

WASTE STREAM	9A46	Miscellaneous Activated Components
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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:	~ 10.0			
Total future arisings:	0.0			
Total waste volume:	10.0			

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

Comment on arising rates: This waste is assumed to be retained to reactor dismantling.

Additional information on quantities: Station operation ceased in March 1989.

Uncertainty factors on volumes: Stock (upper): x 1.20 Arisings (upper): x -
Stock (lower): x 0.80 Arisings (lower): x -

WASTE SOURCE Irradiated components removed from the reactors.

PHYSICAL CHARACTERISTICS

General description: Redundant or defective components such as control rods and chutes removed from reactor cores. Control rods are 8.5 m long x 50 mm diameter and weigh about 80 kg. Other items weigh about 1 to 1.5 t per item.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.0

Comment on density: The bulk density of the waste ranges in value up to 7.5 t/m³. The minimum value has not been assessed. The average is probably about 1 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is principally steel components. Steel (~90%).

Chemical state: Neutral

Sheet metal proportion / thickness: Nearly all of the waste is bulk metal. Dimensions have not been assessed.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	NE	-	
Other ferrous metals.....	~ 90.0	Carbon steels and boron steels are present.	
Iron.....	-	-	
Aluminium.....	NE	-	
Beryllium.....	TR	-	
Cobalt.....	-	-	
Copper.....	NE	-	
Lead.....	NE	-	
Magnox/Magnesium.....	NE	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	NE	-	
Zircaloy/Zirconium.....	NE	-	
Other metals.....	NE	The presence of "other" metals has not been assessed.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
Condensation polymers.....	= 0	-	
Others.....	= 0	-	
Organic ion exchange materials.....	= 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.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	< 10.0	-	
Sand.....		-	
Glass/Ceramics.....	NE	-	
Graphite.....	TR	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	TR	-	
Powder/Ash.....	= 0	-	

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.....	TR	-
Nitrate.....	TR	-
Nitrite.....	TR	-
Phosphate.....	TR	-
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.....	0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....		-
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.....	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 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	On-site	100.0

Comments on planned treatments:

-

Conditioning method:

The current proposal is to store the waste as at present until reactor dismantling. All waste is expected to be retrieved and conditioned when the conditioning campaign is undertaken. The waste is not expected to be supercompacted. The treatment envisaged is the placement of the waste in baskets followed by encapsulation of the baskets in the container.

Conditioning plants:

Plant Name	Location
RDC Encap BRK	Berkeley

Likely conditioning matrix:

Unknown

Further information on the conditioning matrix:

The waste is assumed to be encapsulated.

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	4 m box (0 mm concrete shielding)	100.0	16.2	18.9	1	-

Range in container waste loading: Not yet determined.

Other information on packaging and conditioning:

The waste will be in baskets placed in the waste packages. Baskets of different ILW wastes may be in the same waste packages. The encapsulation matrix would be likely to be BFS/OPC. The density of the encapsulated waste would probably be about 3 t/m³.

Conditioned density (t/m³):
Conditioned density comment:

~ 3.0
The conditioned waste density assumes that the waste will be encapsulated.

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)	100.0		
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:

Irradiated components removed from the reactor. Control rods are likely to be components of high activity.

Uncertainty:

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

Measurement of radioactivities:

Estimates are based upon theoretical assessments.

Chemical form of radionuclides:

H-3: Tritium may be incorporated in the waste or present as surface contamination in the form of inorganic or organic compounds.
C-14: Chemical form of carbon 14 has not been determined but may be graphite.
Cl-36: The 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	< 7.29E-01	D 3			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.00E-02	C D 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	3.00E-05	C C 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54		8			Pb 205		8		
Fe 55	4.09E-03	C D 2			Pb 210		8		
Co 60	9.38E-02	C D 2			Bi 208		8		
Ni 59	4.00E-02	C D 2			Bi 210m		8		
Ni 63	2.65E+00	C D 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	< 2.59E-05	D 3			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232		8		
Nb 94	4.00E-05	C D 2			Th 234	< 7.00E-09	D 3		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	< 1.00E-08	D 3			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	< 6.11E-09	D 3		
Ag 108m	3.88E-05	C D 2			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	< 7.00E-09	D 3		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	< 1.73E-06	D 3		
Sn 123		8			Pu 239	< 3.00E-06	D 3		
Sn 126		8			Pu 240	< 4.00E-06	D 3		
Sb 125		8			Pu 241	< 2.52E-05	D 3		
Sb 126		8			Pu 242	< 2.00E-09	D 3		
Te 125m		8			Am 241	< 9.89E-06	D 3		
Te 127m		8			Am 242m	< 1.83E-08	D 3		
I 129		8			Am 243	< 5.99E-09	D 3		
Cs 134		8			Cm 242	< 1.51E-08	D 3		
Cs 135		8			Cm 243	< 2.64E-09	D 3		
Cs 137	< 4.62E-05	D 3			Cm 244	< 2.52E-08	D 3		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147		8			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	< 6.96E-07	D 3			Unsp a				
Eu 152	2.77E-06	C D 2			Unsp b/g				
Eu 154	1.18E-06	C D 2			Total a	1.87E-05	*	0	*
Eu 155		8			Total b/g	3.54E+00	*	0	*

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