

WASTE STREAM	6N07	Mixed Metallic
--------------	------	----------------

SITE Rutherford Appleton Laboratory

SITE OWNER UK Research and Innovation

WASTE CUSTODIAN UK Research and Innovation

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	~ 133.6		
Future arisings:	1.4.2025 - 31.3.2026	6.6		
	1.4.2026 - 31.3.2027	6.6		
	1.4.2027 - 31.3.2028	6.6		
	1.4.2028 - 31.3.2045	111.9		
Total future arisings:		131.6		
Total waste volume:		265.2		

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

Comment on arising rates: Current stocks assessed from inventory data. Future stocks based on average annual arisings

Additional information on quantities: Volumes are from material densities; wastes are currently not packaged nor significantly processed.

Uncertainty factors on volumes: Stock (upper): x 1.50 Arisings (upper): x 2.00
Stock (lower): x 0.80 Arisings (lower): x 0.50

WASTE SOURCE ISIS neutron spallation source and its predecessor, Nimrod.

PHYSICAL CHARACTERISTICS

General description: Failed and redundant components used to speed-up, guide and shield from high-energy proton beam and associated neutrons.

Changes since waste generated: Solid, dry metals.

Bulk density (t/m³): ~ 7.7

Comment on density: Bulk density is that of iron/steel, which dominates the waste stream. Bulk density of waste packages will be substantially lower.

CHEMICAL COMPOSITION

General description and components (%wt): -

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 40.0	304	
Other ferrous metals.....	~ 30.0	-	
Iron.....	~ 29.7	-	
Aluminium.....	~ 0.10	-	
Beryllium.....	0	-	
Cobalt.....	0	-	
Copper.....	~ 0.10	-	
Lead.....	~ 0.01	-	
Magnox/Magnesium.....	0	-	
Nickel.....	< 0.01	-	
Titanium.....	0	-	
Uranium.....	0	-	
Zinc.....	P	-	
Zircaloy/Zirconium.....	0	-	
Other metals.....	~ 0.01	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0	-	
Paper, cotton.....	0	-	
Wood.....	0	-	
Halogenated plastics.....	P 0	-	
Total non-halogenated plastics.....	0.05	-	
Condensation polymers.....	0	-	
Others.....	~ 0.05	-	
Organic ion exchange materials.....	0	-	
Total rubber.....	0	-	
Halogenated rubber.....	0	-	
Non-halogenated rubber.....	P	-	
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.....	P	-	
Graphite.....	P	-	
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.....	P	Wax containing boric acid inside steel blocks
Boron (in Boral).....		-
Boron (non-Boral).....		-
Cadmium.....	P	Cadmium sheet
Caesium.....	0	-
Selenium.....	0	-
Chromium.....	0	-
Molybdenum.....	0	-
Thallium.....	0	-
Tin.....	TR 0	Silver plated vacuume seals
Vanadium.....	0	-
Mercury compounds.....	0	-
Others.....	0	-

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.....		-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....	P	-
EEE Type 2.....	P	-
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	On-site	~ 80.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	On-site Off-site	~ 30.0 ~ 80.0
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		

Comments on planned treatments:

Treatment fraction estimated from forecasting data. Multiple treatments likely so total exceed 100%

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)			
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	~ 2.0		
Expected to be consigned to a Landfill Facility	~ 18.0		
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	~ 80.0		
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility: 17 04 05, 17 04 07, 17 04 02, 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 by high-energy protons and neutrons.

Uncertainty: Wastes are largely uncharacterised but the current holding are dominated by old wastes (>35 years old) which have mainly Co-60 in the fingerprint and the more recent arisings show higher specific activities and a greater abundance of radionuclides.

Measurement of radioactivities: Gamma-spectrometry and selected destructive analysis of sub-samples.

Chemical form of radionuclides: H-3: Produced within metal during activation and some ingress into metals of pipes.

C-14: -

Cl-36: -

Se-79: -

Tc-99: -

I-129: -

Ra: -

Th: -

U: -

Np: -

Pu: -

WASTE STREAM		6N07		Mixed Metallic					
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	~~	2.33E-05	A B 2	~~	1.57E-05	A C 3	Gd 153		
Be 10							Ho 163		
C 14		4.32E-07	A B 2				Ho 166m		
Na 22	~~	1.74E-04	B B 2	~~	5.00E-04	B B 2	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	~~	2.94E-05	B A 2	~~	8.79E-04	B A 3	Pb 205		
Fe 55	~~	4.02E-03	B A 2	~~	7.59E-03	B A 3	Pb 210		
Co 60	~~	2.48E-04	A A 2	~~	2.48E-04	A A 3	Bi 208		
Ni 59							Bi 210m		
Ni 63	~~	2.55E-04	B B 2	~~	5.00E-04	B B 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							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							Unsp a		
Eu 152							Unsp b/g		
Eu 154							Total a	0	*
Eu 155							Total b/g	4.75E-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