WASTE STREAM 2C05 Sludge

SITE Chapelcross

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	~15.0 m³
Total future arisings:		0 m³
Total waste volume:		15.0 m³

Comment on volumes: Sludge is stored under water.

Uncertainty factors on volumes:

Stock (upper):	x 1.2	Arisings (upper)	x
Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE The sludge arises from the corrosion of fuel cladding.

PHYSICAL CHARACTERISTICS

General description: The waste is a sludge which arises from the corrosion of Magnox fuel cladding. There are no items which require special handling.

Physical components (%vol): Sludge (100%).

Sealed sources: -

Bulk density (t/m³): 1.3

Comment on density: The defined mean density refers to the mass divided by the volume as stored.

CHEMICAL COMPOSITION

General description and components (%wt): Magnesium hydroxide; water; traces of uranium.

Chemical state: Alkali

Chemical form of radionuclides:
H-3: Tritium may be present as tritiated water.
C-14: Carbon-14 may be present as graphite.
Cl-36: Chlorine-36 content is insignificant.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
Ra: The radium isotope content is insignificant.
Th: The thorium isotope content is insignificant.
U: Present in metallic and reacted forms.
Np: The neptunium content is insignificant.
Pu: Present in metallic and mixed oxide forms.

Metals and alloys (%wt): -

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

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	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	TR	Small pieces of uranium.
Organics (%wt):	Organic materials are unlikely to be present.		
	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		
	Oil or grease		
	Fuel		
	Asphalt/Tarmac (cont.coal tar)		
	Asphalt/Tarmac (no coal tar)		
	Bitumen		
	Others		
	Other organics	0	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	~100.0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand		
	Glass/Ceramics	0	
	Graphite	0	
	Desiccants/Catalysts		
	Asbestos	0	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	P	
	Free non-aqueous liquids	0	
	Powder/Ash	0	
Inorganic anions (%wt):	Not fully assessed. Oxides and hydroxides are present.		

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Fluoride	NE
Chloride	NE
Iodide	NE
Cyanide	0
Carbonate	NE
Nitrate	NE
Nitrite	NE
Phosphate	NE
Sulphate	NE
Sulphide	NE

Materials of interest for waste acceptance criteria: No materials likely to pose a fire or other non-radiological hazard have been identified.

Combustible metals	0
Low flash point liquids	0
Explosive materials	0
Phosphorus	0
Hydrides	0
Biological etc. materials	0
Biodegradable materials	
Putrescible wastes	0
Non-putrescible wastes	
Corrosive materials	0
Pyrophoric materials	0
Generating toxic gases	0
Reacting with water	0
Active particles	
Soluble solids as bulk chemical compounds	

Hazardous substances / non hazardous pollutants: Probably no toxic metals present except for small pieces of uranium.

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

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Cadmium.....

Caesium.....

Selenium.....

Chromium.....

Molybdenum.....

Thallium.....

Tin.....

Vanadium.....

Mercury compounds.....

Others.....

Electronic Electrical Equipment (EEE)

EEE Type 1.....

EEE Type 2.....

EEE Type 3.....

EEE Type 4.....

EEE Type 5.....

Complexing agents (%wt):

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... NE

PACKAGING AND CONDITIONING

Conditioning method: Drying of waste into Mosaiks using AVDS.

Plant Name: -

Location: Chapelcross

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
500 l RS drum (0mm Pb)	100.0	1.25	0.49	12

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Likely container type comment:	-
Range in container waste volume:	-
Other information on containers:	-
Likely conditioning matrix:	
Other information:	-
Conditioned density (t/m³):	0.6
Conditioned density comment:	-
Other information on conditioning:	-
Opportunities for alternative disposal routing:	

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	The material is contaminated with Sr-90, Cs-137, Am-241 and various isotopes of plutonium.
Uncertainty:	-
Definition of total alpha and total beta/gamma:	Other alpha comprises plutonium isotopes.
Measurement of radioactivities:	The activity estimates are based on sampling.
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		6			Gd 153		8		
Be 10		8			Ho 163		8		
C 14		6			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36		8			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54	1.36E-06	B D 1			Pb 205		8		
Fe 55		5			Pb 210		8		
Co 60	1.23E-02	B D 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63		8			Po 210		8		
Zn 65	3.57E-08	B D 1			Ra 223		8		
Se 79		4			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	7.26E-02	B D 1			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232		4		
Nb 94		8			Th 234		8		
Mo 93		8			Pa 231		4		
Tc 97		8			Pa 233	2.57E-08	B D 2		
Tc 99		8			U 232		8		
Ru 106	6.15E-06	B D 1			U 233		8		
Pd 107		8			U 234		8		
Ag 108m		8			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238		8		
Cd 113m		8			Np 237	2.61E-08	B D 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	4.75E-08	B D 2		
Sn 123		8			Pu 239		7		
Sn 126		8			Pu 240		7		
Sb 125		8			Pu 241		8		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	8.88E-03	B D 1		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	9.75E-05	B D 2			Cm 242		8		
Cs 135		8			Cm 243		5		
Cs 137	6.50E-02	B D 2			Cm 244		5		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144	6.73E-07	B D 1			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147		4			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		4			Other a				
Eu 152		8			Other b/g				
Eu 154	9.66E-04	B D 1			**Total a**	**8.88E-03**	**B D 2**	**0**	
Eu 155	5.55E-04	B D 1			**Total b/g**	**1.51E-01**	**B D 2**	**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