

WASTE STREAM	9J33	CCP 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

		Reported
Stocks:	At 1.4.2022.....	42.3 m ³
Total future arisings:		0 m ³
Total waste volume:		42.3 m ³
Comment on volumes:	No further arisings are expected.	
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. The stream has been expanded to include the following sludge waste streams: CCP (13.9m³), Miscellaneous Sump (3.2 m³), SRT 1 (11.5m³), SRT2 (4m³), SRT3 (1m³), SNT (2.9m³), Filtrate receiving Tank (0.25 m³), CCP Backwash Receiving Tank (0.25 m³), filtered solids storage tank (4.0m³), CCP Supernatant tank (0.25m³), Miscellaneous Delay tanks (1.0m³)

PHYSICAL CHARACTERISTICS

General description: CCP 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 and water (100%)
 Sealed sources: The waste does not contain sealed sources.
 Bulk density (t/m³): ~1.1
 Comment on density: The density is indicative only and represents raw 'as stored' sludge.

CHEMICAL COMPOSITION

General description and components (%wt): Aluminium hydroxide, silicic acid, silica, potassium ferrous-ferro-cyanide, magnesium hydroxide and water. Proportions have not been determined.
 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.....	<1.0		
Iron.....			
Aluminium.....			
Beryllium.....	0		
Cobalt.....			

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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.....	~100.0	Including approximately 1% aluminium hydroxide and 2% magnesium hydroxide	
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	0		

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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.....	~2.0	
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.....	~2.0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

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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.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

Complexing agents (%wt): No

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

Conditioning method: The waste is expected to be encapsulated in a BFS/OPC matrix. There is no intention to first supercompact the waste.

Plant Name: WILWREP

Location: Hunterston A Decommissioning Site

Plant startup date: -

Total capacity (m³/y incoming waste): ~100.0

Target start date for packaging this stream: 2019

Throughput for this stream (m³/y incoming waste): ~60.0

Other information: All the waste being held in a tank is expected to be retrieved when a conditioning campaign is undertaken. Waste will be co-packaged with stream 9J03

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
	3m³ drum	100.0	~1.174	2.2	36

Likely container type comment: -

Range in container waste volume: Not yet determined. No significant variability is expected.

Other information on containers: The container material is expected to be stainless steel.

Likely conditioning matrix: Blast Furnace Slag / Ordinary Portland Cement

Other information: The matrix is expected to be 9:1 BFS/OPC.

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.

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 Facility	Disposal at LLWR	<50.0	2023	Medium	Characterisation work ongoing for some of the tanks that make up this stream that suggests potential for some to be managed as LLW. Anywhere between 20-50% potentially

RADIOACTIVITY

Source: The principal source of radioactivity is Cs-137, Sr-90 and Pu-241 from fuel.

Uncertainty: The values quoted are indicative of the activities that might be expected.

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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:

Data has been taken from CALC 1064 for SRT2 and SRT3 and CALC 4125 for CCP sludge and SRT 1 as these are the major constituents and an average taken.

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	1.53E-04	CC 1			Gd 153		8		
Be 10	5.11E-08	CC 2			Ho 163	5.64E-08	CC 2		
C 14	3.52E-05	CC 1			Ho 166m	1.74E-05	CC 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1.14E-06	CC 1			Lu 174		8		
Ar 39	2.76E-05	CC 2			Lu 176		8		
Ar 42		8			Hf 178n	1.97E-05	CC 2		
K 40		8			Hf 182		8		
Ca 41	2.33E-06	CC 1			Pt 193	1.87E-05	CC 2		
Mn 53		8			Tl 204	2.00E-06	CC 2		
Mn 54		8			Pb 205		8		
Fe 55	6.71E-06	CC 1			Pb 210		8		
Co 60	3.98E-05	CC 1			Bi 208		8		
Ni 59	1.57E-06	CC 1			Bi 210m		8		
Ni 63	5.67E-05	CC 1			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	7.57E-08	CC 2			Ra 225		8		
Kr 81	4.26E-07	CC 2			Ra 226		8		
Kr 85	9.35E-04	CC 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	1.52E-02	CC 1			Th 227		8		
Zr 93	3.06E-06	CC 2			Th 228	3.56E-08	CC 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	1.18E-05	CC 2			Th 232		8		
Nb 94	2.79E-06	CC 2			Th 234	2.53E-06	CC 2		
Mo 93	6.37E-08	CC 2			Pa 231		8		
Tc 97		8			Pa 233	2.68E-07	CC 2		
Tc 99	2.25E-05	CC 1			U 232	3.46E-08	CC 2		
Ru 106	2.76E-09	CC 2			U 233	5.75E-08	CC 2		
Pd 107	2.15E-07	CC 2			U 234	3.36E-06	CC 1		
Ag 108m	2.85E-06	CC 2			U 235	6.13E-08	CC 1		
Ag 110m		8			U 236	3.32E-07	CC 2		
Cd 109		8			U 238	2.53E-06	CC 1		
Cd 113m	5.39E-06	CC 2			Np 237	2.69E-07	CC 2		
Sn 119m		8			Pu 236		8		
Sn 121m	2.93E-05	CC 2			Pu 238	1.08E-03	CC 1		
Sn 123		8			Pu 239	1.16E-03	CC 1		
Sn 126	7.34E-07	CC 2			Pu 240	1.15E-03	CC 1		
Sb 125	6.37E-07	CC 2			Pu 241	1.80E-02	CC 1		
Sb 126	1.03E-07	CC 2			Pu 242	2.30E-06	CC 2		
Te 125m	1.59E-07	CC 2			Am 241	5.29E-03	CC 1		
Te 127m		8			Am 242m	6.93E-06	CC 2		
I 129	3.1E-07	CC 1			Am 243	8.57E-06	CC 2		
Cs 134	4.91E-08	CC 1			Cm 242	5.72E-06	CC 1		
Cs 135	9.27E-07	CC 2			Cm 243	7.24E-06	CC 1		
Cs 137	9.21E-02	CC 1			Cm 244	8.27E-05	CC 1		
Ba 133	2.87E-06	CC 2			Cm 245	1.26E-08	CC 2		
La 137	4.30E-09	CC 2			Cm 246	1.56E-09	CC 2		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	6.93E-08	CC 2			Cf 250		8		
Pm 147	7.68E-06	CC 1			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	1.05E-03	CC 1			Other a				
Eu 152	4.20E-06	CC 2			Other b/g				
Eu 154	1.04E-04	CC 1			Total a	8.78E-03	CC 2	0	
Eu 155	1.27E-05	CC 1			Total b/g	1.28E-01	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