WASTE STREAM	5H308	UKAEA LA-LLW/LLW

SITE Culham

SITE OWNER UKAEA

WASTE CUSTODIAN United Kingdom Atomic Energy Authority (UKAEA)

WASTE TYPE LLW

WASTE VOLUMES

		Reported (m^3)
Stocks:	At 1.4.2025	= 36.7
Future arisings:	1.4.2025 - 31.3.2040	~ 2424.3
Total future arisings:		**2424.3**
Total waste volume:		**2461.0**

OR

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

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

Comment on arising rates: 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. This waste stream is a combination of 5H07 5H10 5H13 5H14 5H17 5H18 5H302 5H304 waste routes adjusted from the most up to date forecasting.

Additional information on quantities: It is assumed that the JET Experimental Programme is completed at the end of 2023. Decommissioning on this basis starts in 2024. It is planned that decommissioning will be completed at the end of 2040. A material density factor of 8000kg/m3 was applied then a 30% packing fraction (as an estimate) from NonINCIN decommissioning waste was applied to forecast estimates. The uncertianity factor applied to both stock and forecast have been applied to account for material density variaions and packing efficencies.
Infomation dominated by JET deoncomissioning volumes and does not account for small amounts (<10t p/yr) operationally.

Uncertainty factors on volumes:

Stock (upper):	x 1.50	Arisings (upper):	x 2.00
Stock (lower):	x 0.50	Arisings (lower):	x 0.50

WASTE SOURCE The waste arises from the decommissioning of the JET facilities.

PHYSICAL CHARACTERISTICS

General description: This waste will comprise steel and other metallic items contaminated with tritium mainly from the Active Gas Handling System and other areas. There will also be some secondary waste from the decommissioning operations. It is planned that large items will be size reduced in order to be accommodated within LLW ISO containers / 200l steel drums.

Changes since waste generated: It is expected that waste will be processed on-site as per operational non-activated LLW by size reduction. Exact processing methods are to be determined.

Bulk density (t/m^3): ~~ 1.0

Comment on density: The bulk density of operational ILW has been used as an estimation of bulk density for this waste stream, assuming similar processing is undertaken on-site. Process is yet to be optimised.

CHEMICAL COMPOSITION

General description and components (%wt): The waste comprises metallic LLW from decommissioning/dismantling as well as secondary waste arisings. The proportion and form of the tritium in the components is not currently known.

Chemical state: Neutral

Sheet metal proportion / thickness: Majority of metal present as size reduced items to enable packaging in 200l Steel Drums. <1% metal present as sheet and <5% bulk items. Dimensions of bulk items will vary but will be greater than 1mx1m.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel	~ 9.7	-	
Other ferrous metals		-	
Iron	~ 55.3	-	
Aluminium	~ 0.30	-	
Beryllium		-	
Cobalt	TR 0.01	As part of specialist alloys.	
Copper	~ 14.5	-	
Lead	< 0.10	-	
Magnox/Magnesium		As part of specialist alloys.	
Nickel	~ 20.0	Added from Inconel	
Titanium	TR 0.01	-	
Uranium		-	
Zinc	TR 0.01	-	
Zircaloy/Zirconium		Not expected but may be present as part of specialist alloys.	
Other metals	< 0.10	Small quantities of silver and other metals may be present.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	P	-	
Paper, cotton	P	-	
Wood	P	-	
Halogenated plastics	P	-	
Total non-halogenated plastics	P	-	
Condensation polymers	P	-	
Others	P	-	
Organic ion exchange materials	= 0	-	
Total rubber	P	-	
Halogenated rubber	P	-	
Non-halogenated rubber	P	-	
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	P	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	= 0	-	
Inorganic sludges and flocs	P	-	
Soil	= 0	-	
Brick/Stone/Rubble	P	-	
Cementitious material	P	-	
Sand	P	-	
Glass/Ceramics	P	-	
Graphite	P	-	
Desiccants/Catalysts	TR	-	
Asbestos	TR	May be present in individual packages at trace levels.	
Non/low friable	TR	-	
Moderately friable	TR	-	
Highly friable	TR	-	
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	P	-
Explosive materials	= 0	-
Phosphorus	= 0	-
Hydrides	= 0	-
Biological etc. materials	= 0	-
Biodegradable materials	= 0	-
Putrescible wastes	P	-
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	P	Potentially present in trace amounts as arsenides in specialist semiconductors / electronics.
Barium	= 0	-
Boron	P	Included as boronated concrete.
Boron (in Boral)	= 0	-
Boron (non-Boral)	P	-
Cadmium	P	Potentially present in trace amounts in specialist semiconductors / electronics / solders.
Caesium	= 0	-
Selenium	= 0	-
Chromium	P	Included in specialist steels.
Molybdenum	P	Included in specialist steels.
Thallium	= 0	-
Tin	P	Included in solders.
Vanadium	P	Included in specialist steels.
Mercury compounds	= 0	-
Others	P	-

