WASTE STREAM 9G16/C Sludge - Conditioned Material

SITE	Trawsfynydd
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2019.....	~61.6 m³	73.1 m³
Total future arisings:		0 m³	0 m³
Total waste volume:		61.6 m³	73.1 m³
Number of waste packages in stock:	At 1.4.2019.....	28 package(s)	

Comment on volumes: There are 28 drums.

Uncertainty factors on volumes:

Stock (upper):	x 1.0	Arisings (upper)	x
Stock (lower):	x 1.0	Arisings (lower)	x

WASTE SOURCE Sludge retrieved from the main sludge vault and solidified in the solidification plant at Trawsfynydd.

PHYSICAL CHARACTERISTICS

General description: Conditioned sludge in 2.6m3 (displacement volume) stainless steel liners placed into 3m3 concrete overpacks. The overpacks are present to act as shielding during the storage of the packages and do not contribute to the final disposal package. There are 28 of these packages. There are no large items that may require special handling.

Physical components (%wt): Sludge (~46%), cement (~46%) and drum (~8%).

Sealed sources: -

Bulk density (t/m³): 1.8

Comment on density: The maximum density of the waste will be 2.0 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): Sludge (~46%), cement (~46%) and drum (~8%).

Chemical state: Neutral

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 may be present as graphite.
Cl-36: The chemical form of chlorine 36 has not been assessed.
Se-79: The chemical form of selenium has not been determined.
Tc-99: The chemical form of technetium has not been determined.
Ra: The radium isotope content is insignificant.
Th: Traces of thorium may be present in its natural form or as insoluble salts.
U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.
Np: The chemical form of neptunium has not been determined.
Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Stainless steel liners are present.

Stainless steel.....	8.0	Stainless steel liners are present.
Other ferrous metals.....		
Iron.....		
Aluminium.....	<0.10	
Beryllium.....	0	
Cobalt.....		
Copper.....	0	

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	Lead	0	
	Magnox/Magnesium	<0.40	
	Nickel		
	Titanium		
	Uranium		
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	NE	Not fully assessed.
Organics (%wt):	There are no halogenated plastics or rubbers present.		
	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	NE	
	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	NE	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	NE	
	Inorganic sludges and flocs	~46.0	
	Soil	NE	
	Brick/Stone/Rubble	NE	
	Cementitious material	~46.0	
	Sand		
	Glass/Ceramics	NE	
	Graphite	NE	
	Desiccants/Catalysts		
	Asbestos	0	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	NE	

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Free non-aqueous liquids	NE
Powder/Ash	0
Inorganic anions (%wt):	-
Fluoride	0
Chloride	NE
Iodide	0
Cyanide	0
Carbonate	NE
Nitrate	0
Nitrite	0
Phosphate	0
Sulphate	NE
Sulphide	0

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

Combustible metals	NE
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	NE
Active particles	
Soluble solids as bulk chemical compounds	

Hazardous substances / non hazardous pollutants: None expected.

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

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Arsenic.....

Barium.....

Boron.....

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

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... TR

PACKAGING AND CONDITIONING

Container type:

Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
3m³ drum	100.0	2.2	2.2	28

Container type comment: The waste has been conditioned.

Range in container waste volume: The waste loading per package is not expected to vary significantly.

Other information on containers: The container material is stainless steel.

Conditioned density (t/m³): ~1.8

Conditioned density comment: The maximum density of the waste will be 2.0 t/m3.

Other information on conditioning: The waste has been conditioned.

RADIOACTIVITY

Source: Contaminated sludge. Contamination by fission products, actinides and activation products.

Uncertainty: Specific activity is a function of Station operating history.

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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 from the activities of the raw waste stream, 9G16, reduced by a factor to account for the volume increase on conditioning.
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	1.21E-03	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.00E-04	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26	2E-05	C C 2			Tm 171		8		
Cl 36	5E-07	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	9.12E-06	C C 2			Pb 210		8		
Co 60	1.53E-04	C C 2			Bi 208		8		
Ni 59	7E-06	C C 2			Bi 210m		8		
Ni 63	2.82E-04	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	2.42E-02	C C 2			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		8		
Nb 94		8			Th 234	6E-06	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	5.00E-08	C C 2		
Tc 99	3E-05	C C 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	5.06E-06	C C 2		
Ag 108m	1.97E-06	C C 2			U 235	3.00E-08	C C 2		
Ag 110m		8			U 236	1.00E-07	C C 2		
Cd 109		8			U 238	6E-06	C C 2		
Cd 113m		8			Np 237	5.04E-08	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	1.86E-03	C C 2		
Sn 123		8			Pu 239	3E-03	C C 2		
Sn 126		8			Pu 240	4.00E-03	C C 2		
Sb 125	4.14E-07	C C 2			Pu 241	5.19E-02	C C 2		
Sb 126		8			Pu 242		8		
Te 125m	1.04E-07	C C 2			Am 241	1.08E-02	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	4.86E-08	C C 2			Cm 242		8		
Cs 135		8			Cm 243	5.68E-06	C C 2		
Cs 137	1.63E-02	C C 2			Cm 244	1.42E-04	C C 2		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	1.86E-05	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	9.33E-04	C C 2			Other a				
Eu 152	3.15E-06	C C 2			Other b/g				
Eu 154	2.91E-04	C C 2			**Total a**	**1.98E-02**	**C C 2**	**0**	
Eu 155	2.79E-05	C C 2			**Total b/g**	**9.56E-02**	**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