SITE	Sellafield				
SITE OWNER	Nuclear Decommissioning Authority				
WASTE CUSTODIAN	Sellafield Limited	b			
WASTE TYPE	ILW				
Is the waste subject to Scottish Policy:	No				
WASTE VOLUMES			Reported		
Stocks:	At 1.4.2022		4991.2 m ³		
Future arisings -	1.4.2022 - 31.3.2 1.4.2023 - 31.3.2 1.4.2024 - 31.3.2 1.4.2025 - 31.3.2 1.4.2026 - 31.3.2 1.4.2026 - 31.3.2 1.4.2027 - 31.3.2	2023 2024 2025 2026 2027 2028 2050	58.8 m ³ 50.0 m ³ 29.4 m ³ 26.5 m ³ 26.5 m ³ 47.0 m ³ 379.3 m ³		
Total future arisings:			617.4 m ³		
Total waste volume:			5608.6 m ³		
Comment on volumes:	There are no anticipated crate arisings. Filters arise on a continual basis from older facilities as part of plant operations and POCO/decommissioning activities. The stock level provided reflects the current volume held at Sellafield in designated PCM stores, these items are tracked and hence known to a good level of accuracy. Future arisings based on consignor estimates, experience of receipts indicates that there is a 50% uncertainty associated with these predictions.				
Uncertainty factors on volumes:	Stock (upper): Stock (lower):	x 1.05 x 0.95	ļ ļ	Arisings (upper) Arisings (lower)	x 1.5 x 0.5
WASTE SOURCE	PCM has arisen the LLWR is know	principally from Sella	afield operatio other UK nuc	ons. Some crated lear facilities.	waste transferred from

PHYSICAL CHARACTERISTICS

General description:	Contents of crates are predominantly glove boxes, with or without the equipment they contain (e.g. furnaces, ducting, presses etc). Crates are made of timber, S/S or fibreglass and some are covered in driclad (a type of PVC) on steel supports. Most crates (say 60%) are less than 2m x 2m x 2m, although the largest is in the region of 4m x 3m x 6m. Components will not fit into 200 litre drums. It is estimated that crates may weigh up to 10,000 kg. Filters are made of mild steel frame with glass fibre insert and aluminium spacers. The filters are double wrapped in PVC and stored in a stillage. Generally each filter is also housed within an individual stainless steel metal case.
Physical components (%wt):	The content of the waste stream is predominantly metal (~70%), plastic (~18%) wood (~9%), rubber (~3%). This composition includes all crate and filter box materials.
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m ³):	~~0.2
Comment on density:	The density has been estimated from the available weights and dimensions of crates and filter stillages.

CHEMICAL COMPOSITION

General description and components (%wt):	The waste stream comprises metal (~70%), plastic (~18%) wood (~9%), rubber (~3%). This composition includes all crate and filter box materials.
Chemical state:	Neutral
Chemical form of radionuclides:	U: Present as metal, oxide and nitrate. Pu: Present as metal, oxide, fluoride and nitrate.
Metals and alloys (%wt):	Both sheet and bulk metals are likely to be present. Proportions not estimated.

	(%wt)	Т
Stainless steel	<50.2	
Other ferrous metals	<15.0	
Iron	<0.10	
Aluminium	<1.5	
Beryllium		
Cobalt	0	
Copper	<1.0	
Lead	<1.0	
Magnox/Magnesium	TR	
Nickel		
Titanium	<0.50	
Uranium		
Zinc	<0.10	
Zircaloy/Zirconium	0	
Other metals	0	

Type(s) / Grade(s) with proportions

% of total C14 activity

% of total C14

activity

0		(0/	١.
Orga	nics	(%Wt):

The waste contains cellulosic materials, halogenated and non-halogenated plastics and rubber. The crates are constructed of wood, driclad (a form of PVC) and fibreglass. Total organic content is a preliminary estimate only. Driclad (PVC).

	(%wt)	Type(s) and comment
Total cellulosics	<8.6	
Paper, cotton	NE	
Wood	<8.6	
Halogenated plastics	<8.6	
Total non-halogenated plastics	<8.6	
Condensation polymers	0	
Others	<8.6	
Organic ion exchange materials	0	
Total rubber	<3.2	
Halogenated rubber	<1.6	
Non-halogenated rubber	<1.6	
Hydrocarbons	0	
Oil or grease	0	
Fuel	0	
Asphalt/Tarmac (cont.coal tar)	0	
Asphalt/Tarmac (no coal tar)	0	
Bitumen	Р	
Others	0	
Other organics	TR	

Other materials (%wt):

WASTE STREAM

2D06

Plutonium Contaminated Materials; Crates and Filters

Type(s) and comment

	(%wt)
Inorganic ion exchange materials	Ρ
Inorganic sludges and flocs	0
Soil	0
Brick/Stone/Rubble	0
Cementitious material	<0.50
Sand	
Glass/Ceramics	Р
Graphite	0
Desiccants/Catalysts	
Asbestos	<0.10
Non/low friable	NE
Moderately friable	NE
Highly friable	NE
Free aqueous liquids	<1.0
Free non-aqueous liquids	0
Powder/Ash	0

Inorganic anions (%wt):

Fluoride, if present, will be as PuF4. Others are unlikely to be present.

