

WASTE STREAM**7X01****RRSL Low Level Wastes****SITE**

RRSL Derby

SITE OWNER

Ministry of Defence

WASTE CUSTODIAN

Rolls-Royce Submarines Ltd

WASTE TYPE

LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	~225.0 m ³
Future arisings -	1.4.2020 - 31.3.2021.....	~170.0 m ³
	1.4.2021 - 31.3.2022.....	~170.0 m ³
	1.4.2022 - 31.3.2023.....	~170.0 m ³
	1.4.2023 - 31.3.2110.....	~14790.0 m ³
Total future arisings:		15300.0 m ³
Total waste volume:		15525.0 m ³
Comment on volumes:	Wastes arising from Neptune refurbishment and Chemical Plant life extension work. 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 residues resulting from aqueous liquid waste generated from the fuel production cycle. Steel cladding contaminated during fuel production and inspections. Mixed metals created by general maintenance and the upgrading of tools and equipment. Waste paper, plastics and similiar soft compactable waste from general handling.

PHYSICAL CHARACTERISTICS

General description:	Filter residue cemented into 150 litre drums at ~220kg. Steel, typically 20cm square sections and components. Soft waste packed into 5kg bags. Filter residues undergo cementation for disposal. Metals may undergo size reduction.
Physical components (%wt):	Cemented filter residue is 25% filter cake, 70% concrete, 5% drum. Soft waste averages are 75% soft organics, 20% soft plastics, 5% hard plastics.
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m ³):	1.5
Comment on density:	Approx +/- 25%

CHEMICAL COMPOSITION

General description and components (%wt):	Concrete - cemented filter residue (65%), metals - steel (20%), organics (10%), others (<5%).		
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 approx 20cm squares, 40% of 6mm thickness as approx 20cm squares.		
	Stainless steel.....	1.0	
	Other ferrous metals.....	14.0	Tinamel steel alloy >80%, <20% other mild steel
	Iron.....		
	Aluminium.....		
	Beryllium.....		
	Cobalt.....		
	Copper.....	3.0	
	Lead.....		
	Magnox/Magnesium.....		

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	Nickel.....		
	Titanium.....		
	Uranium.....	1.0	Contaminant
	Zinc.....		
	Zircaloy/Zirconium.....	1.0	Contaminant
	Other metals.....		
Organics (%wt):	-		
	Total cellulose.....	6.0	
	Paper, cotton.....	5.0	Mainly Paper, cardboard and used PPE
	Wood.....	1.0	
	Halogenated plastics		
	Total non-halogenated plastics.....	9.0	
	Condensation polymers.....		
	Others.....	9.0	Mainly Polythene
	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.		
	Inorganic sludges and flocs.....		
	Soil.....		
	Brick/Stone/Rubble.....		
	Cementitious material.....	65.0	Cemented Filtercake
	Sand.....		
	Glass/Ceramics.....		
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....		
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		

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	Powder/Ash.....	
Inorganic anions (%wt):	-	
	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:

	-		
	Combustible metals.....	P	Soft compactable waste ~5%
	Low flash point liquids.....	0	
	Explosive materials.....	0	
	Phosphorus.....	0	
	Hydrides.....	0	
	Biological etc. materials.....	0	
	Biodegradable materials.....	P	Soft compactable waste ~5%
	Putrescible wastes.....	0	
	Non-putrescible wastes.....	P	Soft compactable waste ~5%
	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:

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

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Barium.....
 Boron..... 0
 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.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt):

EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents.....

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	~32.0
Solidification	On-site	~56.0
Decontamination	On-site	3.0
Metal treatment	Off-site	~1.0
Size reduction	On-site	~14.0
Decay storage		
Recycling / reuse		
Other / various		
None		

Comment on planned treatments:

-

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Disposal Route	Stream volume %	
Expected to be consigned to the LLW Repository	~66.0	
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		~30.0
Expected to be consigned to a Metal Treatment Facility		~1.0
Expected to be consigned as Out of Scope		~3.0
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 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: -

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: -

RADIOACTIVITY

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Source:	Fuel contamination and operation of a test reactor.
Uncertainty:	-
Definition of total alpha and total beta/gamma:	The total activity for this stream is reported. An activity breakdown by radionuclide is not available.
Measurement of radioactivities:	Activity by mass balance, gamma monitoring, fluorensense. Volume by disposal container known DIMS.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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		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