

WASTE STREAM	6N05	Copper
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SITE Rutherford Appleton Laboratory

SITE OWNER UK Research and Innovation

WASTE CUSTODIAN UK Research and Innovation

WASTE TYPE VLLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	~ 16.0		
Future arisings:	1.4.2025 - 31.3.2026	0.5		
	1.4.2026 - 31.3.2027	0.5		
	1.4.2027 - 31.3.2028	0.5		
	1.4.2028 - 31.3.2045	9.0		
Total future arisings:		10.6		
Total waste volume:		26.6		

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

Comment on arising rates: Unpacked waste volumes based on weights and densities only.

Additional information on quantities: Volumes are not space occupied but the volume calculated from the weight and 8.9 t/m3 density of the items. Packing density will depend on packages used for disposal.

Uncertainty factors on volumes: Stock (upper): x 1.20 Arisings (upper): x 1.20
Stock (lower): x 0.80 Arisings (lower): x 0.80

WASTE SOURCE Large electro-magnet windings, bus bars and cables used at RAL in the ISIS neutron spallation source (currently running) and its predecessor, Nimrod (closed in 1978). Note: electrical insulation but no asbestos.

PHYSICAL CHARACTERISTICS

General description: Generally large pieces of metal (up to 1 te) with some size reduced.

Changes since waste generated: None

Bulk density (t/m³): = 8.9

Comment on density: Density of copper

CHEMICAL COMPOSITION

General description and components (%wt): High purity copper, copper cables and magnet coils

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	= 0	-	
Iron.....	= 0	-	
Aluminium.....	= 0	-	
Beryllium.....	= 0	-	
Cobalt.....	= 0	-	
Copper.....	= 90.0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	= 0	-	
Uranium.....	= 0	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	~ 5.0	PVC cable insulation	
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.....	~ 5.0	Mica resin	

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.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....	= 0	-
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.....	= 0	-
Barium.....	= 0	-
Boron.....	= 0	-
Boron (in Boral).....	= 0	-
Boron (non-Boral).....	= 0	-
Cadmium.....	= 0	-
Caesium.....	= 0	-
Selenium.....	= 0	-
Chromium.....	= 0	-
Molybdenum.....	= 0	-
Thallium.....	= 0	-
Tin.....	= 0	-
Vanadium.....	= 0	-
Mercury compounds.....	= 0	-
Others.....	P	Bromated flame retardants likely

Complexing agents (%wt):

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

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....	NE	Waste stream is largely copper waste from electrical accelerator component. Listing as individual items is not sensible.
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	On-site	80.0
Decay storage	On-site	100.0
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment	Off-site	80.0
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

-

Conditioning method:

-

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
	-	-	-	-	-	-

Range in container waste loading:

Other information on packaging and conditioning: -

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)	20.0	~ 1.0	
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	80.0	~ 1.0	
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	80.0	~ 1.0	
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility: 17 04 01, 16 02 15*, 16 02 16

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Activation of copper components by high energy protons and neutrons.

Uncertainty: Activation is often non-homogenous for many components and thus averaged values are quoted. The specific activity of small portions could be 1000's of times higher than the average.

Measurement of radioactivities: Gamma-spec and sampling followed by destructive analysis for Ni-63

Chemical form of radionuclides: H-3: Bound within the activated metal.

C-14: -

Cl-36: -

Se-79: -

Tc-99: -

I-129: -

Ra: -

Th: -

U: -

Np: -

Pu: -

WASTE STREAM		6N05		Copper					
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	~~ 4.05E-05	B B 2	~~ 4.80E-05	B B 2	Gd 153		4		4
Be 10		4		4	Ho 163		4		4
C 14		4		4	Ho 166m		4		4
Na 22		4		4	Tm 170		4		4
Al 26		4		4	Tm 171		4		4
Cl 36		4		4	Lu 174		4		4
Ar 39		4		4	Lu 176		4		4
Ar 42		4		4	Hf 178n		4		4
K 40		4		4	Hf 182		4		4
Ca 41		4		4	Pt 193		4		4
Mn 53		4		4	Tl 204		4		4
Mn 54		5		5	Pb 205		4		4
Fe 55	~~ 1.12E-05	B B 2	~~ 2.40E-05	B B 2	Pb 210		4		4
Co 60	~ 8.10E-05	B B 2	~ 1.20E-04	B B 2	Bi 208		4		4
Ni 59		4		4	Bi 210m		4		4
Ni 63	~~ 1.76E-03	B B 2	~~ 1.80E-03	B B 2	Po 210		4		4
Zn 65		4		4	Ra 223		4		4
Se 79		4		4	Ra 225		4		4
Kr 81		4		4	Ra 226		4		4
Kr 85		4		4	Ra 228		4		4
Rb 87		4		4	Ac 227		4		4
Sr 90		4		4	Th 227		4		4
Zr 93		4		4	Th 228		4		4
Nb 91		4		4	Th 229		4		4
Nb 92		4		4	Th 230		4		4
Nb 93m		4		4	Th 232		4		4
Nb 94		4		4	Th 234		4		4
Mo 93		4		4	Pa 231		4		4
Tc 97		4		4	Pa 233		4		4
Tc 99		4		4	U 232		4		4
Ru 106		4		4	U 233		4		4
Pd 107		4		4	U 234		4		4
Ag 108m		4		4	U 235		4		4
Ag 110m		4		4	U 236		4		4
Cd 109		4		4	U 238		4		4
Cd 113m		4		4	Np 237		4		4
Sn 119m		4		4	Pu 236		4		4
Sn 121m		4		4	Pu 238		4		4
Sn 123		4		4	Pu 239		4		4
Sn 126		4		4	Pu 240		4		4
Sb 125		4		4	Pu 241		4		4
Sb 126		4		4	Pu 242		4		4
Te 125m		4		4	Am 241		4		4
Te 127m		4		4	Am 242m		4		4
I 129		4		4	Am 243		4		4
Cs 134		4		4	Cm 242		4		4
Cs 135		4		4	Cm 243		4		4
Cs 137		4		4	Cm 244		4		4
Ba 133		4		4	Cm 245		4		4
La 137		4		4	Cm 246		4		4
La 138		4		4	Cm 248		4		4
Ce 144		4		4	Cf 249		4		4
Pm 145		4		4	Cf 250		4		4
Pm 147		4		4	Cf 251		4		4
Sm 147		4		4	Cf 252		4		4
Sm 151		4		4	Unsp a		4		4
Eu 152		4		4	Unsp b/g		4		4
Eu 154		4		4	Total a	0	*	0	*
Eu 155		4		4	Total b/g	1.90E-03	*	1.99E-03	*

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