

<b>WASTE STREAM</b>	<b>9E914</b>	<b>Ponds and Other Wet Fuel Routes LLW</b>
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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.....	62.0 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2023.....	104.2 m <sup>3</sup>
	1.4.2023 - 31.3.2025.....	120.0 m <sup>3</sup>
	1.4.2025 - 31.3.2026.....	16.3 m <sup>3</sup>
	1.4.2026 - 31.3.2031.....	18.0 m <sup>3</sup>
Total future arisings:		258.5 m <sup>3</sup>
Total waste volume:		320.5 m <sup>3</sup>

Comment on volumes: Waste in this stream is assumed to arise after defueling.

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

**WASTE SOURCE** The 9E914 waste stream will be used to capture waste from the pond areas (PA) and associated irradiated fuel routes, flask washdown areas (FW), pond water treatment plant (PWTP), pond water filtration plant (PWFP) and active waste vaults (AWV).

**PHYSICAL CHARACTERISTICS**

General description: The waste consigned under waste stream 9E914 mainly comprises metal (aluminium, copper, iron, magnesium, mild steel, stainless steel, zinc and lead), concrete and rubble, soil, biodegradable materials, plasterboard, plastics, rubber, wood and other materials including glass, EEE materials, MMMF and asbestos. The waste is expected to be in the form of mixed trash, with occasional large items such as pipework, motors and pumps. The waste also includes PWFP Fine Filters. Each filter is a metal canister with a pleated paper internal and is approx 0.03m<sup>3</sup> in volume and 5 kg in weight. The filters are drained. Depending on characterisation results there is likely to be approximately 30 PWFP Fine Filters in the 9E914 waste stream.

Physical components (%wt): Metal (~33% wt), rubble (~9%wt), soil (~1%), biodegradables (~9%), plasterboard (~1%), plastics (~37%), rubber (~1%), wood (~3%wt), other organic (~1%), Others including asbestos and MMMF (Man Made Mineral Fibre) (~5wt).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~0.8

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

**CHEMICAL COMPOSITION**

General description and components (%wt): The waste comprises various general wastes, rubble and metals, including steel, stainless steel, iron ductwork and MMMF. Metal (~33% wt), rubble (~9%wt), soil (~1%), biodegradables (~9%), plasterboard (~1%), plastics (~37%), rubber (~1%), wood (~3%wt), other organic (~1%), Others including asbestos and MMMF (Man Made Mineral Fibre) (~5wt).

Chemical state: -

Chemical form of radionuclides: H-3: The chemical form of tritium has not been determined but may be tritiated water.  
C-14: Carbon 14 may be present as traces of graphite.  
Cl-36: The chemical form of chlorine 36 has not been determined.  
Se-79: The selenium content is insignificant.  
Tc-99: The technetium content is insignificant.  
Ra: Radium isotope content is expected to be 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 content is insignificant.

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Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Thickness of metal items varies from 1 mm to 30 mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~13.8	Items such as pipework, flooring plates, brackets, frames and PWFPP Fine Filters.	
Other ferrous metals.....	~17.2	Mild steel - Items such as pipework, flooring plates, brackets, frames.	
Iron.....	0.32	Iron in waste items such as cast iron piping.	
Aluminium.....	~0.42	Aluminium in waste items such as ladders and ducting.	
Beryllium.....	NE		
Cobalt.....			
Copper.....	~0.05	In waste items such as pipework.	
Lead.....	1.1	Sheet, pipe block and shot.	
Magnox/Magnesium.....	TR	Potential to have trace magnesium metal in waste items.	
Nickel.....			
Titanium.....			
Uranium.....	NE		
Zinc.....	0.08	In galvanised steel in items such as gratings or buckets.	
Zircaloy/Zirconium.....	TR		
Other metals.....	0	"Other" metals have not been identified.	

Organics (%wt): Wood is expected.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~3.0		
Paper, cotton.....	0		
Wood.....	~3.0		
Halogenated plastics .....	~17.0	PVC,PPE	
Total non-halogenated plastics.....	20.0		
Condensation polymers.....	10.0	Pipes, poly, ppe, perspex, containers, sheet and hoses.	
Others.....	10.0	Pipes, poly, ppe, perspex, containers, sheet and hoses.	
Organic ion exchange materials....	0		
Total rubber.....	~1.0		
Halogenated rubber .....	~1.0	Neoprene.	
Non-halogenated rubber.....	~		
Hydrocarbons.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			

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Bitumen.....  
 Others.....  
 Other organics..... ~1.0      Other organic includes miscellaneous items not covered 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.....	1.0		
Brick/Stone/Rubble.....	9.0		
Cementitious material.....			
Sand.....			
Glass/Ceramics.....	TR	Including MMMF lagging and glass.	
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	~1.7		
Non/low friable.....	TR	Gaskets/joints (Chrysotile - white).	
Moderately friable.....	1.7	PPE and soft waste (Chrysotile - white).	
Highly friable.....	TR	Lagging / gaskets (Chrysotile - white).	
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt):      Carbonates and sulphates present in trace quantities.

