

WASTE STREAM	9H323	Pile Cap, Dry Fuel Store and Associated Areas LLW
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SITE Wyifa

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 0		
Future arisings:	1.4.2060 - 31.3.2079	683.3		
Total future arisings:		683.3		
Total waste volume:		683.3		

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: For inventory purposes the arisings are assumed to arise at a uniform rate over 20 years.

Additional information on quantities: Reactor Dismantling & Site Clearance is assumed to commence in 2060 last for 20 years. The volumes and radioactivity have been calculated for 45 years after reactor shutdown, i.e. 2060.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 1.20
Stock (lower):	x -	Arisings (lower):	x 0.80

WASTE SOURCE Waste which has been deferred from Initial Decommissioning Works scope in the areas covered by this waste stream.

PHYSICAL CHARACTERISTICS

General description: Hard trash and redundant equipment. Mainly steel components. No large items are expected.

Changes since waste generated: -

Bulk density (t/m³): = 1.0

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Metal (85%), Concrete/rubble (1%), Soil (1%), Biodegradable non-putrescibles (3%), Plastics halogenated (1%), plastics non-halogenated (1%), Rubber (1%), Wood (1%), Other organic (2%), Others including asbestos (4%)

Chemical state: Neutral

Sheet metal proportion / thickness: Metal thicknesses will be variable from about 1 mm up to about 30 mm.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 29.1	Assorted stainless steel. Metal (pipework, valves, filters, bearings, misc).	
Other ferrous metals.....	= 54.6	Drums, tooling, pipework, valves, filters, misc.	
Iron.....	-	-	
Aluminium.....	= 0.50	Pipework, valves, filters, misc. contaminated dummy magnox alloy fuel elements (0.4 kg of 50kg magnox alloy).	
Beryllium.....	TR	0.002 kg of 50 kg magnox alloy dummy fuel elements.	
Cobalt.....	-	-	
Copper.....	= 0.10	Cable and WEEE.	
Lead.....	= 0.01	Light bulbs (<1m3), lead shot.	
Magnox/Magnesium.....	= 0.01	49.6 kg of 50 kg Magnox alloy dummy fuel elements.	
Nickel.....	-	-	
Titanium.....	= 0.45	Miscellaneous	
Uranium.....	-	-	
Zinc.....	= 0.50	Tooling, scaffolding, buckets, and a minor amount of mangnox dummy fuel elements.	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 1.0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 1.0	-	
Halogenated plastics.....	= 0.72	Liners, lab waste/packaging.	
Total non-halogenated plastics.....	= 0.71	Lab waste/packaging.	
Condensation polymers.....	= 0.71	Lab waste/packaging.	
Others.....	= 0	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 1.0	-	
Halogenated rubber.....	TR	-	
Non-halogenated rubber.....	= 1.0	-	
Hydrocarbons.....	0.50	-	
Oil or grease.....	-	-	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	= 0.50	Flooring	
Asphalt/Tarmac (no coal tar).....	-	-	
Bitumen.....	-	-	
Others.....	-	-	
Other organics.....	= 2.0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 0.10	-	
Soil.....	= 1.0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 1.0	-	
Sand.....	-	-	
Glass/Ceramics.....	= 0.50	fibreglass lagging	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	= 3.0	-	
Non/low friable.....	= 1.0	Equal portions of white/brown/blue asbestos assumed. Lagging.	
Moderately friable.....	= 1.0	Equal portions of white/brown/blue asbestos assumed. Asbestos contaminated plant items and gaskets.	
Highly friable.....	= 1.0	Equal portions of white/brown/blue asbestos assumed. Insulating boards.	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%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.....	= 3.0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	= 3.0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	P	1140m2
Higher activity particles.....	-	-
Soluble solids as bulk chemical compounds.....	-	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	TR 0	-
Benzene.....		-
Chlorinated solvents.....		-
Formaldehyde.....		-
Organometallics.....		-
Phenol.....		-
Styrene.....		-
Tri-butyl phosphate.....		-
Other organophosphates.....		-
Vinyl chloride.....		-
Arsenic.....		-
Barium.....		in light bulbs (<1m3)
Boron.....		-
Boron (in Boral).....		-
Boron (non-Boral).....		-
Cadmium.....		-
Caesium.....		-
Selenium.....		-
Chromium.....		-
Molybdenum.....		-
Thallium.....		-
Tin.....	= 0.10	Paint tins
Vanadium.....		-
Mercury compounds.....		-
Others.....		-

Complexing agents (%wt):

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

Physical components:

	Number	Type(s) and comment
Sources.....	P	-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....		-
EEE Type 5.....	P	-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction	Off-site	= 5.0
Decay storage		
Low force compaction		= 48.0
Supercompaction (HFC)		
Incineration		= 40.0
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		= 7.0

Comments on planned treatments:

2% VLLW to landfill and 5% direct to LLWR so no treatment.

Conditioning method:

-

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	1/2 Height WAMAC IP-2 ISO (TC08)	5.0	21.6	18.8	2	-
	1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	5.0	10.0	18.3	4	-

Range in container waste loading: -

Other information on packaging and conditioning: -

Conditioned density (t/m³): -
Conditioned density comment: -**Management Routes:**

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository	10.0		2060
Expected to be consigned to a Landfill Facility	= 2.0	1.0	2060
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	= 48.0		2060
Expected to be consigned to a Metal Treatment Facility	= 40.0		2060
Expected to be 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 06 01*

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: Activation and contamination of materials.
The activities quoted are those at 45 years after reactor shutdown, i.e. in 2060. There may be some contamination by Cs137.
It is expected that the Waste will become Out of Scope at RDC.

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

Measurement of radioactivities: -

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: Chlorine 36 is expected to be insignificant.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
I-129: -
Ra: Radium isotope content is expected to be insignificant.
Th: The thorium content is insignificant.
U: Uranium isotope content is expected to be insignificant.
Np: The neptunium content is insignificant.
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3			1.89E-05	C C 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			4.63E-06	C C 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			1.76E-06	C C 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	Ti 204				8
Mn 54				8	Pb 205				8
Fe 55			4.64E-09	C C 1	Pb 210				8
Co 60			1.54E-07	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			2.66E-06	C C 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			5.49E-09	C C 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			1.60E-08	C C 2	Th 234				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				8
Ag 108m			3.47E-08	C C 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			3.31E-09	C C 1
Sn 123				8	Pu 239			4.90E-09	C C 1
Sn 126				8	Pu 240			6.37E-09	C C 1
Sb 125				8	Pu 241			7.28E-08	C C 1
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			3.26E-08	C C 1
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			1.59E-07	C C 2	Cm 244				8
Ba 133			1.65E-09	C C 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				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Unsp a				
Eu 152			6.29E-09	C C 2	Unsp b/g				
Eu 154			5.94E-09	C C 2	Total a	0	*	4.72E-08	*
Eu 155				8	Total b/g	0	*	2.84E-05	*

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 the 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
* Total calculated from the 114 declared radionuclides