WASTE STREAM	6N102	Decommissioning Bulk Steel

SITE Rutherford Appleton Laboratory

SITE OWNER UK Research and Innovation

WASTE CUSTODIAN UK Research and Innovation

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m^3)
Stocks: At 1.4.2025	= 0
Future arisings: 1.4.2037 - 31.3.2058	~~ 4200.0
Total future arisings:	**4200.0**
Total waste volume:	**4200.0**

OR

Conditioned (m^3)	Packaged (m^3)

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

Comment on arising rates: Estimated volume calculated for current shielding volume

Additional information on quantities: Nominal uncertainty to account for dimensional errors

Uncertainty factors on volumes:
Stock (upper): x - Arisings (upper): x 1.25
Stock (lower): x - Arisings (lower): x 0.75

WASTE SOURCE Steel support structures/shielding from the decommissioning of the ISIS neutron source.

PHYSICAL CHARACTERISTICS

General description: Dominated by activated steel bulk sheilding, but also relativly small but unkown quantities of plant items and cable.

Changes since waste generated: -

Bulk density (t/m³): = 7.8

Comment on density: Based on the density of steel.

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……	= 0	-	
Other ferrous metals……	~ 100.0	-	
Iron……	= 0	-	
Aluminium……	= 0	-	
Beryllium……	= 0	-	
Cobalt……	= 0	-	
Copper……	= 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 cellulosics	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	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	0	-

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	TR	-
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	= 100.0
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	On-site	~ 20.0
Recycling / reuse	Off-site	~ 80.0
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments: Anticipate that decay storage can divert 80% to recyling, around 18% to landfill, 1% to LLWR and 1% remaining ILW. On site metal treatment for removal of activated parts is likely.

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 (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
Not yet determined	1.0	2.0	-	21	-

Range in container waste loading:

Other information on packaging and conditioning: -

Conditioned density (t/m^3): -
Conditioned density comment: -

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	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	~ 1.0		2090
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository	~ 1.0	~ 7.8	2045
Expected to be consigned to a Landfill Facility	~ 18.0	~ 7.8	2045
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	~ 7.8	2045
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 01, 17 01 01

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
Landfill	Recycled / reused	~ 18.0	AMBER	Reuse as radioactive to mitigate need for decay storage and landfill disposal

RADIOACTIVITY

Source: Neutron activation.

Uncertainty: No characterisation has yet been undertaken so the nuclide list is based on a generic mild steel fingerprint with the data collected from other mild steel components from ISIS.

Measurement of radioactivities: Derived from operational steel wastes as not yet been characterised. The activity is calculated on the assumption that the inner monolith (~15% by volume) is similar to current shutter wastes and remaining bulk shielding (~85% by volume) is similar to current bulk metal arrisings. The reported activity is the weighted sum of these two sources

Chemical form of radionuclides:

H-3: Bound within the steel
C-14: Bound within the steel
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: -
Np: -
Pu: -

WASTE STREAM **6N102** **Decommissioning Bulk Steel**

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3			~ 3.14E-04	C C 2	Gd 153				4
Be 10				4	Ho 163				4
C 14				6	Ho 166m				4
Na 22				5	Tm 170				4
Al 26				5	Tm 171				4
Cl 36				4	Lu 174				4
Ar 39				4	Lu 176				4
Ar 42				4	Hf 178n				4
K 40				5	Hf 182				4
Ca 41				4	Pt 193				4
Mn 53				4	Tl 204				4
Mn 54			~ 1.76E-02	C C 2	Pb 205				4
Fe 55			~ 1.52E-01	C C 2	Pb 210				5
Co 60			~ 4.96E-03	C C 2	Bi 208				4
Ni 59				4	Bi 210m				5
Ni 63				6	Po 210				5
Zn 65				4	Ra 223				4
Se 79				4	Ra 225				5
Kr 81				4	Ra 226				5
Kr 85				4	Ra 228				5
Rb 87				4	Ac 227				5
Sr 90				4	Th 227				4
Zr 93				4	Th 228				5
Nb 91				4	Th 229				4
Nb 92				4	Th 230				5
Nb 93m				4	Th 232				5
Nb 94				4	Th 234				5
Mo 93				4	Pa 231				5
Tc 97				4	Pa 233				4
Tc 99				4	U 232				4
Ru 106				4	U 233				4
Pd 107				4	U 234				5
Ag 108m				4	U 235				5
Ag 110m				4	U 236				4
Cd 109				4	U 238				5
Cd 113m				4	Np 237				4
Sn 119m				4	Pu 236				4
Sn 121m				4	Pu 238				4
Sn 123				4	Pu 239				4
Sn 126				4	Pu 240				4
Sb 125				4	Pu 241				4
Sb 126				4	Pu 242				4
Te 125m				4	Am 241				4
Te 127m				4	Am 242m				4
I 129				4	Am 243				4
Cs 134				6	Cm 242				4
Cs 135				4	Cm 243				4
Cs 137				4	Cm 244				4
Ba 133				4	Cm 245				4
La 137				4	Cm 246				4
La 138				4	Cm 248				4
Ce 144				4	Cf 249				4
Pm 145				4	Cf 250				4
Pm 147				4	Cf 251				4
Sm 147				4	Cf 252				4
Sm 151				4	Unsp a				4
Eu 152				6	Unsp b/g				4
Eu 154				6	**Total a**	**0**	*	**0**	*
Eu 155				6	**Total b/g**	**0**	*	**1.75E-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