

WASTE STREAM	7X01	RRSL Low Level Wastes
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SITE RRSL Derby
SITE OWNER Ministry of Defence
WASTE CUSTODIAN Rolls-Royce Submarines Ltd

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	~90.0m ³
Future arisings -	1.4.2022 - 31.3.2023.....	~176.0m ³
	1.4.2023 - 31.3.2024.....	~176.0m ³
	1.4.2024 - 31.3.2025.....	~176.0m ³
	1.4.2025 - 31.3.2110.....	~~15488.0m ³
Total future arisings:		16016.0m ³
Total waste volume:		16106.0m ³

Comment on volumes: Waste arisings directly related to production rates and facility refurbishments. Waste arisings related directly to production throughput.

Uncertainty factors on volumes: Stock (upper): x 1.5 Arisings (upper) x 1.5
 Stock (lower): x 0.5 Arisings (lower) x 0.5

WASTE SOURCE Filtered residue and contaminated metals generated from the fuel production cycle. Mixed metals created by general maintenance and the upgrading of tools and equipment. Waste paper, plastics and similare soft compactable waste from general handling.

PHYSICAL CHARACTERISTICS

General description: Various metallic wastes, building materials, sludges, vacuum dust, plastics and the drums containing the waste. Filter residues undergo cementation for disposal. Metals may undergo size reduction.

Physical components (%wt): Metals (~41%), Concrete (~35%), Plastics (non-halogenated) ~6%, Wood ~3%, Filtercake (11%) and rubber, Soil and Plastics (Halogenated) <1%.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1

Comment on density: The density can vary ,however, the densities are typically between 0.4 t/m3 and 1.7 t/m3. These densities have included the package weight and volume.

CHEMICAL COMPOSITION

General description and components (%wt): Concrete-cemented filter residue (~46%), metals (~41%), Others (~13%)

Chemical state: Neutral

Chemical form of radionuclides: U: Nitrates and alloys.

Metals and alloys (%wt): 97% of metal is in sheet form. ~20% of ~1mm thickness as 200 litre drum, ~40% of ~2mm thickness as ~20cm squares. 40% of 6mm thickness as approx 20cm squares.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~1.5		
Other ferrous metals.....	~~38.0	Various grades of steel . Tinamel is the main constituent along with drums used to package the waste.	
Iron.....			
Aluminium.....	<0.80		
Beryllium.....			
Cobalt.....			

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Copper.....	<0.70		
Lead.....	P		
Magnox/Magnesium.....			
Nickel.....			
Titanium.....	P		
Uranium.....	P	Contaminant	
Zinc.....	P		
Zircaloy/Zirconium.....	P	Contaminant	
Other metals.....			
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~5.7		
Paper, cotton.....	~2.9	Mainly paper, cardboard and used PPE.	
Wood.....	~2.8		
Halogenated plastics	<0.50		
Total non-halogenated plastics.....	~6.2		
Condensation polymers.....			
Others.....	~6.2	Mainly Polythene.	
Organic ion exchange materials....			
Total rubber.....	<<0.20		
Halogenated rubber			
Non-halogenated rubber.....			
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar).....	P	A very small quantity is possibly present.	
Bitumen.....			
Others.....			
Other organics.....			
Other materials (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..			
Inorganic sludges and flocs.....			
Soil.....	P		
Brick/Stone/Rubble.....	P		
Cementitious material.....	~46.4	Cemented Filtercake	
Sand.....			
Glass/Ceramics.....			
Graphite.....			

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Desiccants/Catalysts.....
 Asbestos.....
 Non/low friable.....
 Moderately friable.....
 Highly friable.....
 Free aqueous liquids.....
 Free non-aqueous liquids.....
 Powder/Ash.....

Inorganic anions (%wt): -

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

Materials of interest for waste acceptance criteria: -

	(%wt)	Type(s) and comment
Combustible metals.....	P	Soft compactable waste
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	P	Soft compactable waste
Putrescible wastes.....	0	
Non-putrescible wastes.....	P	Soft compactable waste
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: -

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....	0	
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....	0	
Styrene.....		
Tri-butyl phosphate.....	P	
Other organophosphates.....		
Vinyl chloride.....	0	
Arsenic.....	0	
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....	0	
Caesium.....		
Selenium.....	0	
Chromium.....	0	
Molybdenum.....	0	
Thallium.....		
Tin.....	0	
Vanadium.....	0	
Mercury compounds.....		
Others.....	P	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	P	
EEE Type 2.....	P	
EEE Type 3.....	P	
EEE Type 4.....	P	
EEE Type 5.....	P	

Complexing agents (%wt): Not yet determined

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

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Potential for the waste to contain discrete items: Yes.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	~32.0
Supercompaction (HFC)		
Incineration	Off-site	~1.3
Solidification	On-site	~50.0
Decontamination	On-site	P
Metal treatment	On-site	~3.6
Size reduction	On-site	P
Decay storage		
Recycling / reuse		
Other / various		
None	On-site	~13.1

Comment on planned treatments:

Decontamination, metal treatment and size reduction is undertaken when it is BAT to do so.

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	~95.2	NE
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	*1.3	~0.15
Expected to be consigned to a Metal Treatment Facility	~3.5	NE
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

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

Various wastes as detailed in the datasheet worksheet.

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: -

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)

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Container	Stream volume %	Waste loading m ³	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 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: Fuel contamination and operation of a test reactor.

Uncertainty: -

Definition of total alpha and total beta/gamma: The total activity for this wastestream is reported. An activity breakdown by radionuclide is not available.

Measurement of radioactivities: Activity by mass balance, gamma monitoring, fluorensense. Volume by disposal known DIMS.

Other information: -

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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		8		8	Gd 153				
Be 10					Ho 163				
C 14		5		5	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		5		5	Pb 210				
Co 60		5		5	Bi 208				
Ni 59					Bi 210m				
Ni 63		5		5	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		5		5
Ag 108m					U 235		5		5
Ag 110m					U 236				
Cd 109					U 238		5		5
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		5		5
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					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					Total a	~1.5E-06	BB 1	~1E-06	BB 2
Eu 155					Total b/g	~1.5E-08	BB 2	~1E-08	CC 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