

WASTE STREAM	2N03	PCM Decommissioning Operations Drummed Secondary Waste
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SITE LLW Repository

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Waste Services (NWS)

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025			
Future arisings:				
Total future arisings:				
Total waste volume:				

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

Comment on arising rates: All waste has been generated from this wastestream.

Additional information on quantities: -

Uncertainty factors on volumes:

Stock (upper):	x 1.00	Arisings (upper):	x -
Stock (lower):	x 1.00	Arisings (lower):	x -

WASTE SOURCE

The waste at LLWR is from the decommissioning of PCM facilities, contaminated due to the storage of PCM. The waste at LLWR mainly originated from Sellafield, but significant amounts were from other UK nuclear installations e.g. Harwell and Aldermaston and was initially classified as PCM. However, a project was started to recategorise the drums following some initial investigations and to prevent long term storage and significant costs. ~1500 drums out of the ~1850 were found to be suitable for VLLW and these have been consigned to an approved Landfill facility since early 2024. The remaining drums are predominantly LLW and are undergoing assessment for appropriate waste routing.

PHYSICAL CHARACTERISTICS

General description: The soft waste consists of PPE and other operational wastes e.g. plastic gloves, air fed suits, hoses, boots, wipes, sizalcraft etc. The hard waste consists of building fabric and redundant equipment contaminated above LLW levels. The waste will mainly comprise of scabbled concrete from the magazines and also from metal and wood fittings within the building as well as any metallic equipment. The waste at LLWR mainly originated from Sellafield, but significant amounts were from other UK nuclear installations e.g. Harwell and Aldermaston. However, a project was started to recategorise the drums following some initial investigations and to prevent long term storage and significant costs. ~1500 drums out of the ~1850 were found to be suitable for VLLW and these have been consigned to an approved Landfill facility since early 2024. The remaining drums are predominantly LLW and are undergoing assessment for appropriate waste routing.

Changes since waste generated: The waste has been size reduced for packing into drums.

Bulk density (t/m³): = -

Comment on density: For soft waste there are a range of densities of 0.01 - 0.1 t/m³. For hard waste a range of densities of 2 - 4 t/m³ is typical. It depends on the drum content (whether it is concrete, metal or a mixture and how well it is packed). Drum weight limits will preclude very efficient packing.

CHEMICAL COMPOSITION

General description and components (%wt): The overall waste composition is estimated to be metal (33%), concrete and brick (28%), PVC (17%), rubber - including neoprene (9%), cellulose (5%), bitumen (3%), wood (2%), other plastics (3%) (also <1% others (including glass)).

Chemical state: Alkali

Sheet metal proportion / thickness: No significant sheet metal is expected to be present as this can be decontaminated to LLW.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 33.0	Breakdown not estimated.	
Other ferrous metals.....	NE	-	
Iron.....	NE	-	
Aluminium.....	-	-	
Beryllium.....	-	-	
Cobalt.....	-	-	
Copper.....	-	-	
Lead.....	-	-	
Magnox/Magnesium.....	-	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	-	-	
Zircaloy/Zirconium.....	-	-	
Other metals.....	-	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	~ 7.0	-	
Paper, cotton.....	~ 5.0	Filters, covershoes, tyveks, wipes etc.	
Wood.....	~ 2.0	Wood building fittings.	
Halogenated plastics.....	~ 17.0	Assumed PVC and Neoprene.	
Total non-halogenated plastics.....	~ 3.0	-	
Condensation polymers.....	NE	-	
Others.....	~ 3.0	Types not known.	
Organic ion exchange materials.....	0	-	
Total rubber.....	~ 9.0	-	
Halogenated rubber.....	~ 9.0	Types not known; gloves, O-rings, neoprene	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	~ 3.0	Captured as bitumen 3% below	
Oil or grease.....	NE	-	
Fuel.....	NE	-	
Asphalt/Tarmac (cont.coal tar).....	NE	-	
Asphalt/Tarmac (no coal tar).....	NE	-	
Bitumen.....	~ 3.0	Bitumen (removed from building structure)	
Others.....	NE	-	
Other organics.....	NE	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	0	-	
Inorganic sludges and flocs.....	0	-	
Soil.....	0	-	
Brick/Stone/Rubble.....	~ 2.0	-	
Cementitious material.....	~ 26.0	-	
Sand.....	0	-	
Glass/Ceramics.....	P	glass (<1%)	
Graphite.....	0	-	
Desiccants/Catalysts.....	0	-	
Asbestos.....	0	-	
Non/low friable.....	0	-	
Moderately friable.....	0	-	
Highly friable.....	0	-	
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	Not expected.
Low flash point liquids.....	= 0	Not expected.
Explosive materials.....	= 0	Not expected.
Phosphorus.....	= 0	Not expected.
Hydrides.....	= 0	Not expected.
Biological etc. materials.....	= 0	Not expected.
Biodegradable materials.....	= 0	Not expected.
Putrescible wastes.....	= 0	Not expected.
Non-putrescible wastes.....	= 0	Not expected.
Corrosive materials.....	= 0	Not expected.
Pyrophoric materials.....	= 0	Not expected.
Generating toxic gases.....	= 0	Not expected.
Reacting with water.....	= 0	Not expected.
Higher activity particles.....	P	Potentially present.
Soluble solids as bulk chemical compounds.....	= 0	Not expected.

