

WASTE STREAM	9A920	Reactor LLW
--------------	-------	-------------

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	~ 0.4		
Future arisings:	1.4.2025 - 31.3.2026	0.4		
	1.4.2026 - 31.3.2027	0.4		
	1.4.2027 - 31.3.2028	0.4		
	1.4.2028 - 31.3.2029	0.4		
	1.4.2029 - 31.3.2038	2.3		
Total future arisings:		3.9		
Total waste volume:		4.4		

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

Comment on arising rates: -

Additional information on quantities: Volumes include an estimate of secondary wastes (from reactor safe store inspection and maintenance).

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 Waste stream 9A920 consists of soft and hard trash resulting from Safestore preparations and ongoing inspection and maintenance of the Berkeley reactor buildings.

PHYSICAL CHARACTERISTICS

General description: Items include steel / stainless steel brackets, boxes, handrails, frames, pipes, cable tray, scaffolding tubes and light-iron ducting. Rubble, mixed lightbulbs. Soft wastes include plastic packaging, rubber, PPE, paper and cloth (clothing), miscellaneous grade asbestos contaminated wastes of varying types. No large assembled items are likely to be present.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.6

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Metal: 25%, Concrete 15%, Soil 10%, Biodegradable (non-putrescible) 10%, Biodegradable (putrescible) 3%, Plastic / rubber 20%, wood 7%, Powders/ash 5%, and others 5%

Chemical state: Neutral

Sheet metal proportion / thickness: Steel brackets, cable tray conduit and ducting, frames handrails, piping and boxes. Some items will have to be cut for packaging.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 7.5	Assorted stainless steel including: Pipework, valves, cable ducting, scaffolding, boxes, handrails, frames and other miscellaneous plant items and equipment.	
Other ferrous metals.....	= 11.2	Assorted mild steel including: Pipework, valves, cable ducting, scaffolding, boxes, handrails and other miscellaneous plant items and equipment.	
Iron.....	-	-	
Aluminium.....	= 2.5	Scaffolding, miscellaneous items and equipment	
Beryllium.....	-	-	
Cobalt.....	-	-	
Copper.....	= 1.3	Electrical cables / pipes	
Lead.....	-	-	
Magnox/Magnesium.....	-	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	= 2.5	Miscellaneous galvanised items (ducting etc.)	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	NE	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 7.0	-	
Paper, cotton.....	-	-	
Wood.....	= 7.0	-	
Halogenated plastics.....	= 5.0	Plastic sheeting, packaging, PPE	
Total non-halogenated plastics.....	= 10.0	-	
Condensation polymers.....	= 5.0	Plastic wrap, packaging, containers, PPE	
Others.....	= 5.0	Plastic wrap, packaging, containers, PPE	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 5.0	-	
Halogenated rubber.....	= 0	-	
Non-halogenated rubber.....	= 5.0	-	
Hydrocarbons.....	-	-	
Oil or grease.....	-	-	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	-	-	
Asphalt/Tarmac (no coal tar).....	-	-	
Bitumen.....	-	-	
Others.....	-	-	
Other organics.....	-	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	NE	-	
Inorganic sludges and flocs.....	-	-	
Soil.....	= 10.0	-	
Brick/Stone/Rubble.....	= 15.0	-	
Cementitious material.....	NE	-	
Sand.....	-	-	
Glass/Ceramics.....	= 1.3	fibreglass lagging	
Graphite.....	NE	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	~ 3.8	-	
Non/low friable.....	= 1.3	Equal portions of white/brown/blue asbestos assumed. Lagging / Contaminated clothing / Insulation Board	
Moderately friable.....	= 1.3	Equal portions of white/brown/blue asbestos assumed. Lagging / Contaminated clothing / Insulation Board	
Highly friable.....	~ 1.3	Equal portions of white/brown/blue asbestos assumed. Lagging / Contaminated clothing / Insulation Board	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 5.0	-	

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

Inorganic anions (%wt):

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

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.....	= 13.0	-
Putrescible wastes.....	= 3.0	-
Non-putrescible wastes.....	= 10.0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	P	50.0m2
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.....	TR	light bulbs
Boron.....	0	-
Boron (in Boral).....	-	-
Boron (non-Boral).....	-	-
Cadmium.....	-	-
Caesium.....	-	-
Selenium.....	-	-
Chromium.....	-	-
Molybdenum.....	-	-
Thallium.....	-	-
Tin.....	-	-
Vanadium.....	-	-
Mercury compounds.....	-	-
Others.....	-	-

Complexing agents (%wt):

No		
	(%wt)	Type(s) and comment
EDTA.....	-	-
DPTA.....	-	-
NTA.....	-	-
Polycarboxylic acids.....	-	-
Other organic complexants.....	-	-
Total complexing agents.....	-	-

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	= 1.9
Incineration	Off-site	~ 60.6
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment	Off-site	~ 4.5
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		~ 33.0

Comments on planned treatments:

60.64% expected to be consigned to incineration, 4.52% to metallic treatment, 31.12% of waste is expected to be consigned to Landfill as VLLW, 1.86% to Supercompaction and 1.86% to direct LLW disposal.

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)	1.9	21.6	18.8	1	-
1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	1.9	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	= 3.7	1.6	
Expected to be consigned to a Landfill Facility	= 31.1	1.6	
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	= 60.6	0.40	
Expected to be consigned to a Metal Treatment Facility	= 4.5	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 05, 17 02 03, 17 05 03*, 17 05 04, 17 06 01*, 20 01 01, 17 02 01

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Activity is mainly from materials contaminated by activation products.

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

Measurement of radioactivities: -

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: Chemical form of chlorine 36 has not been determined.
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.

WASTE STREAM 9A920 Reactor 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	2.00E-04	C C 1	2.00E-04	C C 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	1.05E-04	C C 1	1.05E-04	C C 1	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	3.05E-05	C C 1	3.05E-05	C C 1	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	1.01E-06	C C 2	1.01E-06	C C 2	Pb 210		8		8
Co 60	1.36E-05	C C 2	1.36E-05	C C 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	2.29E-05	C C 2	2.29E-05	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	6.49E-07	C C 2	6.49E-07	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		8		8	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		8		8	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	7.68E-09	C C 2	7.68E-09	C C 2
Sn 123		8		8	Pu 239	1.60E-08	C C 2	1.60E-08	C C 2
Sn 126		8		8	Pu 240	2.13E-08	C C 2	2.13E-08	C C 2
Sb 125		8		8	Pu 241	1.19E-07	C C 2	1.19E-07	C C 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	2.75E-08	C C 2	2.75E-08	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		8		8
Cs 137	9.71E-07	C C 2	9.71E-07	C C 2	Cm 244		8		8
Ba 133	7.64E-08	C C 2	7.64E-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		8		8	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Unsp a				
Eu 152	1.56E-07	C C 2	1.56E-07	C C 2	Unsp b/g				
Eu 154	1.30E-07	C C 2	1.30E-07	C C 2	Total a	7.25E-08	*	7.25E-08	*
Eu 155	6.50E-09	C C 2	6.50E-09	C C 2	Total b/g	3.75E-04	*	3.75E-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