WASTE STREAM 9A84 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 1977. It originated at Berkeley Technology Centre. 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 consists principally of non-fuel element debris from the post irradiation examination work carried out on fuel, steel and graphite in the Berkeley Technology Centre caves and cells.

PHYSICAL CHARACTERISTICS

General description: The waste consists principally of non-fuel element debris from the post irradiation examination work carried out on fuel, steel and graphite in the Berkeley Technology Centre caves and cells. This waste comprises non-combustible wastes such as metals and glass. The waste is contained in 5 mild steel black cans. As the waste is containerised, it is unlikely that there will be any large items that will require special handling.

Physical components (%vol): The waste will include non-combustible items such as metal tools and glassware. The waste is contained in mild steel cans. % Breakdown, 60% metals and 40% glass.

Sealed sources: -

Bulk density (t/m³): 0.48

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

CHEMICAL COMPOSITION

General description and components (%wt): The waste will include steel, glass and graphite. Fission products, actinides and other activation products will be present as contaminants.

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): Much of the metal will be of only 1-2mm thickness, but there will be items of greater thickness.

Stainless steel.....	NE
Other ferrous metals.....	~60.0
Iron.....	
Aluminium.....	0
Beryllium.....	0
Cobalt.....	
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	TR

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	Nickel		
	Titanium		
	Uranium		
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	0	Other' metals have not been identified.
Organics (%wt):	Organic material in unlikely to 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	~40.0	
	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):	The inorganic anion content of the waste has not been fully quantified.	
	Fluoride.....	0
	Chloride.....	NE
	Iodide.....	0
	Cyanide.....	0
	Carbonate.....	NE
	Nitrate.....	0
	Nitrite.....	0
	Phosphate.....	0
	Sulphate.....	0
	Sulphide.....	0
Materials of interest for waste acceptance criteria:	The possible presence of materials likely to represent a fire or other non-radiological hazard has not been fully assessed. Trace quantities of Magnox and uranium hydride might be 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):	Yes		
	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 is to be co-packaged with 9A63, 9A64, 9A83, 9A33, 9A34, 9A35, 9A41, 9A42, 9A43, 9A49, 9A50, 9A51, 9A54, 9A55, 9A56, 9A74. Packages are assigned to 9A33/C, 9A34, 9A74.
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	1.02E-03	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	1.87E-06	C C 2			Pb 210		8		
Co 60	4.13E-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	1.69E-03	C C 2		
Sb 126	<6.09E-09	C 3			Pu 242	1E-07	C C 2		
Te 125m		8			Am 241	3.38E-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	8.42E-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**	**8.23E-04**	**C C 2**	**0**	
Eu 155	3.65E-07	C C 2			**Total b/g**	**1.34E-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