

WASTE STREAM	2D57	Hydrocyclone Solids from Effluent Treatment
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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.....	<< 0.1 m ³
Future arisings -	1.4.2022 - 31.3.2035.....	0 m ³
	1.4.2035 - 31.3.2036.....	3.0 m ³
Total future arisings:		3.0 m ³
Total waste volume:		3.0 m ³
Comment on volumes:	The very low volume of this stream has not justified the commissioning of the line to WPEP for the slurried accumulated solids from the hydrocyclone to be encapsulated.	
Uncertainty factors on volumes:	Stock (upper): x 2.0	Arisings (upper) x 2.0
	Stock (lower): x 0.5	Arisings (lower) x 0.5

WASTE SOURCE Solids removal from streams prior to sentencing of low active liquid effluents from various facilities at Sellafield.

PHYSICAL CHARACTERISTICS

General description: The type of solids seen are sands and grits etc. Particulate matter in an aqueous solution. Particle size: 501 - 2000 µm (18.5 wt%), 261 - 500 µm (5.1 wt%), 51 - 260 µm (62.4 wt%), <50 µm (14 wt%). Larger particles (i.e. >500 µm) consist mainly of flakes of paint; remainder aluminium foil, fibres, rust fragments and splinters of wood. For particles <300 µm: rust (8 wt%), stainless steel debris (6 wt%), calcium aluminosilicate (51 wt%), silica (24 wt%), calcium agglomerates (6 wt%), unclassified (5 wt%). There are no large items. Process solid arising from operations

Physical components (%vol): Paint flakes, aluminium foil, fibres, rust, wood splinters, stainless steel debris, grit, sand and other particulate matter in an aqueous solution.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 2

Comment on density: The density is for the solids. This density would be reduced to approx. 1.1 if the solids were to be slurried in the future to allow discharge from the Segregated Effluent Treatment Plant to the Waste Packaging and Encapsulation Plant.

CHEMICAL COMPOSITION

General description and components (%wt): Paint flakes, aluminium foil, fibres, rust fragments and wood splinters (together <3.8%), rust (<1.3%), stainless steel debris (<1.0%), calcium aluminosilicate (<8.3%), silica (<3.9%), calcium agglomerates (<1.0%), unclassified (<0.8%). Percentages are of slurry at maximum concentration. Water is ~80% of slurry.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritiated water.
C-14: Carbonate.
Tc-99: Technetate.
U: Sodium diuranate.
Pu: Nitrate and/or oxide.

Metals and alloys (%wt): Metal is present as foil or small particles.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	0		

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Beryllium.....	0
Cobalt.....	0
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	0
Titanium.....	0
Uranium.....	0
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): Splinters of wood, paper, cotton cloth fibres (<<4% - typically 0.5%); halogenated plastics (<1%). PVC.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	~0.50	Wood, paper, cotton cloth fibres (<<4% - typically 0.5%).	
Paper, cotton.....			
Wood.....			
Halogenated plastics	<1.0		
Total non-halogenated plastics....			
Condensation polymers.....			
Others.....			
Organic ion exchange materials....			
Total rubber.....			
Halogenated rubber			
Non-halogenated rubber.....			
Hydrocarbons.....	0		
Oil or grease	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar)....	0		
Bitumen.....	0		
Others.....	0		
Other organics.....			

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	~20.0	Slurry, ~80% water, ~20% particulate.	
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	P		

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Glass/Ceramics.....	NE
Graphite.....	0
Desiccants/Catalysts.....	0
Asbestos.....	0
Non/low friable.....	0
Moderately friable.....	0
Highly friable.....	0
Free aqueous liquids.....	~78.5
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): Carbonates, nitrates, phosphates and sulphates are present. Others may be present in trace amounts.

	(%wt)	Type(s) and comment
Fluoride.....	TR	
Chloride.....	TR	
Iodide.....	TR	
Cyanide.....	NE	
Carbonate.....	<1.0	
Nitrate.....	<1.0	
Nitrite.....	<1.0	
Phosphate.....	<1.0	
Sulphate.....	<1.0	
Sulphide.....	TR	

Materials of interest for No hazardous materials are present.
waste acceptance criteria:

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

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non hazardous pollutants:

Lead is present as oxide (<1 ppm). Mercury is present as a contaminant of the sodium hydroxide used in the processes at Sellafield.

