

WASTE STREAM	9A917	Empty Drums and Liners
--------------	-------	------------------------

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:	1.4.2025 - 31.3.2026			
Total future arisings:				
Total waste volume:				

Total future arisings: 1.0

Total waste volume: 8.0

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

Comment on arising rates: -

Additional information on quantities: These wastes are expected to occur when drums and liners are emptied of their contents.
 Celite: 606 x 92 litre red drums = 606 * 0.092 = 55.75m3
 67 x 113 litre black liners = 67 * 0.113 = 8.91m3
 IEX: 75 x 180 litre drums = 75 * 0.18 = 13.5m3
 Total volume = 78.161m3 however an assumption was made that waste will be shredded and only take up 10% of original volume therefore RWI volume set to 8m3

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 Mild steel drums, cans and liners that will be emptied of resin and sludge (Celite) during Station decommissioning (see 9A25, 9A57, 9A58 and 9A59). The waste is managed as ILW since it is mixed with other ILW waste streams although activity estimates indicate that this waste is LLW.

PHYSICAL CHARACTERISTICS

General description: The waste comprises Ion Exchange Material drums from 9A25 (580mm dia x 880mm height), Red Cans (Celite) from 9A57, 9A58 and 9A59 (406mm dia x 711mm height), and Black Can Liners from Celite streams (343mm dia x 1220mm height). The containers are assumed to be emptied of their waste content prior to conditioning. The containers are thin walled and are expected to be corroded. Some residual internal and external contamination is anticipated. There are no large items that may require special handling.

Changes since waste generated: -

Bulk density (t/m³): = 0.10

Comment on density: The density range is not estimated. The density estimate assumes that the empty waste cans and liners are stacked tightly together.

CHEMICAL COMPOSITION

General description and components (%wt): Empty mild steel drums and cans, and mild steel liners. Mild steel (>99 wt%), residual contamination (<1 wt%).

Chemical state: Neutral

Sheet metal proportion / thickness: All of the waste will be in the form of sheet of approximately 1 mm thickness.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	> 99.0	-	
Iron.....		-	
Aluminium.....	= 0	-	
Beryllium.....	TR	-	
Cobalt.....		-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	TR	-	
Nickel.....	TR	Nimonic	
Titanium.....		-	
Uranium.....		-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	TR	-	
Other metals.....	TR	No "other" metals have been identified but there may be trace quantities.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
Condensation polymers.....	= 0	-	
Others.....	= 0	-	
Organic ion exchange materials.....	< 1.0	-	
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.....	< 1.0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	NE	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 0	-	
Sand.....		-	
Glass/Ceramics.....	= 0	-	
Graphite.....	NE	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	TR	-	
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.....	< 1.0	-
Chloride.....	< 1.0	-
Iodide.....	< 1.0	-
Cyanide.....	= 0	-
Carbonate.....	< 1.0	-
Nitrate.....	< 1.0	-
Nitrite.....	< 1.0	-
Phosphate.....	< 1.0	-
Sulphate.....	< 1.0	-
Sulphide.....	< 1.0	-

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.....	= 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.....	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.....	TR	-

Complexing agents (%wt):

Yes		
	(%wt)	Type(s) and comment
EDTA.....	-	-
DPTA.....	-	-
NTA.....	-	-
Polycarboxylic acids.....	-	-
Other organic complexants.....	-	-
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 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:

Current strategy is empty cans will be retrieved using R3 module and co-disposed with other vault wastes within existing container allocation.

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: Empty drums, cans and can liners contaminated by fission products, and activation products including actinides.

Uncertainty: The activity values are indicative of the activities that may be expected. Uncertainty is large. Specific activity is a function of Station operating history. The values quoted were derived by extrapolation from available measurements and are indicative of the activities that might be expected. This waste will possibly be LLW or exempt at the time of disposal depending on the processing method.

Measurement of radioactivities: Calculated from estimates of residual contamination inside drums and external contamination of drums.

