

WASTE STREAM	9A930	Active Waste Vault Retrieval Decommissioning.
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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 = 16.6			
Future arisings:	1.4.2025 - 31.3.2026 25.0			
	1.4.2026 - 31.3.2027 25.0			
	1.4.2027 - 31.3.2028 25.0			
	1.4.2028 - 31.3.2029 23.0			
	1.4.2029 - 31.3.2038 0.2			
Total future arisings:	98.2			
Total waste volume:	114.8			

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

Comment on arising rates: The dates above are under review. The demolition will not start until all the vaults have been emptied.

Additional information on quantities: Arisings are predicted by quantity estimates.

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 Plant arisings from Active Waste Vault Retrieval building. Steel components from dismantling plant and pipework in the Retrieval Building.

PHYSICAL CHARACTERISTICS

General description: Consists of soft and hard trash resulting from Active Waste Vault Retrievals (AWVR), as well as the eventual deplant and demolition of the building in readiness for the sites entry into the Deferral (DEF) phase. This waste will include varied quantities of steel, deplanting materials, general waste, ventilation plant ducting and cable trays, other scrap and concrete. The secondary waste arisings (used PPE, plastic sheeting, tackys and wipealls) from vault retrievals will constitute majority of the LLW generated until the vaults have been emptied. The volume of waste will then increase significantly with the Post Operational Clean Out (POCO) deplanting and demolition of the Active Waste Vaults (AWV) facility.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.3

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): 55% Metal, 29% concrete, 4% plastic, 1% rubber, 8% cellulosic, 3% glass.

Chemical state: Neutral

Sheet metal proportion / thickness: Items will have been cut for packaging. Thicknesses are likely to vary from a few mm to about 25 mm.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	NE	-	
Other ferrous metals.....	~ 24.3	Mild steel - Ventilation equipment, deplanting materials	
Iron.....	-	-	
Aluminium.....	NE	-	
Beryllium.....	0	-	
Cobalt.....	-	-	
Copper.....	~ 29.9	Cabling	
Lead.....	NE	-	
Magnox/Magnesium.....	TR	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	= 0.80	Galvanised vent ducting	
Zircaloy/Zirconium.....	NE	-	
Other metals.....	NE	"Other" metals not identified	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 8.0	-	
Paper, cotton.....	~ 4.0	-	
Wood.....	~ 4.0	-	
Halogenated plastics.....	NE	-	
Total non-halogenated plastics.....	= 4.0	-	
Condensation polymers.....	NE	-	
Others.....	~ 4.0	Secondary waste arising	
Organic ion exchange materials.....	NE	-	
Total rubber.....	~ 1.0	-	
Halogenated rubber.....	NE	-	
Non-halogenated rubber.....	~ 1.0	-	
Hydrocarbons.....	0.10	-	
Oil or grease.....	= 0.10	Hydraulic oil	
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.....	NE	-	
Inorganic sludges and flocs.....	NE	-	
Soil.....	NE	-	
Brick/Stone/Rubble.....	NE	-	
Cementitious material.....	~ 29.0	-	
Sand.....	-	-	
Glass/Ceramics.....	~ 3.0	-	
Graphite.....	NE	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	= 0	-	
Non/low friable.....	-	-	
Moderately friable.....	-	-	
Highly friable.....	-	-	
Free aqueous liquids.....	TR	-	
Free non-aqueous liquids.....	-	-	
Powder/Ash.....	NE	-	

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.....	NE	-
Low flash point liquids.....	= 0	-
Explosive materials.....	= 0	-
Phosphorus.....	= 0	-
Hydrides.....	= 0	-
Biological etc. materials.....	= 0	-
Biodegradable materials.....	8.0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	8.0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	NE	-
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):

No

	(%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.....		-
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	Off-site	= 37.4
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	Off-site	= 32.2
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		= 30.4
None		

Comments on planned treatments:

30.4% by volume of the waste stream is expected to be disposed of as VLLW to landfill.

