WASTE STREAM 2D203 Operational PCM from Aldermaston

SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	5.6 m^3
Future arisings -	1.4.2022 - 31.3.2026.....	0 m^3
Total future arisings:		0 m^3
Total waste volume:		5.6 m^3

Comment on volumes: Future transfers of drums are not quantified in this waste stream to avoid double counting as they are reported by AWE in waste stream 7A21. The 2D203 population is a small and well known population that is tracked for NDA reporting.

Uncertainty factors on volumes:

Stock (upper):	x 1.0	Arisings (upper)	x
Stock (lower):	x 1.0	Arisings (lower)	x

WASTE SOURCE Operational PCM has arisen from a variety of facilities engaged in research, handling andanalysis of plutonium metal or plutonium contaminated material over the past 60 years.

PHYSICAL CHARACTERISTICS

General description: The waste consists of solids arising from operations with plutonium. These include tools, filters, box gloves, discarded and unusable equipment. It also includes some facility re-kit (refurbishment) wastes.

Physical components (%wt): Metal (46.6%), organics (52.88%), Other materials (0.52%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): ~0.38

Comment on density: Mass of waste divided by volume

CHEMICAL COMPOSITION

General description and components (%wt): Metal (46.6%), cellulosic (3.92%), plastics (44.61%), rubber (4.35%), non-organics (0.52%).

Chemical state: Neutral

Chemical form of radionuclides: U: Oxide form
Pu: Oxide form

Metals and alloys (%wt): Metal is present in a large range of thicknesses.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE		
Other ferrous metals.....	~28.3		
Iron.....	NE		
Aluminium.....	~0.67		
Beryllium.....	NE		
Cobalt.....	NE		
Copper.....	NE		
Lead.....	~4.2		
Magnox/Magnesium.....	NE		
Nickel.....	NE		

WASTE STREAM 2D203 Operational PCM from Aldermaston

Titanium	NE
Uranium	NE
Zinc	NE
Zircaloy/Zirconium	NE
Other metals	~13.4

Organics (%wt): Other materials contain filters.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	~3.9		
Paper, cotton	NE		
Wood	~3.9		
Halogenated plastics	~20.8		
Total non-halogenated plastics	~1.8		
Condensation polymers	NE		
Others	~1.8		
Organic ion exchange materials	NE		
Total rubber	~4.4		
Halogenated rubber	NE		
Non-halogenated rubber	~4.4		
Hydrocarbons	NE		
Oil or grease	NE		
Fuel	NE		
Asphalt/Tarmac (cont.coal tar)	NE		
Asphalt/Tarmac (no coal tar)	NE		
Bitumen	NE		
Others	NE		
Other organics	~22.1		

Other materials (%wt): Other materials contain glass/ceramic.

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	NE		
Inorganic sludges and flocs	NE		
Soil	NE		
Brick/Stone/Rubble	NE		
Cementitious material	NE		
Sand	NE		
Glass/Ceramics	~0.52		
Graphite	NE		
Desiccants/Catalysts	NE		
Asbestos	NE		
Non/low friable	NE		
Moderately friable	NE		
Highly friable	NE		

WASTE STREAM 2D203 Operational PCM from Aldermaston

Free aqueous liquids.....	NE
Free non-aqueous liquids.....	NE
Powder/Ash.....	NE

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: -

	(%wt)	Type(s) and comment
Combustible metals.....	NE	
Low flash point liquids.....	NE	
Explosive materials.....	NE	
Phosphorus.....	NE	
Hydrides.....	NE	
Biological etc. materials.....	NE	
Biodegradable materials.....	P	
Putrescible wastes.....	NE	
Non-putrescible wastes.....	P	
Corrosive materials.....	NE	
Pyrophoric materials.....	NE	
Generating toxic gases.....	NE	
Reacting with water.....	NE	
Higher activity particles.....	NE	
Soluble solids as bulk chemical compounds.....	NE	

