

**WASTE STREAM****9J949****Pond and Effluent Treatment Plant LLW**

**SITE** Hunterston A  
**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.....	49.0 m <sup>3</sup>
Future arisings -	1.4.2023 - 31.3.2024.....	32.1 m <sup>3</sup>
	1.4.2024 - 31.3.2025.....	16.1 m <sup>3</sup>
	1.4.2025 - 31.3.2030.....	115.8 m <sup>3</sup>
Total future arisings:		164.0 m <sup>3</sup>
Total waste volume:		213.0 m <sup>3</sup>
Comment on volumes:	Waste volumes include a proportion of secondary waste arisings and contaminated soil.	
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** Waste arisings from Care & Maintenance Preparation of the ponds and Active Effluent Treatment Plant areas, also some contaminated soil.

**PHYSICAL CHARACTERISTICS**

**General description:** The waste includes pond wall scabbling waste, small redundant plant and tools and associated secondary waste, there is also some contaminated soil. There are no large items present which require special treatment. Includes some secondary waste.

**Physical components (%wt):** Metal (26%), Soil/rubble (22%), paper (3%wt), cloth (7%wt), filters and other plastics (38%), wood (3% wt) and other materials (asbestos) (~1%wt).

**Sealed sources:** The waste does not contain sealed sources.

**Bulk density (t/m<sup>3</sup>):** ~0.6

**Comment on density:** The mean waste density is approximately 0.6 t/m3.

**CHEMICAL COMPOSITION**

**General description and components (%wt):** Metal (26%), Soil/rubble (22%), paper (3%wt), cloth (7%wt), filters and other plastics (38%), wood (3% wt) and other materials (asbestos) (~1%wt).

**Chemical state:** Neutral

**Chemical form of radionuclides:**  
 H-3: Tritium may be present as tritiated water.  
 C-14: Chemical form of carbon 14 may be graphite.  
 Cl-36: The chemical form of chlorine 36 has not been determined.  
 Se-79: The chemical form of selenium has not been determined.  
 Tc-99: The chemical form of technetium has not been determined.  
 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: Neptunium isotope content is expected to be insignificant.  
 Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

**Metals and alloys (%wt):** Not fully assessed.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....			
Other ferrous metals.....	25.6	Steel comprising of: 24.78% iron 0.35% nickel and 0.45 chromium	
Iron.....			

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Aluminium.....	0.22	Items e.g. shelving and brackets etc.
Beryllium.....		
Cobalt.....		
Copper.....	0.11	Items e.g. pipework and fittings etc.
Lead.....	0.08	Items e.g. flashings and fittings etc.
Magnox/Magnesium.....	0	
Nickel.....		
Titanium.....		
Uranium.....		
Zinc.....	NE	
Zircaloy/Zirconium.....	0	
Other metals.....	NE	"Other" metals have not been fully assessed.

Organics (%wt):                      The waste contains cellulose in the form of paper and cloth and non-halogenated plastics as polythene. The proportions have not all been estimated. Some halogenated plastics and rubbers are expected.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	~13.0		
Paper, cotton.....	10.0		
Wood.....	3.0		
Halogenated plastics .....	NE		
Total non-halogenated plastics.....	~38.0		
Condensation polymers.....	0		
Others.....	~38.0	Items e.g polythene, tanks, pipework, IBC's etc.	
Organic ion exchange materials....	0		
Total rubber.....	NE		
Halogenated rubber .....	NE		
Non-halogenated rubber.....	NE		
Hydrocarbons.....	0.04		
Oil or grease .....	0.04	Grease, grease/oil contaminated rags	
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		

Other materials (%wt):                      -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	NE		
Inorganic sludges and flocs.....	0		
Soil.....	~1.0		
Brick/Stone/Rubble.....	21.0		

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Cementitious material.....	0	
Sand.....		
Glass/Ceramics.....	0.01	Man made mineral fibre
Graphite.....	NE	
Desiccants/Catalysts.....		
Asbestos.....	0.03	
Non/low friable.....	0.02	chrysotile (white)
Moderately friable.....	0.01	chrysotile (white)
Highly friable.....		
Free aqueous liquids.....	0	
Free non-aqueous liquids.....	0	
Powder/Ash.....	0	

Inorganic anions (%wt): No cyanides are expected, otherwise the inorganic anion content of waste is not estimated.

