

WASTE STREAM	3K02	Active Effluent Filtration Sludges
---------------------	-------------	---

SITE Hartlepool

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	43.8 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	3.0 m ³
	1.4.2023 - 31.3.2024.....	3.0 m ³
	1.4.2024 - 31.3.2025.....	3.0 m ³
Total future arisings:		9.0 m ³
Total waste volume:		52.8 m ³

Comment on volumes: Arisings depend on station operation and are expected to increase during defuelling. Station operation is assumed to end in 2024 and defuelling to last 3 years.

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper) x 1.5
 Stock (lower): x 0.75 Arisings (lower) x 0.5

WASTE SOURCE Filtration of radioactive effluent.

PHYSICAL CHARACTERISTICS

General description: Sludge, sand and any filter precoat material that may be used. There are no large items that may require special handling.

Physical components (%wt): Sludge (100% vol). The breakdown of components constituting the sludge may include dust, grit, sand, oil, paint, clay and plastic coalescers. Water may be about 65% wt of the waste.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.6

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): A wide variety of materials including dust, grit, sand, oil, paint, clay and water. Water is expected to be about 65% wt. Wt% of other constituents has not been assessed.

Chemical state: Alkali

Chemical form of radionuclides: H-3: As tritiated water
 C-14: As graphite particulate or in activated metals
 Cl-36: Not determined
 Se-79: Not expected
 Tc-99: Not expected
 I-129: Not expected
 Ra: Not determined
 Th: Not determined
 U: Not determined
 Np: Not determined
 Pu: Not determined

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE		
Other ferrous metals.....	NE		
Iron.....	NE		
Aluminium.....	NE		

WASTE STREAM	3K02	Active Effluent Filtration Sludges
---------------------	-------------	---

Beryllium.....	NE
Cobalt.....	NE
Copper.....	NE
Lead.....	NE
Magnox/Magnesium.....	NE
Nickel.....	NE
Titanium.....	NE
Uranium.....	NE
Zinc.....	NE
Zircaloy/Zirconium.....	NE
Other metals.....	NE

Traces of lithium cations may be present from lithium hydroxide.

Organics (%wt): Oil may be present at about 2%wt. Plastics may be expected in trace quantities, if any.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	TR		
Paper, cotton.....			
Wood.....			
Halogenated plastics	TR		
Total non-halogenated plastics.....	TR		
Condensation polymers.....			
Others.....			
Organic ion exchange materials....	NE		
Total rubber.....	NE		
Halogenated rubber	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	~2.0		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	NE		
Inorganic sludges and flocs.....	~98.0		
Soil.....	NE		
Brick/Stone/Rubble.....	NE		
Cementitious material.....	NE		
Sand.....	P		
Glass/Ceramics.....	NE		

WASTE STREAM	3K02	Active Effluent Filtration Sludges
---------------------	-------------	---

Graphite.....	NE
Desiccants/Catalysts.....	NE
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	P
Free non-aqueous liquids.....	P
Powder/Ash.....	0

Inorganic anions (%wt): Estimate based upon analysis of previous stocks consigned to the LLWR in 1992.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	<0.10	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	<0.10	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	<0.10	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: No material likely to represent a fire hazard or other non-radiological hazard has been identified.

	(%wt)	Type(s) and comment
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.....	NE	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	0	Not expected
Soluble solids as bulk chemical compounds.....	0	

WASTE STREAM**3K02****Active Effluent Filtration Sludges**

Hazardous substances /
non hazardous pollutants: -

	(%wt)	Type(s) and comment
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	
Barium.....	NE	
Boron.....	NE	
Boron (in Boral).....	NE	
Boron (non-Boral).....	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

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	Expect only trace quantities, if any.
Total complexing agents.....	TR	

WASTE STREAM**3K02****Active Effluent Filtration Sludges**

Potential for the waste to contain discrete items: No.

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	Off-site	100.0

Comment on planned treatments:

Waste is stored pending decommissioning stage 1. However, campaigns to retrieve the waste have occurred in the past with latest treatment by incineration.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
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	

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	100.0	100.0	100.0

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

Waste Packaging for Disposal: (Not applicable to this waste stream)

WASTE STREAM**3K02****Active Effluent Filtration Sludges**

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			

Other information: -

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (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: Contaminated sludge. Contamination by activation products will be the main source of activity.

