

WASTE STREAM	2C921	Ponds LLW
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SITE Chapelcross

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:	1.4.2025 - 31.3.2040	2875.1		
Total future arisings:		2875.1		
Total waste volume:		2875.1		

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

Comment on arising rates: -

Additional information on quantities: The four reactors at Chapelcross ceased generating in the period from August 2001 (R1) to February 2004 (R2).

Uncertainty factors on volumes:

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

WASTE SOURCE Much of this waste stream is metallic waste and building material concrete arising from the main pond building. Wastes also include non-compactable plant from the decontamination centre, active workshop flask cleaning area and pond corridors. There will be some secondary waste from these areas.

PHYSICAL CHARACTERISTICS

General description: The waste includes items such as pumps, motors, cranes, roller systems, skip handling equipment, and waste from the ponds building that is predominantly soft waste. This includes items such as used personal protective equipment, polythene sheeting, disposable wipes/swabs, rubber, PVC and tape. Bulk metallic waste items are also included in this waste stream, this is in the form Flask Vat (Washdown) Tanks. The waste normally contains no free liquid, as the excess liquid is drained and returned to the pond before packaging the waste. Asbestos is also present in the waste stream in the form of gaskets/ropes incorporated into joint, pipework and redundant machinery. These items contain Chrysotile type asbestos. As decommissioning progresses there will be quantities of concrete rubble and soil generated. Any lead included in this waste stream will take the form of lead sheeting.

Changes since waste generated: -

Bulk density (t/m³): ~ 0.70

Comment on density: Density of 0.7t/m³ is an initial estimate subject to confirmation.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (~67%), incinerables (plastic non halogenated (~7%), rubber (~7%), wood (~7%), biodegradable (Non-putrescible) (~7%), concrete/rubble (~2%) & soil (~2%), others (1%). 'Others' accounts for Asbestos cement sheeting, insulation material and gaskets/ropes incorporated into joint, pipeworks and redundant machinery. Note this will be estimated 0.1% but has been included as minimum within the table above. 1% has therefore been deducted from metal as the gaskets would form part of this total.

Chemical state: Neutral

Sheet metal proportion / thickness: This waste stream will contain waste of various sizes and thicknesses.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	NE	-	
Other ferrous metals.....	~ 67.7	Deplanted bulk items i.e. Flask Vats (Washdown tanks), rail bogies, flask transport trailer. Tooling and equipment, pumps/motors, pipework, ducting.	
Iron.....	-	-	
Aluminium.....	= 0.41	Scaffolding poles	
Beryllium.....	NE	-	
Cobalt.....	-	-	
Copper.....	TR	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	NE	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	NE	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 7.0	Soft waste including polythene sheeting, gloves, PPE, tape	
Paper, cotton.....	= 0		
Wood.....	~ 7.0		
Halogenated plastics.....	= 0		
Total non-halogenated plastics.....	~ 7.0		
Condensation polymers.....	~ 3.5		
Others.....	~ 3.5		
Organic ion exchange materials.....	= 0		
Total rubber.....	~ 7.0		
Halogenated rubber.....	~ 3.5		
Non-halogenated rubber.....	~ 3.5		
Hydrocarbons.....	-		
Oil or grease.....	-		
Fuel.....	-		
Asphalt/Tarmac (cont.coal tar).....	-		
Asphalt/Tarmac (no coal tar).....	-		
Bitumen.....	-		
Others.....	-		
Other organics.....	= 0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	Asbestos gaskets in pipework flanges and redundant equipment, chrysotile (white)	
Inorganic sludges and flocs.....	= 0		
Soil.....	~ 2.0		
Brick/Stone/Rubble.....	= 0		
Cementitious material.....	~ 2.0		
Sand.....	-		
Glass/Ceramics.....	= 0		
Graphite.....	= 0		
Desiccants/Catalysts.....	-		
Asbestos.....	= 0.12		
Non/low friable.....	= 0.12		
Moderately friable.....	-		
Highly friable.....	-		
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.....	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.....	= 0	-
Low flash point liquids.....	= 0	-
Explosive materials.....	= 0	-
Phosphorus.....	= 0	-
Hydrides.....	= 0	-
Biological etc. materials.....	= 0	-
Biodegradable materials.....	7.0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	= 7.0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	P	383.35m2
Higher activity particles.....		-
Soluble solids as bulk chemical compounds.....		-

Hazardous substances / non hazardous pollutants:

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

Complexing agents (%wt):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		-
Total complexing agents.....	NE	-

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.....		-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction	Off-site	~ 25.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	Off-site	~ 10.0
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		~ 65.0

Comments on planned treatments:

50% of the stream is expected to be disposed of as VLLW to landfill.

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 IP-2 Disposal/Re-usable ISO (TC01/TC02)	15.0	10.0	18.3	44	-

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)	= 15.0 = 50.0	0.70 0.70	
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	= 25.0 = 10.0	0.40 1.4	
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
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 02 01, 17 02 03, 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.

Uncertainty: Activity values are current best estimates. Specific activity is a function of operating history. The values are indicative of the activities that would be expected.

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: -
Se-79: The chemical form of selenium has not been determined.
Tc-99: The chemical form of technetium has not been determined.
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: Neptunium isotope content is expected to be insignificant.
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

WASTE STREAM 2C921 Ponds LLW									
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			5.44E-07	C C 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.04E-06	C C 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			6.60E-09	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			1.29E-07	C C 1	Pb 210				8
Co 60			1.59E-07	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			1.68E-07	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			5.71E-06	C C 1	Th 227				8
Zr 93				8	Th 228			9.66E-09	C C 2
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232				8
Nb 94				8	Th 234			2.09E-09	C C 2
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			9.31E-09	C C 1	U 232			1.00E-08	C C 1
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m				8	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238			2.09E-09	C C 1
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			1.35E-07	C C 1
Sn 123				8	Pu 239			1.81E-07	C C 1
Sn 126				8	Pu 240			2.23E-07	C C 1
Sb 125			1.46E-09	C C 2	Pu 241			3.81E-06	C C 1
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			1.05E-06	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			1.48E-05	C C 2	Cm 244			4.97E-09	C C 1
Ba 133			1.18E-08	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			3.33E-09	C C 1	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151			1.15E-07	C C 1	Unsp a				
Eu 152			1.54E-09	C C 2	Unsp b/g				
Eu 154			2.21E-08	C C 2	Total a	0	*	1.62E-06	*
Eu 155			4.55E-09	C C 2	Total b/g	0	*	2.65E-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