WASTE STREAM 7V30 Area Z Operational Supercompactable Drummed LLW

SITE	Dounreay (Vulcan)
SITE OWNER	Ministry of Defence
WASTE CUSTODIAN	Ministry of Defence
WASTE TYPE	LLW; SPD1
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	~26.8 m³
Future arisings -	1.4.2022 - 31.3.2025.....	84.0 m³
Total future arisings:		84.0 m³
Total waste volume:		110.8 m³

Comment on volumes: Rates of arising will depend on operations carried out. Operational wastes will arise until the site closure date of 2025. Estimates are based on historical information and best estimates.

Uncertainty factors on volumes:

Stock (upper):	x 1.1	Arisings (upper)	x 1.4
Stock (lower):	x 0.9	Arisings (lower)	x 0.6

WASTE SOURCE Waste predominantly arising from decontamination operations and maintenance work.

PHYSICAL CHARACTERISTICS

General description: The waste comprises general and soft trash including paper swabs, redundant PPE, sheet polythene etc. and metallic items such as filter housings, small tools & pipework. The waste has not undergone any physical/chemical processes or changes.

Physical components (%vol): Estimated material breakdown: Polythene (42.35%), paper (37.87%) rubber (5.21%), plastic (4.90%), stainless steel (4.51%), other ferrous metals (3.03%), cotton 0.98%), glass (0.89%), adsorbent (0.17%), wood (0.06%), copper (0.03%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.6

Comment on density: Waste densities are estimated from the percentage of materials present in historical waste consignments.

CHEMICAL COMPOSITION

General description and components (%wt): The waste comprises general and soft trash including paper swabs, redundant PPE, sheet polythene etc. and metallic items such as filter housings, small tools & pipework. Percentage weight to be determined.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Present in the form of radiologically contaminated materials.
C-14: Present in the form of radiologically contaminated materials.
Cl-36: Not known to be present.
Se-79: Not known to be present.
Tc-99: Not known to be present.
I-129: Not known to be present.
Ra: Not known to be present.
Th: Not known to be present.
U: Present in the form of radiologically contaminated materials.
Np: Present in the form of radiologically contaminated materials.
Pu: Present in the form of radiologically contaminated materials.

Metals and alloys (%wt): Metals will be supercompacted and include the mild steel drums.

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

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

Organics (%wt): The cellulose content of the waste comprises paper, cotton cloth and wood. Halogenated plastic is present as PVC, non-halogenated plastic as polythene. Halogenated rubber may be present as neoprene.

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

Other materials (%wt): Trace amounts of asbestos may be present.

	(%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		

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Glass/Ceramics	NE
Graphite	0
Desiccants/Catalysts	0
Asbestos	NE
Non/low friable	
Moderately friable	
Highly friable	
Free aqueous liquids	0
Free non-aqueous liquids	0
Powder/Ash	0

Inorganic anions (%wt): To be determined.

	(%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: Trace quantities of asbestos may be present.

	(%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	0	
Pyrophoric materials	0	
Generating toxic gases	0	
Reacting with water	0	
Higher activity particles	0	
Soluble solids as bulk chemical compounds	0	

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Hazardous substances / non hazardous pollutants: Trace amounts of sbestos may be present in the waste. The asbestos content has not been quantified.

	(%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	TR	
Caesium	NE	
Selenium	NE	
Chromium	NE	
Molybdenum	NE	
Thallium	NE	
Tin	NE	
Vanadium	NE	
Mercury compounds	NE	
Others	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1	NE	
EEE Type 2	NE	
EEE Type 3	NE	
EEE Type 4	0	
EEE Type 5	0	

Complexing agents (%wt): Not yet determined

	(%wt)	Type(s) and comment
EDTA	0	
DPTA	0	
NTA	0	
Polycarboxylic acids	0	
Other organic complexants	NE	Trace amounts of decontamination agents may be present.
Total complexing agents	NE	

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Potential for the waste to contain discrete items: No. Waste will be supercompacted into pucks

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: -

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	NE

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: Not yet determined

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

Waste Packaging for Disposal:

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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	100.0	~15.6	8

Other information: Waste in 200 litre drums will be supercompacted on the Dounreay site before loading in a HHISO container for grouting & disposal to the Dounreay LLW Facility.

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: The activity has arisen from activation and fission products and contamination of reactor components

Uncertainty: This is based on the best current available information.

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: Activities for future arising are based on the average activities calculated from historical waste consignments.

Other information: -

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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	<1.93E-05	D 3	<2.16E-05	D 3	Gd 153				
Be 10					Ho 163				
C 14	<1.84E-04	D 3	<1.84E-04	D 3	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	<1.41E-06	D 3	<5.04E-06	D 3	Pb 205				
Fe 55	<2.07E-03	D 3	<3.32E-03	D 3	Pb 210				
Co 60	<2.07E-03	D 3	<2.67E-03	D 3	Bi 208				
Ni 59					Bi 210m				
Ni 63	<4.62E-04	D 3	<4.68E-04	D 3	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	<1.33E-04	D 3	<1.4E-04	D 3	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					U 235				
Ag 110m	<1.63E-06	D 3	<7.2E-06	D 3	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	<5.67E-06	D 3	<5.76E-06	D 3
Sn 123					Pu 239	<2.4E-08	D 3	<2.4E-08	D 3
Sn 126					Pu 240				
Sb 125	<1.98E-05	D 3	<3.17E-05	D 3	Pu 241	<1.51E-05	D 3	<1.66E-05	D 3
Sb 126					Pu 242				
Te 125m					Am 241	<1.46E-07	D 3	<9.6E-08	D 3
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	<8.58E-06	D 3	<1.58E-05	D 3	Cm 242				
Cs 135					Cm 243				
Cs 137	<1.63E-04	D 3	<1.71E-04	D 3	Cm 244	<1.11E-07	D 3	<1.2E-07	D 3
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	<7.76E-06	D 3	<3.02E-05	D 3	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	<5.25E-05	D 3	<6.15E-05	D 3	**Total a**	**<5.95E-06**	**D 3**	**<6E-06**	**D 3**
Eu 155	<3.06E-05	D 3	<4.03E-05	D 3	**Total b/g**	**<5.24E-03**	**D 3**	**<7.18E-03**	**D 3**

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