

WASTE STREAM	9H914	Auxiliary Gas Systems LLW
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SITE Wylfa

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.....	15.8 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	5.0 m ³
	1.4.2023 - 31.3.2024.....	3.0 m ³
	1.4.2024 - 31.3.2034.....	36.6 m ³
Total future arisings:		44.6 m ³
Total waste volume:		60.3 m ³
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x 1.1	Arisings (upper) x 1.3
	Stock (lower): x 0.9	Arisings (lower) x 0.7

WASTE SOURCE Waste streams 9H914 represents LLW from the Burst Can Detection (BCD) system and Humidrier System.

PHYSICAL CHARACTERISTICS

General description: Wastes arisings consist of operational and decommissioning LLW from the operations and maintenance of the areas and include mainly solid waste items, redundant equipment and secondary soft wastes (liners, lab equipment, PPE, packaging) ie of a similar nature to 9H14. Principle components include bearings, wire, bolts, washers, broken tools, filters, fuelling machine and dry store ropes, plastic, scaffolding, buckets, paint tins, lightbulbs, concrete/rubble and EEE. In addition, legacy waste associated with redundant plant and items such as pipework and valves, trit kegs (ca. 24 steel drums used to hold tritiated liquor extracted from the reactor driers which have been thoroughly soaked/rinsed and drained) and drum pucks that previously contained desiccant waste are included (packaged in drums).

Physical components (%wt): Metal (80%), Concrete/rubble (1%), Biodegradable non-putrescibles (8%), Plastics halogenated (5%), Plastics non-halogenated (4%), Wood (1%), Others (1%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.39

Comment on density: Density is taken from WCH mass divided by volume

CHEMICAL COMPOSITION

General description and components (%wt): Metal (80%), Concrete/rubble (1%), Biodegradable non-putrescibles (8%), Plastics halogenated (5%), Plastics non-halogenated (4%), Wood (1%), Others (1%)

Chemical state: Neutral

Chemical form of radionuclides:
H-3: The chemical form of tritium has not been determined.
C-14: The chemical form of carbon 14 has not been determined.
Cl-36: The majority of chlorine 36 is expected to be in the form of ammonium chloride.
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: The uranium isotope content is insignificant.
Np: The neptunium content is insignificant.
Pu: Chemical form of plutonium isotopes may be plutonium oxides.

Metals and alloys (%wt): Metal thicknesses will be variable from about 1 mm up to about several mm. 30% of the waste is steel drums with a typical wall thickness of 1-2 mm.

WASTE STREAM	9H914	Auxiliary Gas Systems LLW
---------------------	--------------	----------------------------------

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~8.0	Metal (pipes, flanges, sheets, bars, filters, misc). made up of 17% Chromium, 69.5% Iron, 2.5% Molybdenum, 11% Nickel	
Other ferrous metals.....	~69.3	Metal (pipes, flanges, sheets, bars, filters, misc).	
Iron.....			
Aluminium.....	~1.0	Tooling, equipment.	
Beryllium.....			
Cobalt.....			
Copper.....	~0.50	Cables, WEEE.	
Lead.....	TR	Light bulbs (<1m3)	
Magnox/Magnesium.....			
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....	~1.0	Tools, buckets, scaffolding.	
Zircaloy/Zirconium.....			
Other metals.....	0	There are no "other" metals.	
Organics (%wt):		Cellulosic materials and halogenated plastics expected.	
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	1.0		
Paper, cotton.....	0		
Wood.....	1.0		
Halogenated plastics	~5.0	Soft waste (liners, lab equipment, PPE, packaging).	
Total non-halogenated plastics.....	~4.4	Soft waste (lab equipment, PPE, packaging)	
Condensation polymers.....	~2.2	Soft waste (lab equipment, PPE, packaging)	
Others.....	~2.2	Soft waste (lab equipment, PPE, packaging)	
Organic ion exchange materials....	0		
Total rubber.....	0		
Halogenated rubber	TR		
Non-halogenated rubber.....			
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....			
Other materials (%wt):	-		

WASTE STREAM	9H914	Auxiliary Gas Systems LLW
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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	~1.0		
Cementitious material.....			
Sand.....			
Glass/Ceramics.....	0.50	fibreglass lagging	
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	~1.5		
Non/low friable.....	~0.50	Asbestos contaminated plant items and gaskets. Equal portions of white/blue/brown asbestos assumed.	
Moderately friable.....	~0.50	Insulating boards. Equal portions of white/blue/brown asbestos assumed.	
Highly friable.....	~0.50	Lagging. Equal portions of white/blue/brown asbestos assumed.	
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Only chlorides anticipated.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0.10	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	0	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: Asbestos may be present.

