WASTE STREAM 9E45 Sludge

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.....	15.6 m^3
Total future arisings:		0 m^3
Total waste volume:		15.6 m^3

Comment on volumes: No further arisings of this waste steam are expected.

Uncertainty factors on volumes:

Stock (upper):	x 1.2	Arisings (upper)	x
Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE The sludge originated from routine filtration of liquid effluent and cooling pond water, special pond clean up operation liquors, active laundry liquors and reactor block active drain liquors.

PHYSICAL CHARACTERISTICS

General description: The waste consists of debris washed from persons, corrosion products such as magnesium hydroxide and carbonate detached from fuel elements and extraneous materials such as flakes of paint. Extraneous material particles may be up to several millimetres in size. Sludge particles may be up to millimetre size. There may generally be about 500 kg/m3 of dry matter but concentrations of large particles of extraneous material may result in the dry material being up to about 800 kg/m3. 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 (%vol): Sludge (100%) which contains 50% of Water.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): 1.2

Comment on density: The bulk density of the waste ranges from about 1.07 t/m3 to about 1.38 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): Magnesium hydroxide, magnesium carbonate, water and a wide variety of other materials including some oil and grease.

Chemical state: Alkali

Chemical form of radionuclides:
H-3: Tritium is present, tritiated water.
C-14: Carbon 14 is present, 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 insignificant.
U: Uranium is present,probably as either natural uranium metal or oxides.
Np: The neptunium content is insignificant.
Pu: Plutonium isotopes are present. Trace amount from minor fuel leakage, probably metallic, or otherwise oxides.

Metals and alloys (%wt): There are no metallic 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	1.7		
Beryllium	0		
Cobalt			
Copper	0.03		
Lead	0.02		
Magnox/Magnesium	TR		
Nickel			
Titanium			
Uranium			
Zinc	0.06		
Zircaloy/Zirconium	TR		
Other metals	TR	"Other" metals may be present at trace quantities.	

Organics (%wt): Oil and grease will be present (~10%wt). Halogenated plastics and rubbers will not be present.

	(%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	10.0		
Oil or grease	~10.0		
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics			

Other materials (%wt): -

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	~90.0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	TR		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	TR		
Powder/Ash.....	0		

Inorganic anions (%wt): Not fully assessed. Carbonates are expected to be present.

	(%wt)	Type(s) and comment
Fluoride.....	TR	
Chloride.....	TR	
Iodide.....	TR	
Cyanide.....	0	
Carbonate.....	0.80	
Nitrate.....	TR	
Nitrite.....	TR	
Phosphate.....	TR	
Sulphate.....	0.79	
Sulphide.....	TR	

Materials of interest for waste acceptance criteria: The waste is unlikely to present a fire hazard but this requires confirmation since Magnox may be present and will ignite under appropriate conditions and also sawdust is present. There might be trace quantities of biological material. Oil and grease are present. The possible presence of items that are not estimated is to be determined.

	(%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	

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Non-putrescible wastes.....	
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	TR
Higher activity particles.....	
Soluble solids as bulk chemical compounds.....	

Hazardous substances / non hazardous pollutants: none expected

	(%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: Waste will be transferred to a Type VI yellow box and dried.

Plant Name: -

Location: -

Plant startup date: -

Total capacity (m^3/y incoming waste): -

Target start date for packaging this stream: 2023

Throughput for this stream (m^3/y incoming waste): -

Other information: waste will be loaded using a fill/dry cycle to maximise waste loading volume

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
3m^3 RS box	100.0	7.8	2.5	2

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/m^3): -

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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Facility	Similar to recent experience at DNA with wet boundary wastes.

RADIOACTIVITY

Source:	Sludge contains fission products, activation products and actinides resulting fom filtration of effluents and liquors.
Uncertainty:	Specific activity is a function of Station operating history. The activity values quoted are the specific activity of raw sludge. The values quoted were derived from measurements.
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 values quoted were derived from measurements.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	2.55E-04	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	6.99E-05	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26	5E-07	C C 2			Tm 171		8		
Cl 36	2E-07	C C 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		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	4.26E-07	C C 2			Pb 210		8		
Co 60	6.18E-06	C C 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	8.28E-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	1.50E-04	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	5E-08	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	5.03E-08	C C 2		
Ag 108m	<1.96E-06	C 3			U 235		8		
Ag 110m		8			U 236	<4.00E-09	C 3		
Cd 109		8			U 238	5E-08	C C 2		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	8.18E-06	C C 2		
Sn 123		8			Pu 239	7.00E-06	C C 2		
Sn 126		8			Pu 240	9.99E-06	C C 2		
Sb 125		8			Pu 241	1.69E-04	C C 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	6.33E-05	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	5.31E-09	C C 2			Cm 242		8		
Cs 135		8			Cm 243		8		
Cs 137	1.52E-02	C C 2			Cm 244	3.79E-07	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	1.26E-08	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	3.65E-06	C C 2			Other a				
Eu 152		8			Other b/g				
Eu 154	<3.04E-07	C 3			**Total a**	**8.89E-05**	**C C 2**	**0**	
Eu 155		8			**Total b/g**	**1.60E-02**	**C C 2**	**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 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