

WASTE STREAM	7V24	Metallic ILW from Vulcan
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SITE NRTE Vulcan

SITE OWNER Ministry of Defence (MOD)

WASTE CUSTODIAN Ministry of Defence (MOD)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	1.3		
Future arisings:	1.4.2025 - 31.3.2028	83.2		
Total future arisings:		83.2		
Total waste volume:		84.5		

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: As the plant has ceased critical operation there will no further activation of existing metallic components. The timescales for decommissioning will be tailored to the decommissioning strategy that is being developed for the site.

Additional information on quantities: The ILW inventory will be confirmed through future characterisation work. The waste volumes are based on the assumption that the Reactor 1 RPV & Closure Head will be LLW by the time of decommissioning.

Uncertainty factors on volumes: Stock (upper): x 1.10 Arisings (upper): x 1.40
Stock (lower): x 0.90 Arisings (lower): x 0.60

WASTE SOURCE Reactor decommissioning ILW comprising irradiated steel components. Only the internals of the Reactor 1 Pressure Vessels and the Primary Circuit IX column are expected to be ILW, the RPV itself and all surrounding reactor components are expected to be categorised as LLW.

PHYSICAL CHARACTERISTICS

General description: Activated reactor components and metallic scrap/swarf.

Changes since waste generated: Waste has undergone no chemical or physical transformation processes.

Bulk density (t/m³): ~ 7.9

Comment on density: Quoted density is that of stainless steel. Bulk density still to be determined.

CHEMICAL COMPOSITION

General description and components (%wt): The estimated waste arising is stainless steel (94%wt), Iron (5%), zirconium swarf (<1%wt).

Chemical state: Neutral

Sheet metal proportion / thickness: Proportions of metal to be determined. % of total C14 activity of the waste stream material components to be determined.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 94.0	To be determined.	
Other ferrous metals.....	NE	Mild steel may be present if the cladding cannot be separated from the LLW RPV.	
Iron.....	~ 5.0	As magnetite.	
Aluminium.....	P	-	
Beryllium.....	= 0	-	
Cobalt.....	P	-	
Copper.....	P	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	P	-	
Titanium.....	= 0	-	
Uranium.....	P	-	
Zinc.....	P	-	
Zircaloy/Zirconium.....	~ 1.0	-	
Other metals.....	P	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0	-	
Paper, cotton.....	0	-	
Wood.....	0	-	
Halogenated plastics.....	0	-	
Total non-halogenated plastics.....	0	-	
Condensation polymers.....	0	-	
Others.....	0	-	
Organic ion exchange materials.....	0	-	
Total rubber.....	0	-	
Halogenated rubber.....	0	-	
Non-halogenated rubber.....	0	-	
Hydrocarbons.....	0	-	
Oil or grease.....	0	-	
Fuel.....	0	-	
Asphalt/Tarmac (cont.coal tar).....	0	-	
Asphalt/Tarmac (no coal tar).....	0	-	
Bitumen.....	0	-	
Others.....	0	-	
Other organics.....	0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	0	-	
Inorganic sludges and flocs.....	0	-	
Soil.....	0	-	
Brick/Stone/Rubble.....	0	-	
Cementitious material.....	0	-	
Sand.....	0	-	
Glass/Ceramics.....	0	-	
Graphite.....	0	-	
Desiccants/Catalysts.....	0	-	
Asbestos.....	0	-	
Non/low friable.....	0	-	
Moderately friable.....	0	-	
Highly friable.....	0	-	
Free aqueous liquids.....	0	-	
Free non-aqueous liquids.....	0	-	
Powder/Ash.....	0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
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:

