

WASTE STREAM	9A70	Miscellaneous Contaminated Items from Post Irradiation Examination
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SITE Berkeley

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025			
Future arisings:	= 30.8			
Total future arisings:	0.0			
Total waste volume:	30.8			

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: -

Additional information on quantities: There will be no further arisings of this waste stream. The last arising of this waste was in 1993.

Uncertainty factors on volumes:

Stock (upper):	x 1.10	Arisings (upper):	x -
Stock (lower):	x 0.90	Arisings (lower):	x -

WASTE SOURCE The waste is miscellaneous contaminated items arising at Berkeley Nuclear Laboratories (now Berkeley Technology Centre), principally from the examination of irradiated fuel, steel and graphite.

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 BC caves and cells. This waste will also comprise combustible and non-combustible wastes, metals, glass and cave refurbishment wastes. There will be a small amount of fire suppressant powders and vermiculite. The waste is contained within mild steel black can liners and paint tin liners. Current plans are that the mild steel waste containers described in former stream 9A926 will not be separated from the waste in this stream. Originally, this waste stream included part of the 3m³ of dried ion exchange material that was used as an infill for approximately 175 of the MCI black cans between 1975 and 1987. This mobile waste has now a separate identifier (9A82) and therefore, the volumes for 9A69 and 9A70 have been reduced by 1.5m³ each. As the waste is containerised, it is unlikely that there will be any large items that will require special handling.

Changes since waste generated: -

Bulk density (t/m³): = 0.50

Comment on density: Density calculated using masses and external volumes of containers.

CHEMICAL COMPOSITION

General description and components (%wt): The waste will include steel, plastics, paper and graphite. There may be small amounts of ternary eutectic chloride (sodium chloride, barium chloride and potassium chloride) which was used as fire extinguishant, and incinerator ash. Fission products, actinides and other activation products will be present as contaminants.

Chemical state: Alkali

Sheet metal proportion / thickness: Much of the metal will be of only 1-2 mm thickness but there will be items of greater thickness.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	NE	-	
Other ferrous metals.....	~ 25.0	-	
Iron.....		-	
Aluminium.....	NE	-	
Beryllium.....	NE	-	
Cobalt.....		-	
Copper.....	NE	-	
Lead.....	NE	-	
Magnox/Magnesium.....	NE	-	
Nickel.....		-	
Titanium.....		-	
Uranium.....		-	
Zinc.....	NE	-	
Zircaloy/Zirconium.....	NE	-	
Other metals.....	NE	"Other" metals have not been identified.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	~ 15.0	-	
Paper, cotton.....	~ 15.0	-	
Wood.....	NE	-	
Halogenated plastics.....	NE	-	
Total non-halogenated plastics.....	NE	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	~ 5.0	-	
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):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	~ 5.0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 0	-	
Sand.....		-	
Glass/Ceramics.....	~ 25.0	-	
Graphite.....	NE	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	NE	-	
Powder/Ash.....	NE	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	= 0	-
Chloride.....	~ 5.0	-
Iodide.....	= 0	-
Cyanide.....	= 0	-
Carbonate.....	NE	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	NE	-
Sulphate.....	NE	-
Sulphide.....	= 0	-

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	TR	-
Low flash point liquids.....	= 0	-
Explosive materials.....	= 0	-
Phosphorus.....	= 0	-
Hydrides.....	TR	-
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.....	TR	-
Higher activity particles.....	-	-
Soluble solids as bulk chemical compounds.....	-	-

Hazardous substances / non hazardous pollutants:

	(%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.....	-	-

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	-

Physical components:

	Number	Type(s) and comment
Sources.....	-	-
Electronic & Electrical Equipment (EEE)	-	-
EEE Type 1.....	-	-
EEE Type 2.....	-	-
EEE Type 3.....	-	-
EEE Type 4.....	-	-
EEE Type 5.....	-	-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction Decay storage Low force compaction Supercompaction (HFC) Incineration Drying/dewatering/liquid separation Tie down/fixatives/strippable coating/painting application Decontamination Metal treatment Recycling / reuse Thermal treatment, including vitrification Encapsulation Polymer encapsulation Other physical treatment Other chemical treatment Containerisation Treatment not yet determined None		

