

**WASTE STREAM****7N03****MOD Donnington Miscellaneous LLW****SITE** MOD Donnington**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** Ministry of Defence**WASTE TYPE** LLW**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2023.....	~~16.0 m <sup>3</sup>
	1.4.2023 - 31.3.2033.....	~~20.0 m <sup>3</sup>
	1.4.2033 - 31.3.2053.....	~~20.0 m <sup>3</sup>
Total future arisings:		56.0 m <sup>3</sup>
Total waste volume:		56.0 m <sup>3</sup>

Comment on volumes: MOD Donnington is a repository for in-service and redundant MOD equipment, some of which contain radioactive sources. Waste arisings do not occur at a constant rate. No wastes are currently stored. Items are declared as waste by equipment manager. MOD Donnington then make arrangements for appropriate disposal or recycling. Any future waste arisings are difficult to determine as they are dependent on a number of factors such as equipment being declared obsolete by equipment managers and legacy items being returned following site closures etc. There is uncertainty in the volume as many radioactive components are fitted in equipment, or are equipment spares sealed in an original polythene bag / box packaging. The items remain in the equipment or packaging until an authorised waste contractor downsizes the equipment / packaging and selects an appropriate disposal route.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 10.0  
 Stock (lower): x Arisings (lower) x 0.1

**WASTE SOURCE** The waste arises from disposal of redundant military equipment.**PHYSICAL CHARACTERISTICS**

General description: Scrap luminised dials, gauges, compasses, signs, mostly luminised with radium-226 or tritium. Thoriated engine parts and thoriated optical lenses. Smoke detectors, spark gaps instrument functional check sources

Physical components (%wt): Metal (80%), glass (10%), plastic/perspex (5%), paper (2%), wood (3%).

Sealed sources: The waste contains sealed sources. Instrument functional check sources - number not determined but likley to be low

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

Comment on density: No information available as items not stored for immediate disposal.

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (80%), glass (10%), plastic/perspex (5%), paper (2%), wood (3%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Luminised compound, elemental tritium and tritiated water  
 Cl-36: None present  
 I-129: None present  
 Ra: Luminised compound and radium sulphate  
 Th: Thorium/magnesium metal alloy and thorium oxide

Metals and alloys (%wt): Sheet metal is not present in this waste stream. Majority of metal is in the form of instrument and dial casings.

Stainless steel.....	60.0
Other ferrous metals.....	
Iron.....	
Aluminium.....	11.0
Beryllium.....	

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	Cobalt.....		
	Copper.....	2.0	Brass (2% wt)
	Lead.....		
	Magnox/Magnesium.....	7.0	
	Nickel.....		
	Titanium.....	0	
	Uranium.....		
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....		
Organics (%wt):	NE		
	Total cellulose.....	~~5.0	
	Paper, cotton.....	~~2.0	
	Wood.....	~~3.0	
	Halogenated plastics .....		
	Total non-halogenated plastics.....	~~5.0	
	Condensation polymers.....		
	Others.....	~~5.0	
	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.....	~10.0	
	Graphite.....	0	
	Desiccants/Catalysts.....	0	
	Asbestos.....	0	
	Non/low friable.....		
	Moderately friable.....		

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	Highly friable.....	
	Free aqueous liquids.....	
	Free non-aqueous liquids.....	
	Powder/Ash.....	
Inorganic anions (%wt):	Apart from the entry for Sulphate and Sulphide, none known to be present	
	Fluoride.....	
	Chloride.....	
	Iodide.....	
	Cyanide.....	
	Carbonate.....	
	Nitrate.....	
	Nitrite.....	
	Phosphate.....	
	Sulphate.....	<1.0
	Sulphide.....	<1.0
Materials of interest for waste acceptance criteria:	None known to be present	
	Combustible metals.....	
	Low flash point liquids.....	
	Explosive materials.....	
	Phosphorus.....	
	Hydrides.....	
	Biological etc. materials.....	
	Biodegradable materials.....	
	Putrescible wastes.....	
	Non-putrescible wastes.....	
	Corrosive materials.....	
	Pyrophoric materials.....	
	Generating toxic gases.....	
	Reacting with water.....	
	Active particles.....	
	Soluble solids as bulk chemical compounds.....	
Hazardous substances / non hazardous pollutants:	None known to be present	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	

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- Other organophosphates.....
  - Vinyl chloride.....
  - Arsenic.....
  - Barium.....
  - Boron.....
  - 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.....
- Complexing agents (%wt):
- Not yet determined
  - 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		
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various	Off-site	100.0
None		

Comment on planned treatments:

Tritium wastes are consigned from the Donnington site by an authorised waste contractor (for example ACB) to SRB technologies for re-cycling. The planned treatment for the remaining other waste is unknown.

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Disposal Route	Stream volume %
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

**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:**

The waste is managed by consignment to an authorised waste contractor for disposal. They will determine the quantity that requires routing as radioactive waste and consign it as appropriate to the LLWR, metal decontamination, incineration, recycling/reuse, out of scope etc

**Waste Planned for Disposal at the LLW Repository:** (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH):

It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).

Waste consigned for disposal to LLWR in year of generation:

An appropriate waste disposal or recycling route is identified when the equipment manager authorises items for disposal.

Potential for the waste to contain discrete items:

No

**Non-Containerised Waste for In-Vault Grouting:**

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

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Inaccessible voidage: -

Other information: -

**RADIOACTIVITY**

Source: Radioactivity from radium-226 and associated daughter products and tritium arising from scrap luminised military equipment. Thoriated alloys arising from scrap military aircraft and thoriated optical lenses. Americium from redundant equipment including smoke detectors.

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: -

Other information: -

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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	Gd 153				
Be 10					Ho 163				
C 14				8	Ho 166m				
Na 22				4	Tm 170				
Al 26				4	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					Pb 210				
Co 60				4	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				6
Kr 85				8	Ra 228				
Rb 87					Ac 227				
Sr 90				8	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				6
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				8
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				6
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137				4	Cm 244				
Ba 133				8	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147				8	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>NE</b>
Eu 155					<b>Total b/g</b>	<b>0</b>			<b>NE</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