

<b>WASTE STREAM</b>	<b>9H29</b>	<b>Dry Store Cell 4 Residue</b>
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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.....	1.5 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2023.....	~1.0 m <sup>3</sup>
Total future arisings:		1.0 m <sup>3</sup>
Total waste volume:		2.5 m <sup>3</sup>

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** Mainly from maintenance & decontamination processes.

**PHYSICAL CHARACTERISTICS**

General description: The waste will consist of metal, including skip tubes, drums, rods and sheets, biodegradable - non putrescibles, plastics (halogenated and non-halogenated), rubber, wood, powders/ash and other material i.e. HEPA filters and asbestos contaminated waste. The metal waste will consist of redundant plant removed as part of characterisation/project work and other tooling equipment such as tooling, ladders or paints tins. The remaining waste will be produced supporting project work and will consist of PPE, wipes, plastic sheeting, packaging and some cabling and WEEE. A small volume of Decon 90 may be used during cleaning and decontamination work and will be wiped off with wipalls. There is the potential for some asbestos contaminated materials. No large items are currently planned to be deplanted. The facility is redundant and all waste will arise from the C&M preps project work. None

Physical components (%wt): Metal (66%), biodegradable - non putrescibles (9%), plastics - halogenated (1%), plastics non - halogenated (16%), rubber (4%), wood (2%), powder/ash (1% ), and miscellaneous items (~1% )

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 0.41

Comment on density: data taken from WCH mass divided by volume

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (66%), biodegradable - non putrescibles (9%), plastics - halogenated (1%), plastics non - halogenated (16%), rubber (4%), wood (2%), powder/ash (1% ), and miscellaneous items (~1% )

Chemical state: Neutral

Chemical form of radionuclides: H-3: H-3: The chemical form of tritium has not been determined.  
 C-14: C-14: The chemical form of carbon 14 has not been determined.  
 Cl-36: Chlorine 36 is expected to be insignificant.  
 Se-79: Se-79: The chemical form of selenium has not been determined.  
 Tc-99: Tc-99: The chemical form of technetium has not been determined.  
 Ra: Ra: Radium isotope content is expected to be insignificant.  
 Th: The Thorium content is insignificant  
 U: U: Uranium isotope content is expected to be insignificant.  
 Np: Np: Neptunium isotope content is expected to be insignificant.  
 Pu: Pu: Chemical form of plutonium isotopes has not been determined

Metals and alloys (%wt): -

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	58.6	Tubes, sheets, rods, drums	
Iron.....			
Aluminium.....	3.2	tooling, ladders	
Beryllium.....			
Cobalt.....			
Copper.....	0.80	cables/WEEE	
Lead.....			
Magnox/Magnesium.....	0		
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....	0.80	galvanised tooling, scaffolding, buckets	
Zircaloy/Zirconium.....	0		
Other metals.....			

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	2.0		
Paper, cotton.....	0		
Wood.....	2.0		
Halogenated plastics .....	1.0	liners, packaging	
Total non-halogenated plastics.....	16.0		
Condensation polymers.....	~8.0	tyvek overalls, sheeting, PPE	
Others.....	~8.0	tyvek overalls, sheeting, PPE	
Organic ion exchange materials....	0		
Total rubber.....	4.0		
Halogenated rubber .....	4.0		
Non-halogenated rubber.....	0		
Hydrocarbons.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....			

Other materials (%wt): Trace amounts of Manganese and bromine in light bulbs (ca. 0.2 m3), trace amounts of Tacky mat adhesive - Pressure sensitive' adhesive (acrylate polymer, rubber or silicone rubber)

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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.....	NE		
Cementitious material.....	NE		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	1.8		
Non/low friable.....	1.8	contaminated plant items. Asbestos is a 50:50 mixture of amosite and chrysotile	
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	1.0		

Inorganic anions (%wt): -

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

Materials of interest for waste acceptance criteria: -

	(%wt)	Type(s) and comment
Combustible metals.....	NE	
Low flash point liquids.....	NE	
Explosive materials.....	NE	
Phosphorus.....	NE	
Hydrides.....	NE	
Biological etc. materials.....	0	
Biodegradable materials.....	9.0	
Putrescible wastes.....	0	

