WASTE STREAM 9G78/C Sludge (incorporating MSV and RV1 WRATS) - Conditioned Material

SITE Trawsfynydd

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2022.....	105.6 m^3	125.3 m^3
Total future arisings:		0 m^3	0 m^3
Total waste volume:		105.6 m^3	125.3 m^3
Number of waste packages in stock:	At 1.4.2022.....	48 package(s)	

Comment on volumes: Conditioned volume calculated based on 48 packages x 2.2m3 = 105.6m3. Campaign 3 produced 3 liners and campaign 4 produced 45 liners.

Uncertainty factors on volumes:

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

WASTE SOURCE Includes oily/sludge residues from the base of the vault and sludge resulting from routine filtration of liquid effluents and cooling pond water and from special clean-up operations on cooling ponds.

PHYSICAL CHARACTERISTICS

General description: The waste consists of debris washed from persons, corrosion products such as magnesium hydroxide and carbonate detached from fuel elements and extraneous materials such as flakes of paint. There is also some filter sand.

Physical components (%wt): Sludge (7 wt%), cementitious grout (62 wt%), package furniture (29 wt%) and bound oil (2 wt%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): 1.89

Comment on density: The density was calculated from the conditioned wasteform mass and volume reported in the Periodic Review (LL31196039 Issue 1).

CHEMICAL COMPOSITION

General description and components (%wt): Sludge (7 wt%), cementitious grout (62 wt%), package furniture (29 wt%) and bound oil (2 wt%).

Chemical state: Alkali

Chemical form of radionuclides:
H-3: Most tritium is expected to be present as water but some may be present in the form of other inorganic compounds or as organic compounds.
C-14: Carbon 14 may be present as graphite.
Se-79: Not determined.
Tc-99: Not determined.
Ra: Insignificant.
Th: Traces of thorium may be present in its natural form or as insoluble salts.
U: Not determined but may be uraium oxides.
Np: Not determined.
Pu: Not determined but may be plutonium oxides.

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	29.0	Stainless steel liners and package furniture are present, Grade 316S11.	
Other ferrous metals.....			
Iron.....			

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

Organics (%wt): There is some oil and grease. Organic ion exchange resins are in trace quantities.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	NE		
Paper, cotton	NE		
Wood	NE		
Halogenated plastics	0		
Total non-halogenated plastics	0		
Condensation polymers	0		
Others	0		
Organic ion exchange materials	0.28	Lewatit DN	
Total rubber	0		
Halogenated rubber	0		
Non-halogenated rubber	0		
Hydrocarbons	2.0		
Oil or grease	2.0	Bound oil	
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics			

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	NE		
Inorganic sludges and flocs	7.0		
Soil	NE		
Brick/Stone/Rubble	NE		
Cementitious material	62.0	9:1 BFS/OPC immobilisation matrix.	
Sand			

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

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride	0	
Chloride	0.10	
Iodide	0	
Cyanide	0	
Carbonate	3.9	
Nitrate	0	
Nitrite	0	
Phosphate	0	
Sulphate	1.3	
Sulphide	0	

Materials of interest for 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	TR	
Biodegradable materials	0	
Putrescible wastes	0	
Non-putrescible wastes		
Corrosive materials	0	
Pyrophoric materials	0	
Generating toxic gases	0	
Reacting with water	0	
Higher activity particles		
Soluble solids as bulk chemical compounds		

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Hazardous substances / non hazardous pollutants: -

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

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		
Total complexing agents.....	TR	

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Potential for the waste to contain discrete items: No. In & of itself not a DI; assumed not likely to contain any "rogue" items that could be.

PACKAGING AND CONDITIONING

Container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
3m^3 drum	100.0	2.2	2.2	48

Container type comment: -

Range in container waste volume: -

Other information on containers: -

Conditioned density (t/m^3): 1.89

Conditioned density comment: The density was calculated from the conditioned wasteform mass and volume reported in the Periodic Review (LL31196039 Issue 1).

Other information on conditioning: -

RADIOACTIVITY

Source: -

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: The specific activities have been derived using the radionuclide inventory of the main sludge vault and the known wastestream package mass and volume.

Other information: -

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	3.24E-02	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	5.47E-03	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	6.16E-05	C C 2			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		8			Pb 205		8		
Fe 55	2.8E-02	C C 2			Pb 210		8		
Co 60	2.29E-02	C C 2			Bi 208		8		
Ni 59	2.72E-05	C C 2			Bi 210m		8		
Ni 63	3.96E-02	C C 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	2.93E-01	C C 2			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230	1.3E-09	C C 2		
Nb 93m		8			Th 232		8		
Nb 94	5.02E-05	C C 2			Th 234	5.65E-05	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	1.56E-07	C C 2		
Tc 99	6.08E-04	C C 2			U 232		8		
Ru 106	4.88E-08	C C 2			U 233		8		
Pd 107		8			U 234	4.61E-05	C C 2		
Ag 108m	2.92E-04	C C 2			U 235	1.1E-06	C C 2		
Ag 110m		8			U 236	4.09E-06	C C 2		
Cd 109		8			U 238	5.65E-05	C C 2		
Cd 113m		8			Np 237	1.62E-07	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	2E-02	C C 2		
Sn 123		8			Pu 239	3.76E-02	C C 2		
Sn 126		8			Pu 240	3.74E-02	C C 2		
Sb 125	1.53E-06	C C 2			Pu 241	3.27E-01	C C 2		
Sb 126		8			Pu 242		8		
Te 125m	3.83E-07	C C 2			Am 241	1.63E-01	C C 2		
Te 127m		8			Am 242m		8		
I 129	9.84E-08	C C 2			Am 243		8		
Cs 134	7.86E-07	C C 2			Cm 242	2.87E-09	C C 2		
Cs 135		8			Cm 243	9.61E-05	C C 2		
Cs 137	4.87E-01	C C 2			Cm 244	1.12E-03	C C 2		
Ba 133	1.93E-04	C C 2			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144	1.95E-08	C C 2			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	4.08E-05	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	3.71E-03	C C 2			Other a				
Eu 152	5.22E-04	C C 2			Other b/g				
Eu 154	2.64E-03	C C 2			**Total a**	**2.60E-01**	**C C 2**	**0**	
Eu 155	3.05E-04	C C 2			**Total b/g**	**1.24E+00**	**C C 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