

WASTE STREAM	9H15	Sludge
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SITE Wyifa

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	~ 27.1		
Future arisings:	1.4.2025 - 31.3.2026	8.5		
Total future arisings:		8.5		
Total waste volume:		35.6		

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

Comment on arising rates: Arisings during defuelling are included in this waste stream.

Additional information on quantities: -

Uncertainty factors on volumes:

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

WASTE SOURCE The routine filtration of liquid effluents. Sand from the emptying of the sand filters at the end of defuelling.

PHYSICAL CHARACTERISTICS

General description: The sludge originates from routine filtration of liquid effluents. The sludge may include debris washed from persons, floors and clothing, corrosion products and extraneous materials such as flakes of paint. Filter sand will also be present. There is some oil with the waste. Sludge particles may be up to millimetre size, and there will probably be 50-450 kg/m³ of dry material. Once fluidised the sludges should be readily transferred by pumping, but reconcentration may be time consuming. Any exhausted ion exchange resins from pressure vessel cooling water system treatment plant and corrosion products from that system are accumulated with the sludge, as also is dust from the reactor by-pass filtration systems. There are no large items in the waste that may require special handling.

Changes since waste generated: -

Bulk density (t/m³): = 1.3

Comment on density: The bulk density range of the sludge is estimated to be 1.05 to 1.15 t/m³ with a mean density of 1.1 t/m³. The density of the sand from the sand filters is assumed to be about 2.65 t/m³ so the overall mean bulk density is about 1.3 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): A wide range of materials, including sand, oil, grease and complexing agents may be present.

Chemical state: Neutral

Sheet metal proportion / thickness: No sheet metal or bulk metal items present.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	TR	Only trace quantities of metals present.	
Other ferrous metals.....	TR	Only trace quantities of metals present.	
Iron.....	-	-	
Aluminium.....	TR	Only trace quantities of metals present.	
Beryllium.....	0	-	
Cobalt.....	-	-	
Copper.....	TR	Only trace quantities of metals present.	
Lead.....	= 0	-	
Magnox/Magnesium.....	TR	Only trace quantities of metals present.	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	TR	Only trace quantities of metals present.	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	TR	Trace quantities of "other" metals may be present.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	TR	-	
Paper, cotton.....	TR	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
Condensation polymers.....	= 0	-	
Others.....	= 0	-	
Organic ion exchange materials.....	< 3.0	-	
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.....	~ 10.0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	< 1.0	-	
Inorganic sludges and flocs.....	~ 65.0	-	
Soil.....	< 1.0	-	
Brick/Stone/Rubble.....	NE	-	
Cementitious material.....		-	
Sand.....	~ 19.0	-	
Glass/Ceramics.....	NE	-	
Graphite.....	< 1.0	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	P	-	
Free non-aqueous liquids.....	P	-	
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.....	TR	-
Biodegradable materials.....	0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....		-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	TR	-
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		= 100.0

Comments on planned treatments:

Waste will be mixed in a cementitious matrix and solidified in nominal 210-litre drums, for disposal in a half-height ISO container.

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 IP-2 Disposal/Re-usable ISO (TC01/TC02)	100.0	2.4	18.3	15	-

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)	= 100.0	2.4	
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:	The waste consists of sludge contaminated principally by activation products plus small quantities of fission products and transuranics.
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:	Total activity is based on approximate activity found in sludge at the Station. The accumulated sludge has been sampled and analysed. Radionuclide breakdown is based on measurement.
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. Cl-36: Chemical form of chlorine 36 has not been determined. Se-79: The selenium content is insignificant. Tc-99: The technetium content is insignificant. I-129: - Ra: Radium isotope content is expected to be insignificant. Th: The thorium isotope content is insignificant. U: Chemical form of uranium isotopes has not been determined but may be uranium oxides. Np: The neptunium content is insignificant. Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

WASTE STREAM 9H15 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	8.38E-04	C C 2	2.41E-03	C C 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	9.99E-06	C C 2	9.99E-06	C C 2	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	Ti 204		8		8
Mn 54		8	6.80E-09	C C 2	Pb 205		8		8
Fe 55	1.20E-05	C C 2	3.07E-04	C C 2	Pb 210	2.28E-09	C C 2	4.81E-09	C C 2
Co 60	3.73E-05	C C 2	2.75E-04	C C 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	8.83E-05	C C 2	9.39E-05	C C 2	Po 210	2.32E-09	C C 2	4.53E-09	C C 2
Zn 65		8	< 1.78E-09	C 3	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226		8	< 2.00E-08	C 3
Kr 85		8		8	Ra 228		8	1.33E-09	C C 2
Rb 87		8		8	Ac 227		8		8
Sr 90	3.43E-05	C C 2	5.64E-05	C C 2	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	7.00E-09	C C 2	7.00E-09	C C 2
Nb 93m		8		8	Th 232	< 2.00E-09	C 3	< 2.00E-09	C 3
Nb 94		8		8	Th 234	2.00E-08	C C 2	2.00E-08	8
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233	2.00E-07	C C 2	2.00E-07	C C 2
Tc 99	< 9.00E-09	C 3	< 9.00E-09	C 3	U 232		8		8
Ru 106		8	< 1.03E-08	C 3	U 233	< 1.00E-08	C 3	< 1.00E-08	C 3
Pd 107		8		8	U 234	2.01E-08	C C 2	2.01E-08	C C 2
Ag 108m		8		8	U 235		8		8
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238	2.00E-08	C C 2	2.00E-08	C C 2
Cd 113m		8		8	Np 237	< 2.00E-07	C 3	< 2.00E-07	C 3
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	3.71E-06	C C 2	4.24E-06	C C 2
Sn 123		8		8	Pu 239	3.00E-06	C C 2	3.00E-06	C C 2
Sn 126		8		8	Pu 240	4.00E-06	C C 2	4.00E-06	C C 2
Sb 125	< 1.24E-08	C 3	< 3.13E-07	C 3	Pu 241	4.81E-05	C C 2	1.30E-04	C C 2
Sb 126		8		8	Pu 242	< 2.00E-08	C 3	< 2.00E-08	C 3
Te 125m	3.11E-09	C C 2	7.83E-08	8	Am 241	1.17E-05	C C 2	1.12E-05	C C 2
Te 127m		8		8	Am 242m	9.16E-06	C C 2	9.56E-06	C C 2
I 129	< 1.00E-08	C 3	< 1.00E-08	C 3	Am 243	4.00E-08	C C 2	4.00E-08	C C 2
Cs 134	3.63E-08	C C 2	1.95E-06	C C 2	Cm 242	7.56E-06	C C 2	7.89E-06	C C 2
Cs 135		8		8	Cm 243	3.56E-09	C C 2	6.50E-09	C C 2
Cs 137	4.90E-04	C C 2	8.13E-04	C C 2	Cm 244	5.74E-08	C C 2	1.42E-07	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	1.01E-09	C 3	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	1.01E-08	C C 2	2.78E-07	C C 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	9.77E-07	C C 2	1.87E-06	C C 2	Unsp a				
Eu 152	9.09E-08	C C 2	2.53E-07	C C 2	Unsp b/g				
Eu 154	2.50E-07	C C 2	9.69E-07	C C 2	Total a	3.04E-05	*	3.09E-05	*
Eu 155	3.23E-08	C C 2	2.77E-07	C C 2	Total b/g	1.57E-03	*	4.11E-03	*

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