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Non-putrescible wastes.....	9.0	
Corrosive materials.....	NE	
Pyrophoric materials.....	NE	
Generating toxic gases.....	NE	
Reacting with water.....	P	20m2
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.....	TR	Light bulbs (ca. 0.2 m3)
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....	1.6	paint tins
Vanadium.....		
Mercury compounds.....	TR	light bulbs (ca.0.2m3)
Others.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	P	4 off mixture of stripped down circuit boards VDU, fans, and telephones.
EEE Type 2.....		
EEE Type 3.....	P	4 off corded drills, solenoids
EEE Type 4.....	P	8 off Mainly fluorescent light tubes
EEE Type 5.....		

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Complexing agents (%wt):      Yes

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....	TR	citrates (decon-90) are expected in trace quantities
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	7.5
Supercompaction (HFC)	Off-site	7.5
Incineration		
Solidification		
Decontamination		
Metal treatment	Off-site	18.5
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		74.0

Comment on planned treatments:      65% of this stream is expected to be disposed of to landfill as VLLW

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	16.5	0.41
Expected to be consigned to a Landfill Facility	65.0	0.41
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	18.5	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):**

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			

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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 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	9.0	10	< 1

Other information: 43.2m<sup>3</sup> is calculated based on the fact that waste is compacted so whereas ordinarily you can fit 36 (200 litre/0.2m<sup>3</sup>) drums (7.2m<sup>3</sup>) into a 1/2 height ISO, each drum can be compacted to a 1/2 of it's original volume by low force compaction then again by 1/3 of its original volume by high force compaction so therefore we can get 6 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: -

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 at activation and fission products

Uncertainty: -

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-3WYL-0-WCH-0-4690 v9 - no decay applied as FP reference data was mid range of arisings at 20/03/2023

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	1.22E-06	CC 1	1.22E-06	CC 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	3.02E-07	CC 1	3.02E-07	CC 1	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	1.1E-07	CC 1	1.1E-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	2.07E-08	CC 1	2.07E-08	CC 1	Pb 210		8		8
Co 60	6.81E-08	CC 2	6.81E-08	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	6.56E-07	CC 1	6.56E-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	4.67E-05	CC 1	4.67E-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		8		8	Th 234		8		8
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99	2.67E-08	CC 2	2.67E-08	CC 2	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234	1.78E-08	CC 1	1.78E-08	CC 1
Ag 108m		8		8	U 235	1.48E-08	CC 1	1.48E-08	CC 1
Ag 110m		8		8	U 236	1.48E-09	CC 1	1.48E-09	CC 1
Cd 109		8		8	U 238	2.07E-08	CC 1	2.07E-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	1.75E-06	CC 1	1.75E-06	CC 1
Sn 123		8		8	Pu 239	2.14E-06	CC 1	2.14E-06	CC 1
Sn 126		8		8	Pu 240	2.76E-06	CC 1	2.76E-06	CC 1
Sb 125	5.93E-09	CC 2	5.93E-09	CC 2	Pu 241	4.55E-05	CC 1	4.55E-05	CC 1
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	1.1E-05	CC 1	1.1E-05	CC 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	2.96E-09	CC 2	2.96E-09	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243	7.41E-09	CC 1	7.41E-09	CC 1
Cs 137	9.21E-05	CC 2	9.21E-05	CC 2	Cm 244	1.05E-07	CC 1	1.05E-07	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	2.22E-08	CC 2	2.22E-08	CC 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	3.48E-07	CC 2	3.48E-07	CC 2	Other a				
Eu 152	2.07E-08	CC 2	2.07E-08	CC 2	Other b/g				
Eu 154	2.47E-07	CC 2	2.47E-07	CC 2	<b>Total a</b>	<b>1.78E-05</b>	<b>CC 2</b>	<b>1.78E-05</b>	<b>CC 2</b>
Eu 155	2.67E-08	CC 2	2.67E-08	CC 2	<b>Total b/g</b>	<b>1.87E-04</b>	<b>CC 2</b>	<b>1.87E-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