WASTE STREAM 9A67 Miscellaneous Contaminated Items from Post Irradiation Examination

SITE Berkeley

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0.1 m³
Total future arisings:		0 m³
Total waste volume:		0.1 m³

Comment on volumes: This waste was accumulated in 1966. There will be no further arisings of this waste stream.

Uncertainty factors on volumes:

Stock (upper):	x 1.1	Arisings (upper)	x
Stock (lower):	x 0.9	Arisings (lower)	x

WASTE SOURCE The waste is contaminated magnesium chloride and magnesium hydroxide resulting from the examination of irradiated fuel at Berkeley Nuclear Laboratories (now Berkeley Technology Centre).

PHYSICAL CHARACTERISTICS

General description: The waste is contaminated magnesium chloride and magnesium hydroxide in paint tins and bottles which are contained in a thin walled steel liner of nominal length 1.219 m and nominal diameter 0.343 m. There are no large items that may require special handling.

Physical components (%vol): The physical constituents include magnesium chloride and magnesium hydroxide. The waste is contained within mild steel paint tins, in glass bottles (with plastic tops) and in a mild steel black can liner. % Breakdown, ~25% ferrous metals, ~25% Magnox, ~25% chloride and ~25% glass.

Sealed sources: -

Bulk density (t/m³): 0.14

Comment on density: Density calculated using mass of container and external volume.

CHEMICAL COMPOSITION

General description and components (%wt): The waste includes magnesium hydroxide, magnesium chloride, glass and mild steel.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Most tritium is expected to be present as water but some may be in the form of other inorganic compounds or as organic compounds.
C-14: Chemical form of carbon 14 has not been determined but may be graphite.
Cl-36: The chemical form of chlorine 36 in these wastes is not known.
U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): The only metal present will be the thin walled mild steel black can liner.

Stainless steel.....	NE
Other ferrous metals.....	~25.0
Iron.....	
Aluminium.....	0
Beryllium.....	0
Cobalt.....	
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	~25.0
Nickel.....	

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	Titanium		
	Uranium		
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	0	No "other" metals are anticipated.
Organics (%wt):	A little plastic (bottle tops) and a trace of cellulose may be present.		
	Total cellulosics	TR	
	Paper, cotton	TR	
	Wood	0	
	Halogenated plastics	0	
	Total non-halogenated plastics	NE	
	Condensation polymers	NE	
	Others	0	
	Organic ion exchange materials	0	
	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	0	
Other materials (%wt):	Traces of graphite may be present.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand		
	Glass/Ceramics	~25.0	
	Graphite	TR	
	Desiccants/Catalysts		
	Asbestos	0	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	0	
	Free non-aqueous liquids	0	
	Powder/Ash	NE	
Inorganic anions (%wt):	Hydroxide anions will be present.		

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Fluoride	0
Chloride	~25.0
Iodide	0
Cyanide	0
Carbonate	NE
Nitrate	0
Nitrite	0
Phosphate	0
Sulphate	0
Sulphide	0

Materials of interest for waste acceptance criteria: There will not be any hazardous or problematic materials present.

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: None expected.

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):

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....	TR	Organic complexing agents may be present in small quantities.
Total complexing agents.....	<1.0	

PACKAGING AND CONDITIONING

Conditioning method:	This stream will be co-packaged together in Concrete boxes (9A61, 9A62, 9A32, 9A40, 9A48, 9A53, 9A73). The remainder of vault 1 waste will be co-packaged together in Type VI DCIC containers (9A25, 9A31, 9A39, 9A47, 9A52, 9A60 and 9A66). Packages for vault 1 are assigned to 9A25, 9A32 & 9A73.
Plant Name:	-
Location:	Berkeley 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:	-

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages

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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:	The waste has become contaminated from the processes concerned with the examination of irradiated fuel at Berkeley Nuclear Laboratories (now Berkeley Technology Centre).
Uncertainty:	The values quoted are indicative of the expected activities.
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:	Specific activities were derived by estimation based upon available information.
Other information:	Specific activity is a function of operating history.

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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	3.06E-04	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	1.00E-05	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	7E-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	4.22E-07	C C 2			Pb 210		8		
Co 60	1.44E-05	C C 2			Bi 208		8		
Ni 59	1E-06	C C 2			Bi 210m		8		
Ni 63	7.36E-05	C C 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	1.21E-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	5.26E-03	C C 2			Th 227		8		
Zr 93	6E-07	C C 2			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	3.57E-07	C C 2			Th 232		8		
Nb 94		8			Th 234	3E-07	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	4.12E-08	C C 2		
Tc 99	3E-06	C C 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	3.08E-07	C C 2		
Ag 108m	<2.96E-06	C 3			U 235	7E-09	C C 2		
Ag 110m		8			U 236	4.00E-08	C C 2		
Cd 109		8			U 238	3E-07	C C 2		
Cd 113m		8			Np 237	4.12E-08	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	1.82E-04	C C 2		
Sn 123		8			Pu 239	1.00E-04	C C 2		
Sn 126	4.35E-08	C C 2			Pu 240	2.00E-04	C C 2		
Sb 125		8			Pu 241	1.13E-03	C C 2		
Sb 126	6.09E-09	C C 2			Pu 242	1E-07	C C 2		
Te 125m		8			Am 241	3.22E-04	C C 2		
Te 127m		8			Am 242m	8.48E-07	C C 2		
I 129	6E-09	C C 2			Am 243	3.00E-07	C C 2		
Cs 134		8			Cm 242	7E-07	C C 2		
Cs 135	1E-07	C C 2			Cm 243	1.51E-07	C C 2		
Cs 137	5.30E-03	C C 2			Cm 244	1.27E-06	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	1.68E-08	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	1.82E-05	C C 2			Other a				
Eu 152	1.07E-07	C C 2			Other b/g				
Eu 154	7.58E-06	C C 2			**Total a**	**8.07E-04**	**C C 2**	**0**	
Eu 155	1.28E-07	C C 2			**Total b/g**	**1.21E-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