

WASTE STREAM	9R102	Berkeley Centre Decommissioning: Primary LLW
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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			
Future arisings:	1.4.2025 - 31.3.2026			
	1.4.2026 - 31.3.2027			
	1.4.2027 - 31.3.2028			
	1.4.2028 - 31.3.2029			
	1.4.2029 - 31.3.2038			
Total future arisings:	434.9			
Total waste volume:	459.8			

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

WASTE SOURCE General LLW waste arisings from initial decommissioning of the Berkeley Centre. The main source of the waste is from glove boxes, caves and cells used for post irradiation examination (PIE) of fuel, reactor graphite and steel from Magnox and Advance Gas Reactor (AGR) power stations throughout the UK. Following PIE and analysis, items were sent to the Berkeley Centre ILW store. Following de licence of the Berkeley Centre the site boundaries were changed, and the Shielded Area arisings were included in these waste streams along with some waste from the ILW store.

PHYSICAL CHARACTERISTICS

General description: Contaminated structural material (e.g. concrete and pond scabbings), fixtures, fittings and equipment comprised of mostly metals and plastics and associated secondary waste from decommissioning. Items include ladders, tooling, scaffolding, cabling, ventilation equipment.
Laboratory waste from PIE and analysis of fuels, graphite and steels (i.e. consumable laboratory items) along with waste from remote inspection activities at the Littlebrook site. The predominant materials are metal, plastics and rubber.
Redundant equipment utilised in PIE and analysis of fuel, graphite and steels. The predominant material is metal, with small quantities of plastics and rubble. Items include cave cans, pipework, tooling.
Waste from contamination control procedures applied during the extraction of primary decommissioning waste at the Berkeley Centre, including paper, cotton and plastics.

Changes since waste generated: -

Bulk density (t/m³): ~ 4.4

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): A variety of materials including Metal (87%), Concrete/Rubble (2%), Biodegradable (non-putrescible) (4%), Plastics (Halogenated) (1%), Plastics (non-halogenated) (2%), Rubber (1%), Wood (2%), Others (1%)

Chemical state: Neutral

Sheet metal proportion / thickness: Some items may have been cut for packaging but an assessment of item dimensions has not been made.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 37.7	Assorted stainless steel including: Pipework, tooling, fixtures, fittings, beams, cave-cans, and other miscellaneous plant items and equipment	
Other ferrous metals.....	~ 25.1	Drums, Pipework, tooling, fixtures, fittings, beams, cave-cans, and other miscellaneous plant items and equipment.	
Iron.....	-	-	
Aluminium.....	~ 2.0	Ladders, scaffolding, HEPA filters and miscellaneous items and equipment	
Beryllium.....	-	-	
Cobalt.....	-	-	
Copper.....	~ 2.4	Copper cabling	
Lead.....	~ 19.7	Lead shielding blocks	
Magnox/Magnesium.....	-	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	~ 0.04	Miscellaneous galvanised items, HEPA filters	
Zircaloy/Zirconium.....	-	-	
Other metals.....	NE	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~ 2.0	-	
Paper, cotton.....	~ 0	-	
Wood.....	~ 2.0	-	
Halogenated plastics.....	~ 1.0	Plastic sheeting, tents, bags, packaging, PPE	
Total non-halogenated plastics.....	~ 2.0	-	
Condensation polymers.....	~ 1.0	Plastic wrap, tents, bags, packaging, containers, PPE	
Others.....	~ 1.0	Plastic wrap, tents, bags, packaging, containers, PPE	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	~ 1.0	-	
Halogenated rubber.....	~ 1.0	-	
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.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	NE	-	
Brick/Stone/Rubble.....	NE	-	
Cementitious material.....	~ 2.0	of which circa 0.02% is encapsulated sludge	
Sand.....	-	-	
Glass/Ceramics.....	~ 0.14	Lagging	
Graphite.....	NE	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	~ 0.81	-	
Non/low friable.....	~ 0.27	Equal portions of white/brown/blue asbestos assumed. Lagging / Contaminated clothing / Insulation Board	
Moderately friable.....	~ 0.27	Equal portions of white/brown/blue asbestos assumed. Lagging / Contaminated clothing / Insulation Board	
Highly friable.....	~ 0.27	Equal portions of white/brown/blue asbestos assumed. Lagging / Contaminated clothing / Insulation Board	
Free aqueous liquids.....	= 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.....	NE	-
Carbonate.....	NE	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	TR	-
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.....	P 4.0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	P 4.0	-
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.....		-
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	Citrates from Decon90
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.....	P	-
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)	Off-site	= 4.0
Incineration	Off-site	= 46.0
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment	Off-site	= 34.0
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		= 16.0

Comments on planned treatments:

~15% of this waste stream is expected to be sent to Landfill as VLLW.

