

WASTE STREAM	9R111	Berkeley Centre Decommissioning: LLW Ion Exchange Material
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SITE Berkeley

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 0.1		
Future arisings:				
Total future arisings:		0.0		
Total waste volume:		0.1		

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

Comment on arising rates: -

Additional information on quantities: -

Uncertainty factors on volumes:

Stock (upper):	x 1.20	Arisings (upper):	x -
Stock (lower):	x 0.80	Arisings (lower):	x -

WASTE SOURCE Spent ion exchange materials arising from the treatment of pond water and ion exchange material from columns used in sample analysis.

PHYSICAL CHARACTERISTICS

General description: The waste is a mixture of Duolite C3, IRN 150 (IRN77 and 78), AW 500, AG1-X4/X8, Amberjet 1200H, AG50W-X4/X8/X16, TRU resin, TEVA resin, UTEVA resin, Sr resin, Ln resin and Ni resin ion exchange materials. There are no large items which may require special handling. There are no large items which may require special handling.

Changes since waste generated: -

Bulk density (t/m³): = 1.1

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Ion exchange materials are Duolite C3, IRN 150 (phenol formaldehyde), AW500 (alumino-silicate), amberjet 1200H, AG1 - X4/ X8, AG50W - X4/X8/X16 (all polystyrene), TRU, TEVA, UTEVA, Sr, Ln and Ni Resins (all acrylic ester polymer).

Chemical state: Acid

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	TR	-	
Other ferrous metals.....	TR	-	
Iron.....		-	
Aluminium.....	TR	-	
Beryllium.....		-	
Cobalt.....		-	
Copper.....	TR	-	
Lead.....	TR	-	
Magnox/Magnesium.....	TR	-	
Nickel.....	TR	-	
Titanium.....		-	
Uranium.....		-	
Zinc.....	TR	-	
Zircaloy/Zirconium.....	TR	-	
Other metals.....	TR	Not fully assessed but only trace quantities anticipated, if any.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
Condensation polymers.....	= 0	-	
Others.....	= 0	-	
Organic ion exchange materials.....	~ 69.0	-	
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.....	NE	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	~ 8.0	-	
Inorganic sludges and flocs.....	NE	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 0	-	
Sand.....		-	
Glass/Ceramics.....	= 0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	~ 23.0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 0	-	

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

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%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.....		-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	0	-
Benzene.....		-
Chlorinated solvents.....		-
Formaldehyde.....		-
Organometallics.....		-
Phenol.....		-
Styrene.....		-
Tri-butyl phosphate.....		-
Other organophosphates.....		-
Vinyl chloride.....		-
Arsenic.....		-
Barium.....		-
Boron.....		-
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.....	TR	-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		Possibly in trace quantities.
Total complexing agents.....	TR	-

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		= 100.0
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:

-

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
	1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	100.0	3.6	18.3	1	-

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)	= 100.0	2.4	
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: Contamination by activation products will be the main source of activity.

Uncertainty: Specific activity is a function of operating history. Activity values are current estimates of average specific activities. The waste will fall into the LLW category. The values are indicative of the activities that might be expected.

Measurement of radioactivities: The specific activities have been estimated from waste stream fingerprint. It is thought that the alpha activity will be insignificant but this remains to be confirmed.

Chemical form of radionuclides: H-3: Any tritium is expected to be present as water but could be in the form of other inorganic compounds or as organic compounds.

C-14: -
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: -
Np: -
Pu: -

WASTE STREAM		9R111		Berkeley Centre Decommissioning: LLW Ion Exchange Material					
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			8		Gd 153			8	
Be 10			8		Ho 163			8	
C 14			8		Ho 166m			8	
Na 22			8		Tm 170			8	
Al 26			8		Tm 171			8	
Cl 36			8		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	4.09E-06	C C	2		Pb 210			8	
Co 60	8.43E-05	C C	2		Bi 208			8	
Ni 59			8		Bi 210m			8	
Ni 63	3.53E-04	C C	2		Po 210			8	
Zn 65			8		Ra 223			8	
Se 79			8		Ra 225			8	
Kr 81			8		Ra 226			8	
Kr 85			8		Ra 228			8	
Rb 87			8		Ac 227			8	
Sr 90	2.59E-07	C C	2		Th 227			8	
Zr 93			8		Th 228			8	
Nb 91			8		Th 229			8	
Nb 92			8		Th 230			8	
Nb 93m			8		Th 232			8	
Nb 94			8		Th 234			8	
Mo 93			8		Pa 231			8	
Tc 97			8		Pa 233			8	
Tc 99			8		U 232			8	
Ru 106			8		U 233			8	
Pd 107			8		U 234			8	
Ag 108m			8		U 235			8	
Ag 110m			8		U 236			8	
Cd 109			8		U 238			8	
Cd 113m			8		Np 237			8	
Sn 119m			8		Pu 236			8	
Sn 121m			8		Pu 238			8	
Sn 123			8		Pu 239			8	
Sn 126			8		Pu 240			8	
Sb 125			8		Pu 241			8	
Sb 126			8		Pu 242			8	
Te 125m			8		Am 241			8	
Te 127m			8		Am 242m			8	
I 129			8		Am 243			8	
Cs 134			8		Cm 242			8	
Cs 135			8		Cm 243			8	
Cs 137	6.61E-04	C C	2		Cm 244			8	
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		Cf 251			8	
Sm 147			8		Cf 252			8	
Sm 151			8		Unsp a				
Eu 152			8		Unsp b/g				
Eu 154			8		Total a	0	*	0	*
Eu 155			8		Total b/g	1.10E-03	*	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