

WASTE STREAM	9J33/C	Conditioned Sludge
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SITE Hunterston A
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: Yes

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2022.....	145.2m ³	172.3m ³
Total future arisings:		0 m ³	0 m ³
Total waste volume:		145.2m ³	172.3m ³
Number of waste packages in stock:	At 1.4.2022.....	66 package(s)	

Comment on volumes: -

Uncertainty factors on volumes: Stock (upper): x 1.1 Arisings (upper) x
 Stock (lower): x 0.9 Arisings (lower) x

WASTE SOURCE Sludge arisings from the spent fuel storage pond. SRT2 and SRT3

PHYSICAL CHARACTERISTICS

General description: Sludge contains a mixture of Magnox sludge and a low density aluminium hydroxide floc. There are no large items in this waste stream.

Physical components (%wt): Sludge (79%), grout (21%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~2

Comment on density: this represents the conditioned waste density

CHEMICAL COMPOSITION

General description and components (%wt): Sludge (79%), consisting of Aluminium hydroxide, silicic acid, silica, potassium ferrous-ferro-cyanide, magnesium hydroxide and water. Grout (21%)

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritium will be present as water.
 C-14: Carbon 14 will be present as graphite.
 Cl-36: The chemical form of chlorine 36 has not been determined.
 Se-79: The selenium content is insignificant.
 Tc-99: The technetium content is insignificant.
 Ra: Radium isotope content is insignificant.
 Th: The thorium isotope content is insignificant.
 U: Uranium isotope content is insignificant.
 Np: The neptunium content is insignificant.
 Pu: The chemical form of plutonium isotopes has not been determined but may be present as plutonium oxides.

Metals and alloys (%wt): No sheet metal expected in this waste stream.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	<0.50		
Iron.....			
Aluminium.....			
Beryllium.....	0		
Cobalt.....			

WASTE STREAM	9J33/C	Conditioned Sludge
---------------------	---------------	---------------------------

Copper.....	0
Lead.....	0
Magnox/Magnesium.....	
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	TR

"Other" metals include nickel, chromium, cobalt, calcium and strontium at trace quantities.

Organics (%wt): Small amounts of rubber coating from pond walls, hydraulic fluid and oil spillage, and some ion exchange resins, may 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....	TR		
Total rubber.....	TR		
Halogenated rubber	TR		
Non-halogenated rubber.....	TR		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	TR		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	~79.0	Including <0.5% aluminium hydroxide and <1% magnesium hydroxide	
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	21.0	Grout	
Sand.....			
Glass/Ceramics.....	0		

WASTE STREAM	9J33/C	Conditioned Sludge
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Graphite.....	0
Desiccants/Catalysts.....	
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	P
Free non-aqueous liquids.....	TR
Powder/Ash.....	0

Inorganic anions (%wt): Some ferrous-ferro-cyanide anticipated.

	(%wt)	Type(s) and comment
Fluoride.....	TR	
Chloride.....	TR	
Iodide.....	TR	
Cyanide.....	NE	
Carbonate.....	TR	
Nitrate.....	TR	
Nitrite.....	TR	
Phosphate.....	TR	
Sulphate.....	TR	
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. Potassium ferrous-ferro-cyanide may be hazardous.

	(%wt)	Type(s) and comment
Combustible metals.....	<1.0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....		
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	<1.0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

WASTE STREAM	9J33/C	Conditioned Sludge
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Hazardous substances /
non hazardous pollutants: -

	(%wt)	
Acrylamide.....		Type(s) and comment
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.....		

Complexing agents (%wt): No

	(%wt)	
EDTA.....		Type(s) and comment
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....	0	

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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

Container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	3m ³ drum	100.0	~2.2	2.2	66

Container type comment:

-

Range in container waste volume:

Not yet determined. No significant variability is expected.

Other information on containers:

The container material is stainless steel.

Conditioned density (t/m³):

~2.0

Conditioned density comment:

The conditioned density range is not estimated.

