WASTE STREAM	7D22	Devonport RA Soft Trash (for Disposal to NWS)

SITE HMNB Devonport

SITE OWNER Ministry of Defence (MOD)

WASTE CUSTODIAN Babcock International Group

WASTE TYPE LLW

WASTE VOLUMES

		Reported (m^3)
Stocks:	At 1.4.2025	= 10.2
Future arisings:	1.4.2025 - 31.3.2030	~ 153.8
	1.4.2028 - 31.3.2031	153.8
	1.4.2031 - 31.3.2033	153.8
Total future arisings:		**461.4**
Total waste volume:		**471.6**

OR

Conditioned (m^3)	Packaged (m^3)

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

Comment on arising rates: Future arisings have been calculated from the DRDL Future Waste Strategy Document. Arisings based on current and programmed/predicted generation rates, extrapolated over the next 5 years.

Additional information on quantities: Data derived by extrapolation of historical data and a constant generation rate.

Uncertainty factors on volumes:

Stock (upper):	x 1.30	Arisings (upper):	x 2.00
Stock (lower):	x 0.70	Arisings (lower):	x 0.50

WASTE SOURCE The waste is produced as a consequence of general support to the Naval Nuclear Propulsion Programme including refit, maintenance and refuelling.

PHYSICAL CHARACTERISTICS

General description: The waste consists of soft materials such as contaminated polythene, plastic, protective clothing (cotton and nylon), paper, acetate swabs, filter papers, rubber gloves and hoses, wood etc. Plastic and other materials are used in reactor compartments and, as such, are non-halogenated. The waste contains no large items that cannot fit inside normal 200 litre drums.

Changes since waste generated: Waste will undergo minimal change from the point of generation.

Bulk density (t/m^3): ~ 0.36

Comment on density: Raw density can vary from ~ 0.2 t/m^3 up to ~ 0.5 t/m^3.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (40%), concrete/rubble (1.0%), biodegradables (21%), plastic/rubber (34%), wood (4%). Metal from the drum as it is the primary containment.

Chemical state: Neutral

Sheet metal proportion / thickness: The only major source of metal within this waste stream is the mild steel drum that is used as the waste primary containment.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel……	< 0.10	Very small quantities of metal swarf	
Other ferrous metals……	< 39.9	Mostly contributed by drum composition - which is mild steel	
Iron……		-	
Aluminium……	< 0.01	-	
Beryllium……	= 0	-	
Cobalt……	< 0.01	-	
Copper……	< 0.01	-	
Lead……	= 0	-	
Magnox/Magnesium……		-	
Nickel……	< 0.01	-	
Titanium……		-	
Uranium……	= 0	-	
Zinc……	= 0	-	
Zircaloy/Zirconium……	= 0	-	
Other metals……	< 0.01	Chromium and Molybdenum in metal as an alloy in form of mild steel	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	< 25.0	-	
Paper, cotton	< 21.0	-	
Wood	< 4.0	-	
Halogenated plastics		-	
Total non-halogenated plastics	< 24.0	Total non-halogenated plastics in the form of polythene	
Condensation polymers		-	
Others	< 24.0	-	
Organic ion exchange materials		-	
Total rubber	< 9.0	Rubber in the form of gloves, bungs and hoses	
Halogenated rubber		-	
Non-halogenated rubber	< 9.0	-	
Hydrocarbons		-	
Oil or grease		-	
Fuel		-	
Asphalt/Tarmac (cont.coal tar)		-	
Asphalt/Tarmac (no coal tar)		-	
Bitumen		-	
Others		-	
Other organics		-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	< 0.10	-	
Inorganic sludges and flocs	< 0.10	-	
Soil	= 0	-	
Brick/Stone/Rubble	< 0.80	-	
Cementitious material	< 1.0	-	
Sand	= 0	-	
Glass/Ceramics		-	
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	~ 21.0	-
Putrescible wastes	= 0	-
Non-putrescible wastes	~ 21.0	Mainly paper/cotton.
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		-
Benzene	= 0	-
Chlorinated solvents		-
Formaldehyde		-
Organometallics		-
Phenol	= 0	-
Styrene		-
Tri-butyl phosphate	= 0	-
Other organophosphates		-
Vinyl chloride	= 0	-
Arsenic	= 0	-
Barium		-
Boron	= 0	-
Boron (in Boral)		-
Boron (non-Boral)		-
Cadmium	= 0	-
Caesium		-
Selenium	= 0	-
Chromium	~ 2.3	Chromium in metal as an alloy in form of mild steel
Molybdenum	= 0	-
Thallium		-
Tin	= 0	-
Vanadium	= 0	-
Mercury compounds		-
Others	= 0	-

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA		-
DPTA		-
NTA		-
Polycarboxylic acids		-
Other organic complexants		Organic complexing agents sodium EDTA and citric acid are used in certain decontamination processes. These should not be present in the waste but are included for completeness. If present, these compounds will represent << 0.1% by weight of the total waste stream.
Total complexing agents	<< 0.10	-

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	~ 16.0
Incineration	Off-site	~ 84.0
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 the current planned disposal campaigns/consignments.

