

<b>WASTE STREAM</b>	<b>7E23</b>	<b>Metallic Waste</b>
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**SITE** Rosyth Royal Dockyard

**SITE OWNER** Ministry of Defence

**WASTE CUSTODIAN** Babcock International Group

**WASTE TYPE** LLW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2020.....	<5.0 m <sup>3</sup>
	1.4.2020 - 31.3.2031.....	<16.0 m <sup>3</sup>
Total future arisings:		21.0 m <sup>3</sup>
Total waste volume:		21.0 m <sup>3</sup>

Comment on volumes: The first stage of initial submarine dismantling will give rise to 7E23 waste in the future. There is accurate information on current stocks. Predicted data based upon timing of future operations associated with radioactive material at Rosyth.

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

**WASTE SOURCE** Scrapped reactor components, tools, plant and equipment.

**PHYSICAL CHARACTERISTICS**

General description: Mainly small metallic items including reactor components, tools and plant equipment. Where practicable metallic LLW will be sent for metals recycling.

Physical components (%wt): The waste is made up of metallic items (100%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 1.1

Comment on density: -

**CHEMICAL COMPOSITION**

General description and components (%wt): The waste is metallic in content (100%)

Chemical state: Neutral

Chemical form of radionuclides: C-14: Trace quantities of carbon-14 are present in metal salts e.g. carbonates.

Metals and alloys (%wt): Waste is predominantly three dimensional items (eg. valves, lengths of pipework). Typical sizes range from max. overall dimension 10cm to lengths of pipe of 5m.

Stainless steel.....	6.0
Other ferrous metals.....	94.0
Iron.....	
Aluminium.....	
Beryllium.....	0
Cobalt.....	
Copper.....	
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	
Titanium.....	
Uranium.....	0
Zinc.....	0
Zircaloy/Zirconium.....	0

**WASTE STREAM****7E23****Metallic Waste**

	Other metals.....	0
Organics (%wt):	-	
	Total cellulose.....	
	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):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	0
	Glass/Ceramics.....	
	Graphite.....	0
	Desiccants/Catalysts.....	
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	
Inorganic anions (%wt):	There are no inorganic anions in this waste.	

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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:

There are no hazardous materials in this waste.

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
Active particles.....	0
Soluble solids as bulk chemical compounds.....	0

Hazardous substances / non hazardous pollutants:

There are no heavy metals in this waste.

Acrylamide.....	
Benzene.....	0
Chlorinated solvents.....	
Formaldehyde.....	
Organometallics.....	
Phenol.....	0
Styrene.....	
Tri-butyl phosphate.....	0
Other organophosphates.....	
Vinyl chloride.....	0
Arsenic.....	0
Barium.....	
Boron.....	0

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Cadmium..... 0  
 Caesium.....  
 Selenium..... 0  
 Chromium..... 0  
 Molybdenum..... 0  
 Thallium.....  
 Tin..... 0  
 Vanadium..... 0  
 Mercury compounds.....  
 Others..... 0  
 Electronic Electrical Equipment (EEE)  
     EEE Type 1.....  
     EEE Type 2.....  
     EEE Type 3.....  
     EEE Type 4.....  
     EEE Type 5.....  
 Complexing agents (%wt): No  
     EDTA.....  
     DPTA.....  
     NTA.....  
     Polycarboxylic acids.....  
     Other organic complexants.....  
     Total complexing agents..... 0

**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 Recycling / reuse Other / various None		100.0

Comment on planned treatments:

-

**WASTE STREAM****7E23****Metallic Waste****Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	5.0
Expected to be consigned to a Landfill Facility	
Expected to be consigned to an On-Site Disposal Facility	95.0
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	

**Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):**

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

**Waste Packaging for Disposal:** (Not applicable to this waste stream)

Container	Stream volume %	Waste loading m <sup>3</sup>	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:

Metallic waste sent for treatment at metal recycler. Depending on what can be re-used some may be consigned to LLWR in the future after treatment. There could be some waste which will go to landfill.

**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: -

Potential for the waste to contain discrete items: -

**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: -

**WASTE STREAM****7E23****Metallic Waste****RADIOACTIVITY**

Source:	The activity arises mainly from activation products.
Uncertainty:	-
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:	Specific activity data is derived in accordance with the current waste stream characterisation document, as provided to Regulators. Cobalt-60 activity is estimated using historic disposal data. Other radionuclides are derived by applying a fingerprint for 7E23.
Other information:	-

**WASTE STREAM**

**7E23**

**Metallic Waste**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3			6.45E-05	C D 2	Gd 153				
Be 10					Ho 163				
C 14			3.30E-05	C C 2	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					Pb 205				
Fe 55			3.41E-07	C B 2	Pb 210				
Co 60			6.74E-04	C B 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			1.28E-04	C B 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					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					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					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			2.82E-07	C B 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					Other b/g				
Eu 154					<b>Total a</b>	<b>0</b>		<b>0</b>	
Eu 155					<b>Total b/g</b>	<b>0</b>		<b>9.00E-04</b>	<b>C B 2</b>

**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