	(%wt)	Type(s) and comment
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: Some asbestos is expected. Efforts are made to remove all hazardous materials from the waste during sorting.

	(%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.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....		
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	P	surface area of Aluminium 2500000cm <sup>2</sup> .
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.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....	P	4 of EEE Type 2: Plant items will include electric pumps and motors.
EEE Type 3.....	P	10 corded drills
EEE Type 4.....		
EEE Type 5.....		

Complexing agents (%wt):

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		

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Other organic complexants.....

Total complexing agents..... NE

Potential for the waste to contain discrete items: Not yet determined. In & of itself not a DI; waste stream may include DIs (notably any stainless steel components)

**TREATMENT, PACKAGING AND DISPOSAL**

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	6.0
Supercompaction (HFC)	Off-site	6.0
Incineration	Off-site	10.0
Solidification		
Decontamination		
Metal treatment	Off-site	10.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		74.0

Comment on planned treatments:

54 % of this waste stream is expected to be sent to landfill as VLLW

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	26.0	0.60
Expected to be consigned to a Landfill Facility	54.0	0.60
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	10.0	0.40
Expected to be consigned to a Metal Treatment Facility	10.0	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 05 03\*/04, 17 06 01\*, 20 01 01, 17 02 03

**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	6.0	43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	20.0	7	7
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: 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 ½ 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: It is not anticipated that there will be significant voidage inaccessible to grout.

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**

Source: -

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.

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 waste stream fingerprint compiled from the analysis of a number of waste samples for this stream. As per WCH: 1MXN-3HUA-0-WCH-0-4543 v4 and decayed by 4 years from 1/4/2018-1/4/2022

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	2.71E-07	CC 2	2.71E-07	CC 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	8.5E-08	CC 2	8.5E-08	CC 2	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	6.96E-08	CC 1	6.96E-08	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	2.19E-08	CC 1	2.19E-08	CC 1	Pb 210		8		8
Co 60	6.44E-08	CC 2	6.44E-08	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	2.24E-07	CC 1	2.24E-07	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	9.18E-05	CC 1	9.18E-05	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	3.62E-08	CC 2	3.62E-08	CC 2	Th 234	2.16E-08	CC 2	2.16E-08	CC 2
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99	6.51E-08	CC 2	6.51E-08	CC 2	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234	2.21E-08	CC 1	2.21E-08	CC 1
Ag 108m	9.32E-08	CC 2	9.32E-08	CC 2	U 235	2.55E-09	CC 1	2.55E-09	CC 1
Ag 110m		8		8	U 236	3.53E-09	CC 1	3.53E-09	CC 1
Cd 109		8		8	U 238	2.16E-08	CC 1	2.16E-08	CC 1
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	1.92E-06	CC 1	1.92E-06	CC 1
Sn 123		8		8	Pu 239	1.73E-06	CC 1	1.73E-06	CC 1
Sn 126		8		8	Pu 240	2E-06	CC 1	2E-06	CC 1
Sb 125	5.84E-08	CC 2	5.84E-08	CC 2	Pu 241	3.54E-05	CC 1	3.54E-05	CC 1
Sb 126		8		8	Pu 242		8		8
Te 125m	1.46E-08	CC 2	1.46E-08	CC 2	Am 241	9.08E-06	CC 1	9.08E-06	CC 1
Te 127m		8		8	Am 242m		8		8
I 129	1.22E-07	CC 1	1.22E-07	CC 1	Am 243		8		8
Cs 134	9.24E-09	CC 2	9.24E-09	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243	9.89E-09	CC 1	9.89E-09	CC 1
Cs 137	7.06E-05	CC 2	7.06E-05	CC 2	Cm 244	1.54E-07	CC 1	1.54E-07	CC 1
Ba 133	1.17E-07	CC 2	1.17E-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	2.69E-08	CC 1	2.69E-08	CC 1	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	9.22E-07	CC 2	9.22E-07	CC 2	Other a				
Eu 152	4.6E-07	CC 2	4.6E-07	CC 2	Other b/g				
Eu 154	2.47E-07	CC 2	2.47E-07	CC 2	<b>Total a</b>	<b>1.49E-05</b>	<b>CC 2</b>	<b>1.49E-05</b>	<b>CC 2</b>
Eu 155	6.21E-08	CC 2	6.21E-08	CC 2	<b>Total b/g</b>	<b>2.01E-04</b>	<b>CC 2</b>	<b>2.01E-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