WASTE STREAM 9Z201 Magnox Fuel Transport Flasks

SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2019 - 31.3.2020.....	351.0 m³
Total future arisings:		351.0 m³
Total waste volume:		351.0 m³

Comment on volumes: The flasks are expected to become redundant when Magnox fuel movements cease following Wylfa defuelling. It is possible that some will be taken out of service progressively, depending on operational requirements. The waste consists of 33 M2 fuel transport flasks that will have no continuing duty after completion of Magnox defueling (September 2018) and hence be ready for decommissioning. The declared volume is that of the flasks without any size reduction. The volume of active material will be much less and most of the flask is expected to be broken up and recycled.

Uncertainty factors on volumes:

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

WASTE SOURCE Transport flasks that have been used for irradiated Magnox fuel transport.

PHYSICAL CHARACTERISTICS

General description: The M2 flasks are of steel construction of overall dimensions 2.56 m x 2.18 m x 1.91 m high (excluding lid pintle). The internal cavity of a flask is 1.02 m x 1.40 m x 1.23 m (1.76 m³). The mass of the flask and its lid is 44.6 te and has an external volume of 10.65 m³.

Physical components (%wt): Almost 100% by weight steel. Flask surfaces are painted (~0.1% wt) and there is a seal (viton) (<0.01% wt).

Sealed sources: -

Bulk density (t/m³): 4.02

Comment on density: Mean bulk density of empty flask.

CHEMICAL COMPOSITION

General description and components (%wt): Flask surfaces are painted with CEGB System 6 epoxy based paint and there is a seal made of viton. The chemical components are Steel (~100%), Viton (<0.01%), and epoxy based paint (~0.1%).

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Tritium may be present as water or as other inorganic or organic compounds.
C-14: The carbon 14 content is insignificant.
Ra: The radium isotope content is insignificant.
Th: The thorium isotope content is insignificant.
U: The chemical form of uranium isotopes has not been determined but may be present as uranium oxides.
Pu: The chemical form of plutonium isotopes has not been determined but may be present as plutonium oxides.

Metals and alloys (%wt): Approximately 100% of waste is bulk metal in the form of transport flasks of typical external dimensions 2.56 m x 2.18 m x 1.91 m. Wall thickness is 368 mm.

Stainless steel.....	0	
Other ferrous metals.....	~100.0	Body material is a forging in BS 1503, ASTM/A350 with bolts and other fittings in stainless steel (unidentified). Nickel, niobium and molybdenum are present in alloying proportions in steels.
Iron.....		
Aluminium.....	0	

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	Beryllium	0	
	Cobalt		
	Copper	0	
	Lead	0	
	Magnox/Magnesium	TR	
	Nickel		
	Titanium		
	Uranium	NE	
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	0	No "other" metals present.
Organics (%wt):	Epoxy based paint on flask surfaces. Viton seal between flask lid and flask body.		
	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	Viton seal between flask lid and flask body.
	Non-halogenated rubber	0	
	Hydrocarbons		
	Oil or grease		
	Fuel		
	Asphalt/Tarmac (cont.coal tar)		
	Asphalt/Tarmac (no coal tar)		
	Bitumen		
	Others		
	Other organics	~0.10	Epoxy based paint on flask surfaces.
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand		
	Glass/Ceramics	0	
	Graphite	0	
	Desiccants/Catalysts		
	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.	
	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.	
	Combustible metals.....	0
	Low flash point liquids.....	0
	Explosive materials.....	0
	Phosphorus.....	0
	Hydrides.....	0
	Biological etc. materials.....	0
	Biodegradable materials.....	
	Putrescible wastes.....	0
	Non-putrescible wastes.....	
	Corrosive materials.....	0
	Pyrophoric materials.....	0
	Generating toxic gases.....	0
	Reacting with water.....	0
	Active particles.....	
	Soluble solids as bulk chemical compounds.....	
Hazardous substances / non hazardous pollutants:	None present, except possibly in trace quantities.	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	

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Styrene.....

Tri-butyl phosphate.....

Other organophosphates.....

Vinyl chloride.....

Arsenic.....

Barium.....

Boron.....

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

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... 0

TREATMENT, PACKAGING AND DISPOSAL

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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		100.0
None		

Comment on planned treatments: Treatment will be via size reduction and decontamination, with an anticipated maximum of 5% of the flask assumed to then be disposed of to landfill as VLLW. The remainder is anticipated to be out of scope scrap metal.

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	
Expected to be consigned to a Landfill Facility	5.0
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	95.0
Expected to be recycled / reused	
Disposal route not known	

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: (Not applicable to this waste stream)

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): -

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Waste consigned for disposal to LLWR in year of generation:	-
Potential for the waste to contain discrete items:	-

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:	Contamination from Magnox fuel cooling pond water.
Uncertainty:	The activity values are current best estimates. The waste is expected to be LLW but levels of contamination have to be determined.
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:	Estimated from sampling and analysis data.
Other information:	There may be contamination by fission products, actinides and activation products in Magnox. The values quoted are indicative of the values that might be expected.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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				6	Gd 153				8
Be 10				8	Ho 163				8
C 14				8	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36				8	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				8	Pb 210				8
Co 60			1.55E-07	C C 2	Bi 208				8
Ni 59				6	Bi 210m				8
Ni 63				6	Po 210				8
Zn 65				6	Ra 223				8
Se 79				6	Ra 225				8
Kr 81				8	Ra 226				8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			3.54E-06	C C 2	Th 227				8
Zr 93				6	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				6	Th 232				8
Nb 94				6	Th 234			3E-09	C C 2
Mo 93				6	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				6	U 232				8
Ru 106			9.65E-09	C C 2	U 233			1E-09	C C 2
Pd 107				6	U 234			2E-09	C C 2
Ag 108m				6	U 235				8
Ag 110m				8	U 236				6
Cd 109				8	U 238			3E-09	C C 2
Cd 113m				8	Np 237				6
Sn 119m				8	Pu 236				8
Sn 121m				6	Pu 238			3.99E-09	C C 2
Sn 123				8	Pu 239			3E-07	C C 2
Sn 126				6	Pu 240			1E-07	C C 2
Sb 125			5.69E-08	C C 2	Pu 241			6.29E-06	C C 2
Sb 126				8	Pu 242				6
Te 125m			<1.43E-08	C 3	Am 241			5.52E-07	C C 2
Te 127m				8	Am 242m				6
I 129				6	Am 243				6
Cs 134			1.87E-07	C C 2	Cm 242				8
Cs 135				6	Cm 243				6
Cs 137			1.78E-05	C C 2	Cm 244				6
Ba 133				8	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144			2.35E-09	C C 2	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147				6	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				6	Other a				
Eu 152				6	Other b/g				
Eu 154			4.68E-08	C C 2	**Total a**	**0**		**9.62E-07**	**C C 2**
Eu 155				6	**Total b/g**	**0**		**2.81E-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