WASTE STREAM 3Z202 AGR Fuel Transport Flasks

SITE	Flasks & Flatrols
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.....	0 m³
Future arisings -	1.4.2022 - 31.3.2028.....	0 m³
	1.4.2028 - 31.3.2035.....	387.6 m³
Total future arisings:		387.6 m³
Total waste volume:		387.6 m³

Comment on volumes: Arisings are not constant as waste is expected to arise during flask decommissioning following AGR defuelling. Arisings are from 31 A2 flasks. The flasks are assumed to be in service to the end of AGR station defuelling. A further 15 A2 flasks are held in reserve and being prepared for use during defuelling, however, it is not known if they will be utilised and how many, so have not been included in the above arisings volume.

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

WASTE SOURCE A2 flasks that have been used for transporting irradiated AGR fuel.

PHYSICAL CHARACTERISTICS

General description: A2 Flask - Steel construction of overall dimensons 2.56m x 2.15m x 2.31m. Internal cavity is 1.66 m³. Flasks weigh 49.7 t, and have a volume of 12.71 m³ each.

Physical components (%wt): A2 flask- ~100% steel. Flask surfaces are painted (~0.1% wt) and there is a seal (viton) (<0.01%wt). Overall composition of the waste stream is about 99.9% steel, about 0.1% paint and <0.01% viton.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 3.9

Comment on density: Volume quoted for arisings is an envelope volume for the the empty flask and as such density accounts for the internal space.

CHEMICAL COMPOSITION

General description and components (%wt): Steel A2 Flasks. Flask surfaces are painted with an epoxy based paint and there is a seal made of viton. Steel (~99.9%), Viton (<0.01%) and epoxy based paint (~0.1%).

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): Metal present as massive pieces. A2 flask - wall thickness of 340mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	~99.9		
Iron.....	0		
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....	0		

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Magnox/Magnesium	0
Nickel	
Titanium	0
Uranium	
Zinc	0
Zircaloy/Zirconium	0
Other metals	0

Organics (%wt): Epoxy based paint on flask surfaces. Viton seal between flask lid and flask body. Viton used as seal material.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	0		
Paper, cotton	0		
Wood	0		
Halogenated plastics	0		
Total non-halogenated plastics	0		
Condensation polymers	0		
Others	0		
Organic ion exchange materials	0		
Total rubber	<0.01		
Halogenated rubber	<0.01		
Non-halogenated rubber	0		
Hydrocarbons	0		
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics	~0.10		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	0		
Inorganic sludges and flocs	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.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): Contaminants from fuel pond water are expected to be insignificant.

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

Materials of interest for waste acceptance criteria: No materials likely to pose a fire or other non-radiological hazard have 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.....	0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	NE	
Benzene.....	NE	
Chlorinated solvents.....	NE	

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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): No

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

Potential for the waste to contain discrete items: No. No

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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	Off-site	95.0
Metal treatment	Off-site	95.0
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None	Off-site	5.0

Comment on planned treatments: Details of flask decommissioning process yet to be finalised. Flasks are expected to be capable of being decontaminated with the majority (~95%) being suitable for free release/recycling.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	5.0	
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	95.0	
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: -

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

Waste Packaging for Disposal:

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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	5.0	10	2

Other information: Expected that decommissioned flasks will be dispatched to an off-site facility for decontamination/treatment and disposal.

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: No. Waste will be disposed of at the end of AGR defuelling.

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: Residual contamination of fuel flasks.

Uncertainty: Activity values are current best estimates. Any waste is expected to be LLW, levels of contamination have to be determined.

Definition of total alpha and total beta/gamma: Total alpha and total beta/gamma are defined as the sums of the listed nuclide activities. Beta/gamma activity includes the activities of all nuclides other than alpha emitters.

Measurement of radioactivities: Theoretical assessment.

Other information: There may be contamination by fission products, actinides and activation products in stainless steel.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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				8	Gd 153				
Be 10				8	Ho 163				
C 14				8	Ho 166m				
Na 22				4	Tm 170				
Al 26				4	Tm 171				
Cl 36				8	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41				8	Pt 193				
Mn 53					Tl 204				
Mn 54			1E-06	C C 2	Pb 205				
Fe 55				6	Pb 210				8
Co 60			1E-05	C C 2	Bi 208				
Ni 59				6	Bi 210m				
Ni 63				6	Po 210				8
Zn 65				8	Ra 223				
Se 79				6	Ra 225				
Kr 81					Ra 226				8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			1E-06	C C 2	Th 227				
Zr 93				6	Th 228				
Nb 91					Th 229				8
Nb 92					Th 230				8
Nb 93m				6	Th 232				6
Nb 94				6	Th 234				
Mo 93				6	Pa 231				8
Tc 97					Pa 233				
Tc 99				6	U 232				
Ru 106			1E-08	C C 2	U 233			1E-09	C C 2
Pd 107				6	U 234			2E-07	C C 2
Ag 108m				6	U 235				8
Ag 110m					U 236				6
Cd 109					U 238			1E-07	C C 2
Cd 113m					Np 237			2E-08	C C 2
Sn 119m					Pu 236				
Sn 121m				6	Pu 238			2E-08	C C 2
Sn 123					Pu 239			1E-07	C C 2
Sn 126				6	Pu 240			1E-07	C C 2
Sb 125					Pu 241			5E-06	C C 2
Sb 126					Pu 242				6
Te 125m					Am 241			2E-07	C C 2
Te 127m					Am 242m				6
I 129				8	Am 243				6
Cs 134			6E-08	C C 2	Cm 242			3E-08	C C 2
Cs 135				6	Cm 243				6
Cs 137			3E-06	C C 2	Cm 244				6
Ba 133					Cm 245				8
La 137					Cm 246				8
La 138					Cm 248				
Ce 144				6	Cf 249				
Pm 145					Cf 250				
Pm 147				6	Cf 251				
Sm 147					Cf 252				
Sm 151				6	Other a				8
Eu 152				6	Other b/g			1E-09	C C 2
Eu 154				6	**Total a**	**0**		**7.71E-07**	**C C 2**
Eu 155				6	**Total b/g**	**0**		**2.01E-05**	**C C 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