

WASTE STREAM

7A115 Decommissioning LLW - Plutonium

	Stainless steel.....	11.7	
	Other ferrous metals.....	49.8	
	Iron.....		
	Aluminium.....	0.38	
	Beryllium.....		
	Cobalt.....		
	Copper.....	1.5	Includes cables.
	Lead.....	0.28	
	Magnox/Magnesium.....		
	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....	0.07	Brass.
Organics (%wt):	-		
	Total cellulose.....	10.4	
	Paper, cotton.....	2.9	
	Wood.....	7.5	
	Halogenated plastics	7.6	PVC.
	Total non-halogenated plastics.....	4.0	
	Condensation polymers.....	4.0	
	Others.....		
	Organic ion exchange materials....		
	Total rubber.....	1.2	
	Halogenated rubber		
	Non-halogenated rubber.....	1.2	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....		
Other materials (%wt):	-		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....	0.27	
	Brick/Stone/Rubble.....	11.5	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....	1.1	

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	Graphite.....	0.07	
	Desiccants/Catalysts.....		
	Asbestos.....	<0.10	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		
	Powder/Ash.....		
Inorganic anions (%wt):	None		
	Fluoride.....		
	Chloride.....		
	Iodide.....		
	Cyanide.....		
	Carbonate.....		
	Nitrate.....		
	Nitrite.....		
	Phosphate.....		
	Sulphate.....		
	Sulphide.....		
Materials of interest for waste acceptance criteria:	-		
	Combustible metals.....	0	
	Low flash point liquids.....	0	
	Explosive materials.....	0	
	Phosphorus.....	0	
	Hydrides.....	0	
	Biological etc. materials.....	0	
	Biodegradable materials.....	P	
	Putrescible wastes.....	P	There is potential for some dead animals.
	Non-putrescible wastes.....	P	Paper and wood.
	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:	-		
	Acrylamide.....	0	
	Benzene.....	NE	
	Chlorinated solvents.....	0	

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Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	NE	
Styrene.....	0	
Tri-butyl phosphate.....	NE	
Other organophosphates.....	0	
Vinyl chloride.....	P	PVC.
Arsenic.....	NE	
Barium.....	0	
Boron.....	NE	
Cadmium.....	NE	
Caesium.....	0	
Selenium.....	NE	
Chromium.....	NE	
Molybdenum.....	NE	
Thallium.....	0	
Tin.....	NE	
Vanadium.....	NE	
Mercury compounds.....	0	
Others.....	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		
Complexing agents (%wt):	Yes	
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....	TR	
Other organic complexants.....	TR	
Total complexing agents.....	TR	

Complexing agents from decontaminants will only be present as trace residues.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	~9.5
Supercompaction (HFC)		
Incineration	Off-site	~29.5
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage	Off-site	~61.0
Recycling / reuse		
Other / various		
None		

Comment on planned treatments:

Planned treatment percentages have been estimated based on disposals of this waste stream made in the last 3 years.

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	~9.5
Expected to be consigned to a Landfill Facility	~61.0
Expected to be consigned to an On-Site Disposal Facility	~29.5
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	

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 ³	Number of packages
1/3 Height IP-1 ISO	9.5	17	65
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			

Other information:

Drums would be supercompacted prior to transfer to LLWR.

Waste Planned for Disposal at the LLW Repository:

Container voidage:

Voidage would be minimal because HHISO would contain supercompacted pucks.

Waste Characterisation Form (WCH):

The waste meets the LLWR's Waste Acceptance Criteria (WAC).
 The waste has a current WCH.
 Inventory information is consistent with the current WCH.

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Waste consigned for disposal to LLWR in year of generation:

Yes.

Potential for the waste to contain discrete items:

No - this will be managed by following the LLWR WAC.

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%):

-

Waste stream variation:

-

Bounding cuboidal volume:

Inaccessible voidage:

-

Other information:

-

RADIOACTIVITY

Source:

Pu-238, Pu-239, Pu-240, Pu-241, Pu-242 and Am-241 as contamination.

Uncertainty:

The gross alpha and gross beta activity of the in-stock wastes is accurate, the radionuclide contributions have been estimated. The activity of the waste arisings has been estimated from the activity of wastes disposed in this waste stream over the last 3 years, and is considered to be a best estimate.

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:

Fingerprints are generated by assaying whole gloveboxes non-destructively prior to commencing decommissioning. The fingerprint is used with high resolution gamma spectrometry or probe measurements to generate an activity for each drum / item of waste.

Other information:

Decay nuclides with a half life of less than 3 months have been omitted.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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					Gd 153				
Be 10					Ho 163				
C 14					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					Pb 205				
Fe 55					Pb 210				5
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				5
Zn 65					Ra 223				5
Se 79					Ra 225				5
Kr 81					Ra 226				5
Kr 85					Ra 228				5
Rb 87					Ac 227				5
Sr 90					Th 227				5
Zr 93					Th 228				5
Nb 91					Th 229				5
Nb 92					Th 230				5
Nb 93m					Th 232				5
Nb 94					Th 234				5
Mo 93					Pa 231				5
Tc 97					Pa 233				5
Tc 99					U 232				5
Ru 106					U 233				5
Pd 107					U 234	4.64E-08	BB 2	9.82E-08	CC 2
Ag 108m					U 235	1.83E-09	BB 2	7.66E-09	CC 2
Ag 110m					U 236	3.95E-10	BB 2	1.62E-09	CC 2
Cd 109					U 238	9.51E-09	BB 2	3.25E-07	CC 2
Cd 113m					Np 237				5
Sn 119m					Pu 236				
Sn 121m					Pu 238	8.69E-06	BB 2	1.74E-07	CC 2
Sn 123					Pu 239	2.14E-04	BB 2	4.25E-06	CC 2
Sn 126					Pu 240	5.52E-05	BB 2	1.07E-06	CC 2
Sb 125					Pu 241	7.04E-05	BB 2	6.05E-06	CC 2
Sb 126					Pu 242	1.12E-08	BB 2	1.26E-10	CC 2
Te 125m					Am 241	8.30E-05	BB 2	2.38E-06	CC 2
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				
Eu 154					Total a	3.61E-04	BB 2	8.31E-06	CC 2
Eu 155					Total b/g	7.04E-05	BB 2	6.05E-06	CC 2

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