

WASTE STREAM**9F911****Ponds and Effluent Treatment Plant LLW**

SITE Sizewell 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.....	0 m ³
Future arisings -	1.4.2022 - 31.3.2034.....	475.2 m ³
Total future arisings:		475.2 m ³
Total waste volume:		475.2 m ³

Comment on volumes: Waste in this stream is assumed to arise following Defuelling. Volumes stated assume waste has been removed from the system and size corrected awaiting further treatment and disposal. This work will occur during Care and Maintenance Preparations.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.75
 Stock (lower): x Arisings (lower) x 0.9

WASTE SOURCE Care and Maintenance preparations activities to decommission the ponds and AETP.

PHYSICAL CHARACTERISTICS

General description: Hard and soft trash arising from the pond/effluent treatment plant areas including metal, plastic, paper, glass, rubber and occasionally HEPA filters. Any large items will be cut to fit standard packages.

Physical components (%wt): Metallic trash (~91%), biodegradables (2%) plastics (~2%), concrete/rubble (~1%), rubber (1%), wood (1%), other organics (1%), and others (1%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~3.19

Comment on density: Density estimate based on WCH mass divided by volume

CHEMICAL COMPOSITION

General description and components (%wt): The waste consists of metals, various plastics including polythene, concrete and rubble and a small amount of wood. Metallic trash (~91%), biodegradables (2%) plastics (~2%), concrete/rubble (~1%), rubber (1%), wood (1%), other organics (1%), and others (1%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritium present as surface contamination of waste by tritiated liquor.
 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-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: The uranium isotope content is insignificant.
 Np: The neptunium isotope content is insignificant.
 Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): 200 litre drums have wall thickness of about 1 mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	45.0	Ponds furniture, redundant plant/equipment, structural metal, pipework	
Other ferrous metals.....	45.0	Mild steel - Ponds furniture, redundant plant/equipment, structural metal, pipework	
Iron.....	TR	Ponds furniture, redundant	

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		plant/equipment, structural metal, pipework
Aluminium.....	<0.10	Scaffold
Beryllium.....		
Cobalt.....	TR	Ponds furniture, redundant plant/equipment, structural metal, pipework
Copper.....	<0.10	Redundant plant and equipment
Lead.....	<0.10	Blocks, shavings and shielding
Magnox/Magnesium.....	TR	Ponds furniture, redundant plant/equipment, structural metal, pipework
Nickel.....	TR	Ponds furniture, redundant plant/equipment, structural metal, pipework
Titanium.....	TR	Ponds furniture, redundant plant/equipment, structural metal, pipework
Uranium.....		
Zinc.....	~0.01	Scaffold and redundant items coating
Zircaloy/Zirconium.....	0	
Other metals.....		

Organics (%wt): The waste will contain cellulose in the form of paper.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	1.0		
Paper, cotton.....			
Wood.....	1.0		
Halogenated plastics	1.0	Ponds furniture, redundant plant/equipment, pipework	
Total non-halogenated plastics.....	~1.0	Ponds furniture, redundant plant/equipment, pipework	
Condensation polymers.....	~0.50		
Others.....	~0.50		
Organic ion exchange materials....			
Total rubber.....	1.0		
Halogenated rubber	~0.50		
Non-halogenated rubber.....	~0.50		
Hydrocarbons.....	<0.11		
Oil or grease	<0.10	Trace contamination	
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....	~0.01	expansion joints etc.	
Others.....			
Other organics.....	~1.0		

Other materials (%wt): -

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..			
Inorganic sludges and flocs.....			
Soil.....			
Brick/Stone/Rubble.....	0.50		
Cementitious material.....	0.50		
Sand.....			
Glass/Ceramics.....	0.06	Man made mineral fibre lagging	
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....	<0.23		
Non/low friable.....	~0.22	Decommissioning waste, valves, gaskets, tiles - mostly chrysotile	
Moderately friable.....	~0.01	Decommissioning waste, valves, gaskets, tiles - mostly amosite	
Highly friable.....	TR	Decommissioning waste, valves, gaskets, tiles - mostly crocidolite	
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Possibly present in trace quantities.