(%wt) Type(s) and comment

Acrylamide.....

Benzene.....

Chlorinated solvents.....

Formaldehyde.....

Organometallics.....

Phenol.....

Styrene.....

Tri-butyl phosphate.....

Other organophosphates.....

Vinyl chloride.....

Arsenic.....

Barium.....

Boron.....

Boron (in Boral).....

Boron (non-Boral).....

Cadmium.....

Caesium.....

Selenium.....

Chromium.....

Molybdenum.....

Thallium.....

Tin.....

Vanadium.....

Mercury compounds.....

Others.....

Electronic Electrical Equipment (EEE)

EEE Type 1..... 0

EEE Type 2..... 0

EEE Type 3..... 0

EEE Type 4..... 0

EEE Type 5..... 0

Complexing agents (%wt): No

(%wt) Type(s) and comment

EDTA..... 0

DPTA..... 0

NTA..... 0

Polycarboxylic acids..... 0

Other organic complexants..... 0

Total complexing agents..... 0

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Potential for the waste to contain discrete items:

No. No large item and not recognisable(Definition from Discrete Items in WAC v5.0)

PACKAGING AND CONDITIONING

Conditioning method: Waste is encapsulated in a cement matrix.

Plant Name: WPEP.

Location: Sellafield.

Plant startup date: February 1994.

Total capacity (m³/y incoming waste): 800.0

Target start date for packaging this stream: -

Throughput for this stream (m³/y incoming waste): -

Other information: Waste is encapsulated when sufficient volume has accumulated for transfer and processing. WPEP also encapsulates other feeds: EARP floc, EPMF scrap.

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
500 l drum	100.0	NE	0.5	NE

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Stainless Steel.

Likely conditioning matrix: PFA/OPC

Other information: -

Conditioned density (t/m³): 1.8

Conditioned density comment: -

Other information on conditioning: This waste stream is not likely to increase in volume from it's current very low figure, so any proposed conditioning method is currently uncertain.

Opportunities for alternative disposal routing: Not yet determined

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

RADIOACTIVITY

Source: The main sources of activity will be actinide radionuclides with some mixed fission

Uncertainty: Activity figures based on limited sampling and analysis.

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: -

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Other information:

This waste stream is under review as part of the site wide solids study. It may become a LLW stream, depending on the outcome of the project.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	2.24E-05	BB 2	2.00E-02	CC 2	Gd 153				
Be 10					Ho 163				
C 14	4.57E-12	BB 2	1.40E-09	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	7.18E-17	BB 2	1.40E-09	CC 2	Pb 205				
Fe 55					Pb 210				
Co 60	4.12E-10	BB 2	1.40E-06	CC 2	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	1.46E-08	BB 2	7.20E-06	CC 2	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	1.69E-10	BB 2	5.30E-08	CC 2	U 232				
Ru 106	1.83E-13	BB 2	8.70E-07	CC 2	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	4.07E-07	BB 2	3.60E-08	CC 2
Sn 123					Pu 239	6.89E-07	BB 2	5.20E-08	CC 2
Sn 126					Pu 240	8.87E-07	BB 2	6.70E-08	CC 2
Sb 125	6.37E-12	BB 2			Pu 241	1.26E-09	BB 2	9.70E-07	CC 2
Sb 126					Pu 242	5.30E-10	BB 2	4.00E-11	CC 2
Te 125m	1.59E-12	BB 2			Am 241	3.29E-07	BB 2	2.60E-08	CC 2
Te 127m					Am 242m				
I 129	1.33E-09	BB 2	4.10E-07	CC 2	Am 243				
Cs 134	3.09E-11	BB 2	2.20E-06	CC 2	Cm 242				
Cs 135					Cm 243				
Cs 137	2.94E-08	BB 2	1.40E-05	CC 2	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	2.09E-13	BB 2	1.00E-05	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	1.55E-10	BB 2	4.20E-06	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152	1.71E-12	BB 2	1.40E-09	CC 2	Other b/g	2.91E-07	BB 2		
Eu 154	1.22E-10	BB 2	1.70E-07	CC 2	Total a	~2.31E-06	BB 2	~1.81E-07	CC 2
Eu 155	4.25E-11	BB 2	1.70E-07	CC 2	Total b/g	~2.27E-05	BB 2	~2.00E-02	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