Type(s) and comment

(%wt)

Fluoride	TR
Chloride	TR
lodide	TR
Cyanide	0
Carbonate	TR
Nitrate	TR
Nitrite	NE
Phosphate	TR
Sulphate	TR
Sulphide	TR

Materials of interest for Some crates may contain hazardous materials in small quantities (<1%). 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	NE	
Putrescible wastes	NE	
Non-putrescible wastes	NE	

2022 Inventory

% of total C14 activity

WASTE STREAM 2D06

Plutonium Contaminated Materials; Crates and Filters

Type(s) and comment

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

Toxic metals present in trace quantities only.

(%wt)

Hazardous substances / non hazardous pollutants:

> 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..... 0 Barium..... NE Boron..... NE Boron (in Boral)..... Boron (non-Boral)..... Cadmium..... < 0.10 Caesium..... NE Selenium..... NE NE Chromium..... Molybdenum..... NE Thallium..... NE Tin..... < 0.10 Vanadium..... NE Mercury compounds..... NE Others..... NE Electronic Electrical Equipment (EEE) EEE Type 1..... 0 EEE Type 2..... <0.50 EEE Type 3..... 0 EEE Type 4..... 0 EEE Type 5..... 0 2022 Inventory

2D06

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA		
DPTA		
NTA		
Polycarboxylic acids	0	
Other organic complexants	TR	Trace amounts of organic complexing agents may be present.
Total complexing agents	TR	

Potential for the waste to contain discrete items: Yes. Crates have the possibility to contain discrete items however larger items are likely to be broken down into 200L drums and then compacted.

PACKAGING AND CONDITIONING

Conditioning method:	To be compatible with the current conditioning process for PCM items in the 2D06 waste stream would need to be size reduced and loaded into 200 litre drums. These 200 litre drums could then be supercompacted in the Waste Treatment Complex (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. There are currently no operational facilities for the size reduction of crates and filter stillages in to 200 litre drums. 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).
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):	NE
Target start date for packaging this stream:	-
Throughput for this stream (m ³ /y incoming waste):	NE
Other information:	Backlog and fresh arisings will be conditioned concurrently.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m³)	Number of packages
	500 I drum (basket for waste)	100.0	~0.844	~0.504	6646

Likely container type comment:	-
Range in container waste volume:	Typically between 1 and 10 compacted 200 litre drums will be loaded into a 500 litre drum, with an average of 5.6. It is expected that 10% of crated waste (7.11% of total waste volume) won't be compactable so will be directly grouted. 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 information:	Other GGBS/CEM I
Conditioned density (t/m ³): Conditioned density comment:	2.1 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

2D06

Other information on conditioning:	possible. -				
disposal routing:	ernative 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 LLWR	~1.0	2023	Medium	26 crates to be processed by active demonstrator project. Will be consigned under 2X89 waste stream.
Disposal at a Geological Disposal Facility	Disposal at LLWR	~20.0	2025	Medium	3,500 filters are projected to be below LLW limits once subject to assay. Will be consigned under 2X41 waste stream.
Disposal at a Geological Disposal Facility	Disposal at LLWR	~31.0	2030	Low	Following the active demonstration work it is estimated that 50% of the remaining crate population may fall within the LLW limits. Identification and segregation of these crates will be informed by the demonstration work and as such this opportunity is currently very immature.

RADIOACTIVITY

Source:	The principal nuclides are Pu-238, Pu-239, Pu-240, Pu241, Pu 242 and Am241.
Uncertainty:	The activity accuracy 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:	The specific activities were calculated using an average fingerprint for the stream (determined through measurements of several thousand drums of similar provenance through the WTC and EDS assay suites) and the total Pu mass of the current stocks.
Other information:	-

WASTE STREAM 2D06 Plutonium Contaminated Materials; Crates and Filters

	Mean radioactivity. TBɑ/m³			1	1	Mean radioactivity. TBg/m ³			
	Waste at	Bands and	Future	Bands and		Waste at	Bands and	Future	Bands and
Nuclide	1.4.2022	Code	arisings	Code	Nuclide	1.4.2022	Code	arisings	Code
H 3		l		l	Gd 153				
Be 10		l		l	Ho 163				
C 14		l		l	HO 166M				
Na 22					Tm 170				
AI 20					1111 171				
Δr 39					Lu 174				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					TI 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	5 4 4 5 0 0			
ND 93m					Th 232	5.44E-08	BB 2		
ND 94					IN 234 Do 221				
Tc 97					Pa 231				
Tc 97					Fa 233				
Ru 106					11 233				
Pd 107					U 234				
Ag 108m					U 235	1 21F-07	BB 2		
Ag 110m					U 236		22 -		
Cd 109					U 238	4.55E-07	BB 2	3.01E-08	CC 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	4.82E-03	BB 2	8.75E-03	CC 2
Sn 123					Pu 239	2.31E-02	BB 2	2.03E-02	CC 2
Sn 126					Pu 240	1.11E-02	BB 2	1.67E-02	CC 2
Sb 125					Pu 241	2.48E-01	BB 2	4.95E-01	CC 2
Sb 126					Pu 242	5.52E-06	BB 2	1.04E-05	CC 2
Te 125m					Am 241	9.40E-03	BB 2	8.30E-03	CC 2
Te 127m					Am 242m				
l 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 143					Cf 250				
Sm 147					Cf 251				
Sm 147 Sm 151					Cf 252				
511 152 Eu 152					Other a				
Eu 152					Other b/g	4 845 02		5 41E 02	CC 3
Eu 155					Total a	4.64E-02	BB 2	5.41E-02	
20100					Total b/g	2.400-01	DD Z	4.952-01	

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