

WASTE STREAM

2D19

Aluminium-Ferric Floc from Effluent Treatment

Chemical state: Alkali

Chemical form of radionuclides: Tc-99: Likely to be Tc VII as TcO4-.
 U: U is not present in simple metallic or oxide forms. Is present as a hydrated oxide associated with aluminium/ferric floc.
 Pu: Pu is not present in simple metallic or oxide forms. Is present as a hydrated oxide associated with aluminium/ferric floc.

Metals and alloys (%wt): The waste contains no sheet or bulk metal.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	0		
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): The following are present at the approximate weight percentages, but have been assumed to be components of the floc: OK (0.05%), TBP (0.004%), DBP (0.04%), others (0.01%). There are no cellulose or ion exchange resins present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....			
Paper, cotton.....			
Wood.....			
Halogenated plastics			
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		

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Other organics.....

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..			
Inorganic sludges and flocs.....	70.0	Includes small amounts of organic material (~0.1%).	
Soil.....			
Brick/Stone/Rubble.....			
Cementitious material.....			
Sand.....			
Glass/Ceramics.....			
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....			
Non/low friable.....	0		
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	30.0	Ammonium nitrate (as supernate).	
Free non-aqueous liquids.....			
Powder/Ash.....			

Inorganic anions (%wt): Nitrates, nitrites, chlorides, fluorides and hydroxides are present.

	(%wt)	Type(s) and comment
Fluoride.....	TR	
Chloride.....	~0.09	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....		
Nitrate.....	~14.9	
Nitrite.....	P	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: No hazardous materials are present. The free liquid is aqueous ammonium nitrate.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	

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Biodegradable materials.....	0
Putrescible wastes.....	0
Non-putrescible wastes.....	0
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	20.0
Reacting with water.....	0
Higher activity particles.....	P
Soluble solids as bulk chemical compounds.....	0

Hazardous substances / non hazardous pollutants: Pb, U, Cr, Zn are present in trace amounts.

	(%wt)	Type(s) and comment
Acrylamide.....	NE	
Benzene.....	NE	
Chlorinated solvents.....	NE	
Formaldehyde.....	NE	
Organometallics.....	NE	
Phenol.....	NE	
Styrene.....	NE	
Tri-butyl phosphate.....	TR	
Other organophosphates.....	TR	
Vinyl chloride.....	NE	
Arsenic.....	NE	
Barium.....	NE	
Boron.....	NE	
Boron (in Boral).....		
Boron (non-Boral).....		
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.....	0	
EEE Type 2.....	0	
EEE Type 3.....	0	
EEE Type 4.....	0	

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EEE Type 5..... 0

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA.....	0	
DPTA.....	0	
NTA.....	0	
Polycarboxylic acids.....	0	
Other organic complexants.....	~0.05	TBP & DBP.
Total complexing agents.....	~0.05	

Potential for the waste to contain discrete items: Yes. Large, recognisable and robust in Repository conditions (Definition from Discrete Items in WAC v5.0)

PACKAGING AND CONDITIONING

Conditioning method: The waste is treated in EARP, then encapsulated at WPEP. There is no intention to supercompact the waste.

Plant Name: EARP/WPEP

Location: Sellafield

Plant startup date: Processing in EARP/WPEP from 1994.

Total capacity (m³/y incoming waste): <1300.0

Target start date for packaging this stream: 2005

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

Other information: PS1, 3 and 4 now emptied to heel level. PS 2, 5 and 6 to follow. Throughput varies.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	1.05	0.5	0

Likely container type comment: Conditioning factor depends on degree of concentration achieved in EARP.

Range in container waste volume: <5%.

Other information on containers: Stainless Steel

Likely conditioning matrix: PFA/OPC

Other information: Will contain lime.

Conditioned density (t/m³): -

Conditioned density comment: -

Other information on conditioning: Packages read as zero as this waste is transferred to 2D27_C when it is conditioned and packaged.

Opportunities for alternative disposal routing: -

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

Source:	The main sources are actinides from fuel reprocessing, where >90% is Am-241. Uranium and plutonium are also present.
Uncertainty:	The activity accuracy is good, as it is based on analytical records.
Definition of total alpha and total beta/gamma:	Total alpha and total beta values declared are direct from analysis results. The sum of the individual nuclides and "others" listed is greater than the total alpha and beta values declared because a number of the results for nuclides are reported as "<".
Measurement of radioactivities:	From analytical records after sampling of tanks.
Other information:	Other betagamma includes Zr95 <1.26E-14 and Nb95 <2.8E-14, plus other unspecified nuclides.

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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					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	<4.38E-15	A 3	<4.38E-15	A 3	Pb 205				
Fe 55					Pb 210				
Co 60	<1.05E-06	A 3	<1.05E-06	A 3	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65	<1.52E-17	A 3	<1.52E-17	A 3	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.83E-03	AA 2	1.83E-03	AA 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	<1.28E-04	A 3	<1.28E-04	A 3
Tc 99	2.44E-04	AA 2	2.44E-04	AA 2	U 232				
Ru 106	<7.32E-13	A 3	<7.32E-13	A 3	U 233				
Pd 107					U 234	<3.25E-05	C 3	<3.25E-05	C 3
Ag 108m					U 235	3.63E-07	CC 2	3.63E-07	CC 2
Ag 110m	<2.20E-17	A 3	<2.20E-17	A 3	U 236	<3.24E-07	C 3	<3.24E-07	C 3
Cd 109					U 238	7.56E-06	CC 2	7.56E-06	CC 2
Cd 113m					Np 237	<1.28E-04	A 3	<1.28E-04	A 3
Sn 119m					Pu 236				
Sn 121m					Pu 238	<1.92E-03	C 3	<1.92E-03	C 3
Sn 123					Pu 239	<9.02E-03	C 3	<9.02E-03	C 3
Sn 126					Pu 240	<4.35E-03	C 3	<4.35E-03	C 3
Sb 125	<7.66E-08	A 3	<7.66E-08	A 3	Pu 241	<2.02E-03	C 3	<2.02E-03	C 3
Sb 126					Pu 242	<1.36E-06	C 3	<1.36E-06	C 3
Te 125m					Am 241	~1.86E-01	AA 2	~1.86E-01	AA 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	<3.04E-09	A 3	<3.04E-09	A 3	Cm 242				
Cs 135					Cm 243				
Cs 137	~1.05E-04	AA 2	~1.05E-04	AA 2	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	<6.63E-15	A 3	<6.63E-15	A 3	Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152	<3.16E-05	A 3	<3.16E-05	A 3	Other b/g				
Eu 154	<9.80E-06	A 3	<9.80E-06	A 3	Total a	~2.02E-01	AA 2	~2.02E-01	AA 2
Eu 155	<1.22E-06	A 3	<1.22E-06	A 3	Total b/g	~4.37E-03	BB 2	~4.37E-03	BB 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