WASTE STREAM 9C20 AETP Sludge

SITE	Dungeness A
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	LLW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	~12.9 m^3
Total future arisings:		0 m^3
Total waste volume:		12.9 m^3

Comment on volumes: Heel of sludge from SST1 and SST2 (0.4m3), in addition to evap/ regen tank (<0.5m3) and backwash tank 1&2 (1.35m3). Tank inspection carried out on the oil trap in early 2019 confirmed that additional 10.56m3 of sludge remains within the oil separator

Uncertainty factors on volumes:

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

WASTE SOURCE The sludge originates from routine filtration of liquid effluents. Some of the sludge has also originated from filtration of cooling pond water. Pond sludge is now accumulated separately (see waste stream 9C16).

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 oil and 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. There are no large items that may require special handling.

Physical components (%vol): Sludge (50%) and sand (50%). No other constituents anticipated.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): 1.9

Comment on density: The bulk density of the sludge is expected to range from 1.05 to 1.15 t/m3 with an average of about 1.1 t/m3. Sand from sand filters (5.9 m3) will have a density of about 2.65 t/m3 so that the overall mean bulk density is about 1.9 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): Magnesium hydroxide, magnesium carbonate, water, siliceous materials including sand, oil (~10% wt) and a range of other materials.

Chemical state: Alkali

Chemical form of radionuclides:
H-3: H-3: Most tritium is expected to be present as water but some may be present in the form of other organic or inorganic compounds.
C-14: C-14: Carbon 14 may be present as graphite.
Se-79: Se-79: The chemical form of selenium has not been determined.
Tc-99: Tc-99: The chemical form of technetium has not been determined.
U: U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.
Np: Np: The chemical form of neptunium has not been determined.
Pu: Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): The metal content has not been fully assessed, but some unreacted Magnox is expected.There are no bulk metal items present.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....			
Other ferrous metals.....			
Iron.....			
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....			
Magnox/Magnesium.....			
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....			
Zircaloy/Zirconium.....			
Other metals.....			

Organics (%wt): The cellulosic material content of the waste has not been assessed. Approximately 10% wt of the waste is mineral oil with particulate matter and waters. Ion exchange resins would be expected in only trace quantities. Halogenated plastics and rubbers are not present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	0		
Paper, cotton.....			
Wood.....			
Halogenated plastics			
Total non-halogenated plastics.....	0		
Condensation polymers.....			
Others.....			
Organic ion exchange materials....			
Total rubber.....	0		
Halogenated rubber			
Non-halogenated rubber.....			
Hydrocarbons.....			
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..			
Inorganic sludges and flocs.....	~45.0		
Soil.....			
Brick/Stone/Rubble.....			
Cementitious material.....			
Sand.....	~45.0		
Glass/Ceramics.....			
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....			
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....			
Free non-aqueous liquids.....			
Powder/Ash.....			

Inorganic anions (%wt): -

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

Materials of interest for waste acceptance criteria: Magnox, will ignite under appropriate conditions. There might be trace quantities of biological material.

	(%wt)	Type(s) and comment
Combustible metals.....	<1.0	
Low flash point liquids.....		
Explosive materials.....		
Phosphorus.....		
Hydrides.....		
Biological etc. materials.....		
Biodegradable materials.....		
Putrescible wastes.....		
Non-putrescible wastes.....		

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Corrosive materials.....		
Pyrophoric materials.....		
Generating toxic gases.....		
Reacting with water.....	<1.0	
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.....		
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):

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

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.

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recyling / reuse Other / various None	On-site	100.0

Comment on planned treatments: waste will be encapsulated to meet LLWR WAC, likely to be in HHISO's. Waste may be co-disposed with LLW pond skips from SZA

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	100.0	2.4
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: -

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Opportunities for alternative disposal routing: -

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Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at LLWR	Disposal at a Geological Disposal Facility	NE	2023	Medium	Baseline position is encapsulation and LLW disposal but this is under threat, under investigation still

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m³	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	100.0	6.3	3

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste does not have a current WCH.

Waste consigned for disposal to LLWR in year of generation: -

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: -

Uncertainty: Activity is derived from sample result ref's EX09246/06/10/25, EX09246/06/10/27, EX09246/06/10/23, DNA/WP/23605/RPT/6624

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 taken from sample results in 2016 and decayed by six years for RWI 2022

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	2.51E-05	B B 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	1.51E-05	B B 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1.1E-06	B B 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	1.66E-05	B B 2			Pb 210		8		
Co 60	8.54E-06	B B 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	6.41E-05	B B 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	5.51E-04	B B 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	1.41E-07	B B 2			Th 234	3.32E-08	B B 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	4.32E-07	B B 2			U 232		8		
Ru 106	7.40E-08	B B 2			U 233		8		
Pd 107		8			U 234	3.26E-08	B B 2		
Ag 108m	7.46E-06	B B 2			U 235		8		
Ag 110m		8			U 236	3.00E-09	B B 2		
Cd 109		8			U 238	3.32E-08	B B 2		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	1.16E-04	B B 2		
Sn 123		8			Pu 239	2.05E-04	B B 2		
Sn 126		8			Pu 240	2.05E-04	B B 2		
Sb 125	3.17E-07	B B 2			Pu 241	3.30E-03	B B 2		
Sb 126		8			Pu 242		8		
Te 125m	7.93E-08	B B 2			Am 241	3.03E-04	B B 2		
Te 127m		8			Am 242m		8		
I 129	1.66E-09	B B 2			Am 243		8		
Cs 134	6.94E-07	B B 2			Cm 242	1.52E-09	B B 2		
Cs 135		8			Cm 243	1.48E-05	B B 2		
Cs 137	3.14E-03	B B 2			Cm 244	1.35E-05	B B 2		
Ba 133	4.51E-07	B B 2			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		8			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		8			Other a				
Eu 152	6.46E-07	B B 2			Other b/g				
Eu 154	3.27E-05	B B 2			**Total a**	**8.57E-04**	**B B 2**	**0**	
Eu 155	8.56E-06	B B 2			**Total b/g**	**7.17E-03**	**B B 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