

WASTE STREAM	9E17	Sludge
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SITE Oldbury

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	= 13.0		
Future arisings:	1.4.2025 - 31.3.2029	4.0		
	1.4.2029 - 31.3.2039	1.0		
Total future arisings:		5.0		
Total waste volume:		18.0		

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

Comment on arising rates: -

Additional information on quantities: Although the waste is ILW it may be possible to re-classify some as LLW after suitable analysis. Future arisings will originate from backwashing sand filters and de-sludging of Facet gravity filters. Tank capacity is 25.9 m³.

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 The sludge will originate from routine filtration of liquid effluent, active laundry liquors and reactor block active drain liquors, and from ion exchange treatment of cooling pond water. There will also be sand from the final emptying of the AETP sand filters.

PHYSICAL CHARACTERISTICS

General description: The waste consists of debris washed from persons, floors and clothing, filter sand, Mg(OH)₂ and MgCO₃ detached from fuel elements and extraneous material e.g. paint flakes. Extraneous material particles may be up to several millimetres size. Sludge particles may be up to millimetre size. Generally there may be about 400 kg/m³ of dry matter but this may be up to about 800 kg/m³ from concentrations of large particles of extraneous material. Once fluidised the sludge should be readily transferred by pumping but reconcentration may be time consuming. There are no large items that may require special handling.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.4

Comment on density: The mean density of the sludge is assumed to be 1.2 t/m³. However, the density of sand from the emptying of process vessels will be about 1.6 t/m³ and so the overall average density will be about 1.4 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Sand, water and a wide variety of other materials possibly including some oil and grease.

Chemical state: Alkali

Sheet metal proportion / thickness: There are no bulk or sheet metal items present.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	TR	-	
Other ferrous metals.....	TR	-	
Iron.....		-	
Aluminium.....	= 0.61	-	
Beryllium.....	0	-	
Cobalt.....		-	
Copper.....	= 0.02	-	
Lead.....	< 0.01	-	
Magnox/Magnesium.....	TR	-	
Nickel.....		-	
Titanium.....		-	
Uranium.....		-	
Zinc.....	= 0.06	-	
Zircaloy/Zirconium.....	TR	-	
Other metals.....	TR	Only trace quantities expected, if any.	

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.....	~ 15.0	-	
Oil or grease.....	~ 15.0	-	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	-	-	
Asphalt/Tarmac (no coal tar).....	-	-	
Bitumen.....	-	-	
Others.....	-	-	
Other organics.....	-	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	~ 35.0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	-	-	
Sand.....	NE	-	
Glass/Ceramics.....	= 0	-	
Graphite.....	TR	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	= 0	-	
Non/low friable.....	-	-	
Moderately friable.....	-	-	
Highly friable.....	-	-	
Free aqueous liquids.....	~ 50.0	-	
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.....	< 0.01	-
Iodide.....	TR	-
Cyanide.....	= 0	-
Carbonate.....	= 1.2	-
Nitrate.....	TR	-
Nitrite.....	TR	-
Phosphate.....	TR	-
Sulphate.....	= 0.63	-
Sulphide.....	TR	-

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.....	TR	-
Biodegradable materials.....	0	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	-	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	NE	-
Reacting with water.....	TR	-
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):

Yes		
	(%wt)	Type(s) and comment
EDTA.....	TR	-
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:

Waste is expected to be dried into DCICs.

Conditioning plants:

Plant Name	Location
OLD AVDS	Oldbury

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
	3 m³ RS box	100.0	7.6	2.5	3	-

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		
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: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
GDF	LLWR	100.0	AMBER	Potential for disposal as LLW following encapsulation to meet LLWR WAC. Similar to recent experience at DNA with wet boundary wastes.

RADIOACTIVITY

Source: Sludge contains fission products, activation products and actinides from filtration of effluent and liquors.

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: The activities quoted were derived from available measurements.

Chemical form of radionuclides:

H-3: Tritium will be present in trace amounts possibly as water.
C-14: Carbon 14 will be present as graphite dust particles.
Cl-36: Chlorine 36 may be present in graphite dust particles.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
I-129: -
Ra: The radium isotope content is insignificant.
Th: The thorium isotope content is expected to be insignificant.
U: Uranium isotopes are expected to be present as trace contamination as natural uranium metal or uranium oxides.

Np: The neptunium content is insignificant.
Pu: Plutonium isotopes are expected to be present as trace amounts from minor fuel leakage, probably metallic or as oxides.

WASTE STREAM			9E17			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	9.38E-04	C C 2	9.38E-04	C C 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	2.00E-04	C C 2	2.00E-04	C C 2	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26	5.00E-07	C C 2	5.00E-07	C C 2	Tm 171		8		8
Cl 36	2.00E-07	C C 2	2.00E-07	C C 2	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	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55	5.80E-06	C C 2	5.80E-06	C C 2	Pb 210		8		8
Co 60	2.00E-05	C C 2	2.00E-05	C C 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	8.21E-05	C C 2	8.21E-05	C C 2	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	2.96E-04	C C 2	2.96E-04	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		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		8		8	Th 234	6.00E-08	C C 2	6.00E-08	C C 2
Mo 93		8		8	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		8		8
Pd 107		8		8	U 234	9.09E-08	C C 2	9.09E-08	C C 2
Ag 108m	1.95E-06	C C 2	1.95E-06	C C 2	U 235		8		8
Ag 110m		8		8	U 236	< 4.00E-09	C 3	< 4.00E-09	C 3
Cd 109		8		8	U 238	6.00E-08	C C 2	6.00E-08	C C 2
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	1.79E-05	C C 2	1.79E-05	C C 2
Sn 123		8		8	Pu 239	1.00E-05	C C 2	1.00E-05	C C 2
Sn 126		8		8	Pu 240	2.00E-05	C C 2	2.00E-05	C C 2
Sb 125		8		8	Pu 241	5.52E-04	C C 2	5.52E-04	C C 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	1.14E-04	C C 2	1.14E-04	C C 2
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	4.31E-05	C C 2	4.31E-05	C C 2	Cm 242		8		8
Cs 135		8		8	Cm 243	1.43E-09	C C 2	1.43E-09	C C 2
Cs 137	1.43E-02	C C 2	1.43E-02	C C 2	Cm 244	6.32E-07	C C 2	6.32E-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		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	8.28E-07	C C 2	8.28E-07	C C 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	7.22E-06	C C 2	7.22E-06	C C 2	Unsp a				
Eu 152		8		8	Unsp b/g				
Eu 154	3.24E-06	C C 2	3.24E-06	C C 2	Total a	1.63E-04	*	1.63E-04	*
Eu 155		8		8	Total b/g	1.64E-02	*	1.64E-02	*

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