

WASTE STREAM	9E17	Sludge
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SITE Oldbury
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	11.0 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	1.0 m ³
	1.4.2023 - 31.3.2027.....	4.0 m ³
Total future arisings:		5.0 m ³
Total waste volume:		16.0 m ³

Comment on volumes: 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 1.2 Arisings (upper) x 1.2
Stock (lower): x 0.8 Arisings (lower) x 0.8

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.

Physical components (%wt): Sludge and sand (100%).

Sealed sources: The waste does not contain sealed sources.

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

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.
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.

Metals and alloys (%wt): There are no bulk or sheet metal items present.

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	(%wt)	Type(s) / Grade(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): Oil and grease will be present, probably at between 10 and 15% wt. Halogenated plastics or rubbers will not be present.

	(%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): Traces of graphite may be present.

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	(%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		

Inorganic anions (%wt): Not fully assessed. Carbonates may be present.

	(%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: The waste is unlikely to present a fire hazard. There might be trace quantities of biological material.

	(%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.....		

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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 / none expected
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.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

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Complexing agents (%wt): Yes

(%wt) Type(s) and comment

- EDTA.....
- DPTA.....
- NTA.....
- Polycarboxylic acids.....
- Other organic complexants.....
- Total complexing agents..... TR

Potential for the waste to contain discrete items: No. In & of itself not a DI; assumed not likely to contain any "rogue" items that could be.

PACKAGING AND CONDITIONING

- Conditioning method: -
- Plant Name: -
- Location: Oldbury Power Station
- Plant startup date: -
- Total capacity (m³/y incoming waste): ~100.0
- Target start date for packaging this stream: 2026
- Throughput for this stream (m³/y incoming waste): -
- Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
	3m³ RS box	100.0	7.63	2.5	3

Likely container type comment: Waste will be transferred to Type VI yellow boxes and dried.

- Range in container waste volume: -
- Other information on containers: -
- Likely conditioning matrix: -
- Other information: -
- Conditioned density (t/m³): -
- Conditioned density comment: -
- Other information on conditioning: -
- Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at a Geological Disposal	Disposal at LLWR	100.0	2023	Medium	Potential for disposal as LLW following encapsulation to meet LLWR WAC.

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Sludge

Facility

Similar to recent experience at DNA with wet boundary wastes.

RADIOACTIVITY

Source:	Sludge contains fission products, activation products and actinides from filtration of effluents and liquors.
Uncertainty:	Specific activity is a function of Station operating history. The values quoted are indicative of the activities that might be expected.
Definition of total alpha and total beta/gamma:	Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.
Measurement of radioactivities:	The activities quoted were derived from available measurements.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	1.11E-03	CC 2	1.11E-03	CC 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	2.00E-04	CC 2	2.00E-04	CC 2	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26	5E-07	CC 2	5E-07	CC 2	Tm 171		8		8
Cl 36	2E-07	CC 2	2E-07	CC 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	1.24E-05	CC 2	1.24E-05	CC 2	Pb 210		8		8
Co 60	2.97E-05	CC 2	2.97E-05	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	8.38E-05	CC 2	8.38E-05	CC 2	Po 210		8		8
Zn 65	4.18E-09	CC 8	4.18E-09	CC 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	3.18E-04	CC 2	3.18E-04	CC 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	6E-08	CC 2	6E-08	CC 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	9.07E-08	CC 2	9.07E-08	CC 2
Ag 108m	1.96E-06	CC 2	1.96E-06	CC 2	U 235		8		8
Ag 110m		8		8	U 236	<4E-09	C 3	<4E-09	C 3
Cd 109		8		8	U 238	6E-08	CC 2	6E-08	CC 2
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	1.83E-05	CC 2	1.83E-05	CC 2
Sn 123		8		8	Pu 239	1E-05	CC 2	1E-05	CC 2
Sn 126		8		8	Pu 240	2E-05	CC 2	2E-05	CC 2
Sb 125		8		8	Pu 241	6.38E-04	CC 2	6.38E-04	CC 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	1.12E-04	CC 2	1.12E-04	CC 2
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	1.18E-04	CC 2	1.18E-04	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243	1.53E-09	CC 2	1.53E-09	CC 2
Cs 137	1.53E-02	CC 2	1.53E-02	CC 2	Cm 244	7.09E-07	CC 2	7.09E-07	CC 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	1.83E-06	CC 2	1.83E-06	CC 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	7.39E-06	CC 2	7.39E-06	CC 2	Other a				
Eu 152		8		8	Other b/g				
Eu 154	4.13E-06	CC 2	4.13E-06	CC 2	Total a	1.61E-04	CC 2	1.61E-04	CC 2
Eu 155		8		8	Total b/g	1.78E-02	CC 2	1.78E-02	CC 2

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 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