

WASTE STREAM**2P03****BTC Level 3 Laboratories and Other General Active Areas**

SITE Sellafield NNL

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN National Nuclear Laboratory

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	<10.0 m ³
	1.4.2023 - 31.3.2024.....	<10.0 m ³
	1.4.2024 - 31.3.2025.....	<10.0 m ³
	1.4.2025 - 31.3.2037.....	<100.0 m ³
Total future arisings:		130.0 m ³
Total waste volume:		130.0 m ³

Comment on volumes: This waste stream has been operational since October 2004.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.25
Stock (lower):	x	Arisings (lower)	x 0.75

WASTE SOURCE General laboratory wastes plus general wastes arising from normal building operations.

PHYSICAL CHARACTERISTICS

General description: General mixed waste. Large items arise infrequently.

Physical components (%wt): Typically contains paper, tissues, paper towels, cardboard, wood, tacky mats, scrap wrapping materials, polythene bottles, polystyrene packing, gloves, cable, tweezers, metal sheet, pipes, rubble and glassware.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.26

Comment on density: The density of waste is based on the updated waste stream characterisation document (version 8.0) issued in September 2021. Disposals to date support this figure.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (40%), Soil (1%), Biodegradable - Non-Putrescibles (1%), Plasterboard (1%) Halogenated Plastic (18%), Non-Halogenated Plastic (18%), Rubber (7%), Wood (1%), Other organic (1%), Others (15%). Others consist of glassware contained within rigid containers, Eli-dry absorbant granules loaded with Insta-Gel plus and or Insta-Fluor plus liquid scintillation cocktails, grouted ion-exchange resins, grouted fumed silica/nitric acid electrolyte decontamination gel, WEEE, lagging, HEPA filters, air filters, oils, paints, Hoover bags and contents, magnox and AGR graphite waste, onconel 601 crucible alloy elements (manganese, carbon, silicon, sulfur)

Chemical state: Neutral

Chemical form of radionuclides:

- H-3: Trace residues left in sample containers
- C-14: Trace residues left in sample containers
- Cl-36: Trace residues left in sample containers
- Se-79: Not anticipated to be present.
- Tc-99: Trace residues left in sample containers
- I-129: Trace residues left in sample containers.
- Ra: Not anticipated to be present.
- Th: Thorium 232 Oxide and oxalate solids on filter papers or encapsulated in epoxy resin.
- U: Natural Uranium - U235, U236 and U238, Uranium metal, U oxides (UO₂, UO₃ and U₃O₈) powder or U nitrate solids.
- Np: Np237 as oxide or nitrate solids.
- Pu: Plutonium nitrate solids, plutonium oxides.

Metals and alloys (%wt): Likely to be metals of various thicknesses.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	<11.1		
Other ferrous metals.....	<11.1		
Iron.....	<4.5		
Aluminium.....	<0.40		
Beryllium.....			
Cobalt.....			
Copper.....	<1.4		
Lead.....	<1.1		
Magnox/Magnesium.....	<0.10		
Nickel.....	<0.10		
Titanium.....	<0.10		
Uranium.....			
Zinc.....	<0.10		
Zircaloy/Zirconium.....			
Other metals.....			

Organics (%wt):

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	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	8.0		
Paper, cotton.....	7.0		
Wood.....	1.0		
Halogenated plastics	18.0		
Total non-halogenated plastics.....	18.0		
Condensation polymers.....			
Others.....			
Organic ion exchange materials....	<1.0		
Total rubber.....	7.0		
Halogenated rubber			
Non-halogenated rubber.....			
Hydrocarbons.....			
Oil or grease	<1.0		
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	<1.0	Relatively small quantities of liquid scintillation cocktails are also present.	

Other materials (%wt):

Mixture of glass and Eli-Dry absorbant granules (a clay based material similar to cat litter). The granules have unspecified quantities of liquid scintillation cocktails and ion exchange resins loaded onto them.

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	<1.0	Liquid scintillation cocktails.	
Inorganic sludges and flocs.....			
Soil.....	<1.0		
Brick/Stone/Rubble.....	1.0		
Cementitious material.....	1.0	Includes grout for resins, decon gels.	
Sand.....			
Glass/Ceramics.....	<12.0	Glassware, uranium encapsulated in glass, HEPA filters	
Graphite.....	<1.0	Magnox and AGR reactor graphite waste (dust)	
Desiccants/Catalysts.....			
Asbestos.....			
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....			
Free non-aqueous liquids.....			
Powder/Ash.....			

Inorganic anions (%wt): Trace amounts of various anions may be present.

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

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.....	8.0	

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Putrescible wastes.....	1.0	Roof waste
Non-putrescible wastes.....	7.0	Paper, cotton and wood.
Corrosive materials.....		
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: May be small amounts, assume <0.1% wt.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....	0	
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....	0	
Styrene.....		
Tri-butyl phosphate.....	0	
Other organophosphates.....		
Vinyl chloride.....	P	PVC bags.
Arsenic.....	0	
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....	0	
Caesium.....		
Selenium.....	0	
Chromium.....	P	Alloy in stainless steel.
Molybdenum.....	P	Alloy in stainless steel.
Thallium.....		
Tin.....	0	
Vanadium.....	P	Alloy in stainless steel.
Mercury compounds.....		
Others.....	0	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	100.0	Computers, telephones, circuit boards etc.
EEE Type 2.....	100.0	Pumps, motors, transformers etc.
EEE Type 3.....	100.0	Hand tools.
EEE Type 4.....	25.0	Fluorescent light tubes.
EEE Type 5.....	25.0	Lithium ion batteries.

