WASTE STREAM 9D24 Sludge

SITE	Hinkley Point A
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	19.4 m³
Total future arisings:		0 m³
Total waste volume:		19.4 m³
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x 1.1	Arisings (upper) x
	Stock (lower): x 0.9	Arisings (lower) x

WASTE SOURCE The sludge originates from routine filtration of cooling pond water and from special clean-up operations on cooling ponds.

PHYSICAL CHARACTERISTICS

General description:	Sludge removed from the pond sand pressure filters by backwashing and transfer to the sludge tank. The waste consists of debris/sludge filtered from pond water, effluents and clean-up operations. There will be some filter sand, small quantities of ion exchange material from Caesium Removal Units (CRU), paint flakes and waste hold up tank debris (rust and paint particulate). There are no large items that may require special handling.
Physical components (%wt):	Sand, sludge and other materials (~35%wt), water (~63%wt). The oil content was determined as ~2%wt.
Sealed sources:	-
Bulk density (t/m³):	1.29
Comment on density:	The bulk density of the waste ranges from 0.8 to 1.5 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt):	Water (~63% wt). Sand and sludge (~35% wt) which includes magnesium hydroxides and carbonates at ~14%wt of the waste. The oil content was determined as ~2%wt and 'others' of <1%wt in the waste. Quantities of ion exchange material are also present.
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 or organic compounds. C-14: Carbon 14 may be present as graphite. Cl-36: The chlorine 36 content is insignificant. U: The chemical form of uranium isotopes has not been determined but will probably 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 will probably be plutonium oxides.
Metals and alloys (%wt):	No sheet or bulk metal present.

Stainless steel.....	0	
Other ferrous metals.....	0	
Iron.....		
Aluminium.....	0	
Beryllium.....	0	
Cobalt.....		
Copper.....	0	
Lead.....	0	
Magnox/Magnesium.....	TR	Some unreacted Magnox may be present.

WASTE STREAM 9D24 Sludge

	Nickel	
	Titanium	
	Uranium	
	Zinc	0
	Zircaloy/Zirconium	0
	Other metals	0
Organics (%wt):	There may be trace quantities of organic material present in the waste. There are no halogenated plastics or rubbers 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	<1.0
	Total rubber	0
	Halogenated rubber	0
	Non-halogenated rubber	0
	Hydrocarbons	~2.0
	Oil or grease	~2.0
	Fuel	
	Asphalt/Tarmac (cont.coal tar)	
	Asphalt/Tarmac (no coal tar)	
	Bitumen	
	Others	
	Other organics	0
Other materials (%wt):	-	
	Inorganic ion exchange materials.	TR
	Inorganic sludges and flocs	~20.0
	Soil	0
	Brick/Stone/Rubble	0
	Cementitious material	0
	Sand	~15.0
	Glass/Ceramics	0
	Graphite	0
	Desiccants/Catalysts	
	Asbestos	0
	Non/low friable	
	Moderately friable	
	Highly friable	
	Free aqueous liquids	63.0
	Free non-aqueous liquids	0

WASTE STREAM 9D24 Sludge

	Powder/Ash	0
Inorganic anions (%wt):	Silicates and alumino-silicates may be present.	
	Fluoride	0
	Chloride	TR
	Iodide	0
	Cyanide	0
	Carbonate	~4.0
	Nitrate	0
	Nitrite	0
	Phosphate	~1.0
	Sulphate	~2.0
	Sulphide	0
Materials of interest for waste acceptance criteria:	The waste is unlikely to present a fire hazard but this requires confirmation since Magnox may be present and will ignite under appropriate conditions. There might be trace quantities of biological material.	
	Combustible metals	TR
	Low flash point liquids	0
	Explosive materials	0
	Phosphorus	0
	Hydrides	0
	Biological etc. materials	TR
	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:	None expected.	
	Acrylamide	
	Benzene	
	Chlorinated solvents	
	Formaldehyde	
	Organometallics	
	Phenol	
	Styrene	
	Tri-butyl phosphate	
	Other organophosphates	
	Vinyl chloride	
	Arsenic	

WASTE STREAM 9D24 Sludge

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): No

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... 0

PACKAGING AND CONDITIONING

Conditioning method: Externally mixed into CB.

Plant Name: -

Location: Hinkley Point A Decommissioning Site

Plant startup date: 2020

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

Target start date for packaging this stream: 2022

Throughput for this stream (m^3/y incoming waste): -

Other information: Assumption is that waste will be co packaged with other sludge streams - 9D22, 9D24, 9D32, 9D60, 9D67, 9D68, 9D69 & 9D70 - 34 CBs overall.

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
6m^3 concrete box (SD)	100.0	2.7	5.8	8

WASTE STREAM 9D24 Sludge

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

Treatment	Stream volume (%)	Comment
-	-	-

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:	The values quoted were derived by extrapolation from available measurements.
Other information:	-

WASTE STREAM 9D24 Sludge

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	5.33E-04	C C 2		8	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	8.00E-05	C C 2		8	Ho 166m		8		8
Na 22		8			Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36		8		8	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54	<4.97E-08	C 3		8	Pb 205		8		8
Fe 55	2.02E-03	C C 2		8	Pb 210		8		8
Co 60	1.87E-03	C C 2		8	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	1.84E-03	C C 2		8	Po 210		8		8
Zn 65	<1.50E-08	C 3		8	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226		8		8
Kr 85		8		8	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	2.83E-02	C C 2		8	Th 227		8		8
Zr 93		8		8	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		8		8	Th 234	9E-06	C C 2		8
Mo 93		8		8	Pa 231	1.94E-09	C C 2		8
Tc 97		8		8	Pa 233	2.61E-07	C C 2		8
Tc 99		8		8	U 232		8		8
Ru 106	2.44E-05	C C 2		8	U 233		8		8
Pd 107		8		8	U 234	3.70E-06	C C 2		8
Ag 108m		8		8	U 235	5.92E-07	C C 2		8
Ag 110m		8		8	U 236	2.71E-07	C C 2		8
Cd 109		8		8	U 238	9E-06	C C 2		8
Cd 113m		8		8	Np 237	2.62E-07	C C 2		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	4.28E-03	C C 2		8
Sn 123		8		8	Pu 239	5.54E-03	C C 2		8
Sn 126		8		8	Pu 240	7.32E-03	C C 2		8
Sb 125	1.36E-04	C C 2		8	Pu 241	2.74E-01	C C 2		8
Sb 126		8		8	Pu 242		8		8
Te 125m	<3.40E-05	C 3		8	Am 241	2.45E-02	C C 2		8
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	4.71E-05	C C 2		8	Cm 242		8		8
Cs 135		8		8	Cm 243	4.66E-05	C C 2		8
Cs 137	2.69E-02	C C 2		8	Cm 244	7.08E-04	C C 2		8
Ba 133		8		8	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144	1.22E-06	C C 2		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	1.11E-03	C C 2		8	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152		8		8	Other b/g				
Eu 154	2.39E-03	C C 2		8	**Total a**	**4.24E-02**	**C C 2**	**0**	
Eu 155	8.99E-04	C C 2		8	**Total b/g**	**3.41E-01**	**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