WASTE STREAM 2N14 LLW from PCM Operations for Metal Treatment

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.....	59.5 m^3
Future arisings -	1.4.2022 - 31.3.2023.....	0 m^3
Total future arisings:		0 m^3
Total waste volume:		59.5 m^3

Comment on volumes: No arisings as all waste has been generated.

Uncertainty factors on volumes:

Stock (upper):	x 1.3	Arisings (upper)	x
Stock (lower):	x 0.7	Arisings (lower)	x

WASTE SOURCE The waste primarily comprises of metallic waste generated as part of decommissioning activities (Magazines).

PHYSICAL CHARACTERISTICS

General description:	Metallic waste generated from decommissioning activities within the magazines (including small plant components and larger items such as MAFI bogies and vent ductwork). The waste has not undergone any change since generated.
Physical components (%wt):	Metal (100%)
Sealed sources:	The waste does not contain sealed sources. N/A
Bulk density (t/m^3):	~0.6
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):	Metallic waste stream (100%wt) - ~19.13%wt stainless steel, ~75%wt other ferrous metals, ~5.78% aluminium, ~0.09%wt copper.
Chemical state:	Alkali
Chemical form of radionuclides:	H-3: Trace quantities could be present as organically bound or free tritium. 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: Could be present as metals, oxides or other forms. Th: Could be present as metals, oxides or other forms. U: Oxides, fluorides. Np: Could be present as metals, oxides or other forms. Pu: Nitrate, sulphide, fluoride or mixed oxides.
Metals and alloys (%wt):	The majority of metal will be steel (mild or stainless); the ventilation ductwork is zinc galvanised. Ventilation system ductwork sheets (~3mm thick) of galvanised steel (~6%wt). Larger items such as fork lift trucks and drum handling equipment will be size reduced as part of the waste export process. Items will vary in size and size reduction requirements will be influenced by the waste route.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	~19.1	Grades not known.	
Other ferrous metals	~75.0	Grades not known.	
Iron			
Aluminium	~5.8	Grades not known.	
Beryllium			
Cobalt			
Copper	~0.09	Predominantly in electrical equipment.	
Lead	TR	Trace could be present in redundant equipment.	
Magnox/Magnesium			
Nickel	TR	Trace could be present in redundant equipment.	
Titanium			
Uranium			
Zinc	TR	Trace could be present in redundant equipment.	
Zircaloy/Zirconium			
Other metals			

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	0		
Paper, cotton	0		
Wood	0		
Halogenated plastics	0		
Total non-halogenated plastics	0		
Condensation polymers	0		
Others	0		
Organic ion exchange materials	0		
Total rubber	0		
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): -

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	(%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.....	0		
Sand.....	0		
Glass/Ceramics.....	0		
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		

Inorganic anions (%wt): Not expected to be added - only physical processes are being applied for decontamination.

	(%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: N/A

	(%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	

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Corrosive materials	0
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: N/A - any residual oil/ grease has been removed and is not expected to be present.

	(%wt)	Type(s) and comment
Acrylamide	0	
Benzene	0	
Chlorinated solvents	0	
Formaldehyde	0	
Organometallics	0	
Phenol	0	
Styrene	0	
Tri-butyl phosphate	0	Potentially present in hydrauulic fluids but metallic items will be drained as much as is reasonably practicable.
Other organophosphates	0	
Vinyl chloride	0	
Arsenic	0	
Barium	0	
Boron	0	
Boron (in Boral)	0	
Boron (non-Boral)	0	
Cadmium	0	
Caesium	0	
Selenium	0	
Chromium	P	Could be present in stainless steel alloy.
Molybdenum	P	Could be present in stainless steel alloy.
Thallium	0	
Tin	NE	
Vanadium	NE	
Mercury compounds	0	
Others	0	
Electronic Electrical Equipment (EEE)		
EEE Type 1	0	
EEE Type 2	0	
EEE Type 3	0	
EEE Type 4	0	
EEE Type 5	0	

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Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....	0	
DPTA.....	0	
NTA.....	0	
Polycarboxylic acids…….		Not estimated.
Other organic complexants.....		Not estimated.
Total complexing agents.....	0	

Potential for the waste to contain discrete items: No.

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 Recyling / reuse Other / various None	Off-site	~100.0

Comment on planned treatments: N/A

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	~0.60

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: -

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Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

Waste Packaging for Disposal: (Not applicable to this waste stream)

Container	Stream volume %	Waste loading m³	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 (loose load)			

Other information: Items that are exempt or SCO1 (exclusive use) under ADR will be shipped loose on a flatbed trailer for treatment.

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

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 has become contaminated through contact with PCM waste stored / processed in the buildings.

Uncertainty: Specfic activities have been based on sample results for waste items or similar waste items or inferred from monitoring data where available, but the majority of the waste volume is still to be characterised. Specific activities by mass have been converted to specific activties by volume, so uncertaities in the volume estimates will also be carried over.

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: A number of characterisation methods have been used including; sampling, hand held monitoring. The majority of measurement data used has been collected in the past four years.

Other information: Waste is present with a range of specific activities within the LLW Metals category.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	~1.05E-11	C C 2			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	~1.27E-10	C C 2			Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55	~2.09E-13	C C 2			Pb 210	~6.58E-11	C C 2		
Co 60	~5.92E-14	C C 2			Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	~5.96E-11	C C 2		
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	~6.92E-11	C C 2		
Kr 85					Ra 228	~9.41E-11	C C 2		
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228	~1.90E-10	C C 2		
Nb 91					Th 229	~1.34E-13	C C 2		
Nb 92					Th 230	~6.2E-11	C C 2		
Nb 93m					Th 232	~2.29E-10	C C 2		
Nb 94					Th 234	~6.12E-12	C C 2		
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99	~3.98E-12	C C 2			U 232	~1.20E-12	C C 2		
Ru 106					U 233				
Pd 107					U 234	~1.05E-08	B B 2		
Ag 108m					U 235	~4.43E-10	B B 2		
Ag 110m					U 236	~8.59E-12	B B 2		
Cd 109					U 238	~1.20E-09	C C 2		
Cd 113m					Np 237	~3.59E-12	C C 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	~7.24E-09	B B 2		
Sn 123					Pu 239	~3.33E-07	B B 2		
Sn 126					Pu 240	~2.50E-08	B B 2		
Sb 125					Pu 241	~2.32E-07	B B 2		
Sb 126					Pu 242	~4.64E-10	B B 2		
Te 125m					Am 241	~9.88E-08	B B 2		
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242	~1.52E-12	C C 2		
Cs 135					Cm 243				
Cs 137	~2.22E-09	C C 2			Cm 244	~3.29E-13	C C 2		
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				
Eu 152					Other b/g				
Eu 154					**Total a**	**~4.77E-07**	**C C 2**	**0**	
Eu 155					**Total b/g**	**~2.35E-07**	**C C 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