WASTE STREAM 7E23 Metallic Waste

SITE	Rosyth Royal Dockyard
SITE OWNER	Babcock International Group
WASTE CUSTODIAN	Babcock International Group
WASTE TYPE	LLW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	~3.0 m³
Future arisings -	1.4.2022 - 31.3.2023.....	13.9 m³
	1.4.2023 - 31.3.2024.....	44.0 m³
	1.4.2024 - 31.3.2025.....	1.0 m³
	1.4.2025 - 31.3.2035.....	138.0 m³
Total future arisings:		196.9 m³
Total waste volume:		199.9 m³

Comment on volumes: Estimate of 1m3 per year of miscellaneous metal waste generated based off current stock. Thirteen resin catch tanks will be generated as waste, expected by the end of 2023, following transfer activities into new containers. Following the removal of all resins for treatment and disposal there will be a total of 32 waste resin holding containers to be disposed of, date not yet confirmed. It is also assumed at this point that the waste resin holding containers will be disposed of by the waste contractor dealing with resins and so may not actually be generated as waste on this site - data has been included for them at this point though. Visual estimate for current stocks and assumptions made about rate of future arisings based on what seen so far, however, there is expected to be variation depending upon timing of particular operations. Volume calculated from dimensions of containers. Assumptions have been made that for certain containers only the inner container will be radioactive waste (as expected due to design) but not confirmed in practice. As previously stated, the thirty-two waste resin holding containers may not actually be included here if disposal taken on by the waste contractor dealing with the resins.

Uncertainty factors on volumes:				
	Stock (upper):	x 2.0	Arisings (upper)	x 2.0
	Stock (lower):	x 0.2	Arisings (lower)	x 0.2

WASTE SOURCE Tools, plant and equipment used in support of submarine dismantling operations, or those activities in other facilities supporting it. Containers becoming waste to be disposed of following the emptying of their contents (resin).

PHYSICAL CHARACTERISTICS

General description:	Miscellaneous metal tools, plant and equipment and empty containers. Some of the containers consist of an outer and inner mild-steel layer with concrete in between for shielding purposes. The rest of the containers consist of the inner liner container of stainless steel.
Physical components (%vol):	Metal, mostly steel (76%) and some concrete (24%).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m³):	~1.4
Comment on density:	Calculated based on estimates.

CHEMICAL COMPOSITION

General description and components (%wt):	Expected to be 5.5% mild steel, 70.5% stainless steel and 24% concrete.
Chemical state:	Neutral
Chemical form of radionuclides:	-
Metals and alloys (%wt):	-

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~70.5		
Other ferrous metals.....	~5.5	Mild steels	
Iron.....			
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....			
Magnox/Magnesium.....			
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....			
Zircaloy/Zirconium.....			
Other metals.....			

Organics (%wt): Not expected

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

Other materials (%wt): Concrete present in some containers - estimated 24% volume of the total.

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..			
Inorganic sludges and flocs.....			
Soil.....			
Brick/Stone/Rubble.....			
Cementitious material.....	~24.0	Concrete in between liners of some of the containers.	
Sand.....			
Glass/Ceramics.....			
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....			
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....			
Free non-aqueous liquids.....			
Powder/Ash.....			

Inorganic anions (%wt): Not expected.

	(%wt)	Type(s) and comment
Fluoride.....		
Chloride.....		
Iodide.....		
Cyanide.....		
Carbonate.....		
Nitrate.....		
Nitrite.....		
Phosphate.....		
Sulphate.....		
Sulphide.....		

Materials of interest for waste acceptance criteria: Not expected.

	(%wt)	Type(s) and comment
Combustible metals.....		
Low flash point liquids.....		
Explosive materials.....		
Phosphorus.....		
Hydrides.....		
Biological etc. materials.....		
Biodegradable materials.....		
Putrescible wastes.....		
Non-putrescible wastes.....		

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Corrosive materials.....

Pyrophoric materials.....

Generating toxic gases.....

Reacting with water.....

Higher activity particles.....

Soluble solids as bulk chemical compounds.....

Hazardous substances / non hazardous pollutants: Not expected.

(%wt) Type(s) and comment

Acrylamide.....

Benzene.....

Chlorinated solvents.....

Formaldehyde.....

Organometallics.....

Phenol.....

Styrene.....

Tri-butyl phosphate.....

Other organophosphates.....

Vinyl chloride.....

Arsenic.....

Barium.....

Boron.....

Boron (in Boral).....

Boron (non-Boral).....

Cadmium.....

Caesium.....

Selenium.....

Chromium.....

Molybdenum.....

Thallium.....

Tin.....

Vanadium.....

Mercury compounds.....

Others.....

Electronic Electrical Equipment (EEE)

EEE Type 1.....

EEE Type 2.....

EEE Type 3.....

EEE Type 4.....

EEE Type 5.....

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Complexing agents (%wt): No

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

Potential for the waste to contain discrete items: Not yet determined.

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		100.0

Comment on planned treatments: Not known at this point. Waste routes not yet confirmed. Waste resin catch tanks have previously been sent to LLWR for disposal but routing for future arisings not yet determined.

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	

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			

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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: (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			

Other information: Waste routes not yet determined. Previous resin catch tanks have been sent to LLWR for disposal. The waste resin holding containers disposal may be captured by the waste contractor for resin treatment and disposal as part of that project.

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 arises mainly from activation products.

Uncertainty: Calculations based on estimates and historical disposal data where available, and sampling and analysis campaigns as appropriate.

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: Measurements of Co-60 from existing stocks from Large Article Monitor with fingerprint applied from recent sampling and analysis campaign. Future arisings for miscellaneous metal (similar to stocks) using estimates derived from current stocks and application of generic fingerprint. Future arisings for resin waste containers based on historical disposal data.

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	9.93E-11	C C 2	1.82E-08	C D 2	Gd 153				
Be 10					Ho 163				
C 14	1.64E-07	C C 2	7.87E-06	C C 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	8.05E-10	C C 2	8.05E-10	C D 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			5.13E-08	C C 2	Pb 205				
Fe 55	3.01E-08	C C 2	1.8E-06	C C 2	Pb 210				
Co 60	2.58E-06	C C 2	1.97E-05	C C 2	Bi 208				
Ni 59	2.36E-08	C C 2	2.36E-08	C D 2	Bi 210m				
Ni 63	2.74E-06	C C 2	4.37E-06	C C 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	5.99E-10	C C 2	5.99E-10	C D 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					Pa 231				
Tc 97					Pa 233				
Tc 99	6.85E-10	C C 2	6.85E-10	C D 2	U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m	1.3E-09	C C 2	1.3E-09	C D 2	U 235	2.98E-13	C C 2	2.98E-13	C D 2
Ag 110m			1.45E-07	C C 2	U 236				
Cd 109					U 238	6.94E-12	C C 2	6.94E-12	C D 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241	1.62E-12	C C 2	1.62E-12	C D 2
Te 127m					Am 242m				
I 129	1.97E-10	C C 2	1.97E-10	C D 2	Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	6.07E-10	C C 2	9.71E-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					Other a				
Eu 152	8.54E-09	C C 2	8.54E-09	C D 2	Other b/g				
Eu 154					**Total a**	**8.86E-12**	**C D 2**	**8.86E-12**	**C D 2**
Eu 155					**Total b/g**	**5.55E-06**	**C D 2**	**3.41E-05**	**C D 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