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
-	-	-	-	-	-

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)	= 30.4	= 1.3	
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	= 37.4	= 0.40	
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal	= 32.2	= 1.4	
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:

17 04 05, 17 01 01

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Contamination of steelwork, equipment and structure materials.

Uncertainty: -

Measurement of radioactivities: The sampling plan was based on the ILW (FED) stored in the vaults as opposed to the secondary LLW arisings that have arisen with the recent retrieved operations. The FED that was initially retrieved was subjected to a number of gamma spectrometry measurements using a High Resolution Gamma Spectrometer (HRGS) in order to determine the concentration of gamma emitting radionuclides in the waste. Each item of FED retrieved was subjected to HRGS measurements and radiochemical analyses. This has been used to determine the fingerprint for 9A930, whereby:- historic data from past LLW disposals (VLLW, Combustible, Supercompaction, Metallic Treatment and Direct) have been used in estimating the total activity in the stocks and arisings for this waste stream and the resulting nuclide fractions used to determine the nuclide activities for this waste stream.

Chemical form of radionuclides: H-3: Any tritium is expected to be present as water.
C-14: Carbon-14 maybe present as graphite.
Cl-36: The chlorine 36 content is insignificant.
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: Chemical form of uranium has not been determined but may be uranium oxides.
Np: -
Pu: Chemical form of plutonium has not been determined but may be plutonium oxides.

WASTE STREAM		9A930		Active Waste Vault Retrieval Decommissioning.					
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	5.96E-05	C C 1	5.96E-05	C C 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	2.20E-05	C C 1	2.20E-05	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	6.59E-09	C C 1	6.59E-09	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	3.53E-08	C C 2	3.53E-08	C C 2	Pt 193	2.00E-07	C C 2	2.00E-07	C C 2
Mn 53		8		8	Tl 204	4.66E-09	C C 2	4.66E-09	C C 2
Mn 54		8		8	Pb 205		8		8
Fe 55	1.24E-08	C C 1	1.24E-08	C C 1	Pb 210		8		8
Co 60	5.33E-07	C C 2	5.33E-07	C C 2	Bi 208		8		8
Ni 59	1.78E-08	C C 2	1.78E-08	C C 2	Bi 210m		8		8
Ni 63	1.25E-07	C C 1	1.25E-07	C C 1	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	2.64E-08	C C 2	2.64E-08	C C 2	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	1.32E-06	C C 1	1.32E-06	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	5.73E-09	C C 2	5.73E-09	C C 2	Th 232		8		8
Nb 94	2.48E-08	C C 2	2.48E-08	C C 2	Th 234		8		8
Mo 93	3.59E-09	C C 2	3.59E-09	C C 2	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	4.19E-09	C C 2	4.19E-09	C C 2
Pd 107		8		8	U 234		8		8
Ag 108m	1.90E-08	C C 2	1.90E-08	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	7.15E-08	C C 1	7.15E-08	C C 1
Sn 123		8		8	Pu 239	9.65E-08	C C 1	9.65E-08	C C 1
Sn 126		8		8	Pu 240	9.76E-08	C C 1	9.76E-08	C C 1
Sb 125		8		8	Pu 241	3.56E-06	C C 1	3.56E-06	C C 1
Sb 126		8		8	Pu 242	2.51E-09	C C 1	2.51E-09	C C 1
Te 125m		8		8	Am 241	4.22E-07	C C 1	4.22E-07	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	4.25E-07	C C 2	4.25E-07	C C 2	Cm 244	4.49E-09	C C 1	4.49E-09	C C 1
Ba 133	1.08E-08	C C 2	1.08E-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	1.46E-07	C C 1	1.46E-07	C C 1	Unsp a				
Eu 152	1.53E-07	C C 2	1.53E-07	C C 2	Unsp b/g				
Eu 154	2.03E-07	C C 2	2.03E-07	C C 2	Total a	6.99E-07	*	6.99E-07	*
Eu 155	9.51E-09	C C 2	9.51E-09	C C 2	Total b/g	8.84E-05	*	8.84E-05	*

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