Hazardous substances / non hazardous pollutants: Non-putrescible wastes

	(%wt)	Type(s) and comment
Acrylamide.....	NE	
Benzene.....	NE	
Chlorinated solvents.....	NE	
Formaldehyde.....	NE	
Organometallics.....	NE	

Phenol	NE
Styrene	NE
Tri-butyl phosphate	NE
Other organophosphates	NE
Vinyl chloride	NE
Arsenic	NE
Barium	NE
Boron	NE
Boron (in Boral)	NE
Boron (non-Boral)	NE
Cadmium	NE
Caesium	NE
Selenium	NE
Chromium	NE
Molybdenum	NE
Thallium	NE
Tin	NE
Vanadium	NE
Mercury compounds	NE
Others	NE
Electronic Electrical Equipment (EEE)	
EEE Type 1	NE
EEE Type 2	NE
EEE Type 3	NE
EEE Type 4	NE
EEE Type 5	NE

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA	NE	
DPTA	NE	
NTA	NE	
Polycarboxylic acids	NE	
Other organic complexants	NE	
Total complexing agents	NE	

Potential for the waste to contain discrete items: Yes.

PACKAGING AND CONDITIONING

Conditioning method: Drums are processed through the Waste Treatment Complex (WTC). These drums could then be supercompacted in WTC and loaded into a basket within a 500 l drum such that there is a cement annulus between the basket and the drum skin. Future Waste Treatment Complex (WTC) facilities are currently projected to use a similar treatment method.

Plant Name: Waste Treatment Complex (future capabilities are anticpated to be titled WTC2 & WTC3).

WASTE STREAM 2D203 Operational PCM from Aldermaston

Location:	Sellafield.
Plant startup date:	1997 (It is anticipated that WTC2 will become operational in ~2034 and WTC3 in ~2061).
Total capacity (m^3/y incoming waste):	~500.0
Target start date for packaging this stream:	-
Throughput for this stream (m^3/y incoming waste):	-
Other information:	-

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
500 l drum (basket for waste)	100.0	~~1.1	~~0.504	6

Likely container type comment:	-
Range in container waste volume:	The reported waste loading is for the current WTC (supercompaction) process. Typically between 1 and 10 compacted 200 litre drums will be loaded into a 500 litre drum, with an average of 5.6. The range and variability for WTC2 & WTC3 have yet to be assessed, although it is assumed that the values will be similar to those for the current WTC facility.
Other information on containers:	Stainless steel
Likely conditioning matrix:	Other
Other information:	A GGBS/ CEM I grout mix is used to generate the grout annulus which surrounds the compacted feed drums in a WTC product drum. The conditioning matrix relevant to future facilities (WTC2 and WTC3) is currently unknown.
Conditioned density (t/m^3):	2.1
Conditioned density comment:	Conditioned density calculated using data from current WTC product drum stock. The density is typically between 1.8 and 2.6 t/m^3, although values outside of this range are possible.
Other information on conditioning:	-
Opportunities for alternative disposal routing:	Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at a Geological Disposal Facility	Disposal at a Geological Disposal Facility	-	N/A	Low	Potential for stream volume reduction if one of the planned future treatment plants utilises thermal treatment

RADIOACTIVITY

Source:	The source of radioactivity is from glovebox and operations at AWE site.
Uncertainty:	The specific activity is based on records of arisings.
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:	Specific activity has been derived using measured activity and dividing by the measured waste volume.
Other information:	-

WASTE STREAM 2D203 Operational PCM from Aldermaston

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	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				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					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					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					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	2.74E-03	B B 2		
Sn 123					Pu 239	8.48E-02	B B 2		
Sn 126					Pu 240	1.97E-02	B B 2		
Sb 125					Pu 241	2.11E-02	B B 2		
Sb 126					Pu 242	2.30E-06	B B 2		
Te 125m					Am 241	2.24E-02	B B 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**	**1.30E-01**		**0**	
Eu 155					**Total b/g**	**2.11E-02**		**0**	

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