WASTE STREAM 2D33 Fuel Handling Plant Sludges

SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	~12.5 m³
Future arisings -	1.4.2019 - 31.3.2020.....	5.0 m³
	1.4.2020 - 31.3.2021.....	7.5 m³
	1.4.2021 - 31.3.2022.....	8.0 m³
	1.4.2022 - 31.3.2023.....	0 m³
Total future arisings:		20.5 m³
Total waste volume:		33.0 m³

Comment on volumes: Based on estimated receipts of Uranium Bit Bins. It is approximated that where sludge is present, the skip holds 50% fuel and 50% sludge, giving 0.5m3 sludge per skip. However the sludge volume could vary from very little to the majority of the skip contents.

Uncertainty factors on volumes:

Stock (upper):	x 2.0	Arisings (upper)	x 2.0
Stock (lower):	x 0.1	Arisings (lower)	x 0.1

WASTE SOURCE Importing of Magnox Uranium Bit Bin skips with sludge.

PHYSICAL CHARACTERISTICS

General description: Magnox sludge from fuel handling plant consisting of a slurry of fine particles and some larger particles. No special handling requirements.

Physical components (%wt): Magnox sludge (100%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.6

Comment on density: The density is an estimated typical raw sludge density.

CHEMICAL COMPOSITION

General description and components (%wt): Magnox sludge (100%).

Chemical state: Alkali

Chemical form of radionuclides: U: U234, U235, U236, U238. Present as metal and oxides.
Pu: Pu238, Pu239, Pu240, Pu241, Pu242. Present as metal and oxide.

Metals and alloys (%wt): -

Stainless steel.....	0
Other ferrous metals.....	0
Iron.....	0
Aluminium.....	0
Beryllium.....	0
Cobalt.....	0
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	<5.0
Nickel.....	0
Titanium.....	0
Uranium.....	5.0
Zinc.....	0

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	Zircaloy/Zirconium	0
	Other metals	0
Organics (%wt):	-	
	Total cellulosics	0
	Paper, cotton	0
	Wood	0
	Halogenated plastics	0
	Total non-halogenated plastics	0
	Condensation polymers	0
	Others	0
	Organic ion exchange materials	0
	Total rubber	0
	Halogenated rubber	0
	Non-halogenated rubber	0
	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	0
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs	90.0
	Soil	0
	Brick/Stone/Rubble	0
	Cementitious material	0
	Sand	0
	Glass/Ceramics	0
	Graphite	0
	Desiccants/Catalysts	0
	Asbestos	0
	Non/low friable	0
	Moderately friable	0
	Highly friable	0
	Free aqueous liquids	0
	Free non-aqueous liquids	0
	Powder/Ash	0
Inorganic anions (%wt):	Hydroxide is present as magnesium hydroxide. Carbonates are present. Others are unlikely to be present except in trace quantities.	

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Fluoride	TR
Chloride	TR
Iodide	TR
Cyanide	NE
Carbonate	P
Nitrate	TR
Nitrite	TR
Phosphate	TR
Sulphate	TR
Sulphide	TR

Materials of interest for waste acceptance criteria: -

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
Active particles	0
Soluble solids as bulk chemical compounds	0

Hazardous substances / non hazardous pollutants: -

Acrylamide	0
Benzene	0
Chlorinated solvents	0
Formaldehyde	0
Organometallics	0
Phenol	0
Styrene	
Tri-butyl phosphate	0
Other organophosphates	0
Vinyl chloride	0
Arsenic	0
Barium	0
Boron	0

Cadmium..... 0

Caesium..... 0

Selenium..... 0

Chromium..... 0

Molybdenum..... 0

Thallium..... 0

Tin..... 0

Vanadium..... 0

Mercury compounds..... 0

Others..... 0

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

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... 0

PACKAGING AND CONDITIONING

Conditioning method: Conditioning plans are yet to be established, the sludge is likely to be routed to SIXEP and SWP for treatment. Any fuel based sludge is likely to be routed to BEP or BUFT.