	(%wt)	Type(s) and comment
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.....	~ 1.0	As zirconium alloys
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....	NE	-
Soluble solids as bulk chemical compounds.....	= 0	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	= 0	-
Benzene.....	= 0	-
Chlorinated solvents.....	= 0	-
Formaldehyde.....	= 0	-
Organometallics.....	= 0	-
Phenol.....	= 0	-
Styrene.....	= 0	-
Tri-butyl phosphate.....	= 0	-
Other organophosphates.....	= 0	-
Vinyl chloride.....	= 0	-
Arsenic.....	P	Component of stainless steel alloy.
Barium.....	= 0	-
Boron.....	= 0	-
Boron (in Boral).....	= 0	-
Boron (non-Boral).....	= 0	-
Cadmium.....	= 0	-
Caesium.....	= 0	-
Selenium.....	= 0	-
Chromium.....	P	Component of stainless steel alloy.
Molybdenum.....	P	Component of stainless steel alloy.
Thallium.....	= 0	-
Tin.....	P	Component of stainless steel alloy.
Vanadium.....	P	Component of stainless steel alloy.
Mercury compounds.....	= 0	-
Others.....	P	-

Complexing agents (%wt):

No		
	(%wt)	Type(s) and comment
EDTA.....	= 0	-
DPTA.....	= 0	-
NTA.....	= 0	-
Polycarboxylic acids.....	= 0	-
Other organic complexants.....	= 0	-
Total complexing agents.....	= 0	-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction		
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		= 100.0

Comments on planned treatments:

No decisions made on decommissioning process until site handover in 2028, at which point NDA / NRS Dounreay will take ownership.

Conditioning method:

No decisions made on conditioning process until site handover in 2028, at which point NDA / NRS Dounreay will take ownership.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	Not yet determined	100.0	-	-	-	-

Range in container waste loading: Container options most likely to be 6m3 concrete box (SD) or a 500 l drum.

Other information on packaging and conditioning: Future packaging and conditioning not yet determined.

Conditioned density (t/m³): -
Conditioned density comment: -

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known	= 100.0		

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

Opportunities for alternative disposal routing: Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: The waste will consist of predominantly stainless steel components irradiated during reactor operations.

Uncertainty: Activities calculated from area fingerprint. This will be refined following further sampling.

Measurement of radioactivities: Activities calculated from area fingerprint.

Chemical form of radionuclides:

- H-3: Likely to be present
- C-14: Likely to be present
- Cl-36: Not known to be present
- Se-79: Not known to be present
- Tc-99: May be present
- I-129: Likely to be present
- Ra: Likely to be present
- Th: Likely to be present
- U: Likely to be present
- Np: Likely to be present
- Pu: Likely to be present

WASTE STREAM 7V24 Metallic ILW from Vulcan									
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	2.39E-04	D D 2	2.83E-04	D D 2	Gd 153				
Be 10					Ho 163				
C 14	2.39E-02	D D 2	2.39E-02	D D 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					Ti 204				
Mn 54	5.79E-06	D D 2	6.59E-05	D D 2	Pb 205				
Fe 55	2.03E-02	D D 2	4.34E-02	D D 2	Pb 210				
Co 60	2.35E-02	D D 2	3.49E-02	D D 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	5.99E-03	D D 2	6.12E-03	D D 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	1.71E-03	D D 2	1.84E-03	D D 2	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	4.50E-06	D D 2	9.42E-05	D D 2	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	7.36E-05	D D 2	7.54E-05	D D 2
Sn 123					Pu 239	3.14E-07	D D 2	3.14E-07	D D 2
Sn 126					Pu 240				
Sb 125	1.95E-04	D D 2	4.14E-04	D D 2	Pu 241	1.88E-04	D D 2	2.17E-04	D D 2
Sb 126					Pu 242				
Te 125m	4.88E-05				Am 241	2.22E-06	D D 2	1.26E-06	D D 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	7.56E-05	D D 2	2.07E-04	D D 2	Cm 242				
Cs 135					Cm 243				
Cs 137	2.08E-03	D D 2	2.23E-03	D D 2	Cm 244	1.40E-06	D D 2	1.57E-06	D D 2
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	2.75E-05	D D 2	3.96E-04	D D 2	Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Unsp a				
Eu 152					Unsp b/g				
Eu 154	6.29E-04	D D 2	8.01E-04	D D 2	Total a	7.76E-05	*	7.85E-05	*
Eu 155	3.44E-04	D D 2	5.28E-04	D D 2	Total b/g	7.93E-02	*	1.15E-01	*

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 the 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
* Total calculated from the 114 declared radionuclides