

WASTE STREAM	7D31	Devonport Filters (for Disposal to NWS)
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SITE HMNB Devonport

SITE OWNER Ministry of Defence (MOD)

WASTE CUSTODIAN Babcock International Group

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	3.4		
Future arisings:	1.4.2025 - 31.3.2032	~ 23.8		
Total future arisings:		23.8		
Total waste volume:		27.2		

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: This arisings rate is expected to remain steady for planned work.

Additional information on quantities: Future volumes are subject to variability due to changes in demand of platforms therefore uncertainty is large.

Uncertainty factors on volumes:

Stock (upper):	x 1.20	Arisings (upper):	x 2.00
Stock (lower):	x 0.80	Arisings (lower):	x 0.50

WASTE SOURCE The waste originates from radioactive effluent treatment. The filters are used to remove radioactive particulates from the liquid during processing. Liquid arises from the refit, repair and maintenance of nuclear powered submarines.

PHYSICAL CHARACTERISTICS

General description: Majority of the filters currently used on site are polypropylene cartridge filters of varying length and pore sizes.

Changes since waste generated: Filters will be wet when generated & will be stored in the waste drum.

Bulk density (t/m³): = 0.30

Comment on density: The density is variable, as it depends on the type of filter employed and the number of filters per drum. The stated value is based on an unconditioned (i.e. non super-compacted) 50kg/drum payload i.e not including drum mass.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (52%), Biodegradable - non-putrescibles (32%), Plastics (non-halogenated) (8%), Rubber (8%)

Chemical state: Neutral

Sheet metal proportion / thickness: Metal frames from a single type of filter.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	10.0	-	< 0.1
Other ferrous metals.....	42.0	Most of the metal content is mild steel (due to the drum).	< 0.1
Iron.....	0	-	
Aluminium.....	0	-	
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):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	32.0	Proportion of filter construction material.	
Paper, cotton.....	32.0	-	
Wood.....	0	-	
Halogenated plastics.....	0	-	
Total non-halogenated plastics.....	8.0	Proportion of filter construction material.	
Condensation polymers.....	0	-	
Others.....	8.0	-	
Organic ion exchange materials.....	0	-	
Total rubber.....	8.0	Proportion of filter construction material.	
Halogenated rubber.....	0	-	
Non-halogenated rubber.....	8.0	-	
Hydrocarbons.....		-	
Oil or grease.....		-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....		-	
Asphalt/Tarmac (no coal tar).....		-	
Bitumen.....		-	
Others.....		-	
Other organics.....	0	-	

Other materials (%wt):

	(%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.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	0	-	
Free non-aqueous liquids.....	0	-	
Powder/Ash.....	0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%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:

	(%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.....	32.0	-
Putrescible wastes.....	0	-
Non-putrescible wastes.....	32.0	Cotton based cloth and plastics in the form of polypropylene.
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:

	(%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).....	0	-
Boron (non-Boral).....	0	-
Cadmium.....	0	-
Caesium.....	0	-
Selenium.....	0	-
Chromium.....	0	-
Molybdenum.....	0	-
Thallium.....	0	-
Tin.....	0	-
Vanadium.....	0	-
Mercury compounds.....	0	-
Others.....	0	-

Complexing agents (%wt):

No		
	(%wt)	Type(s) and comment
EDTA.....	0	-
DPTA.....	0	-
NTA.....	0	-
Polycarboxylic acids.....	0	-
Other organic complexants.....	0	There are no complexing agents present.
Total complexing agents.....	0	-

Physical components:

	Number	Type(s) and comment
Sources.....	= 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	-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction		
Decay storage		
Low force compaction		
Supercompaction (HFC)	Off-site	~ 25.0
Incineration	Off-site	~ 75.0
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

Stream volumes estimated from previous inventory of filters. Due to the nature of the filters some may be incinerated, dismantling may occur in rare occasions. The percentage estimated to be incinerated was based on dose rate in current stocks assuming future higher dose rates would be approx 25% to NWS . Evidently the supercompacted drum will be grouted.

Conditioning method:

Wastes are not conditioned on-site, and are not stored long-term.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

None

Further information on the conditioning matrix:

Supercompaction for waste that is not suitable for incineration.

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	25.0	39.4	13.0	1	-

Range in container waste loading: Variability is very much dependant on the ability of the treatment site to divert the waste to other streams such as incineration. In this case the use of a disposal container would not be necessary. Diversion is dependant on treatment facility current CoA which can be updated during this DCT reporting period.

