WASTE STREAM 9R101 Berkeley Centre Decommissioning : Primary ILW

SITE Berkeley

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	12.2 m³
Future arisings -	1.4.2019 - 31.3.2021.....	25.6 m³
Total future arisings:		25.6 m³
Total waste volume:		37.8 m³

Comment on volumes: Decommissioning of active facilities commenced in 2005.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.2	Arisings (upper)	x 1.2
	Stock (lower):	x 0.8	Arisings (lower)	x 0.8

WASTE SOURCE Materials that have been used in the examination of irradiated fuel, steel and graphite.

PHYSICAL CHARACTERISTICS

General description: A variety of mild steel, stainless steel, lead and other materials mostly laboratory constructional materials and equipment. Includes some secondary waste. Waste can be packaged in standard ILW packages.

Physical components (%vol): 67% General Scrap, 14% General Waste, 10% Steel, 4% Plastics, 2% Stainless Steel, 3% Other.

Sealed sources: -

Bulk density (t/m³): ~1.5

Comment on density: The average bulk density is estimated at ~1.5 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): A variety of mild steels, stainless steels, lead and other materials. Percentage breakdown has not been assessed.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: The chemical form of tritium has not been assessed.
C-14: The chemical form of carbon 14 has not been assessed.
Cl-36: The chemical form of chlorine 36 has not been assessed.
Ra: The radium isotopes content is expected to be insignificant.
Th: The thorium isotopes content is expected to be insignificant.
U: The chemical form of uranium isotopes has not been assessed.
Pu: The chemical form of plutonium isotopes has not been assessed.

Metals and alloys (%wt): Proportions of bulk metal items have not been assessed. Some items may be cut for packaging.

Stainless steel.....	NE	
Other ferrous metals.....	NE	
Iron.....		
Aluminium.....	NE	
Beryllium.....	NE	
Cobalt.....	NE	Stellite
Copper.....	NE	
Lead.....	NE	
Magnox/Magnesium.....	TR	
Nickel.....	TR	Nimonic
Titanium.....		

	Uranium		
	Zinc	NE	
	Zircaloy/Zirconium	NE	
	Other metals	NE	Not fully assessed.
Organics (%wt):	Some organic materials may be present.		
	Total cellulosics	NE	
	Paper, cotton	NE	
	Wood	NE	
	Halogenated plastics	NE	
	Total non-halogenated plastics	NE	
	Condensation polymers	NE	
	Others	NE	
	Organic ion exchange materials	0	
	Total rubber	NE	
	Halogenated rubber	NE	
	Non-halogenated rubber	NE	
	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.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand		
	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	TR	
Inorganic anions (%wt):	Not assessed.		

Fluoride	NE
Chloride	NE
Iodide	NE
Cyanide	NE
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: Some lead is expected, other toxic metal contents have not been fully assessed.

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

Conditioning method: To be co-packaged with 9R02, 9R10, 9R13, 9R17, 9R19, 9R112, 9R118. Packages are assigned to 9R02 & 9R101.

Plant Name: -

Location: -

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
3m^3 RS box	100.0	~3.15	2.5	12

WASTE STREAM 9R101 Berkeley Centre Decommissioning : Primary ILW

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:	Contamination of the materials.
Uncertainty:	Estimates have been made from waste disposed during previous cave line refurbishment.
Definition of total alpha and total beta/gamma:	Activity estimates have been made from analysis of waste from a previous refurbishment of the caves along with a fingerprint of typical isotopes. The totals are from the fingerprints.
Measurement of radioactivities:	From health physics returns of LLW packages sent for disposal.
Other information:	There will be contamination by fission products and activation products.

WASTE STREAM 9R101 Berkeley Centre Decommissioning : Primary ILW

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	1.53E-04	C C 2	2.39E-04	C C 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	2E-05	C C 2	2E-05	C C 2	Ho 166m		8		8
Na 22		8			Tm 170		8		8
Al 26		8			Tm 171		8		8
Cl 36	5E-05	C C 2	5E-05	C C 2	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		6	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55	1.41E-05	C C 2	1.08E-04	C C 2	Pb 210		8		8
Co 60	4.13E-05	C C 2	1.18E-04	C C 2	Bi 208		8		8
Ni 59		8		6	Bi 210m		8		8
Ni 63	5.52E-04	C C 2	5.84E-04	C C 2	Po 210		8		8
Zn 65		8		8	Ra 223		8		8
Se 79		8		6	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	1.50E-02	C C 2	1.82E-02	C C 2	Th 227		8		8
Zr 93		8		6	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		6	Th 232		8		8
Nb 94		8		6	Th 234	1E-07	C C 2	1E-07	C C 2
Mo 93		8		6	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99		8		6	U 232		8		8
Ru 106	2.61E-09	C C 2	6.39E-07	C C 2	U 233		8		6
Pd 107		8		6	U 234	4.09E-07	C C 2	4.04E-07	C C 2
Ag 108m	9.8E-06	C C 2	9.93E-06	C C 2	U 235	7E-09	C C 2	7E-09	C C 2
Ag 110m		8		8	U 236	8E-08	C C 2	8E-08	C C 2
Cd 109		8		8	U 238	1E-07	C C 2	1E-07	C C 2
Cd 113m		8		8	Np 237		8		6
Sn 119m		8		8	Pu 236		8		6
Sn 121m		8		6	Pu 238	2.73E-04	C C 2	2.91E-04	C C 2
Sn 123		8		8	Pu 239	7E-05	C C 2	7E-05	C C 2
Sn 126		8		6	Pu 240	1E-04	C C 2	1E-04	C C 2
Sb 125	2.9E-06	C C 2	2.18E-05	C C 2	Pu 241	3.93E-03	C C 2	5.78E-03	C C 2
Sb 126		8		8	Pu 242		8		6
Te 125m	7.27E-07	C C 2	5.74E-06	C C 2	Am 241	3.96E-04	C C 2	3.39E-04	C C 2
Te 127m		8		8	Am 242m		8		6
I 129	4E-09	C C 2	4E-09	C C 2	Am 243		8		6
Cs 134	1.78E-06	C C 2	2.61E-05	C C 2	Cm 242		8		8
Cs 135		8		6	Cm 243	1.51E-06	C C 2	1.83E-06	C C 2
Cs 137	6.83E-03	C C 2	8.21E-03	C C 2	Cm 244	5.06E-05	C C 2	6.86E-05	C C 2
Ba 133	3.18E-06	C C 2	5.38E-06	C C 2	Cm 245		8		6
La 137		8		8	Cm 246		8		6
La 138		8		8	Cm 248		8		8
Ce 144		8	2.29E-08	C C 2	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	2.52E-05	C C 2	2.09E-04	C C 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152		8		6	Other b/g			6.33E-07	C C 2
Eu 154	7.58E-05	C C 2	1.45E-04	C C 2	**Total a**	**8.91E-04**	**C C 2**	**8.71E-04**	**C C 2**
Eu 155	9.18E-06	C C 2	2.85E-05	C C 2	**Total b/g**	**2.67E-02**	**C C 2**	**3.37E-02**	**C C 2**

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