Hazardous substances / non hazardous pollutants:

-

	(%wt)	Type(s) and comment
Acrylamide.....	= 0	-
Benzene.....	= 0	Not expected.
Chlorinated solvents.....	= 0	-
Formaldehyde.....	= 0	-
Organometallics.....	= 0	-
Phenol.....	= 0	Not expected.
Styrene.....	= 0	-
Tri-butyl phosphate.....	= 0	Not expected.
Other organophosphates.....	= 0	-
Vinyl chloride.....	= 0	Not expected.
Arsenic.....	= 0	Not expected.
Barium.....	= 0	-
Boron.....	= 0	Not expected.
Boron (in Boral).....	-	-
Boron (non-Boral).....	-	-
Cadmium.....	= 0	Not expected.
Caesium.....	-	-
Selenium.....	= 0	Not expected.
Chromium.....	P	Could be present in stainless steel alloy.
Molybdenum.....	P	Could be present in stainless steel alloy.
Thallium.....	NE	-
Tin.....	= 0	Not expected.
Vanadium.....	= 0	Not expected.
Mercury compounds.....	= 0	-
Others.....	P	-

Complexing agents (%wt):

No

	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....	NE	-
NTA.....	NE	-
Polycarboxylic acids.....	NE	Not expected.
Other organic complexants.....	NE	Not expected.
Total complexing agents.....	= 0	-

Physical components:

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

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction		
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
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	Off-site	80.0
Other chemical treatment		
Containerisation		
Treatment not yet determined	Off-site	20.0
None		

Comments on planned treatments:

80% of the waste has already been consigned to a Landfill Facility. The remaining 20% has been issued to Service Providers for suitability.

Conditioning method:

None forecasted.

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
-	-	-	-	-	-

Range in container waste loading: All waste is packaged into 200 litre Black Drums.

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			
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	= 100.0		

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
Unknown	Landfill	~ 10.0	AMBER	Drum information is currently with Service Providers to determine most appropriate Waste Route.
Unknown	Incineration facility	~ 10.0	AMBER	Drum information is currently with Service Providers to determine most appropriate Waste Route.

RADIOACTIVITY

Source: Material generated under the 2N03 waste stream has become Plutonium Contaminated (PCM) material through contact with PCM historically processed within the magazines. Additionally, Decommissioning Operations of the Magazines has also generated PCM. However, the drums were reassayed and recategorised to LLW and VLLW (all the VLLW has been dispatched from site)

Uncertainty: -

Measurement of radioactivities: All drums were assayed on equipment that complies with modern standards. The assay data was then interpreted and activities assigned by an external consultancy company. The data was checked by internal Intelligent Customers and signed off.

Chemical form of radionuclides: H-3: Trace quantities could be present.
C-14: Not expected to be present.
Cl-36: Not expected to be present.
Se-79: Not expected to be present.
Tc-99: Not expected to be present.
I-129: Not expected to be present.
Ra: Trace quantities could be present.
Th: Trace quantities could be present.
U: Oxides, fluorides.
Np: Trace quantities could be present.
Pu: Nitrate, sulphide, fluoride or mixed oxides.

WASTE STREAM		2N03		PCM Decommissioning Operations Drummed Secondary Waste					
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	~ 2.39E-07 A A 1				Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					~ 7.25E-06 A A 1				
Ag 110m					~ 3.04E-07 A A 1				
Cd 109					~ 2.98E-09 A A 1				
Cd 113m					~ 7.09E-07 A A 1				
Sn 119m					~ 1.17E-09 A A 1				
Sn 121m					Pu 236				
Sn 123					Pu 238				
Sn 126					~ 4.92E-06 A A 1				
Sb 125					~ 2.70E-04 A A 1				
Sb 126					Pu 239				
Te 125m					Pu 240				
Te 127m					Pu 241				
I 129					~ 1.12E-04 A A 1				
Cs 134					Pu 242				
Cs 135					~ 9.32E-10 A A 1				
Cs 137					~ 7.63E-05 A A 1				
Ba 133					Am 241				
La 137					Am 242m				
La 138					Am 243				
Ce 144					Cm 242				
Pm 145					Cm 243				
Pm 147					Cm 244				
Sm 147					Cm 245				
Sm 151	Cm 246								
Eu 152	Cm 248								
Eu 154	Cf 249								
Eu 155	Cf 250								
	Cf 251								
	Cf 252								
	Unsp a								
	Unsp b/g								
	Total a								
	Total b/g								
	3.59E-04								
	1.12E-04								
	*								
	*								
	0								
	0								
	*								
	*								

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