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 WAMAC IP-2 ISO (TC08)	4.0	21.6	18.8	1	-
1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	1.0	10.0	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)			
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	= 5.0	4.4	
Expected to be consigned to a Landfill Facility	= 15.0	4.4	
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	= 46.0	0.40	
Expected to be consigned to a Metal Treatment Facility	= 34.0	1.4	
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:

17 04 07, 17 01 01, 17 06 01*

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Contamination of the materials.
No radionuclides other than those listed as possibly being present are expected to be significant.

Uncertainty: Only approximate estimates have been made of specific activities from measured activity on waste drums and the use of fingerprints.

Measurement of radioactivities: The fingerprint for Berkeley 9R102 was originally derived from five sources; Magnox and AGR Graphite, AGR Fuel Waste, General Magnox Trash Steel. The waste inventory was derived from fingerprints based on multiple swab samples and bulk samples.

Chemical form of radionuclides: H-3: The chemical form of tritium has not been assessed.
C-14: The chemical form of carbon 14 has not been assessed.
Cl-36: The chemical form of chlorine 36 has not been assessed.
Se-79: -
Tc-99: -
I-129: -
Ra: The radium isotope content is expected to be insignificant.
Th: Thethorium isotope content is expected to be insignificant.
U: The chemical form of uranium isotopes has not been assessed.
Np: -
Pu: The chemical form of plutonium isotopes has not been assessed.

WASTE STREAM 9R102 Berkeley Centre Decommissioning: Primary LLW									
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	1.25E-06	C C 2	1.25E-06	C C 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	2.39E-07	C C 2	2.39E-07	C C 2	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	5.80E-07	C C 2	5.80E-07	C C 2	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Ti 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55	6.73E-08	C C 2	6.73E-08	C C 2	Pb 210		8		8
Co 60	2.33E-07	C C 2	2.33E-07	C C 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	6.60E-06	C C 2	6.60E-06	C C 2	Po 210		8		8
Zn 65		8		8	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226		8		8
Kr 85		8		8	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	1.05E-04	C C 2	1.05E-04	C C 2	Th 227		8		8
Zr 93		8		8	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94	7.56E-08	C C 2	7.56E-08	C C 2	Th 234		8		8
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99		8		8	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m	1.39E-07	C C 2	1.39E-07	C C 2	U 235		8		8
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238		8		8
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	3.38E-06	C C 2	3.38E-06	C C 2
Sn 123		8		8	Pu 239	1.21E-06	C C 2	1.21E-06	C C 2
Sn 126		8		8	Pu 240	1.59E-06	C C 2	1.59E-06	C C 2
Sb 125	9.04E-09	C C 2	9.04E-09	C C 2	Pu 241	4.18E-05	C C 2	4.18E-05	C C 2
Sb 126		8		8	Pu 242		8		8
Te 125m	2.26E-09	C C 2	2.26E-09	C C 2	Am 241	6.26E-06	C C 2	6.26E-06	C C 2
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134		8		8	Cm 242		8		8
Cs 135		8		8	Cm 243	1.49E-08	C C 2	1.49E-08	C C 2
Cs 137	1.10E-04	C C 2	1.10E-04	C C 2	Cm 244	6.88E-07	C C 2	6.88E-07	C C 2
Ba 133	3.25E-08	C C 2	3.25E-08	C C 2	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	1.09E-07	C C 2	1.09E-07	C C 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Unsp a				
Eu 152	1.60E-07	C C 2	1.60E-07	C C 2	Unsp b/g				
Eu 154	4.45E-07	C C 2	4.45E-07	C C 2	Total a	1.31E-05	*	1.31E-05	*
Eu 155	4.99E-08	C C 2	4.99E-08	C C 2	Total b/g	2.67E-04	*	2.67E-04	*

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