



**WASTE STREAM**

**5H07**

**JET LLW**

Magnox/Magnesium.....	TR	As part of specialist alloys.
Nickel.....	~3.0	Inconel 90%, pure nickel and other specialist alloys 10%.
Titanium.....	<<1.0	
Uranium.....	0	
Zinc.....	~2.0	
Zircaloy/Zirconium.....	TR	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):

Possible that a very small quantity (by weight) of PVC could be present.

Total cellulose.....	TR
Paper, cotton.....	TR
Wood.....	TR
Halogenated plastics .....	TR
Total non-halogenated plastics.....	TR
Condensation polymers.....	TR
Others.....	TR
Organic ion exchange materials....	TR
Total rubber.....	TR
Halogenated rubber .....	TR
Non-halogenated rubber.....	TR
Hydrocarbons.....	TR
Oil or grease .....	TR
Fuel.....	TR
Asphalt/Tarmac (cont.coal tar)...	TR
Asphalt/Tarmac (no coal tar)....	TR
Bitumen.....	TR
Others.....	TR
Other organics.....	TR

Other materials (%wt):

-	
Inorganic ion exchange materials.	0
Inorganic sludges and flocs.....	~1.0
Soil.....	0
Brick/Stone/Rubble.....	<0.20
Cementitious material.....	~1.0
Sand.....	~1.0
Glass/Ceramics.....	<1.0
Graphite.....	~1.0
Desiccants/Catalysts.....	TR
Asbestos.....	TR
Non/low friable.....	TR
Moderately friable.....	TR
Highly friable.....	TR

May be present in individual packages at trace levels.

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	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	No inorganic anions are present.	
	Fluoride.....	TR
	Chloride.....	TR
	Iodide.....	0
	Cyanide.....	0
	Carbonate.....	0
	Nitrate.....	0
	Nitrite.....	0
	Phosphate.....	0
	Sulphate.....	TR
	Sulphide.....	0
Materials of interest for waste acceptance criteria:	Beryllium dust contamination is present. There may be some solid beryllium items included in this stream which account for the <0.3% by wt.	
	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
	Active particles.....	0
	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	Beryllium dust is typically present at < 0.1% by weight, solid beryllium may be present in individual packages above 0.1%.	
	Acrylamide.....	0
	Benzene.....	0
	Chlorinated solvents.....	0
	Formaldehyde.....	0
	Organometallics.....	0
	Phenol.....	0
	Styrene.....	0
	Tri-butyl phosphate.....	0
	Other organophosphates.....	0

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Vinyl chloride.....	0	
Arsenic.....	0	
Barium.....	0	
Boron.....	P	Included as boronated concrete.
Cadmium.....	0	
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	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	TR	
EEE Type 2.....	<1.0	
EEE Type 3.....	<1.0	
EEE Type 4.....	0	
EEE Type 5.....	0	
Complexing agents (%wt):	Yes	
EDTA.....	0	
DPTA.....	0	
NTA.....	0	
Polycarboxylic acids.....	TR	
Other organic complexants.....	TR	Trace quantities of complexing agents may be present from cleaning solutions.
Total complexing agents.....	TR	

**TREATMENT, PACKAGING AND DISPOSAL**

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	~50.0
Supercompaction (HFC)		
Incineration	Off-site	~10.0
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various	~40.0	
None		

Comment on planned treatments:

Drummed waste will be supercompacted, bulk undrummed waste expected to be consigned in a third height ISO.

**WASTE STREAM****5H07****JET LLW****Disposal Routes:**

Disposal Route	Stream volume %	
Expected to be consigned to the LLW Repository	~90.0	
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility		~10.0
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

**Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):**

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known			

**Waste Packaging for Disposal:**

Container	Stream volume %	Waste loading m <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	90.0	<9.3	9

Other information: -

**Waste Planned for Disposal at the LLW Repository:**

Container voidage: &lt;10%

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).  
The waste does not have a current WCH.

Waste consigned for disposal to LLWR in year of generation: No. There will always be a quantity of waste collected towards the end of a year which is not processed for disposal until the following year. Quite likely that this type of waste will not be despatched for a year after generation.

Potential for the waste to contain discrete items: Yes, discrete items may be included but not expected in large quantities.

**Non-Containerised Waste for In-Vault Grouting:**

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

**RADIOACTIVITY**

Source:	The main sources of activity are tritium contamination and neutron activation. Loose activated carbon/beryllium dust contaminating material surfaces.
Uncertainty:	Nuclide activities are only indicative and relate to operational waste already analysed by JET. In the future the activities may increase according to changes in the experimental programme and related, further exposure to activating neutrons.
Definition of total alpha and total beta/gamma:	Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.
Measurement of radioactivities:	Nuclide activities are only indicative and are based on combustion followed by liquid scintillation counting and gamma spectroscopy. Future neutron activation and tritium contamination levels will be determined by the experimental programme.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3	~1.3E-03	BC 2	~1.8E-03	CC 2	Gd 153				
Be 10					Ho 163				
C 14			~5E-08	CC 2	Ho 166m				
Na 22					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			~4E-08	CC 2	Pb 205				
Fe 55	~3E-06	CC 2	~4E-04	CC 2	Pb 210				
Co 60	~1E-06	CC 2	~1E-03	CC 2	Bi 208				
Ni 59			~6E-07	CC 2	Bi 210m				
Ni 63	~3E-06	CC 2	~4E-05	CC 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			~8E-07	CC 2	Th 229				
Nb 92					Th 230				
Nb 93m			~6E-05	CC 2	Th 232				
Nb 94			~2E-06	CC 2	Th 234				
Mo 93			~1E-07	CC 2	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					Other a				
Eu 152					Other b/g		~5E-08	CC 2	
Eu 154					<b>Total a</b>	<b>0</b>	<b>0</b>		
Eu 155					<b>Total b/g</b>	<b>~1.31E-03</b>	<b>CC 2</b>		<b>~3.3E-03</b> <b>CC 2</b>

**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 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