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Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA.....	P	0.00088 kg
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....	<0.01	

Potential for the waste to contain discrete items: . Yes. Large lab equipment such as furnace, microscopes etc.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	On-site	40.0
Incineration	Off-site	54.0
Solidification		
Decontamination		
Metal treatment	Off-site	1.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various	On-site	1.0
None	Off-site	4.0

Comment on planned treatments:

Other is on site disposal of VLLW eg putrescible waste, rubble etc to CLESA. None is off site direct disposal to LLWR where required.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	41.0	NE
Expected to be consigned to a Landfill Facility	1.0	NE
Expected to be consigned to an On-Site Disposal Facility	1.0	NE
Expected to be consigned to an Incineration Facility	54.0	NE
Expected to be consigned to a Metal Treatment Facility	1.0	NE
Expected to be consigned as Out of Scope	1.0	NE
Expected to be recycled / reused	1.0	NE
Disposal route not known		

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

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			

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at LLWR	Incineration	54.0	2022	Medium	This waste was not included in previous soft bag waste trial but will be potentially included in future incineration trials.

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	41.0	59.28	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	1.0	10	< 1
2m box (no shielding)			
4m box (no shielding)			
Other (Metal treatment)			

Other information: Small heavy duty items from research experiments and supporting plant operations. General laboratory and plant items. Soft wastes from research experiments or supporting plant operations.

Waste Planned for Disposal at the LLW Repository:

Container voidage: NNL do not load containers. NNL waste is mixed with Sellafield Ltd waste on Sellafield site. Voidage and packaging efficiency is determined by Sellafield Ltd.

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: Yes.

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: Process waste (such as gloves/paper etc.) contaminated with fission products and other radionuclides will be generated from experiments.

Uncertainty: This is a best estimate at present based on the WSCD and operations to date.

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 fingerprint is based on a theoretical assessment by Sellafield Ltd Facility Characterisation, using data on real activities, materials and operations provided by NNL Plant personnel and Plant Solid Waste Coordinator in 2019

Other information: Other beta / gamma on the radionuclide spreadsheet includes Ca45, Zr95 and Nb95.

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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			4.70E-07	CC 2	Gd 153				
Be 10					Ho 163				
C 14			3.74E-07	CC 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36			8.85E-09	CC 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54			1.30E-09	CC 2	Pb 205				
Fe 55			2.12E-07	CC 2	Pb 210				
Co 60			1.16E-06	CC 2	Bi 208				
Ni 59			1.53E-10	CC 2	Bi 210m				
Ni 63			4.95E-08	CC 2	Po 210				
Zn 65			6.34E-09	CC 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85			8.85E-07	CC 2	Ra 228				
Rb 87					Ac 227				
Sr 90			4.43E-07	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232		1.30E-09	CC 2	
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99			1.77E-06	CC 2	U 232		8.85E-13	CC 2	
Ru 106			2.25E-09	CC 2	U 233		2.65E-07	CC 2	
Pd 107					U 234		1.19E-06	CC 2	
Ag 108m			7.63E-11	CC 2	U 235		5.08E-08	CC 2	
Ag 110m			4.43E-07	CC 2	U 236		9.77E-12	CC 2	
Cd 109			8.85E-12	CC 2	U 238		1.53E-06	CC 2	
Cd 113m					Np 237		4.42E-07	CC 2	
Sn 119m					Pu 236		8.85E-13	CC 2	
Sn 121m					Pu 238		1.53E-08	CC 2	
Sn 123					Pu 239		1.40E-08	CC 2	
Sn 126					Pu 240		6.34E-09	CC 2	
Sb 125			3.44E-07	CC 2	Pu 241		1.02E-08	CC 2	
Sb 126					Pu 242		3.10E-07	CC 2	
Te 125m					Am 241		8.85E-09	CC 2	
Te 127m					Am 242m				
I 129			8.85E-09	CC 2	Am 243		1.42E-06	CC 2	
Cs 134			5.11E-09	CC 2	Cm 242		7.63E-11	CC 2	
Cs 135					Cm 243		1.53E-10	CC 2	
Cs 137			8.85E-07	CC 2	Cm 244		8.85E-09	CC 2	
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144			9.01E-08	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147			1.30E-09	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151			8.89E-08	CC 2	Other a		8.85E-13	CC 2	
Eu 152			1.76E-07	CC 2	Other b/g		8.85E-12	CC 2	
Eu 154			1.30E-09	CC 2	Total a	0	5.26E-06	CC 2	
Eu 155			5.34E-10	CC 2	Total b/g	0	7.44E-06	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