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

Materials of interest for waste acceptance criteria:      Magnox may be present in trace quantities but will not constitute a hazard. Some MMMF is expected to be present.

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	(%wt)	Type(s) and comment
Combustible metals.....	TR	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	9.0	
Putrescible wastes.....	1.0	
Non-putrescible wastes.....	8.0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	P	76.56m2
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.....		

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Mercury compounds.....  
 Others..... 5.0 Including 0.03% ET-150-AF Fixative and EEE materials (2.5te).  
 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. pumps and motors, transformers and capacitors.  
 EEE Type 3..... P 100 off Electrical tools e.g. saws and drills.  
 EEE Type 4..... P 50 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 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	On-site	9.0
Supercompaction (HFC)	Off-site	9.0
Incineration	Off-site	58.7
Solidification		
Decontamination		
Metal treatment	Off-site	15.3
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		17.0

Comment on planned treatments:

6.67% of this waste stream is expected to be sent for VLLW Landfill.

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	19.3	0.80
Expected to be consigned to a Landfill Facility	6.7	0.80
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	58.7	0.40
Expected to be consigned to a Metal Treatment Facility	15.3	1.4
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

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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):**

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 <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO	9.0	43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	10.3	~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. 43.2m<sup>3</sup> 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/0.2m<sup>3</sup> drum (400 litres/0.4m<sup>3</sup>), you can then fit 36 drums (14.4m<sup>3</sup>) 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 (43.2m<sup>3</sup>).

**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: -

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Other information: -

**RADIOACTIVITY**

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-0-4750 V4 and decayed by 1 year for RWI 2022.

Other information: -

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	7.44E-06	CC 1	7.44E-06	CC 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	9.97E-06	CC 1	9.97E-06	CC 1	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	1.51E-07	CC 1	1.51E-07	CC 1	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	5.21E-06	CC 1	5.21E-06	CC 1	Pb 210		8		8
Co 60	2.72E-06	CC 2	2.72E-06	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	6.02E-06	CC 1	6.02E-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	4.41E-04	CC 1	4.41E-04	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	9.9E-08	CC 2	9.9E-08	CC 2	Th 234	1.65E-08	CC 2	1.65E-08	CC 2
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	6.49E-09	CC 2	6.49E-09	CC 2	U 233		8		8
Pd 107		8		8	U 234	1.48E-08	CC 2	1.48E-08	CC 2
Ag 108m	1.84E-07	CC 2	1.84E-07	CC 2	U 235		8		8
Ag 110m		8		8	U 236	4.14E-09	CC 2	4.14E-09	CC 2
Cd 109		8		8	U 238	1.65E-08	CC 2	1.65E-08	CC 2
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	2.15E-06	CC 1	2.15E-06	CC 1
Sn 123		8		8	Pu 239	2.9E-06	CC 1	2.9E-06	CC 1
Sn 126		8		8	Pu 240	3.75E-06	CC 1	3.75E-06	CC 1
Sb 125	6.05E-08	CC 2	6.05E-08	CC 2	Pu 241	7.8E-05	CC 1	7.8E-05	CC 1
Sb 126		8		8	Pu 242		8		8
Te 125m	1.49E-08	CC 2	1.49E-08	CC 2	Am 241	1.26E-05	CC 1	1.26E-05	CC 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	2.77E-07	CC 2	2.77E-07	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243	1.32E-07	CC 1	1.32E-07	CC 1
Cs 137	3.33E-04	CC 2	3.33E-04	CC 2	Cm 244	1.34E-07	CC 1	1.34E-07	CC 1
Ba 133	1.6E-07	CC 2	1.6E-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	9.14E-07	CC 1	9.14E-07	CC 1	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152	4.16E-07	CC 2	4.16E-07	CC 2	Other b/g				
Eu 154	5.87E-07	CC 2	5.87E-07	CC 2	<b>Total a</b>	<b>2.17E-05</b>	<b>CC 2</b>	<b>2.17E-05</b>	<b>CC 2</b>
Eu 155	1.66E-07	CC 2	1.66E-07	CC 2	<b>Total b/g</b>	<b>8.87E-04</b>	<b>CC 2</b>	<b>8.87E-04</b>	<b>CC 2</b>

**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