

**WASTE STREAM****7V31****Area Z Decommissioning LLW****SITE** Dounreay (Vulcan)**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** Ministry of Defence**WASTE TYPE** LLW; SPD1**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2030.....	~250.0 m <sup>3</sup>
Total future arisings:		250.0 m <sup>3</sup>
Total waste volume:		250.0 m <sup>3</sup>

Comment on volumes: Decommissioning wastes will be generated following cessation of site operations in 2022. The rate of arising will be dependent on the future decommissioning programme. Existing stock is zero. The rate of arising will be determined by the future decommissioning programme. Characterisation and fingerprint work is still to be carried out therefore there is a large uncertainty in the potential arisings.

Uncertainty factors on volumes:	Stock (upper):	x	Arisings (upper)	x 3.0
	Stock (lower):	x	Arisings (lower)	x 0.5

**WASTE SOURCE** The waste will arise from decommissioning of a reactor and ancillary plant equipment.**PHYSICAL CHARACTERISTICS**

General description: The waste will comprise plant, equipment, structural and building materials. The waste will include compactable and non-compactable waste. Components %wt not estimated and will be updated in future inventories. There has been no physical/chemical processes or changes to the wastes.

Physical components (%wt): Will include, but not limited to, metal, concrete/rubble, plastics/rubber, wood, soft organics etc. Components %wt not estimated and will be updated in future inventories.

Sealed sources: Not yet determined.

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

Comment on density: To be determined.

**CHEMICAL COMPOSITION**

General description and components (%wt): Will include, but not limited to, metal, concrete/rubble, plastics/rubber, wood, soft organics etc. Components %wt not estimated and will be updated in future inventories.

Chemical state: Neutral

Chemical form of radionuclides:

- H-3: To be determined
- C-14: To be determined
- Cl-36: To be determined
- Se-79: To be determined
- Tc-99: To be determined
- I-129: To be determined
- Ra: To be determined
- Th: To be determined
- U: To be determined
- Np: To be determined
- Pu: To be determined

Metals and alloys (%wt): To be determined.

Stainless steel.....	NE
Other ferrous metals.....	NE
Iron.....	NE
Aluminium.....	NE
Beryllium.....	NE
Cobalt.....	NE
Copper.....	NE

**WASTE STREAM****7V31****Area Z Decommissioning LLW**

	Lead.....	NE
	Magnox/Magnesium.....	NE
	Nickel.....	NE
	Titanium.....	NE
	Uranium.....	NE
	Zinc.....	NE
	Zircaloy/Zirconium.....	NE
	Other metals.....	NE
Organics (%wt):	To be determined.	
	Total cellulose.....	NE
	Paper, cotton.....	NE
	Wood.....	NE
	Halogenated plastics .....	NE
	Total non-halogenated plastics.....	NE
	Condensation polymers.....	NE
	Others.....	NE
	Organic ion exchange materials....	NE
	Total rubber.....	NE
	Halogenated rubber .....	NE
	Non-halogenated rubber.....	NE
	Hydrocarbons.....	NE
	Oil or grease .....	NE
	Fuel.....	NE
	Asphalt/Tarmac (cont.coal tar)...	NE
	Asphalt/Tarmac (no coal tar)....	NE
	Bitumen.....	NE
	Others.....	NE
	Other organics.....	
Other materials (%wt):	The volumes of other materials has still to be quantified.	
	Inorganic ion exchange materials.	NE
	Inorganic sludges and flocs.....	NE
	Soil.....	NE
	Brick/Stone/Rubble.....	NE
	Cementitious material.....	NE
	Sand.....	NE
	Glass/Ceramics.....	NE
	Graphite.....	NE
	Desiccants/Catalysts.....	NE
	Asbestos.....	NE
	Non/low friable.....	NE
	Moderately friable.....	NE
	Highly friable.....	NE
	Free aqueous liquids.....	NE

**WASTE STREAM****7V31****Area Z Decommissioning LLW**

	Free non-aqueous liquids.....	NE
	Powder/Ash.....	NE
Inorganic anions (%wt):	To be determined.	
	Fluoride.....	NE
	Chloride.....	NE
	Iodide.....	NE
	Cyanide.....	NE
	Carbonate.....	NE
	Nitrate.....	NE
	Nitrite.....	NE
	Phosphate.....	NE
	Sulphate.....	NE
	Sulphide.....	NE
Materials of interest for waste acceptance criteria:	Asbestos is likely to be present.	
	Combustible metals.....	NE
	Low flash point liquids.....	NE
	Explosive materials.....	NE
	Phosphorus.....	NE
	Hydrides.....	NE
	Biological etc. materials.....	NE
	Biodegradable materials.....	NE
	Putrescible wastes.....	NE
	Non-putrescible wastes.....	NE
	Corrosive materials.....	NE
	Pyrophoric materials.....	NE
	Generating toxic gases.....	NE
	Reacting with water.....	NE
	Active particles.....	NE
	Soluble solids as bulk chemical compounds.....	NE
Hazardous substances / non hazardous pollutants:	Asbestos is likely to be present.	
	Acrylamide.....	NE
	Benzene.....	NE
	Chlorinated solvents.....	NE
	Formaldehyde.....	NE
	Organometallics.....	NE
	Phenol.....	NE
	Styrene.....	NE
	Tri-butyl phosphate.....	NE
	Other organophosphates.....	NE
	Vinyl chloride.....	NE

**WASTE STREAM****7V31****Area Z Decommissioning LLW**

Arsenic..... NE  
 Barium..... NE  
 Boron..... NE  
 Cadmium..... NE  
 Caesium..... NE  
 Selenium..... NE  
 Chromium..... NE  
 Molybdenum..... NE  
 Thallium..... NE  
 Tin..... NE  
 Vanadium..... NE  
 Mercury compounds..... NE  
 Others..... NE  
 Electronic Electrical Equipment (EEE)  
     EEE Type 1..... NE  
     EEE Type 2..... NE  
     EEE Type 3..... NE  
     EEE Type 4..... NE  
     EEE Type 5..... NE  
 Complexing agents (%wt): Not yet determined  
     EDTA..... 0  
     DPTA..... 0  
     NTA..... 0  
     Polycarboxylic acids..... 0  
     Other organic complexants..... NE  
     Total complexing agents..... NE

Trace amounts of decontamination agents may be present.

**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		

Comment on planned treatments:

The waste treatment options have still to be determined.

**WASTE STREAM****7V31****Area Z Decommissioning LLW****Disposal Routes:**

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 package option is still to be determined.

**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**

**WASTE STREAM****7V31****Area Z Decommissioning LLW**

Source:	The activity has arisen from activation and contamination of reactor components.
Uncertainty:	To be determined.
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:	To be determined.
Other information:	-

**WASTE STREAM**

**7V31**

**Area Z Decommissioning LLW**

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					Gd 153				
Be 10					Ho 163				
C 14					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					Pb 210				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					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					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>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