

WASTE STREAM	9B55/C	Ponds Decontamination Sludge
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SITE Bradwell

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		11.5	66.0
Future arisings:				0.0
				0.0
Total future arisings:			0.0	0.0
Total waste volume:			11.5	66.0

Number of waste packages in stock: At 1.4.2025..... 50 packages

Comment on arising rates: -

Additional information on quantities: Volume obtained from voidage calculations.

Uncertainty factors on volumes: Stock (upper): x 1.00 Arisings (upper): x -
Stock (lower): x 1.00 Arisings (lower): x -

WASTE SOURCE Sludge from ultra high pressure washing of the pond walls and skips and sludge accumulated at the base of the pond during operations. Sand originated from the Pond Water Treatment Plant (PWTP).

PHYSICAL CHARACTERISTICS

General description: The Centre Bay waste comprises pond sludge, cementitious pond wall particulates from ultra-high-pressure (UHP) water jetting operations, FED and other solid debris collected from the pond floor. Includes MAC debris and small waste items such as tape fragments and gloves. The FED is concentrated in 12 to 15 drums, with solid debris in three, and the remaining 32 to 35 containing predominantly sludge. Some of this waste was co-packaged with sand filter waste into 50 MOSAIKs.

Changes since waste generated: -

Bulk density (t/m³): = 2.5

Comment on density: The bulk density is calculated from known waste mass and volume from package records.

CHEMICAL COMPOSITION

General description and components (%wt): Centre Bay wastes consists of sludge solids (22 wt%), Magnox FED (2 wt%), metallic debris, for example nimonic springs (2 wt%), plastic/rubber debris (<1 wt%), mild steel shielded drums (50 wt%), cement in drums (1 wt%) and sand (24 wt%).

Chemical state: -

Sheet metal proportion / thickness: None

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	= 49.8	Mild steel shielded drums	
Iron.....	-	-	
Aluminium.....	= 0	-	
Beryllium.....	NE	-	
Cobalt.....	-	-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 1.5	Magnox FED	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	NE	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 1.7	Metallic debris, composition unknown	

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.....	= 0.20	Plastic/rubber debris	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 21.7	Sludge solids	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 1.4	Cementitious grout	
Sand.....	= 23.7	-	
Glass/Ceramics.....	= 0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....		-	
Asbestos.....	NE	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....		-	
Free non-aqueous liquids.....	NE	-	
Powder/Ash.....	= 0	-	

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.....	= 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.....	TR	-
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):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
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		

Comments on planned treatments:

Conditioning method:

This waste has now been conditioned with some of the sand from the stream formerly known as 9B65 The waste was freeze dredged to remove approximately 50% of the free water. Residual material not removed by freeze dredging was removed using vacuum cleaning. The waste was packed into fifty 140L shielded drums and placed in stillages (4 per stillage). The waste has subsequently been transferred into 50 Mosaiiks and placed into the ISF.

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
	500 l RS drum (0mm Pb)	100.0	0.23	0.23	50	-

Range in container waste loading: No significant variability is expected.

Other information on packaging and conditioning: The container material is cast iron.

Conditioned density (t/m³): = 2.5

Conditioned density comment: The conditioned density is calculated from known waste mass and volume from package records.

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: Contamination from pond operations and plant operation.

Uncertainty: Specific activities of all 50 waste packages were determined using gamma spectroscopy and fingerprints.

Measurement of radioactivities: The above values (Tbq/m³) are calculated by using the sum of individual package inventories and the volume of the waste stream. Decayed to 01/04/2025.

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: -
- Se-79: -
- Tc-99: -
- I-129: -
- Ra: -
- Th: -
- U: -
- Np: -
- Pu: The chemical form of plutonium isotopes may be plutonium oxides.

WASTE STREAM		9B55/C		Ponds Decontamination Sludge					
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	2.37E-03	C C 2			Gd 153		8		
Be 10	8.78E-09	C C 2			Ho 163	1.20E-05	C C 2		
C 14	1.46E-03	C C 2			Ho 166m	1.08E-04	C C 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171	3.00E-08	C C 2		
Cl 36	4.39E-06	C C 2			Lu 174	5.06E-09	C C 2		
Ar 39	4.70E-04	C C 2			Lu 176		8		
Ar 42	1.34E-09	C C 2			Hf 178n	1.49E-04	C C 2		
K 40	2.77E-09	C C 2			Hf 182		8		
Ca 41	1.25E-05	C C 2			Pt 193	4.59E-05	C C 2		
Mn 53		8			Tl 204	1.07E-05	C C 2		
Mn 54		8			Pb 205		8		
Fe 55	3.60E-03	C C 2			Pb 210		8		
Co 60	1.21E-02	C C 2			Bi 208		8		
Ni 59	7.29E-04	C C 2			Bi 210m		8		
Ni 63	3.34E-02	C C 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	3.67E-07	C C 2			Ra 225		8		
Kr 81	5.29E-08	C C 2			Ra 226		8		
Kr 85	7.33E-03	C C 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	6.07E-02	C C 2			Th 227		8		
Zr 93	6.09E-04	C C 2			Th 228	4.84E-08	C C 2		
Nb 91	1.08E-08	C C 2			Th 229		8		
Nb 92		8			Th 230	8.18E-09	C C 2		
Nb 93m	1.13E-03	C C 2			Th 232		8		
Nb 94	3.99E-06	C C 2			Th 234	9.77E-06	C C 2		
Mo 93	8.98E-06	C C 2			Pa 231	1.03E-09	C C 2		
Tc 97		8			Pa 233	1.27E-06	C C 2		
Tc 99	4.95E-03	C C 2			U 232	4.70E-08	C C 2		
Ru 106	6.99E-09	C C 2			U 233	1.10E-07	C C 2		
Pd 107	8.93E-07	C C 2			U 234	8.71E-06	C C 2		
Ag 108m	9.95E-06	C C 2			U 235	2.98E-07	C C 2		
Ag 110m		8			U 236	1.10E-06	C C 2		
Cd 109		8			U 238	9.77E-06	C C 2		
Cd 113m	2.78E-05	C C 2			Np 237	1.28E-06	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m	4.82E-03	C C 2			Pu 238	5.59E-03	C C 2		
Sn 123		8			Pu 239	9.60E-03	C C 2		
Sn 126	3.32E-06	C C 2			Pu 240	9.52E-03	C C 2		
Sb 125	2.90E-06	C C 2			Pu 241	9.87E-02	C C 2		
Sb 126	4.65E-07	C C 2			Pu 242	4.54E-06	C C 2		
Te 125m	7.27E-07	C C 2			Am 241	3.62E-02	C C 2		
Te 127m		8			Am 242m	2.68E-05	C C 2		
I 129	2.31E-05	C C 2			Am 243	8.53E-06	C C 2		
Cs 134	1.14E-05	C C 2			Cm 242	2.21E-05	C C 2		
Cs 135	6.68E-06	C C 2			Cm 243	9.42E-06	C C 2		
Cs 137	4.00E-02	C C 2			Cm 244	1.14E-04	C C 2		
Ba 133	5.64E-06	C C 2			Cm 245	3.63E-09	C C 2		
La 137	3.52E-07	C C 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	1.99E-08	C C 2			Cf 250		8		
Pm 147	1.52E-04	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	2.51E-03	C C 2			Unsp a				
Eu 152	1.39E-05	C C 2			Unsp b/g				
Eu 154	4.51E-04	C C 2			Total a	6.11E-02	*	0	*
Eu 155	4.99E-05	C C 2			Total b/g	2.76E-01	*	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