

WASTE STREAM**3K20****Gas Circulator Maintenance Sludge****SITE** Hartlepool**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**WASTE TYPE** LLW; SPD1**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	1.5 m ³
Future arisings -	1.4.2019 - 31.3.2024.....	0.3 m ³
	1.4.2024 - 31.3.2026.....	0.2 m ³
Total future arisings:		0.5 m ³
Total waste volume:		2.0 m ³

Comment on volumes: Rates of arising are dependant upon station operation and are expected to increase slightly during defuelling. Station operation is assumed to end in 2019 and defuelling to last 2 years. Future arisings volumes are current best estimates based upon operating experience.

Uncertainty factors on volumes:	Stock (upper):	x 1.5	Arisings (upper)	x 1.5
	Stock (lower):	x 0.5	Arisings (lower)	x 0.5

WASTE SOURCE Sludge arising from Gas Circulator Maintenance.**PHYSICAL CHARACTERISTICS**

General description: Sludge arising from Gas Circulator Maintenance. There will be no large items that may require special handling.

Physical components (%vol): Sludge, no other items identified. The breakdown of components constituting the sludge has not been assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~2

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): A wide variety of materials is expected.

Chemical state: -

Chemical form of radionuclides:

- H-3: To be determined
- C-14: To be determined
- Cl-36: To be determined
- Se-79: To be determined
- Tc-99: To be determined
- I-129: To be determined
- Ra: To be determined
- Th: To be determined
- U: To be determined
- Np: To be determined
- Pu: To be determined

Metals and alloys (%wt): -

Stainless steel.....	NE
Other ferrous metals.....	NE
Iron.....	NE
Aluminium.....	NE
Beryllium.....	NE
Cobalt.....	NE
Copper.....	NE
Lead.....	NE

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	Magnox/Magnesium.....	NE
	Nickel.....	NE
	Titanium.....	NE
	Uranium.....	NE
	Zinc.....	NE
	Zircaloy/Zirconium.....	NE
	Other metals.....	NE
Organics (%wt):	Oil and grease may be present.	
	Total cellulosics.....	NE
	Paper, cotton.....	
	Wood.....	
	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.....	NE
	Oil or grease	
	Fuel.....	
	Asphalt/Tarmac (cont.coal tar)...	
	Asphalt/Tarmac (no coal tar)....	
	Bitumen.....	
	Others.....	
	Other organics.....	NE
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	~100.0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	0
	Glass/Ceramics.....	
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	P
	Free non-aqueous liquids.....	P

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	Powder/Ash.....	0
Inorganic anions (%wt):	-	
	Fluoride.....	NE
	Chloride.....	NE
	Iodide.....	NE
	Cyanide.....	NE
	Carbonate.....	NE
	Nitrate.....	NE
	Nitrite.....	NE
	Phosphate.....	NE
	Sulphate.....	NE
	Sulphide.....	NE

Materials of interest for waste acceptance criteria:

No material likely to represent a fire or other non-radiological hazard is expected to be present, but there may be some oil and grease and trace quantities of biological material.

Combustible metals.....	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.....	0
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Active particles.....	0
Soluble solids as bulk chemical compounds.....	0

Not expected

Hazardous substances / non hazardous pollutants:

-	
Acrylamide.....	NE
Benzene.....	NE
Chlorinated solvents.....	NE
Formaldehyde.....	NE
Organometallics.....	NE
Phenol.....	NE
Styrene.....	NE
Tri-butyl phosphate.....	NE
Other organophosphates.....	NE
Vinyl chloride.....	NE
Arsenic.....	NE

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Barium.....	NE
Boron.....	NE
Cadmium.....	NE
Caesium.....	NE
Selenium.....	NE
Chromium.....	NE
Molybdenum.....	NE
Thallium.....	NE
Tin.....	NE
Vanadium.....	NE
Mercury compounds.....	NE
Others.....	NE
Electronic Electrical Equipment (EEE)	
EEE Type 1.....	0
EEE Type 2.....	0
EEE Type 3.....	0
EEE Type 4.....	0
EEE Type 5.....	0
Complexing agents (%wt):	Not yet determined
EDTA.....	NE
DPTA.....	NE
NTA.....	NE
Polycarboxylic acids.....	NE
Other organic complexants.....	NE
Total complexing agents.....	NE

Expect only trace quantities, if any.

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 Recycling / reuse Other / various None	On-site	100.0

Comment on planned treatments:

Further treatments not yet determined but assumed to be encapsulation. The waste will be incinerated if possible or high force compaction may be used to condition the waste depending on the oil content and other factors which may affect these methods of treatment.

WASTE STREAM**3K20****Gas Circulator Maintenance Sludge****Disposal Routes:**

Disposal Route	Stream volume %
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	100.0

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m ³	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	10.39	< 1

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH):

It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).
The waste does not have a current WCH.

