WASTE STREAM 9A84 Miscellaneous Contaminated Items from Post Irradiation Examination

SITE	Berkeley
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.....	0.1 m^3
Total future arisings:		0 m^3
Total waste volume:		0.1 m^3

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: The waste does not contain sealed sources.

Bulk density (t/m^3): 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.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE		
Other ferrous metals.....	~60.0		
Iron.....			
Aluminium.....	0		
Beryllium.....	0		

WASTE STREAM 9A84 Miscellaneous Contaminated Items from Post Irradiation Examination

Cobalt		
Copper	0	
Lead	0	
Magnox/Magnesium	TR	
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.

	(%wt)	Type(s) and comment	% of total C14 activity
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.

	(%wt)	Type(s) and comment	% of total C14 activity
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		

WASTE STREAM 9A84 Miscellaneous Contaminated Items from Post Irradiation Examination

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.

	(%wt)	Type(s) and comment
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.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....		
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

WASTE STREAM 9A84 Miscellaneous Contaminated Items from Post Irradiation Examination

Hazardous substances / non hazardous pollutants: None expected.

	(%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.....		

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....	TR	Organic complexing agents may be present in small quantities.
Total complexing agents.....	<1.0	

WASTE STREAM 9A84 Miscellaneous Contaminated Items from Post Irradiation Examination

Potential for the waste to contain discrete items: Not yet determined. In & of itself not a DI; waste stream may include DIs (notably any stainless steel components)

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

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
-	-	-	-	-	-

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'.

WASTE STREAM	9A84	Miscellaneous Contaminated Items from Post Irradiation Examination

Measurement of radioactivities:	Specific activities were derived by estimation based upon available information.
Other information:	Specific activity is a function of operating history.

WASTE STREAM 9A84 Miscellaneous Contaminated Items from Post Irradiation Examination

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	8.63E-04	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	9.99E-06	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	8.74E-07	C C 2			Pb 210		8		
Co 60	2.79E-05	C C 2			Bi 208		8		
Ni 59	1E-06	C C 2			Bi 210m		8		
Ni 63	7.21E-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	4.89E-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	3.85E-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	4.16E-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	3.09E-07	C C 2		
Ag 108m	<2.94E-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	4.16E-08	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	1.78E-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	1.46E-03	C C 2		
Sb 126	<6.09E-09	C 3			Pu 242	1E-07	C C 2		
Te 125m		8			Am 241	3.44E-04	C C 2		
Te 127m		8			Am 242m	8.36E-07	C C 2		
I 129	6E-09	C C 2			Am 243	3.00E-07	C C 2		
Cs 134		8			Cm 242	6.90E-07	C C 2		
Cs 135	1E-07	C C 2			Cm 243	1.41E-07	C C 2		
Cs 137	4.95E-03	C C 2			Cm 244	1.13E-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	3.81E-08	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	1.78E-05	C C 2			Other a				
Eu 152	9.19E-08	C C 2			Other b/g				
Eu 154	5.95E-06	C C 2			**Total a**	**8.24E-04**	**C C 2**	**0**	
Eu 155	2.38E-07	C C 2			**Total b/g**	**1.23E-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