Uncertainty: Specific activity is a function of station operating history. The values quoted are based upon activity measurements made on previously conditioned wastes.

Definition of total alpha and total beta/gamma: Activity gross alpha and beta values quoted are from sample analysis report. Alpha value as Am241, gross beta as K-40.

Measurement of radioactivities: Activity estimates are based on fingerprint of wastestream and on limited dose rate measurements and spectroscopic analysis.

Other information: Other beta/gamma nuclides of arisings (in TBq/m³) include Ca45 (3.8E-4), Cr51 (1.3E-6), Co58 (2.1E-6), Zr95 (9.0E-6), Nb95 (5.8E-6), Ru103 (9.0E-7), Ta182 (2.4E-7), Sc46 (8.0E-6), Fe59 (6.6e-7), Se75 (1.2E-5), Sb124 (7.8E-7) and Hg203 (2.0E-6).

WASTE STREAM

3K02

Active Effluent Filtration Sludges

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	4.01E-04	CC 1	4.01E-04	CC 2	Gd 153				
Be 10					Ho 163				
C 14	2.24E-05	CC 1	2.24E-05	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	<2.4E-08	C 1	<2.4E-08	C 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40	<7.8E-07	C 1	<7.8E-07	C 2	Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54	3.1E-07	CC 1	3.1E-07	CC 2	Pb 205				
Fe 55	2.4E-06	CC 1	2.4E-06	CC 2	Pb 210	<3.8E-06	C 1	<3.8E-06	C 2
Co 60	2.31E-06	CC 1	2.31E-06	CC 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	5.4E-06	CC 1	5.4E-06	CC 2	Po 210				
Zn 65	<1.07E-07	C 1	<1.07E-07	C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	<1.12E-06	C 1	<1.12E-06	C 2
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.48E-06	CC 1	1.48E-06	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	<2.5E-08	C 1	<2.5E-08	C 2	Th 234	<3.5E-07	C 1	<3.5E-07	C 2
Mo 93					Pa 231				
Tc 97					Pa 233	<6.4E-08	C 1	<6.4E-08	C 2
Tc 99					U 232				
Ru 106	<4.8E-07	C 1	<4.8E-07	C 2	U 233				
Pd 107					U 234	1.6E-08	CC 1	1.6E-08	CC 2
Ag 108m					U 235	<6.4E-08	C 1	<6.4E-08	C 2
Ag 110m	<3.5E-08	C 1	<3.5E-08	C 2	U 236	<2.1E-11	C 1	<2.1E-11	C 2
Cd 109					U 238	1.1E-08	CC 1	1.1E-08	CC 2
Cd 113m					Np 237	<2.7E-07	C 1	<2.7E-07	C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	3.1E-07	CC 1	3.1E-07	CC 2
Sn 123					Pu 239	5.8E-07	CC 1	5.8E-07	CC 2
Sn 126					Pu 240				
Sb 125	<1.76E-07	C 1	<1.76E-07	C 2	Pu 241				
Sb 126					Pu 242	<4E-09	C 3	<4E-09	C 3
Te 125m					Am 241	1.38E-06	CC 1	1.38E-06	CC 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	7.4E-08	CC 1	7.4E-08	CC 2	Cm 242	6.56E-09	CC 1	6.56E-09	CC 2
Cs 135					Cm 243	5.4E-08	CC 1	5.4E-08	CC 3
Cs 137	1.73E-05	CC 1	1.73E-05	CC 2	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	<1.49E-06	C 3	<1.49E-06	C 2	Cf 249				
Pm 145					Cf 250				
Pm 147	3.8E-06	CC 1	3.8E-06	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151	2.6E-07	CC 1	2.6E-07	CC 2	Other a	<1E-09	8	<1E-09	8
Eu 152	<5.8E-08	CC 1	<5.8E-08	CC 2	Other b/g	1.92E-07	CC 2	1.92E-07	CC 2
Eu 154	2.7E-07	CC 1	2.7E-07	CC 2	Total a	3.82E-06	CC 2	3.82E-06	CC 2
Eu 155	1.3E-07	CC 1	1.3E-07	CC 2	Total b/g	4.65E-04	CC 2	4.65E-04	CC 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