WASTE STREAM 9C16 PWTP Sludge

SITE	Dungeness A
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	11.0 m^3
Total future arisings:		0 m^3
Total waste volume:		11.0 m^3
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x 1.2	Arisings (upper) x
	Stock (lower): x 0.8	Arisings (lower) x

WASTE SOURCE The sludge originates from routine filtration of liquid effluents and cooling pond water and from special clean-up operations on cooling ponds. There will also be sand from the final emptying of the pond sand filters.

PHYSICAL CHARACTERISTICS

General description:	The waste consists of corrosion products such as magnesium hydroxide and carbonate detached from fuel elements and extraneous materials such as flakes of paint from the ponds. Also there is some filter sand. Sludge particles may be up to millimetre size, and there will probably be 50-450 kg/m^3 of dry material. Once fluidised the sludges should be readily transferred by pumping but reconcentration may be time consuming. There are no large items that may require special handling.
Physical components (%wt):	Sludge and sand (100%). Paint flakes present but % not yet estimated. No other constituent anticipated.
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m^3):	1.9
Comment on density:	The bulk density of the sludge is likely to range from 1.05 to 1.15 t/m^3 with an average of 1.1 t/m^3. Sand from sand filters (4.8 m^3) will have a density of about 2.65 t/m^3 so the overall mean bulk density is about 1.9 t/m^3.

CHEMICAL COMPOSITION

General description and components (%wt):	Magnesium hydroxide, magnesium carbonate, siliceous materials including sand, perhaps some oil contamination and a range of other materials including paint flakes.
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 organic or inorganic compounds. C-14: Carbon 14 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. 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):	There are no bulk metal items present.

WASTE STREAM 9C16 PWTP Sludge

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	0		
Other ferrous metals	0		
Iron			
Aluminium	0		
Beryllium	TR		
Cobalt			
Copper	0		
Lead	0		
Magnox/Magnesium	<1.0	Some unreacted Magnox (<1%) is expected.	
Nickel			
Titanium			
Uranium	0		
Zinc	0		
Zircaloy/Zirconium	0		
Other metals			

Organics (%wt): The cellulosic material content of the waste has not been assessed. Ion exchange materials would be expected in only trace quantities. There may be some oil. There are no halogenated plastics or rubbers present.

	(%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	TR		
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	~10.0		

Other materials (%wt): -

WASTE STREAM 9C16 PWTP Sludge

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	~40.0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	~47.0		
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	P		
Free non-aqueous liquids.....	TR		
Powder/Ash.....	0		

Inorganic anions (%wt): Not fully assessed. Carbonates are expected to be present.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	NE	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: Magnox will ignite under appropriate conditions. There might be some oil and trace quantities of biological material. The possible presence of items that are not estimated is to be determined.

	(%wt)	Type(s) and comment
Combustible metals.....	<1.0	
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.....		

WASTE STREAM 9C16 PWTP Sludge

Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	NE
Reacting with water.....	<1.0
Higher activity particles.....	
Soluble solids as bulk chemical compounds.....	

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.....		

WASTE STREAM 9C16 PWTP Sludge

Complexing agents (%wt): Yes

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

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

Conditioning method: -

Plant Name: AVDS

Location: Dungeness A Site

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: waste will be dried using a fill/dry cycle to optimise waste loading volume

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	~0.46	0.49	24

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: -

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

WASTE STREAM 9C16 PWTP Sludge

RADIOACTIVITY

Source:	Contaminated sludge. Contamination by fission products, actinides and activation products.
Uncertainty:	Specific activity is a function of Station operating history. The values quoted are indicative of the activities that might be expected.
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:	Estimated from available data.
Other information:	-

WASTE STREAM 9C16 PWTP Sludge

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	3.75E-05	C C 2			Gd 153		8		
Be 10	1E-07	C C 2			Ho 163		8		
C 14	6.99E-06	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26	3E-05	C C 2			Tm 171		8		
Cl 36	1E-04	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	2E-05	C C 2			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54	3.33E-06	C C 2			Pb 205		8		
Fe 55	8.31E-03	C C 2			Pb 210		8		
Co 60	3.44E-03	C C 2			Bi 208		8		
Ni 59	2E-05	C C 2			Bi 210m		8		
Ni 63	1.89E-03	C C 2			Po 210		8		
Zn 65	1.55E-06	C C 2			Ra 223		8		
Se 79	2.76E-08	C C 2			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	3.26E-03	C C 2			Th 227		8		
Zr 93	3E-07	C C 2			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	1.10E-07	C C 2			Th 232		8		
Nb 94		8			Th 234	3E-06	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	1E-05	C C 2		
Tc 99	9E-08	C C 2			U 232		8		
Ru 106	5.91E-05	C C 2			U 233		8		
Pd 107	1E-08	C C 2			U 234	3.01E-06	C C 2		
Ag 108m	4.93E-08	C C 2			U 235	8E-08	C C 2		
Ag 110m	6.29E-09	C C 2			U 236	4.00E-07	C C 2		
Cd 109		8			U 238	3E-06	C C 2		
Cd 113m	1.31E-07	C C 2			Np 237	1E-05	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	4.69E-04	C C 2		
Sn 123		8			Pu 239	6.00E-04	C C 2		
Sn 126	7.88E-08	C C 2			Pu 240	8.00E-04	C C 2		
Sb 125	4.21E-05	C C 2			Pu 241	4.68E-02	C C 2		
Sb 126	1.10E-08	C C 2			Pu 242	1E-06	C C 2		
Te 125m	<1.05E-05	C 3			Am 241	1.76E-03	C C 2		
Te 127m		8			Am 242m	7.67E-06	C C 2		
I 129	4E-09	C C 2			Am 243	3.00E-06	C C 2		
Cs 134	3.10E-05	C C 2			Cm 242	6.33E-06	C C 2		
Cs 135	2E-07	C C 2			Cm 243	1.65E-06	C C 2		
Cs 137	4.94E-03	C C 2			Cm 244	4.35E-05	C C 2		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144	1.41E-05	C C 2			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	1.28E-03	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	3.74E-05	C C 2			Other a				
Eu 152	1.30E-06	C C 2			Other b/g	1.12E-08	C C 2		
Eu 154	5.12E-04	C C 2			**Total a**	**3.70E-03**	**C C 2**	**0**	
Eu 155	3.15E-04	C C 2		C	**Total b/g**	**7.11E-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