEE Type 5.....	P	10 off Rechargeable batteries, Nickel-Cadmium/Lithium-Ion.

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....	0	

Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs Oils - In & of itself not a DI Large Concrete Items (LCIs) may be DIs; drummed (ungROUTED)/"rubbleised" wastes assumed NOT DIs

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	24.0
Supercompaction (HFC)	Off-site	24.0
Incineration	Off-site	40.0
Solidification		
Decontamination		
Metal treatment	Off-site	14.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		22.0

Comment on planned treatments:

2% of this waste stream is expected to be sent for VLLW Landfill disposal.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	44.0	0.40
Expected to be consigned to a Landfill Facility	2.0	0.40
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	40.0	0.40
Expected to be consigned to a Metal Treatment Facility	14.0	1.4
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: 17 04 05, 17 01 07, 17 02 01, 17 02 02, 17 02 03, 17 05 04, 17 06 04, 17 06 01*

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

WASTE STREAM 9E958 Dry Fuel Route (excluding BCD) LLW

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:

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	24.0	43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	20.0	10	4
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: It is likely that this waste will be placed in a container with other LLW. 43.2m³ loading volume is calculated based on the fact that you can low force compact two times the normal volume of waste into a 200 litre/0.2m³ drum (400 litres/0.4m³), you can then fit 36 drums (14.4m³) into a 1/2 height ISO, each drum can be super-compacted to a 1/3 of its original volume so therefore we can get 3 x the amount of un-compacted drums into the final disposal container (43.2m³).

Waste Planned for Disposal at the LLW Repository:

Container voidage: No significant inaccessible voidage is expected.

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC). The waste has a current WCH. Inventory information is consistent with the current WCH.

Waste consigned for disposal to LLWR in year of generation: Yes.

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**9E958****Dry Fuel Route (excluding BCD) LLW**

Source:	Activation and contamination of materials.
Uncertainty:	Activity values are current best estimates. Specific activity is a function of Station operating history. The values quoted are indicative of the activities that would be expected, although demolition wastes are predicted to be lower in activity than the routine operational wastes and so the values quoted for this stream are expected to be an over estimate.
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:	data taken from WCH 1MXN-3OLD-0-WCH-0-4746 V4 decayed by one year for RWI 2022.
Other information:	-

WASTE STREAM 9E958 Dry Fuel Route (excluding BCD) LLW

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	2.86E-04	CC 1	2.86E-04	CC 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	5.47E-05	CC 1	5.47E-05	CC 1	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	7.97E-06	CC 2	7.97E-06	CC 2	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55	4.87E-05	CC 1	4.87E-05	CC 1	Pb 210		8		8
Co 60	1.98E-05	CC 2	1.98E-05	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	5.37E-06	CC 1	5.37E-06	CC 1	Po 210		8		8
Zn 65		8		8	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226		8		8
Kr 85		8		8	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	1.47E-06	CC 1	1.47E-06	CC 1	Th 227		8		8
Zr 93		8		8	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94	5.7E-07	CC 2	5.7E-07	CC 2	Th 234		8		8
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99		8		8	U 232		8		8
Ru 106	4.22E-09	CC 2	4.22E-09	CC 2	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m	5.71E-07	CC 2	5.71E-07	CC 2	U 235		8		8
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238		8		8
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	1.43E-08	CC 1	1.43E-08	CC 1
Sn 123		8		8	Pu 239	5.8E-09	CC 1	5.8E-09	CC 1
Sn 126		8		8	Pu 240	7.4E-09	CC 1	7.4E-09	CC 1
Sb 125	1.43E-07	CC 2	1.43E-07	CC 2	Pu 241	9.67E-07	CC 1	9.67E-07	CC 1
Sb 126		8		8	Pu 242		8		8
Te 125m	3.51E-08	CC 2	3.51E-08	CC 2	Am 241	5.73E-08	CC 1	5.73E-08	CC 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	2.53E-08	CC 2	2.53E-08	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	1.24E-06	CC 2	1.24E-06	CC 2	Cm 244	5.01E-09	CC 1	5.01E-09	CC 1
Ba 133	2.12E-07	CC 2	2.12E-07	CC 2	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	3.5E-08	CC 2	3.5E-08	CC 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152	1.17E-06	CC 2	1.17E-06	CC 2	Other b/g				
Eu 154	6E-07	CC 2	6E-07	CC 2	Total a	8.98E-08	CC 2	8.98E-08	CC 2
Eu 155	3.61E-07	CC 2	3.61E-07	CC 2	Total b/g	4.30E-04	CC 2	4.30E-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