

WASTE STREAM**2N01****Legacy Drum Sampling Secondary Waste**

SITE LLWR (near Drigg)
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN LLWR SLC Limited

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	15.3 m ³
Total future arisings:		0 m ³
Total waste volume:		15.3 m ³

Comment on volumes: There have been no arisings from 2019 onwards, stocks only. The volumes quoted are representative of the final consignment of miscellaneous vault disposal items. All divertable secondary soft waste has been consigned off site for incineration. 10 x ILW secondary soft waste bags are awaiting further characterisation to underpin disposal in the vault.

Uncertainty factors on volumes: Stock (upper): x 1.2 Arisings (upper) x
 Stock (lower): x 0.8 Arisings (lower) x

WASTE SOURCE LLWR have a population of legacy drummed waste (believed to have originated from Springfields in the 1950's and 60's). An intrusive sampling campaign was initiated with an aim to characterise these drums, therefore, this stream was identified to cover the secondary waste generated i.e sampling equipment, airfed suits, vacuum filters etc.

PHYSICAL CHARACTERISTICS

General description: Sampling equipment including bunds, drum dollies, coring rig assembly, drills, core bits, drill shrouds, saws, breakers, long handled tools, cutting tools, A-Frame, drum lifter, sample storage equipment, endoscopes, liquid/sludge sampling tools, sampling work bench and trays etc. Vacuums, vacuum filters and vacuum bags. Soft waste bags including airfed suits, PVC, covershoes, wipes etc. Proban suits (for acid protection) and stripped outer Legacy Drum metal. All soft waste was bagged and loaded into drums for assaying. Waste not suitable for assay was subject to an Activity Assessment to identify appropriate route, i.e Metallic Waste Treatment, LLW Disposal.

Physical components (%wt): Metals (10%), Plastics (73%), Rubber (2%), Wood (7.5%), Cementitious Material (7.5%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.07

Comment on density: Bulk density is based on an estimate of the total waste mass divided by the total waste volume.

CHEMICAL COMPOSITION

General description and components (%wt): Mild Steel from plant items and tools, halogenated and non-halogenated plastics from soft waste, plant items and tools, Stainless Steel from plant items and tools and various electrical equipment.

Chemical state: Neutral

Chemical form of radionuclides: Tc-99: Present.
 Th: Present as metals, oxides or other forms.
 U: Present as metals, oxides or other forms.
 Np: Present as metals, oxides or other forms.
 Pu: Present as metals, oxides or other forms.

Metals and alloys (%wt): N/A - bulk items.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~0.20		
Other ferrous metals.....	~9.8		
Iron.....	0		
Aluminium.....	0		

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Beryllium.....	0
Cobalt.....	0
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	0
Titanium.....	0
Uranium.....	0
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): Plastics from airfed suits (72%), sampling tools (2%), plant equipment (8%).

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	7.7		
Paper, cotton.....	0		
Wood.....	~7.7		
Halogenated plastics	~68.9		
Total non-halogenated plastics.....	~3.8		
Condensation polymers.....	0		
Others.....	0		
Organic ion exchange materials....	0		
Total rubber.....	~1.9		
Halogenated rubber	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....	0		
Oil or grease	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar).....	0		
Bitumen.....	0		
Others.....	0		
Other organics.....	0		

Other materials (%wt): Trace potential if asbestos identified in primary waste, type and quantity unknown (<1%).

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	7.7	Contents of Hoover bags.	
Sand.....	0		
Glass/Ceramics.....	0		

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Graphite.....	0	
Desiccants/Catalysts.....	0	
Asbestos.....	NE	
Non/low friable.....	NE	Trace potential if asbestos identified in primary waste, type and quantity unknown.
Moderately friable.....	NE	
Highly friable.....	NE	
Free aqueous liquids.....	0	
Free non-aqueous liquids.....	0	
Powder/Ash.....	0	

Inorganic anions (%wt): N/A

	(%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:

Some samples appeared to contain a possible adduct of hydrated uranyl fluoride with hydrogen fluoride. Many of the primary waste was found to be wet or damp and some drum have leaked an acid liquor in the past. It is likely that hydrogen fluoride is present in these drums. Given these chemical components, the primary waste is expected to react with water.

	(%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.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	0	
Corrosive materials.....	P	0.2m3.
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	P	0.2m3.
Higher activity particles.....	0	

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Soluble solids as bulk chemical compounds..... 0

Hazardous substances / non hazardous pollutants: EEE present in form of small electrical items and tools.

