



**WASTE STREAM**

**2C925**

**Chapelcross Processing Plant Dismantling LLW**

Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt):

This waste stream will contain waste of various sizes and thicknesses.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	7.5	Metals deplanting and legacy metals (pipework, motors, pumps, tanks, frames, benches, tools, scaffold tubes/fittings, electrical boxes, heaters, ducting, shielding)	
Other ferrous metals.....	62.4	Metals deplanting and legacy metals (pipework, tanks, frames, benches, tools, scaffold tubes/fittings, electrical boxes, heaters, ducting, shielding)	
Iron.....	0.75	Cast iron plant fittings: radiators, lights, brackets	
Aluminium.....	3.8	Scaffold poles, ladders, walkway sections and HEPA filters	
Beryllium.....			
Cobalt.....			
Copper.....	0		
Lead.....	0.75	Metals deplanting and legacy metals - lead blocks	
Magnox/Magnesium.....	0		
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....	0.09	Zinc oxide coating on galvanised scaffold tubes, floor plates/grates, handrails	
Zircaloy/Zirconium.....	0		
Other metals.....	0		

Organics (%wt):

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	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	4.0		
Paper, cotton.....	0		
Wood.....	4.0		
Halogenated plastics .....	0.45	Tacky mats, PVC Suits	
Total non-halogenated plastics.....	7.0		
Condensation polymers.....	7.0	soft wastes. Plastics from controlled area works	
Others.....	0		
Organic ion exchange materials....	0		
Total rubber.....	3.0		
Halogenated rubber .....	1.5		
Non-halogenated rubber.....	1.5		
Hydrocarbons.....	0.24		
Oil or grease .....	0.22	radioactive oils	
Fuel.....			

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Asphalt/Tarmac (cont.coal tar)...	TR	Land Remediation	
Asphalt/Tarmac (no coal tar)....	0.01	Land Remediation	
Bitumen.....	0.01	Land Remediation	
Others.....			
Other organics.....	2.7	Liquid scintillation cocktail	
Other materials (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	1.0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	~1.0		
Sand.....			
Glass/Ceramics.....			
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	0.84		
Non/low friable.....	0.84	Asbestos within gaskets, rope seals. Bulk will be Chrysotile (white asbestos) with smaller quantities of Crocidolite (blue) and Amosite (brown).	
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		
Inorganic anions (%wt):	-		
	(%wt)	Type(s) and comment	
Fluoride.....	NE		
Chloride.....	NE		
Iodide.....	NE		
Cyanide.....	NE		
Carbonate.....	NE		
Nitrate.....	NE		
Nitrite.....	NE		
Phosphate.....	NE		
Sulphate.....	NE		
Sulphide.....	NE		
Materials of interest for waste acceptance criteria:	-		

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	(%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.....	5.0	
Putrescible wastes.....	1.0	
Non-putrescible wastes.....	4.0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	P	2282m2
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / None expected  
non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	TR	Boronsilicate Glass (Boron 0.79kg of 6.04kg total)
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		

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Vanadium.....		
Mercury compounds.....	0.36	Liquid Elemental Mercury from pump draining
Others.....	1.0	Plasterboard
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	P	400 Computers
EEE Type 2.....	P	250 pumps, motors and electronic capacitors.
EEE Type 3.....	P	50 corded drills
EEE Type 4.....	P	200 Fluorescent light tubes
EEE Type 5.....	P	125 rechargeable batteries

Complexing agents (%wt): No

(%wt) Type(s) and comment

EDTA.....	
DPTA.....	
NTA.....	
Polycarboxylic acids.....	
Other organic complexants.....	
Total complexing agents.....	0

Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs

**TREATMENT, PACKAGING AND DISPOSAL**

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration	Off-site	62.8
Solidification		
Decontamination		
Metal treatment	Off-site	21.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		16.2

Comment on planned treatments:

It is expected that 16.18% of this waste stream will be sent to Landfill as VLLW and 0.04% is unknown at this time.

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository		
Expected to be consigned to a Landfill Facility	16.2	1.4
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	62.8	0.40
Expected to be consigned to a Metal Treatment Facility	21.0	1.4
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known	0.04	

Classification codes for waste expected to be consigned to a landfill facility: 17 04 07, 17 02 03, 17 06 01\*

**Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):**

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Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
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			

**Opportunities for alternative disposal routing:** -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

**Waste Packaging for Disposal:** (Not applicable to this waste stream)

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			

Other information: -

**Waste Planned for Disposal at the LLW Repository:** (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

**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: Activation and contamination of materials.

Uncertainty: Activity values are current best estimates. Specific activity is a function of operating history. The values are indicative of the activities that would be expected.