Other information on packaging and conditioning:

The raw waste is consigned to an external contractor for Incineration or supercompaction. The waste is then consigned to NWS depot in half height ISO freight containers. A typical conditioning factor for drums is 0.33 relative to the original displaced volume of the 200 litre drum. Waste loading (m3) determined using Raw waste volume (m3)/conditioned waste volume (m3) x TC01/TC02 container expected fill volume payload of 13 m3.

Conditioned density (t/m³):

~ 0.76

Conditioned density comment:

Based on supercompaction of a 200L drum into a puck geometry

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository	~ 25.0	~ 0.25	
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	~ 75.0	~ 0.25	
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

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

Opportunities for alternative disposal routing: Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source:

The radioactivity arises from particulate activation products, mainly Co-60, Fe-55, C-14, Ni-63, Mn-54 and Sb-125. The radioactivity is removed from liquids during treatment by filtration. The radioactivity is fixed to the filter medium.

Uncertainty:

Each drum used for storage of the 7D31 waste filters at Devonport Royal Dockyard is individually characterised by representative sampling.

Measurement of radioactivities:

Each drum used for storage of the 7D31 waste filters at Devonport Royal Dockyard is individually characterised by representative sampling. Specific activity figures have been derived from current stock data and represent a reasonably consistent waste origin, therefore future arisings, which are expected to remain consistent, can only be estimated based on the same SA estimated figure i.e. the values are specific activity not total activity (which would vary depending on expected volume).

Chemical form
of radionuclides:

H-3: Very small quantities of HTO on filter medium.

C-14: Average ~5-10% of the total waste stream. Filters are sampled and analysed prior to disposal so the C-14 activity will vary.

Cl-36: -

Se-79: -

Tc-99: -

I-129: -

Ra: -

Th: -

U: -

Np: -

Pu: -

WASTE STREAM		7D31		Devonport Filters (for Disposal to NWS)					
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	~ 3.54E-05	B B 2	~ 3.54E-05	C C 2	Gd 153	~ 1.63E-08	B B 2	~ 1.63E-08	C C 2
Be 10					Ho 163				
C 14	~ 3.05E-05	B B 2	~ 3.05E-05	C C 2	Ho 166m				
Na 22	~ 7.32E-11	B B 2	~ 7.32E-11	C C 2	Tm 170				
Al 26					Tm 171				
Cl 36	~ 2.21E-10	B B 2	~ 2.21E-10	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	~ 1.69E-07	B B 2	~ 1.69E-07	C C 2	Pb 205				
Fe 55	~ 6.90E-06	B B 2	~ 6.90E-06	C C 2	Pb 210				
Co 60	~ 1.16E-05	B B 2	~ 1.16E-05	C C 2	Bi 208				
Ni 59	~ 1.19E-08	B B 2	~ 1.19E-08	C C 2	Bi 210m				
Ni 63	~ 5.41E-07	B B 2	~ 5.41E-07	C C 2	Po 210				
Zn 65	~ 5.58E-07	B B 2	~ 5.58E-07	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	~ 2.08E-10	B B 2	~ 2.08E-10	C C 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93	~ 1.49E-10	B B 2	~ 1.49E-10	C C 2	Pa 231				
Tc 97					Pa 233				
Tc 99	~ 1.04E-11	B B 2	~ 1.04E-11	C C 2	U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m	~ 3.03E-08	B B 2	~ 2.00E-08	C C 2	U 235				
Ag 110m	~ 2.53E-07	B B 2	~ 2.53E-07	C C 2	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125	~ 6.99E-07	B B 2	~ 6.99E-07	C C 2	Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129	~ 3.61E-10	B B 2	~ 3.61E-10	C C 2	Am 243				
Cs 134	~ 4.31E-09	B B 2	~ 4.31E-09	C C 2	Cm 242				
Cs 135					Cm 243				
Cs 137	~ 1.54E-08	B B 2	~ 1.54E-08	C C 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					Unsp a				
Eu 152	~ 1.22E-08	B B 2	~ 1.22E-08	C C 2	Unsp b/g	~ 3.18E-07	B B 2	~ 3.18E-07	C C 2
Eu 154	~ 6.18E-08	B B 2	~ 6.18E-08	C C 2	Total a	1.63E-08	*	1.63E-08	*
Eu 155	~ 9.12E-09	B B 2	~ 9.12E-09	C C 2	Total b/g	8.71E-05	*	8.71E-05	*

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 the 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
* Total calculated from the 114 declared radionuclides