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: Carbon 14 will probably be present as graphite.
Cl-36: Chlorine 36 may be present as contamination from the wastes held in the drums and liners. The chemical form of chlorine 36 from these wastes may be from barium impurity (BaCl₂), inorganic chloride or another undetermined form.
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: Chemical form of U isotopes has not been determined but may be oxides.
Np: -
Pu: Chemical form of Pu isotopes has not been determined but may be oxides.

WASTE STREAM 9A917 Empty Drums and Liners									
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	< 1.30E-05	C 3	< 1.30E-05	C 3	Gd 153		8		8
Be 10		8		8	Ho 163	2.00E-08	C C 2	2.00E-08	C C 2
C 14	< 5.00E-07	C 3	< 5.00E-07	C 3	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26	2.00E-09	C C 2	2.00E-09	C C 2	Tm 171		8		8
Cl 36	< 1.00E-07	C 3	< 1.00E-07	C 3	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	< 2.00E-08	C 3	< 2.00E-08	C 3	Pt 193		8		8
Mn 53		8		8	Ti 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55	< 4.41E-07	C 3	< 4.41E-07	C 3	Pb 210		8		8
Co 60	< 4.19E-06	C 3	< 4.19E-06	C 3	Bi 208		8		8
Ni 59	< 6.00E-07	C 3	< 6.00E-07	C 3	Bi 210m		8		8
Ni 63	< 5.41E-05	C 3	< 5.41E-05	C 3	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	< 3.49E-05	C 3	< 3.49E-05	C 3	Th 227		8		8
Zr 93	< 3.00E-08	C 3	< 3.00E-08	C 3	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m	< 1.79E-07	C 3	< 1.79E-07	C 3	Th 232		8		8
Nb 94	2.00E-09	C C 2	2.00E-09	C C 2	Th 234	4.00E-09	C C 2	4.00E-09	C C 2
Mo 93	< 2.00E-08	C 3	< 2.00E-08	C 3	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99	< 1.00E-08	C 3	< 1.00E-08	C 3	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234	3.09E-09	C C 2	3.09E-09	C C 2
Ag 108m	< 1.96E-08	C 3	< 1.96E-08	C 3	U 235		8		8
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238	4.00E-09	C C 2	4.00E-09	C C 2
Cd 113m	< 1.41E-07	C 3	< 1.41E-07	C 3	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m	< 2.48E-05	C 3	< 2.48E-05	C 3	Pu 238	1.79E-06	C C 2	1.79E-06	C C 2
Sn 123		8		8	Pu 239	2.00E-06	C C 2	2.00E-06	C C 2
Sn 126		8		8	Pu 240	2.00E-06	C C 2	2.00E-06	C C 2
Sb 125		8		8	Pu 241	2.92E-05	C C 2	2.92E-05	C C 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	4.92E-06	C C 2	4.92E-06	C C 2
Te 127m		8		8	Am 242m	9.29E-09	C C 2	9.29E-09	C C 2
I 129		8		8	Am 243	3.00E-09	C C 2	3.00E-09	C C 2
Cs 134		8		8	Cm 242	7.67E-09	C C 2	7.67E-09	C C 2
Cs 135	3.00E-09	C C 2	3.00E-09	C C 2	Cm 243	2.13E-09	C C 2	2.13E-09	C C 2
Cs 137	2.13E-04	C C 2	2.13E-04	C C 2	Cm 244	2.25E-08	C C 2	2.25E-08	C C 2
Ba 133		8		8	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	< 1.72E-08	C 3	< 1.72E-08	C 3	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	< 1.79E-05	C 3	< 1.79E-05	C 3	Unsp a				
Eu 152	2.77E-05	C C 2	2.77E-05	C C 2	Unsp b/g				
Eu 154	5.97E-06	C C 2	5.97E-06	C C 2	Total a	1.08E-05	*	1.08E-05	*
Eu 155	5.94E-07	C C 2	5.94E-07	C C 2	Total b/g	4.27E-04	*	4.27E-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