Plant Name: SIXEP, BEP, BUFT

Location: Sellafield

Plant startup date: -

Total capacity (m^3/y incoming waste): -

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
Sellafield 3m^3 box	100.0	~0.8	2.7	42

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Likely container type comment:	-
Range in container waste volume:	-
Other information on containers:	Stainless Steel
Likely conditioning matrix:	Not specified
Other information:	-
Conditioned density (t/m³):	NE
Conditioned density comment:	-
Other information on conditioning:	-
Opportunities for alternative disposal routing:	No

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	Magnox sludge containing uranium and mixed fission products.
Uncertainty:	-
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:	Major radionuclides are measured by analysis of samples (1996) taken from storage tanks.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	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	1.20E-04	B B 2	1.20E-04	B B 2	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	8.98E-11	B B 1		
Co 60	3.92E-03	B B 1	1.70E-02	B B 2	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	8.62E-11	B B 1		
Zn 65					Ra 223	2.33E-09	B B 1		
Se 79	3.57E-05	B B 2	3.57E-05	B B 2	Ra 225	3.46E-12	B B 2		
Kr 81					Ra 226	3.14E-10	B B 1		
Kr 85					Ra 228	6.19E-14	B B 1		
Rb 87					Ac 227	2.36E-09	B B 1		
Sr 90	2.32E+01	B B 1	3.26E+01	B B 2	Th 227	2.31E-09	B B 1		
Zr 93	1.30E-03	B B 2	1.30E-03	B B 2	Th 228	4.75E-14	B B 1		
Nb 91					Th 229	3.48E-12	B B 2		
Nb 92					Th 230	7.49E-08	B B 1		
Nb 93m	5.39E-04	B B 2			Th 232	1.12E-13	B B 1		
Nb 94					Th 234	1.56E-03	B B 1		
Mo 93					Pa 231	1.07E-08	B B 1		
Tc 97					Pa 233	8.21E-05	B B 2		
Tc 99	7.42E-03	B B 1	7.42E-03	B B 2	U 232				
Ru 106	2.87E-04	B B 2	6.70E-03	B B 2	U 233	4.54E-09	B B 2		
Pd 107					U 234	6.12E-04	B B 1	5.97E-04	B B 2
Ag 108m					U 235	3.77E-05	B B 1	3.77E-05	B B 2
Ag 110m					U 236	1.76E-04	B B 1	1.76E-04	B B 2
Cd 109					U 238	1.56E-03	B B 1	1.56E-03	B B 2
Cd 113m					Np 237	8.24E-05	B B 2	7.48E-05	B B 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	3.69E-01	B B 1	4.14E-01	B B 2
Sn 123					Pu 239	5.86E-01	B B 1	5.86E-01	B B 2
Sn 126					Pu 240	7.68E-01	B B 1	7.69E-01	B B 2
Sb 125					Pu 241	1.79E+01	B B 1	3.44E+01	B B 2
Sb 126					Pu 242	6.84E-04	B B 1	6.84E-04	B B 2
Te 125m					Am 241	1.89E+00	B B 1	1.44E+00	B B 2
Te 127m					Am 242m				
I 129	2.01E-05	B B 2	2.01E-05	B B 2	Am 243				
Cs 134	8.18E-03	B B 1	9.34E-02	B B 2	Cm 242				
Cs 135	1.18E-04	B B 2	1.18E-04	B B 2	Cm 243				
Cs 137	4.84E+00	B B 1	6.73E+00	B B 2	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	2.04E-05	B B 2	6.16E-04	B B 2	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	1.44E-01	B B 1	3.97E-01	B B 2	**Total a**	**3.62E+00**	**B B 2**	**3.21E+00**	**B B 2**
Eu 155	4.75E-02	B B 1	2.21E-01	B B 2	**Total b/g**	**4.62E+01**	**B B 2**	**7.45E+01**	**B B 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