Conditioning method: Supercompaction of waste in steel drums. Ave conditioning factor of supercompacted drum to puck is ~ 0.25

Conditioning plants:

Plant Name	Location

Likely conditioning matrix: Unknown

Further information on the conditioning matrix: High-force compaction - drums of soft trash are subjected to high-force compaction. A typical conditioning factor for 7D22 drums is 0.25 relative to the
original displaced volume of the 200 litre drum. then grouted into final disposal container.

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	16.0	52.0	13.0	2	-

Range in container waste loading: Supercompacted waste will be presented as crushed drum "pucks'. These are loaded into a disposal container as specified in table above. Once full, container is grouted and sent for disposal.

Other information on packaging and conditioning: 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/m^3): < 0.10
Conditioned density comment: A typical conditioning factor for 7D22 drums is 0.25 relative to the original displaced volume of the 200 litre drum. Conditioned density of the full and grouted disposal container is unknown.

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	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	~ 16.0	~ 0.50	
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	~ 84.0	~ 0.50	
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: Waste becomes contaminated with (primarily) beta/gamma activation products from submarine primary plant contact. Major nuclides are Fe-55 (34%), Co-60 (41%), C-14 (5 %), Mn-54 (1.3%) and Ni-63 (1.6%).

Uncertainty: A drum monitor is used to assess the gamma activity of the waste using a segmented gamma spectroscopy system. The system accuracy is assessed to be ±20% of gamma activity. Activity of other beta/gamma nuclides associated with the waste is assessed using a generic fingerprint relative to the measured Co-60 activity. Accuracy of the total activity measurement and assessment is considered to be within 50%.

Measurement of radioactivities:	Co-60 is measured directly by the drum monitor system using segmented gamma spectroscopy. Other gamma emitters will also be detected if present within the waste. The fingerprint has been derived by the use of best available sampling information and accepted international practice to determine correlations and relationships. All other nuclides are determined relative to Co-60 activity. 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:	Potential to be present as tritiated water (0.02% total activity)
C-14:	Potentially present in waste in several forms, carbonate (5.9% total activity)
Cl-36:	-
Se-79:	-
Tc-99:	-
I-129:	-
Ra:	-
Th:	-
U:	-
Np:	-
Pu:	-

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	~ 1.13E-06	B B 2	~ 1.13E-06	C C 2	Gd 153				
Be 10					Ho 163				
C 14	~ 3.88E-07	B B 2	~ 3.88E-07	C C 2	Ho 166m				
Na 22	~ 1.34E-11	B B 2	~ 1.34E-11	C C 2	Tm 170				
Al 26					Tm 171				
Cl 36	~ 1.71E-11	B B 2	~ 1.71E-11	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	~ 3.69E-08	B B 2	~ 3.69E-08	C C 2	Pb 205				
Fe 55	~ 1.68E-06	B B 2	~ 1.68E-06	C C 2	Pb 210				
Co 60	~ 1.92E-06	B B 2	~ 1.92E-06	C C 2	Bi 208				
Ni 59	~ 2.75E-08	B B 2	~ 2.75E-08	C C 2	Bi 210m				
Ni 63	~ 4.97E-08	B B 2	~ 4.97E-08	C C 2	Po 210				
Zn 65	~ 4.38E-08	B B 2	~ 4.38E-08	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	~ 1.24E-11	B B 2	~ 1.24E-11	B B 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	~ 1.93E-11	B B 2	~ 1.93E-11	C C 2	Pa 231				
Tc 97					Pa 233				
Tc 99	~ 8.30E-10	B B 2	~ 8.30E-10	C C 2	U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m	~ 1.37E-10	B B 2	~ 1.37E-10	C C 2	U 235				
Ag 110m	~ 1.04E-08	B B 2	~ 1.04E-08	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	~ 2.31E-08	B B 2	~ 2.31E-08	C C 2	Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241	~ 1.39E-11	B B 2	~ 1.39E-11	C C 2
Te 127m					Am 242m				
I 129	~ 3.97E-10	B B 2	~ 3.97E-10	C C 2	Am 243				
Cs 134	~ 8.20E-10	B B 2	~ 8.20E-10	C C 2	Cm 242				
Cs 135					Cm 243				
Cs 137	~ 1.93E-09	B B 2	~ 1.93E-09	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	~ 1.07E-09	B B 2	~ 1.07E-09	C C 2	Unsp b/g	~ 4.86E-09	B B 2	~ 4.86E-09	C C 2
Eu 154	~ 1.79E-08	B B 2	~ 1.79E-08	C C 2	**Total a**	**1.39E-11**	*	**1.39E-11**	*
Eu 155	~ 3.57E-10	B B 2	~ 3.57E-10	C C 2	**Total b/g**	**5.35E-06**	*	**5.35E-06**	*

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