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'.

**WASTE STREAM****2C925****Chapelcross Processing Plant Dismantling LLW**Measurement of  
radioactivities:Activity data taken from waste stream WCH - 1MXN-1CHA-0-WCH-0-4687 V7 (activity ref  
date of 2020) with stocks decayed two years and future arisings three years for RWI 2022

Other information:

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	3.46E-03	CC 1	3.27E-03	CC 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	5.86E-05	CC 1	5.86E-05	CC 1	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	6.4E-08	CC 1	6.4E-08	CC 1	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55	1.02E-05	CC 1	7.9E-06	CC 1	Pb 210		8		8
Co 60	1.15E-05	CC 2	1.01E-05	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	2.21E-05	CC 1	2.19E-05	CC 1	Po 210		8		8
Zn 65		8		8	Ra 223		8		8
Se 79		8		8	Ra 225		8	1.11E-09	CC 2
Kr 81		8		8	Ra 226		8		8
Kr 85		8		8	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	1.29E-06	CC 1	1.26E-06	CC 1	Th 227		8		8
Zr 93		8		8	Th 228	2.01E-07	CC 2	2.57E-07	CC 2
Nb 91		8		8	Th 229		8	1.13E-09	CC 2
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		8		8	Th 234	3.56E-07	CC 2	3.56E-07	CC 2
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233	2.12E-05	CC 2	2.12E-05	CC 2
Tc 99	8.05E-06	CC 1	8.05E-06	CC 1	U 232	3.86E-07	CC 2	3.82E-07	CC 2
Ru 106	2.26E-09	CC 2	1.14E-09	CC 2	U 233	3.99E-06	CC 2	3.99E-06	CC 2
Pd 107		8		8	U 234	1.5E-07	CC 2	1.5E-07	CC 2
Ag 108m		8		8	U 235	2.3E-08	CC 2	2.3E-08	CC 2
Ag 110m		8		8	U 236		8		8
Cd 109	1.22E-08	CC 2	7.07E-09	CC 2	U 238	3.56E-07	CC 2	3.56E-07	CC 2
Cd 113m		8		8	Np 237	2.12E-05	CC 2	2.12E-05	CC 2
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	6.7E-07	CC 1	6.65E-07	CC 1
Sn 123		8		8	Pu 239	6.43E-09	CC 1	6.43E-09	CC 1
Sn 126		8		8	Pu 240	8.55E-09	CC 1	8.58E-09	CC 1
Sb 125	4.36E-07	CC 2	3.39E-07	CC 2	Pu 241	5.83E-05	CC 1	5.56E-05	CC 1
Sb 126		8		8	Pu 242	4.69E-07	CC 2	4.69E-07	CC 2
Te 125m	1.09E-07	CC 2	8.5E-08	CC 2	Am 241	2.78E-06	CC 1	2.86E-06	CC 1
Te 127m		8		8	Am 242m		8		8
I 129	1.2E-05	CC 2	1.2E-05	CC 2	Am 243		8		8
Cs 134	2.85E-08	CC 2	2.04E-08	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243	1.56E-08	CC 1	1.52E-08	CC 1
Cs 137	1.17E-05	CC 2	1.14E-05	CC 2	Cm 244	3.19E-07	CC 1	3.07E-07	CC 1
Ba 133	2.04E-06	CC 2	1.91E-06	CC 2	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	6.9E-07	CC 1	5.29E-07	CC 1	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	5.23E-07	CC 1	5.19E-07	CC 1	Other a				
Eu 152	1.26E-07	CC 2	1.2E-07	CC 2	Other b/g				
Eu 154	3.16E-08	CC 2	2.91E-08	CC 2	<b>Total a</b>	<b>3.06E-05</b>	<b>CC 2</b>	<b>3.07E-05</b>	<b>CC 2</b>
Eu 155	7.36E-07	CC 2	6.38E-07	CC 2	<b>Total b/g</b>	<b>3.68E-03</b>	<b>CC 2</b>	<b>3.48E-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