Other information on conditioning:

Wet ILW recovery and encapsulation plant used to condition Waste.

RADIOACTIVITY

Source:

-

Uncertainty:

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:

Activity information taken from CALC 1064 issue 2

Other information:

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Conditioned Sludge

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	1.03E-04	CC 1			Gd 153		8		
Be 10	3.43E-08	CC 2			Ho 163	3.79E-08	CC 2		
C 14	2.37E-05	CC 1			Ho 166m	1.17E-05	CC 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	7.65E-07	CC 1			Lu 174		8		
Ar 39	1.86E-05	CC 2			Lu 176		8		
Ar 42		8			Hf 178n	1.32E-05	CC 2		
K 40		8			Hf 182		8		
Ca 41	1.56E-06	CC 1			Pt 193	1.26E-05	CC 2		
Mn 53		8			Tl 204	1.34E-06	CC 2		
Mn 54		8			Pb 205		8		
Fe 55	4.51E-06	CC 1			Pb 210		8		
Co 60	2.67E-05	CC 1			Bi 208		8		
Ni 59	1.06E-06	CC 1			Bi 210m		8		
Ni 63	3.81E-05	CC 1			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	5.08E-08	CC 2			Ra 225		8		
Kr 81	2.86E-07	CC 2			Ra 226		8		
Kr 85	6.28E-04	CC 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	1.02E-02	CC 1			Th 227		8		
Zr 93	2.06E-06	CC 2			Th 228	2.39E-08	CC 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	7.93E-06	CC 2			Th 232		8		
Nb 94	1.88E-06	CC 2			Th 234	1.70E-06	CC 2		
Mo 93	4.28E-08	CC 2			Pa 231		8		
Tc 97		8			Pa 233	1.80E-07	CC 2		
Tc 99	1.51E-05	CC 1			U 232	2.32E-08	CC 2		
Ru 106	1.85E-09	CC 2			U 233	3.86E-08	CC 2		
Pd 107	1.45E-07	CC 2			U 234	2.26E-06	CC 1		
Ag 108m	1.91E-06	CC 2			U 235	4.12E-08	CC 1		
Ag 110m		8			U 236	2.23E-07	CC 2		
Cd 109		8			U 238	1.70E-06	CC 1		
Cd 113m	3.62E-06	CC 2			Np 237	1.81E-07	CC 2		
Sn 119m		8			Pu 236		8		
Sn 121m	1.97E-05	CC 2			Pu 238	7.23E-04	CC 1		
Sn 123		8			Pu 239	7.77E-04	CC 1		
Sn 126	4.93E-07	CC 2			Pu 240	7.69E-04	CC 1		
Sb 125	4.28E-07	CC 2			Pu 241	1.21E-02	CC 1		
Sb 126	6.9E-08	CC 2			Pu 242	1.55E-06	CC 2		
Te 125m	1.07E-07	CC 2			Am 241	3.55E-03	CC 1		
Te 127m		8			Am 242m	4.66E-06	CC 2		
I 129	2.08E-07	CC 1			Am 243	5.76E-06	CC 2		
Cs 134	3.30E-08	CC 1			Cm 242	3.84E-06	CC 1		
Cs 135	6.23E-07	CC 2			Cm 243	4.87E-06	CC 1		
Cs 137	6.19E-02	CC 1			Cm 244	5.56E-05	CC 1		
Ba 133	1.93E-06	CC 2			Cm 245	8.44E-09	CC 2		
La 137	2.89E-09	CC 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	4.66E-08	CC 2			Cf 250		8		
Pm 147	5.16E-06	CC 1			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	7.06E-04	CC 1			Other a				
Eu 152	2.82E-06	CC 2			Other b/g				
Eu 154	6.97E-05	CC 1			Total a	5.90E-03	CC 2	0	
Eu 155	8.55E-06	CC 1			Total b/g	8.59E-02	CC 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