WASTE STREAM 3M14 Gas Circulator Maintenance LLW

SITE	Heysham 2
SITE OWNER	EDFE NGL
WASTE CUSTODIAN	EDFE NGL
WASTE TYPE	LLW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	5.5 m³
Future arisings -	1.4.2022 - 31.3.2029.....	70.0 m³
	1.4.2029 - 31.3.2031.....	20.0 m³
Total future arisings:		90.0 m³
Total waste volume:		95.5 m³

Comment on volumes: Waste volumes will be variable depending on station operating conditions.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.25	Arisings (upper)	x 1.75
	Stock (lower):	x 0.75	Arisings (lower)	x 0.25

WASTE SOURCE Waste stream covers general solid LLW arisings from the Gas Circulators and Gas Circulator Maintenance Workshop.

PHYSICAL CHARACTERISTICS

General description:	Generally wastes from these areas are mixed materials such as metal items, spent filters, redundant plant items, cabels, soft waste, heavy duty plastic and rubber waste. Other materials such as asbestos, dried paint, fibre glass, glass, grease,lagging, oily pads, and plaster may be generated. Any free liquids will be removed as far as practical during the sorting process and disposed via an appropriate effluent route. The site does undertake volume reduction by low force compaction, but this is principally to incinerable waste.
Physical components (%wt):	Metal (14%), Biodegradable- non putrescibles (9%), plastics (halogenated) (2%), plastics (non-halogenated) (4%), rubber (1%), others (70%)
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m³):	0.56
Comment on density:	Density based on raw volume and weight at arising as provided in WCH.

CHEMICAL COMPOSITION

General description and components (%wt):	Metal (15%wt), concrete (1%wt), Soft organics (50%wt), plastics/rubber (30%wt), wood (4%wt).
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: Tritiated water C-14: Contamination by activated graphiteand metallic particulate Cl-36: To be determined Se-79: Not expected to be significant Tc-99: Not expected to be significant I-129: To be determined Ra: Not expected to be significant Th: To be determined U: To be determined Np: Not expected to be significant Pu: To be determined
Metals and alloys (%wt):	Metal thicknesses will be variable.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	~2.0	Metallic plant items/ equipment	
Other ferrous metals	~10.0	Mild steel-Metallic plant items/ equipment and drums	
Iron	NE		
Aluminium	~1.0	Metallic plant items/ equipment	
Beryllium	NE		
Cobalt	NE		
Copper	~1.0	e.g. cables and piping	
Lead	NE		
Magnox/Magnesium	NE		
Nickel	NE		
Titanium	NE		
Uranium	NE		
Zinc	NE		
Zircaloy/Zirconium	NE		
Other metals	NE		

Organics (%wt): ~80.54% organic materials, mainly soft waste (e.eg wipes and clothes)

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	~~67.0		
Paper, cotton	~~67.0	Biodegradable non-putrescible	
Wood	~0		
Halogenated plastics	~2.0		
Total non-halogenated plastics	~4.0		
Condensation polymers	NE		
Others	NE		
Organic ion exchange materials	0		
Total rubber	~1.0		
Halogenated rubber	NE		
Non-halogenated rubber	NE		
Hydrocarbons	NE		
Oil or grease	NE		
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics	NE		

Other materials (%wt): ~5.46% other materials

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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.....	~~5.0		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	1.0	highly friable plus man made mineral fibres	
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Inorganic anions likely to be below 1% but not estimated.

	(%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: Some of the materials in the waste would burn under appropriate conditions and plastics and rubber could generate toxic fumes. The waste might include some asbestos occasionally.

	(%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	

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Non-putrescible wastes.....	9.0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	0	Not expected
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	NE	
Benzene.....	NE	
Chlorinated solvents.....	NE	
Formaldehyde.....	NE	
Organometallics.....	NE	
Phenol.....	NE	
Styrene.....	NE	
Tri-butyl phosphate.....	NE	
Other organophosphates.....	NE	
Vinyl chloride.....	NE	
Arsenic.....	NE	
Barium.....	NE	
Boron.....	NE	
Boron (in Boral).....	NE	
Boron (non-Boral).....	NE	
Cadmium.....	NE	
Caesium.....	NE	
Selenium.....	NE	
Chromium.....	NE	
Molybdenum.....	NE	
Thallium.....	NE	
Tin.....	NE	
Vanadium.....	NE	
Mercury compounds.....	0	
Others.....	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	NE	
EEE Type 2.....	NE	
EEE Type 3.....	NE	
EEE Type 4.....	NE	
EEE Type 5.....	NE	