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

Materials of interest for waste acceptance criteria: May contain traces of unreacted Magnox.

	(%wt)	Type(s) and comment	
Combustible metals.....			
Low flash point liquids.....			
Explosive materials.....			
Phosphorus.....			
Hydrides.....			
Biological etc. materials.....			
Biodegradable materials.....	~2.0		
Putrescible wastes.....	~1.0	Pigeon waste	

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Non-putrescible wastes.....	~1.0	
Corrosive materials.....		
Pyrophoric materials.....		
Generating toxic gases.....		
Reacting with water.....	P	Reactive metals will typically be painted to avoid reaction with grout, 10m2 has been conservatively declared for the entire wastestream although due to the painting process the actual value is expected to be lower.
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: None expected, except possibly in trace quantities.

	(%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.....	TR	Ponds furniture, redundant plant/equipment, structural metal, pipework
Molybdenum.....	TR	Ponds furniture, redundant plant/equipment, structural metal, pipework
Thallium.....		
Tin.....	TR	Ponds furniture, redundant plant/equipment, structural metal, pipework
Vanadium.....	TR	Ponds furniture, redundant plant/equipment, structural metal, pipework
Mercury compounds.....		
Others.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	P	500 off Stripped down circuit boards

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EEE Type 2..... P 500 off Redundant plant and machinery arising from decommissioning activities.
 EEE Type 3..... P 500 off electrical and electron components retrieved from redundant plant and machinery items.
 EEE Type 4.....
 EEE Type 5..... P 500 off Rechargeable batteries

Complexing agents (%wt): No

(%wt) Type(s) and comment

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

Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	20.1
Supercompaction (HFC)	Off-site	20.1
Incineration	Off-site	12.8
Solidification		
Decontamination		
Metal treatment	Off-site	21.7
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		45.4

Comment on planned treatments:

It is expected that 12.75% of this waste stream will be sent for incineration, 21.70% sent for Metal Recycling, 20.14% for supercompaction and 45.41% for direct LLWR disposal.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	65.6	3.2
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	12.8	0.40
Expected to be consigned to a Metal Treatment Facility	21.7	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: -

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

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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	~20.1	~43.2	3
1/2 Height IP-2 Disposal/Re-usable ISO	~45.4	~10	22
2m box (no shielding)			
4m box (no shielding)			
Other (200 litre drums may also be used for incinerable and supercompactable waste)			

Other information: Data have been presented as though the waste will be segregated and packaged in dedicated containers. It is likely that the waste will be packaged in containers with other LLW. 43.2m³ loading volume for WAMAC 1/2 height product container 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: Significant inaccessible voidage is not 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

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.
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 taken from the WCH decayed to start date of first arising (01/04/2022)
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			1.84E-05	CC 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			8.1E-06	CC 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			1.76E-08	CC 1	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			6.64E-06	CC 1	Pb 210				8
Co 60			1.76E-06	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			3.69E-06	CC 1	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			2.56E-04	CC 1	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			3.05E-09	CC 2	Th 234		2.74E-08		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		3.45E-08	CC 1	
Ag 108m			2.47E-09	CC 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238		2.74E-08	CC 1	
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238		4.83E-06	CC 1	
Sn 123				8	Pu 239		3.64E-06	CC 1	
Sn 126				8	Pu 240		3.64E-06	CC 1	
Sb 125				8	Pu 241		1.23E-04	CC 1	
Sb 126				8	Pu 242				8
Te 125m				8	Am 241		1.26E-05	CC 1	
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			1.29E-07	CC 2	Cm 242				8
Cs 135				8	Cm 243		2.23E-07	CC 1	
Cs 137			2.95E-04	CC 2	Cm 244		2.13E-07	CC 1	
Ba 133			1.71E-09	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			2.9E-06	CC 1	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152			4.73E-09	CC 2	Other b/g				
Eu 154			6.25E-07	CC 2	Total a	0	2.52E-05	CC 2	
Eu 155			2.48E-07	CC 2	Total b/g	0	7.16E-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