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	0	
Arsenic.....	0	
Barium.....	0	
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....	0	
Caesium.....	0	
Selenium.....	0	
Chromium.....	0	
Molybdenum.....	0	
Thallium.....	0	
Tin.....	0	
Vanadium.....	0	
Mercury compounds.....	0	
Others.....	~1.0	

Electronic Electrical Equipment (EEE)

EEE Type 1.....	P	2x endoscopes and drum weigh scales (battery, electrical).
EEE Type 2.....		
EEE Type 3.....	P	Drill for coring, saw, breaker and vacuum.
EEE Type 4.....		
EEE Type 5.....	P	Drum scales and endoscope both with bespoke batteries.

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....	0	
DPTA.....	0	
NTA.....	0	

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Polycarboxylic acids..... 0
 Other organic complexants..... 0
 Total complexing agents..... 0

Potential for the waste to contain discrete items: Yes. small hand held tools would class as discrete items.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None	On-site	~100.0

Comment on planned treatments: -

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
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	~100.0	~0.07

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

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: No

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 ³	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	~100.0	~15.29	1

Other information: N/A

Waste Planned for Disposal at the LLW Repository:

Container voidage: Total voidage will not exceed 10% of overall container. Biodegradation voidage will be minimal as there is no soil/rubble (loose or otherwise) present in the container. Inaccessible voidage will be present from items generated under other waste streams i.e scaffold poles. Any soft waste identified for disposal has been bagged accordingly and air will have been expressed from the bag prior to taping (swan-necking).

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.
N/A

Waste consigned for disposal to LLWR in year of generation: No. Disposal containers are currently full and are awaiting consignment. It is anticipated that they will be consigned in the next FY 2023/24.

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: Waste generated under the 2N01 stream has been contaminated through sampling of the primary waste form - legacy drums (2N17).

Uncertainty: The expanded uncertainty will be applied at a 99% confidence level to the calculated gamma activities, to determine an 'upper uncertainty activity'.

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: In the Project Waste Management Plan each type of waste item had been assigned an expected waste route and a total mass calculated. A specific activity has been assigned to each type of item based on the following four assumptions:- 1. Waste expected to be suitable for the combustible route has been assigned an activity of 1MBq per waste item (prior to any size reduction), based on this being the individual item limit applied to LLWRs WS119 soft waste route. 2. Non-porous waste with no inaccessible areas (e.g. sheet metal) has been assigned a specific activity of 20Bq/g based on preliminary activity assessments on stripped drum metal to date. 3. Non-porous waste with inaccessible areas or areas that require swabbing has been assigned a specific activity of 200Bq/g. A preliminary assessment of a drill core calculated similar specific levels, but this is largely an estimate. 4. Items at risk of being ILW, i.e. hoover bags and plastic sampling tools have been assigned a specific activity of 4000Bq/g, based on them being at the alpha limit for LLW.

Other information: These assumptions are intended to be pessimistic. The mass estimated for each item type

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has then been used to calculate the total activity of the waste stream. No differentiation has been made between alpha and beta/gamma.

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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					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	-3.25E-06	CC 2		
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	-3.25E-06	CC 2		
Kr 85					Ra 228	-1.08E-06	CC 2		
Rb 87					Ac 227				
Sr 90	-8.33E-08	CC 2			Th 227				
Zr 93					Th 228	-1.08E-06	CC 2		
Nb 91					Th 229				
Nb 92					Th 230	-3.25E-06	CC 2		
Nb 93m					Th 232	-2.06E-07	CC 2		
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233	-9.83E-05	CC 2		
Tc 99	-1.02E-04	CC 2			U 232	-2.78E-08	CC 2		
Ru 106					U 233	-5.56E-08	CC 2		
Pd 107					U 234	-4.11E-05	CC 2		
Ag 108m					U 235	-1.78E-06	CC 2		
Ag 110m					U 236	-6.67E-07	CC 2		
Cd 109					U 238	-3.61E-05	CC 2		
Cd 113m					Np 237	-9.83E-05	CC 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	-1.94E-07	CC 2		
Sn 123					Pu 239	-9.69E-06	CC 2		
Sn 126					Pu 240	-7.5E-07	CC 2		
Sb 125					Pu 241	-6.42E-06	CC 2		
Sb 126					Pu 242	-5.56E-08	CC 2		
Te 125m					Am 241	-1.94E-06	CC 2		
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	-3.89E-07	CC 2			Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a	-8.67E-06	CC 2		
Eu 152					Other b/g				
Eu 154					Total a	-2.07E-04	CC 2	0	
Eu 155					Total b/g	-2.12E-04	CC 2	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 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