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Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids…….	NE	
Other organic complexants.....	~0.02	Decon 90
Total complexing agents.....	0.02	

Potential for the waste to contain discrete items: Yes.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	Off-site	~10.0
Incineration	Off-site	~65.0
Solidification		
Decontamination		
Metal treatment	Off-site	15.0
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None	Off-site	~10.0

Comment on planned treatments: In line with the waste hierarchy, wastes will be treated preferentially by incineration, metal decontamination/melting, supercompaction, optimal packaging in HHISOs or immobilisation by encapsulation where necessary, prior to ultimate disposal at the LLW Repository. These treatments will be carried out off-site under contract with companies such as LLWR Ltd, Cyclife, Tradebe Inutec.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~20.0	
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	~65.0	
Expected to be consigned to a Metal Treatment Facility	~15.0	
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
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):

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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: -

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 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	~20.0	~30.4	< 1

Other information: Waste loading is representative of the raw waste following further planned treatments. Supercompaction assumed to reduce volume to 20% of original. Solidification assumed to increase volume to 300% of original. No treatment results in the same volume.

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

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: No. Efforts are made to dispose of waste during year of arising, but this is dependent on rate of arising throughout the year. This is also dependent on consignment of waste to third parties.

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: Contamination will be main source of activity with possibly some activation of certain

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	reactor or fuel route components.
Uncertainty:	Activity estimates have been made from drum dose rate measurements and some limited fingerprint data.
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 beta/gamma emitting radionuclides plus 'other beta/gamma' not listed on the datasheet.
Measurement of radioactivities:	From the radiochemical analysis fingerprints were derived per bulk sample, with activation products ratioed to Co-60 and fission products and actinides are ratioed to Cs-137.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	5.02E-05	C C 2	5.02E-05	C C 2	Gd 153				
Be 10					Ho 163				
C 14	4.72E-06	C C 2	4.72E-06	C C 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	6.52E-07	C C 2	6.52E-07	C C 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	5.68E-06	C C 2	5.68E-06	C C 2	Pb 205				
Fe 55	1.85E-04	C C 2	1.85E-04	C C 2	Pb 210				
Co 60	2.46E-05	C C 2	2.46E-05	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	1.53E-05	C C 2	1.53E-05	C C 2	Po 210				
Zn 65	3.34E-07	C C 2	3.34E-07	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.13E-07	C C 2	1.13E-07	C C 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	6.6E-09	C C 2	6.6E-09	C C 2	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106	1.81E-07	C C 2	1.81E-07	C C 2	U 233				
Pd 107					U 234				
Ag 108m	7.6E-09	C C 2	7.6E-09	C C 2	U 235				
Ag 110m	7.18E-08	C C 2	7.18E-08	C C 2	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.2E-09	C C 2	1.2E-09	C C 2
Sn 123					Pu 239	8E-10	C C 2	8E-10	C C 2
Sn 126					Pu 240	2E-09	C C 2	2E-09	C C 2
Sb 125	1.04E-07	C C 2	1.04E-07	C C 2	Pu 241	9.8E-08	C C 2	9.8E-08	C C 2
Sb 126					Pu 242				
Te 125m					Am 241	3.4E-09	C C 2	3.4E-09	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	1.28E-07	C C 2	1.28E-07	C C 2	Cm 242	7.2E-09	C C 2	7.2E-09	C C 2
Cs 135					Cm 243				
Cs 137	3.81E-07	C C 2	3.81E-07	C C 2	Cm 244	2.6E-09	C C 2	2.6E-09	C C 2
Ba 133	3.82E-08	C C 2	3.82E-08	C C 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	6.14E-08	C C 2	6.14E-08	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147	8.12E-08	C C 2	8.12E-08	C C 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152	1.74E-08	C C 2	1.74E-08	C C 2	Other b/g	1.48E-07	C C 2	1.48E-07	C C 2
Eu 154	1.82E-08	C C 2	1.82E-08	C C 2	**Total a**	**1.74E-08**	**C C 2**	**1.74E-08**	**C C 2**
Eu 155	9.4E-09	C C 2	9.4E-09	C C 2	**Total b/g**	**2.88E-04**	**C C 2**	**2.88E-04**	**C C 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