Comments on planned treatments:

-

Conditioning method:

This stream is to be co-packaged with 9A37, 9A38, 9A57, 9A58, 9A59, 9A65, 9A68, 9A69, 9A71, 9A72, 9A75, 9A77, 9A78, 9A82. Packages are assigned to 9A68, 9A71 & 9A75.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
-	-	-	-	-	-

Range in container waste loading: -

Other information on packaging and conditioning:

-

Conditioned density (t/m³):

-

Conditioned density comment:

-

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: The waste has become contaminated from the processes concerned with the examination of irradiated fuel, steel and graphite at Berkeley Nuclear Laboratories (now Berkeley Technology Centre).

Uncertainty: The values quoted are indicative of the activities that might be expected. Specific activity is a function of operating history.

Measurement of radioactivities: Specific activities were derived by estimation based upon available information.

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.
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
Np: -
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	1.09E-03	C C 2			Gd 153		8		
Be 10					Ho 163		8		
C 14	9.99E-06	C C 2			Ho 166m		8		
Na 22					Tm 170		8		
Al 26					Tm 171		8		
Cl 36	7.00E-07	C C 2			Lu 174		8		
Ar 39					Lu 176		8		
Ar 42					Hf 178n		8		
K 40					Hf 182		8		
Ca 41					Pt 193		8		
Mn 53					Tl 204		8		
Mn 54					Pb 205		8		
Fe 55	2.05E-05	C C 2			Pb 210		8		
Co 60	9.38E-05	C C 2			Bi 208		8		
Ni 59	1.00E-06	C C 2			Bi 210m		8		
Ni 63	7.93E-05	C C 2			Po 210		8		
Zn 65					Ra 223		8		
Se 79	1.21E-08	C C 2			Ra 225		8		
Kr 81					Ra 226		8		
Kr 85					Ra 228		8		
Rb 87					Ac 227		8		
Sr 90	4.55E-03	C C 2			Th 227		8		
Zr 93	6.00E-07	C C 2			Th 228		8		
Nb 91					Th 229		8		
Nb 92					Th 230		8		
Nb 93m	4.09E-07	C C 2			Th 232		8		
Nb 94					Th 234	3.00E-07	C C 2		
Mo 93					Pa 231		8		
Tc 97					Pa 233	4.13E-08	C C 2		
Tc 99	3.00E-06	C C 2			U 232		8		
Ru 106					U 233		8		
Pd 107					U 234	3.11E-07	C C 2		
Ag 108m	< 2.93E-06	C 3			U 235	7.00E-09	C C 2		
Ag 110m					U 236	4.01E-08	C C 2		
Cd 109					U 238	3.00E-07	C C 2		
Cd 113m					Np 237	4.13E-08	C C 2		
Sn 119m					Pu 236		8		
Sn 121m					Pu 238	1.73E-04	C C 2		
Sn 123					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					Pu 241	1.27E-03	C C 2		
Sb 126	6.09E-09	C C 2			Pu 242	1.00E-07	C C 2		
Te 125m					Am 241	2.51E-04	C C 2		
Te 127m					Am 242m	8.24E-07	C C 2		
I 129	6.00E-09	C C 2			Am 243	3.00E-07	C C 2		
Cs 134	9.51E-09	C C 2			Cm 242	6.80E-07	C C 2		
Cs 135	1.00E-07	C C 2			Cm 243	1.98E-07	C C 2		
Cs 137	4.62E-03	C C 2			Cm 244	2.01E-06	C C 2		
Ba 133					Cm 245		8		
La 137					Cm 246		8		
La 138					Cm 248		8		
Ce 144					Cf 249		8		
Pm 145					Cf 250		8		
Pm 147	7.72E-07	C C 2			Cf 251		8		
Sm 147					Cf 252		8		
Sm 151	2.60E-05	C C 2			Unsp a				
Eu 152	1.19E-07	C C 2			Unsp b/g				
Eu 154	1.18E-05	C C 2			Total a	7.28E-04	*	0	*
Eu 155	1.55E-06	C C 2			Total b/g	1.18E-02	*	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 the 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
* Total calculated from the 114 declared radionuclides