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

WASTE STREAM	9H914	Auxiliary Gas Systems LLW
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Biological etc. materials.....	0	
Biodegradable materials.....	~8.0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	~8.0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	P	150m2
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: Asbestos <1% wt. Trace amounts of barium, manganese and bromine in light bulbs.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....	TR	Light bulbs (<1m3)
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....	~0.50	Paint tins.
Vanadium.....		
Mercury compounds.....		
Others.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	P	10 items of a mixture of VDU, electronic circuit boards and telephones
EEE Type 2.....		

WASTE STREAM 9H914 Auxiliary Gas Systems LLW

EEE Type 3..... P 3 items of corded drills
 EEE Type 4..... P 10 items of mainly fluorescent light tubes
 EEE Type 5.....

Complexing agents (%wt): Yes

(%wt) Type(s) and comment

EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants..... TR Citrates (decon-90) and Phosphoric acid (jenolite/Kamco)
 Total complexing agents..... TR

Potential for the waste to contain discrete items: No. 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	54.5
Solidification		
Decontamination		
Metal treatment	Off-site	35.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		4.5

Comment on planned treatments:

0.6% planned for disposal as VLLW to landfill

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~9.9	0.39
Expected to be consigned to a Landfill Facility	~0.60	0.39
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	54.5	0.39
Expected to be consigned to a Metal Treatment Facility	35.0	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 04 07, 17 02 03, 17 06 01*

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

WASTE STREAM 9H914 Auxiliary Gas Systems 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			
1/2 Height IP-2 Disposal/Re-usable ISO	~3.9	~10	< 1
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: 43.2m³ loading volume is calculated based on the fact that you can fit 36 off (200 litre/0.2m³) drums (7.2m³) into a 1/2 height ISO, the waste is low force compacted into the drums to 1/2 its original volume, then each drum can be super-compacted to a 1/3 of its original volume so therefore we can get 6 x the amount of un-compacted drums into the final disposal container (43.2m³)

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 has a current WCH. Inventory information is consistent with the 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: Contamination by activation products and fission products.

Uncertainty: Activity estimates are as shown in the radionuclide table.

WASTE STREAM**9H914****Auxiliary Gas Systems LLW**

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 1MXN-3WYL-0-WCH-4607 V5 with a reference decay date of 20/03/2021 as the mid point of the validity period of the WCH. A single fingerprint with this reference date will be used for consignments over the period of the WCH without annual decay correction. Decayed by one year for RWI 2022.

Other information:

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WASTE STREAM 9H914 Auxiliary Gas Systems 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	3.55E-03	CC 1	3.55E-03	CC 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	8.85E-06	CC 1	8.85E-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	5.44E-04	CC 1	5.44E-04	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	4.81E-07	CC 1	4.81E-07	CC 1	Pb 210		8		8
Co 60	1.39E-07	CC 2	1.39E-07	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	9.18E-08	CC 1	9.18E-08	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	8.07E-08	CC 1	8.07E-08	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		8		8	Th 234	2.75E-09	8	2.75E-09	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		8		8	U 233		8		8
Pd 107		8		8	U 234	2.44E-09	CC 1	2.44E-09	CC 1
Ag 108m		8		8	U 235		8		8
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238	2.75E-09	CC 1	2.75E-09	CC 1
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	2.32E-09	CC 1	2.32E-09	CC 1
Sn 123		8		8	Pu 239	1.41E-09	CC 1	1.41E-09	CC 1
Sn 126		8		8	Pu 240	1.84E-09	CC 1	1.84E-09	CC 1
Sb 125		8		8	Pu 241	1.24E-07	CC 1	1.24E-07	CC 1
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	6.46E-09	CC 1	6.46E-09	CC 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134		8		8	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	7.98E-08	CC 1	7.98E-08	CC 1	Cm 244	2.04E-09	CC 1	2.04E-09	CC 1
Ba 133		8		8	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	6.19E-09	CC 1	6.19E-09	CC 1	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152		8		8	Other b/g				
Eu 154		8		8	Total a	1.93E-08	CC 2	1.93E-08	CC 2
Eu 155		8		8	Total b/g	4.10E-03	CC 2	4.10E-03	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