

WASTE STREAM	9A921	AETP and Decontamination 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	= 1.5		
Future arisings:	1.4.2025 - 31.3.2026	0.2		
	1.4.2026 - 31.3.2027	0.4		
	1.4.2027 - 31.3.2028	0.4		
	1.4.2028 - 31.3.2029	2.5		
	1.4.2029 - 31.3.2038	27.8		
Total future arisings:		31.3		
Total waste volume:		32.8		

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

Comment on arising rates: -

Additional information on quantities: Current volume estimates will be subject to review and refinement as Initial Decommissioning Works proceeds. Arisings are predicted by quantity survey and contamination levels advised by health physics. Volumes include a contingency of 5% by vol secondary wastes (handling / decontamination).

Uncertainty factors on volumes:

Stock (upper):	x 1.10	Arisings (upper):	x 1.20
Stock (lower):	x 0.90	Arisings (lower):	x 0.80

WASTE SOURCE Waste stream 9A921 consists of wastes that arise from the AETP decontamination and initial decommissioning works on Berkeley site. The waste is expected to contain redundant pipework, rubber, plastic, pumps, motors and rags. Both activation and fission product, as well as actinide contamination, is expected.

PHYSICAL CHARACTERISTICS

General description: The waste consists of hard and soft trash and redundant equipment. Items in the waste are predominantly metal work including pipework, pumps, motors, scaffolding, ventilation ducting and manhole covers and some copper cabling. Some rubble is also present. Secondary wastes such as plastic sheeting, containers, bags and rubber gloves. Organics such as small quantities of wood, rags, cloth and paper; rubber; some lightbulbs and miscellaneous grade asbestos lagging/insulation. Small volumes of sludges remain in stock and may arise from inspections and maintenance. A drum containing roofing felt / bitumen is known to be in stock.

The waste will likely be stored in 200 litre drums.

Contamination is predominantly in the form of fission products (predominantly Cs-137 and Sr-90) and some actinides (Pu-241). No significant accidents or spills have been reported to have occurred affecting the waste stream.

Changes since waste generated: This waste stream consists of wastes arising from the decommissioning of the AETP and decontamination work on the Berkeley Decommissioning Site. It does not include any process effluent waste. The waste is expected to contain redundant pipework, rubber, plastic, pumps, motors and rags.

Bulk density (t/m³): ~ 1.6

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Metal: 25%, Concrete / rubble: 9%, Soil 10%, Biodegradable- non putrescibles 10%, Biodegradable - Putrescibles 3%, plastics - halogenated 5%, plastics non-halogenated 10%, rubber 5%, Wood 7%, powders/ash 4% and others 12%

Chemical state: Alkali

Sheet metal proportion / thickness: Items will have to be cut for packaging. Large volumes of metal plant typically include steel skip mast shutter, waste retrieval machine, waste retrieval running track, access doors to vault etc.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 8.1	Assorted stainless steel including: Pipework, tanks, valves, cable ducting, scaffolding, boxes, railings, frames, conveyor belts, ventilation ducts, manhole covers and other miscellaneous plant items and equipment.	
Other ferrous metals.....	~ 11.5	Drums, pipework, tanks, valves, cable ducting, scaffolding, boxes, railings, frames, conveyor belts, ventilation ducts, manhole covers and other miscellaneous plant items and equipment.	
Iron.....	-		
Aluminium.....	~ 2.4	Scaffolding and miscellaneous items and equipment	
Beryllium.....	0	-	
Cobalt.....	-		
Copper.....	~ 1.2	Cabling	
Lead.....	NE	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	TR	Alloy Constituent	
Titanium.....	-		
Uranium.....	-		
Zinc.....	< 2.5	Miscellaneous galvanised items	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 1.2	Other metals have not been identified	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~ 8.1	-	
Paper, cotton.....	NE	-	
Wood.....	~ 8.1	-	
Halogenated plastics.....	~ 5.8	Plastic sheeting, tents, bags, packaging, PPE	
Total non-halogenated plastics.....	~ 11.6	-	
Condensation polymers.....	~ 5.8	Plastic wrap, tents, bags, packaging, containers, PPE	
Others.....	~ 5.8	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 5.8	-	
Halogenated rubber.....	~ 2.9	-	
Non-halogenated rubber.....	~ 2.9	-	
Hydrocarbons.....	~ 1.6	-	
Oil or grease.....	-	-	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	-	-	
Asphalt/Tarmac (no coal tar).....	-	-	
Bitumen.....	~ 1.6	Roofing felt	
Others.....	-	-	
Other organics.....	TR	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 7.9	Solid Unencapsulated sludge estimate = 400kg	
Soil.....	~ 11.5	-	
Brick/Stone/Rubble.....	~ 10.4	-	
Cementitious material.....	-	-	
Sand.....	-	-	
Glass/Ceramics.....	~ 2.3	glass (70kg) and fibreglass (45kg)	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	~ 0.57	Equal portions of white/brown/blue asbestos assumed. Lagging / Contaminated clothing / Insulation Board	
Non/low friable.....	~ 0.19	-	
Moderately friable.....	~ 0.19	-	
Highly friable.....	~ 0.19	-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 4.6	-	

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

Inorganic anions (%wt):

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

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.....	= 0	50m2 Aluminum scaffolding and miscellaneous galvanised ducting may be present as reactive materials. If this metal is present at greater than 10 m2 in a given consignment, the items will be treated, i.e. by painting, to prevent hydrogen production following interactions with the grout.
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):

	(%wt)	Type(s) and comment
EDTA.....	= 0	-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		-
Total complexing agents.....		-

Physical components:

	Number	Type(s) and comment
Sources.....	P	-
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)	Off-site	~ 2.2
Incineration	Off-site	~ 65.0
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment	Off-site	~ 4.2
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		~ 28.6

Comments on planned treatments:

4.2% of this waste stream will be consigned for Metal Recycling and 26.5% 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)	2.2	21.6	18.8	1	-
1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	2.1	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	~ 4.3	1.6	
Expected to be consigned to a Landfill Facility	~ 26.5	1.6	
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility	~ 65.0	0.40	
Expected to be consigned to a Metal Treatment Facility	~ 4.2	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 04 07, 17 06 01*

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Activity is from fission products, activation products and actinides.

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.

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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	4.10E-07	C C 1	4.10E-07	C C 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14		8		8	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36		8		8	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	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55		8		8	Pb 210		8		8
Co 60		8		8	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63		8		8	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	2.62E-05	C C 1	2.62E-05	C C 1	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	1.85E-07	C C 1	1.85E-07	C C 1
Sn 123		8		8	Pu 239	3.70E-07	C C 1	3.70E-07	C C 1
Sn 126		8		8	Pu 240	4.91E-07	C C 1	4.91E-07	C C 1
Sb 125		8		8	Pu 241	4.28E-06	C C 1	4.28E-06	C C 1
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	1.79E-06	C C 1	1.79E-06	C C 1
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	1.47E-04	C C 2	1.47E-04	C C 2	Cm 244		8		8
Ba 133	1.24E-09	C C 2	1.24E-09	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		8		8	Unsp b/g				
Eu 154		8		8	Total a	2.84E-06	*	2.84E-06	*
Eu 155		8		8	Total b/g	1.77E-04	*	1.77E-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