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA	= 0	-
DPTA	= 0	-
NTA	= 0	-
Polycarboxylic acids	TR	-
Other organic complexants	TR	None expected from the primary waste stream but there may be some from secondary waste (e.g. protective clothing, swabs, cleaning materials).
Total complexing agents	TR	-

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		100.0
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: Treatment methods will depend on the exact nature of the waste which is not known at this stage. It is expected that the majority of secondary waste will be compacted on-site prior to disposal for incineration.

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
1/3 Height IP-2 ISO (TC03)	15.0	14.5	11.5	26	-
Pallet Box (Rigid Plastic and lidded)	85.0	-	-	-	-

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			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository	~~ 15.0	~~ 1.0	
Expected to be consigned to a Landfill Facility	~~ 85.0	~~ 1.0	
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			
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: No

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

RADIOACTIVITY

Source: Tritium contamination of process plant components.

Uncertainty: This waste will come from a plant which is still operational so the detailed information is not available.

Measurement of radioactivities: These cannot be determined until the end of the JET project. Sampling and measurement will be used to characterise this waste.

Chemical form of radionuclides:

H-3: Gas or oxide.
C-14: -
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: There is a remote possibility that a very small quantity of this waste stream might have some contamination from the tritium storage beds which are uranium.
Np: -
Pu: -

WASTE STREAM **5H308** **UKAEA LA-LLW/LLW**

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	= 2.90E-09	A A 1	~ 4.72E-04	D D 2	Gd 153				
Be 10					Ho 163				
C 14	~ 1.18E-13	B B 2	~ 7.28E-11	C C 2	Ho 166m				
Na 22			~ 6.44E-11	C C 2	Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39			~ 6.98E-10	C C 2	Lu 176				
Ar 42					Hf 178n				
K 40			~ 2.87E-09	C C 2	Hf 182				
Ca 41			~ 4.89E-12	C C 2	Pt 193				
Mn 53					Tl 204				
Mn 54	~ 1.35E-12	B B	~ 1.31E-05	C C 2	Pb 205				
Fe 55	~ 1.90E-11	B B 2	~ 1.64E-04	C C 2	Pb 210				
Co 60	= 2.00E-12	A A 1	~ 1.93E-06	C C 2	Bi 208				
Ni 59	~ 3.53E-15	B B	~ 1.55E-10	C C 2	Bi 210m				
Ni 63	~ 1.89E-11	B B 2	~ 2.82E-07	C C 2	Po 210				
Zn 65	~ 7.78E-11	B B	~ 4.47E-10	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	~ 8.97E-13	B B 2		
Kr 85					Ra 228			~ 4.19E-08	C C 2
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228			~ 4.12E-08	C C 2
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m			~ 8.82E-13	C C 2	Th 232			~ 4.34E-08	C C 2
Nb 94					Th 234				
Mo 93	~ 2.42E-13	B B			Pa 231				
Tc 97					Pa 233			~ 1.62E-11	C C 2
Tc 99	~ 3.40E-14	B B			U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m			~ 5.62E-09	C C 2	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m			~ 2.25E-09	C C 2	Pu 236				
Sn 121m					Pu 238				
Sn 123			~ 3.17E-10	C C 2	Pu 239				
Sn 126					Pu 240				
Sb 125			~ 8.71E-10	C C 2	Pu 241				
Sb 126					Pu 242				
Te 125m			~ 2.06E-10	C C 2	Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	~ 1.21E-14	B B			Cm 244				
Ba 133			~ 7.99E-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			~ 4.20E-11	C C 2	Unsp b/g			~ 3.33E-06	C C 2
Eu 154			~ 3.25E-11	C C 2	**Total a**	**8.97E-13**	*	**8.46E-08**	*
Eu 155					**Total b/g**	**3.02E-09**	*	**6.54E-04**	*

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