WASTE STREAM	9E01	Sludge

SITE Oldbury

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m^3)
Stocks: At 1.4.2025	= 14.7
Future arisings:	
Total future arisings:	**0.0**
Total waste volume:	**14.7**

OR

Conditioned (m^3)	Packaged (m^3)

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

Comment on arising rates: -

Additional information on quantities: -

Uncertainty factors on volumes:

Stock (upper):	x 1.20	Arisings (upper):	x -
Stock (lower):	x 0.80	Arisings (lower):	x -

WASTE SOURCE The sludge originates from routine filtration of liquid effluents and cooling pond water and from special clean up operations on cooling ponds.

PHYSICAL CHARACTERISTICS

General description: The waste consists of debris washed from persons, floors and clothing, corrosion products such as magnesium hydroxide and carbonate detached from fuel elements and extraneous materials such as flakes of paint. Also there is some filter sand. 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. The density of sand from the emptying of process vessels is expected to be about 2 t/m3 with a voidage of about 0.15. There are no large items that may require special handling.

Changes since waste generated: -

Bulk density (t/m³): = 1.5

Comment on density: The mean density of the sludge is assumed to be 1.1 t/m3. However the density of sand from the emptying of process vessels will be about 2 t/m3 and so the overall average will be about 1.5 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): Magnesium hydroxide, magnesium carbonate, water and a wide variety of other materials which may include graphite dust from surfaces of fuel cans.

Chemical state: Alkali

Sheet metal proportion / thickness: There are no bulk or sheet metallic 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……	= 0.07	-	
Beryllium……	0	-	
Cobalt……		-	
Copper……	< 0.01	-	
Lead……	< 0.01	-	
Magnox/Magnesium……	TR	-	
Nickel……		-	
Titanium……		-	
Uranium……		-	
Zinc……	< 0.01	-	
Zircaloy/Zirconium……	TR	-	
Other metals……	0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	= 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	< 0.04	-	
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	~ 50.0	-	
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	= 1.3	-
Nitrate	TR	-
Nitrite	TR	-
Phosphate	TR	-
Sulphate	< 0.03	-
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		-
Benzene		-
Chlorinated solvents		-
Formaldehyde		-
Organometallics		-
Phenol		-
Styrene		-
Tri-butyl phosphate		-
Other organophosphates		-
Vinyl chloride		-
Arsenic		-
Barium		-
Boron	0	-
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		-
DPTA		-
NTA		-
Polycarboxylic acids		-
Other organic complexants		-
Total complexing agents	TR	-

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	On-site	100.0
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: Waste will be loaded using a fill/dry cycle to maximise loading volume To be dried in Type VI 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 (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
3 m^3 RS box	100.0	3.8	2.5	4	-

Range in container waste loading: -

Other information on packaging and conditioning: -

Conditioned density (t/m^3): -
Conditioned density comment: -

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	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: Contaminated sludge. Pond sludge incorporating fission products, activation products and actinides.

Uncertainty: Specific activity is a function of Station operating history and pond conditions. 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 as tritiated 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 insignificant.
U: Uranium isotopes are expected to be present from trace contamination of the Magnox can surrounding fuel elements and as natural uranium metal.
Np: The neptunium content is insignificant.
Pu: Plutonium isotopes are expected to be present as trace amounts from minor fuel leakage, probably metallic.

WASTE STREAM **9E01** **Sludge**

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	1.04E-03	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	6.99E-03	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26	3.00E-05	C C 2			Tm 171		8		
Cl 36	3.00E-07	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	8.89E-05	C C 2			Pb 210		8		
Co 60	1.01E-04	C C 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	9.03E-05	C C 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	1.41E-03	C C 2			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		8			Th 234	1.00E-07	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99		8			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	1.04E-07	C C 2		
Ag 108m	< 5.94E-06	C 3			U 235		8		
Ag 110m		8			U 236	1.00E-08	C C 2		
Cd 109		8			U 238	1.00E-07	C C 2		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	5.43E-05	C C 2		
Sn 123		8			Pu 239	4.00E-05	C C 2		
Sn 126		8			Pu 240	7.00E-05	C C 2		
Sb 125		8			Pu 241	1.72E-03	C C 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	3.38E-04	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	7.80E-05	C C 2			Cm 242		8		
Cs 135		8			Cm 243	3.80E-09	C C 2		
Cs 137	2.29E-02	C C 2			Cm 244	1.03E-06	C C 2		
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	4.40E-06	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	2.68E-05	C C 2			Unsp a				
Eu 152		8			Unsp b/g				
Eu 154	1.23E-05	C C 2			**Total a**	**5.04E-04**	*	**0**	*
Eu 155		8			**Total b/g**	**3.45E-02**	*	**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