

WASTE STREAM	5H309	UKAEA ILW
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SITE Culham

SITE OWNER UKAEA

WASTE CUSTODIAN United Kingdom Atomic Energy Authority (UKAEA)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 0		
Future arisings:	1.4.2025 - 31.3.2040	= 165.2		
Total future arisings:		165.2		
Total waste volume:		165.2		

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

Comment on arising rates: This waste stream is a combination of the 5H301 and 5H306 waste streams. As the JET facilities have now transitioned to decommissioning as of 2024, the operational wastes will now transition to decommissioning and arise from the decommissioning activities of the JDR programme. The decommissioning wastes will comprise of the redundant stainless-steel plant and equipment, carbon tiles, in-vessel structure, tiles and diagnostics associated with the JET machine as well as the Uranium beds (U-beds) within the AGHS. In both instances these will be predominantly activated metallic in nature but with some components being beryllium, beryllium coated or contaminated (as well as tritium). All large items will be size reduced in order to be accommodated within standard ILW containers.

Additional information on quantities: As the JET facilities have now transitioned to decommissioning as of 2024, the operational wastes will now transition to decommissioning and arise from the decommissioning activities of the JDR programme. The uncertainties are due to programme decisions dictation full d-plant of the in-vessel components and AGHS U-beds.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 2.00
Stock (lower):	x -	Arisings (lower):	x 0.50

WASTE SOURCE The decommissioning wastes will comprise of the redundant stainless-steel plant and equipment, carbon tiles, in-vessel structure, tiles and diagnostics associated with the JET machine as well as the Uranium beds (U-beds) within the AGHS.

PHYSICAL CHARACTERISTICS

General description: The waste will be largely redundant stainless steel plant and equipment, including carbon tiles. The items will range from small components to large sections of the vacuum vessel. Components will also be contaminated with beryllium (as well as tritium). There will also be some beryllium components as well as the Uranium beds (U-beds) within the AGHS. All large items will be size reduced in order to be accommodated within standard ILW containers.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.7

Comment on density: The bulk density of 1.7 t/m³ is based on nominal 50% average voidage for plant items and an average density for components (range 1.8 - 8.4 t/m³).

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (~74%), beryllium (<5%), copper (~5.5%), carbon steel (~8.2%), inconel (~5%), carbon/graphite (~2%), Depleted Uranium (<1%) others (~0.3%).

Chemical state: Neutral

Sheet metal proportion / thickness: The metallic items are large scale fabrications from plate and bulk items. There is no information at present on proportions, but it is estimated that sheet metal will be less than 2% by weight.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 73.0	-	
Other ferrous metals.....	~ 7.2	-	
Iron.....	~ 1.0	-	
Aluminium.....	TR	-	
Beryllium.....	< 5.0	-	
Cobalt.....	TR	-	
Copper.....	~ 5.5	-	
Lead.....	TR	-	
Magnox/Magnesium.....	TR	-	
Nickel.....	~ 5.0	Inconel 600, Inconel 625.	
Titanium.....	TR	-	
Uranium.....	< 1.0	-	
Zinc.....	TR	-	
Zircaloy/Zirconium.....	TR	-	
Other metals.....	~ 0.30	Other metals (0.3%)	

Organics (%wt):

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

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.....	TR	-	
Glass/Ceramics.....	NE	-	
Graphite.....	~ 2.0	-	
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.....	P	Included in specialist steels.
Molybdenum.....	P	Included in specialist steels.
Thallium.....	= 0	-
Tin.....	P	Included in solder.
Vanadium.....	P	Included in specialist steels.
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	It is unlikely that complexants will be present.
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	On-site	~ 50.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application	On-site	~ 50.0
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:

To be determined. Waste may be pre-treated to remove tritium on-site. Likely conditioning matrix: Polymer Other information: Not finalised, but polymer encapsulation being pursued as a preferred option, with the possibility of using inert glass beads as aggregate.

Conditioning method:

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Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

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Further information on the conditioning matrix:

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Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
500 l drum	-	50.0	0.47	-	-
1/3 Height IP-2 ISO (TC03)	-	50.0	11.5	-	-

Range in container waste loading: This will depend on the activity of the waste item(s).

Other information on packaging and conditioning:

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Conditioned density (t/m³):

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Conditioned density comment:

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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)	~ 50.0		
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			
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	~ 50.0		
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

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: Source of radioactivity is from activation by neutron irradiation of machine components and tritium contamination.

Uncertainty: -

Measurement of radioactivities: A method for calculating the total activity was given in the Alstec Decommissioning study, and is likely that FISPACT will have been used. The inventory is that estimated at 1 month after decommissioning decayed for 3 years as this is assumed to be the earliest time that completed packages will be prepared after cessation of operations, which equates to 2023 under the current operating schedule.

Chemical form of radionuclides: H-3: Mainly outgassed tritium present in the form of tritiated water vapour, and some absorbed into material surfaces.

C-14: As carbon in graphite/CFC tiles.
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: < 1% Depleted Uranium
Np: -
Pu: -

WASTE STREAM 5H309 UKAEA ILW									
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			~ 2.36E+01	D D 2	Gd 153				
Be 10			~ 1.43E-11	C C 2	Ho 163				
C 14			~ 3.74E-09	C C 2	Ho 166m				
Na 22			~ 6.49E-10	C C 2	Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39			~ 6.20E-11	C C 2	Lu 176				
Ar 42					Hf 178n				
K 40			~ 1.16E-11	C C 2	Hf 182				
Ca 41					Pt 193				
Mn 53			~ 2.61E-10	C C 2	Ti 204				
Mn 54			~ 3.99E-04	C C 2	Pb 205				
Fe 55			~ 5.73E-03	C C 2	Pb 210				
Co 60			~ 1.59E-03	C C 2	Bi 208				
Ni 59			~ 1.03E-06	C C 2	Bi 210m				
Ni 63			~ 1.13E-04	C C 2	Po 210				
Zn 65			~ 2.52E-09	C C 2	Ra 223			~ 3.75E-12	C C 2
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227			~ 3.78E-12	C C 2
Sr 90					Th 227			~ 3.71E-12	C C 2
Zr 93					Th 228				
Nb 91			~ 4.13E-09	C C 2	Th 229				
Nb 92					Th 230			~ 1.01E-10	C C 2
Nb 93m			~ 1.29E-06	C C 2	Th 232				
Nb 94			~ 9.95E-09	C C 2	Th 234				
Mo 93			~ 9.32E-10	C C 2	Pa 231			~ 1.08E-11	C C 2
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234			~ 3.79E-07	C C 2
Ag 108m			~ 8.03E-10	C C 2	U 235				
Ag 110m			~ 1.83E-07	C C 2	U 236				
Cd 109			~ 1.69E-09	C C 2	U 238			~ 3.83E-07	C C 2
Cd 113m			~ 8.42E-11	C C 2	Np 237				
Sn 119m			~ 8.87E-07	C C 2	Pu 236				
Sn 121m			~ 2.31E-08	C C 2	Pu 238				
Sn 123			~ 1.22E-07	C C 2	Pu 239			~ 6.71E-10	C C 2
Sn 126					Pu 240				
Sb 125			~ 2.67E-07	C C 2	Pu 241				
Sb 126			~ 8.44E-10	C C 2	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			~ 8.28E-12	C C 2	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			~ 2.56E-02	C C 2
Eu 154					Total a	0	*	7.63E-07	*
Eu 155					Total b/g	0	*	2.36E+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