Waste will require treatment / conditioning in order to be suitable for disposal to LLWR.

Waste consigned for disposal to LLWR in year of generation:

No. Waste is expected to remain in storage pending decommissioning stage 1.

Potential for the waste to contain discrete items:

No

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

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

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Other information:

-

RADIOACTIVITY

Source:

Contaminated sludge. Contamination by activation products will be the main source of activity.

Uncertainty:

The waste is expected to be LLW, but may fall into ILW category.

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:

Radionuclide Content based on AETP Sludge (3K02). Error bands reflect that Individual activity levels are indicative only. Datasheet provided by Alan Simpson on 28/2/18.

Other information:

Specific activity will be a function of station operating history.

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Gas Circulator Maintenance Sludge

Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3	1.58E-03	DD 2	1.58E-03	DD 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	5.06E-06	DD 2	5.06E-06	DD 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	<1.58E-07	DD 3	<1.58E-07	DD 3	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40	<1.14E-07	DD 3	<1.14E-07	DD 3	Hf 182				
Ca 41		8		8	Pt 193				
Mn 53					Tl 204				
Mn 54	3.69E-06	DD 2	3.69E-06	DD 2	Pb 205				
Fe 55	1.28E-05	DD 2	1.28E-05	DD 2	Pb 210	<1.18E-06	DD 3	<1.18E-06	DD 3
Co 60	1.6E-05	DD 2	1.6E-05	DD 2	Bi 208				
Ni 59		8		6	Bi 210m				
Ni 63	5.2E-06	DD 2	5.2E-06	DD 2	Po 210		8		8
Zn 65	<8.8E-08	DD 3	<8.8E-08	DD 3	Ra 223				
Se 79		8		8	Ra 225				
Kr 81					Ra 226	<1.15E-06	DD 3	<1.15E-06	DD 3
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	3.46E-06	DD 2	3.46E-06	DD 2	Th 227				
Zr 93		8		8	Th 228				
Nb 91					Th 229				8
Nb 92					Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94	<4.16E-08	DD 3	<4.16E-08	DD 3	Th 234	<5.44E-07	DD 3	<5.44E-07	DD 3
Mo 93		8		8	Pa 231		8		8
Tc 97					Pa 233	<1.2E-07	DD 3	<1.2E-07	DD 3
Tc 99		8		8	U 232				
Ru 106	<4.64E-07	DD 3	<4.64E-07	DD 3	U 233		8		8
Pd 107		8		8	U 234	2.38E-08	DD 2	2.38E-08	DD 2
Ag 108m		8		8	U 235	<1.55E-09	DD 3	<1.55E-09	DD 3
Ag 110m	<4.96E-08	DD 3	<4.96E-08	DD 3	U 236		8		8
Cd 109					U 238	1.46E-08	DD 2	1.46E-08	DD 2
Cd 113m					Np 237	<3.36E-07	DD 3	<3.36E-07	DD 3
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	4.83E-07	DD 2	4.83E-07	DD 2
Sn 123					Pu 239		8		8
Sn 126		8		8	Pu 240	<7.97E-07	DD 3	<7.97E-07	DD 3
Sb 125	<3.2E-07	DD 3	<3.2E-07	DD 3	Pu 241	3.06E-05	DD 2	3.06E-05	DD 2
Sb 126					Pu 242	<2.88E-08	DD 3	<2.88E-08	DD 3
Te 125m					Am 241	1.92E-06	DD 2	1.92E-06	DD 2
Te 127m					Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	8.48E-06	DD 2	8.48E-06	DD 2	Cm 242	2.14E-08	DD 2	2.14E-08	DD 2
Cs 135		8		8	Cm 243	1.34E-07	DD 2	1.34E-07	DD 2
Cs 137	2.34E-04	DD 2	2.34E-04	DD 2	Cm 244	1.34E-07	DD 2	1.34E-07	DD 2
Ba 133					Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	<2.4E-07	DD 3	<2.4E-07	DD 3	Cf 249				
Pm 145					Cf 250				
Pm 147	4.9E-06	DD 2	4.9E-06	DD 2	Cf 251				
Sm 147					Cf 252				
Sm 151	<6.05E-07	DD 3	<6.05E-07	DD 3	Other a	<1E-09	8	<1E-09	8
Eu 152	<4.48E-08	DD 3	<4.48E-08	DD 3	Other b/g	1.92E-07	CC 2	1.92E-07	CC 2
Eu 154	1.07E-06	DD 2	1.07E-06	DD 2	Total a	5.05E-06	CC 2	5.05E-06	DD 2
Eu 155	6.14E-07	DD 2	6.14E-07	DD 2	Total b/g	1.91E-03	CC 2	1.91E-03	DD 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