WASTE STREAM 9G319 Secondary Wastes LLW

SITE	Trawsfynydd
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2074 - 31.3.2083.....	1092.0 m³
Total future arisings:		1092.0 m³
Total waste volume:		1092.0 m³

Comment on volumes: Waste arisings are assumed to occur at a uniform rate over 9 years. Final Dismantling & Site Clearance is assumed to commence in 2074. Volumes and radioactivity have been calculated for 85 years after reactor shutdown.

Uncertainty factors on volumes:				
	Stock (upper):	x	Arisings (upper)	x 1.2
	Stock (lower):	x	Arisings (lower)	x 0.8

WASTE SOURCE Wastes arising from contamination control procedures during plant dismantling.

PHYSICAL CHARACTERISTICS

General description: A variety of combustible and non combustible materials. There are no large items expected.

Physical components (%vol): Metallic pipe and other items (~50% vol), plastic pipework, sheet and other items (~10% vol), rubber gloves and other items (~5% vol), clothing (~5% vol), wood (~5% vol), encapsulated sludge (~5% vol), air filters (~5% vol), combustible material (e.g. paper sheet) (~15-20 % vol). Percentages of constituents are very uncertain.

Sealed sources: -

Bulk density (t/m³): ~1

Comment on density: The density is likely to lie between 0.5 and 1.5 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is expected to include cloth (~5%vol), plastics (~15%vol), paper (~15%vol), wood (~5%vol), rubber (~5%vol), encapsulated sludge (~5%vol) and metals (~50%vol). Percentages of constituents are very uncertain.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: The chemical form of tritium has not been assessed.
C-14: The chemical form of carbon 14 has not been assessed.
Cl-36: The chemical form of chlorine 36 has not been assessed.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
Ra: The radium isotope content is insignificant.
Th: The thorium content is insignificant.
U: The uranium isotope content is insignificant.
Np: The neptunium content is insignificant.
Pu: The plutonium isotope content is insignificant.

Metals and alloys (%wt): Metal thicknesses will probably be typically 1-3 mm.

Stainless steel.....	<<1.0
Other ferrous metals.....	~50.0
Iron.....	
Aluminium.....	<<1.0
Beryllium.....	0
Cobalt.....	
Copper.....	<<1.0
Lead.....	0
Magnox/Magnesium.....	0

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	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....	0	
	Zircaloy/Zirconium.....	0	
	Other metals.....	<<1.0	There may be "other" metals present (<<1% wt).
Organics (%wt):	A wide variety of materials may be present. Halogenated plastics and rubbers are expected but the materials have not been determined.		
	Total cellulosics.....	~25.0	
	Paper, cotton.....	~20.0	
	Wood.....	~5.0	
	Halogenated plastics	<7.5	
	Total non-halogenated plastics.....	<7.5	
	Condensation polymers.....	<3.8	
	Others.....	<3.8	
	Organic ion exchange materials....	0	
	Total rubber.....	~5.0	
	Halogenated rubber	<2.5	
	Non-halogenated rubber.....	<2.5	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar).....		
	Bitumen.....		
	Others.....		
	Other organics.....	TR	
Other materials (%wt):	Graphite may be present in at least trace quantities.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	TR	
	Brick/Stone/Rubble.....	TR	
	Cementitious material.....	~5.0	encapsulated sludges
	Sand.....		
	Glass/Ceramics.....	0	
	Graphite.....	TR	
	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): Only likely to be present in trace quantities.

Fluoride..... TR

Chloride..... TR

Iodide..... 0

Cyanide..... 0

Carbonate..... TR

Nitrate..... TR

Nitrite..... TR

Phosphate..... TR

Sulphate..... TR

Sulphide..... TR

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 expected.

Acrylamide.....

Benzene.....

Chlorinated solvents.....

Formaldehyde.....

Organometallics.....

Phenol.....

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):

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... TR

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		100.0

Comment on planned treatments: -

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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: (Not applicable to this waste stream)

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			

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: -

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

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Source:	Contamination by activation products from the reactor structure.
Uncertainty:	Only very approximate estimates have been made of the total specific activities. The activities quoted are those at the time of Final Dismantling & Site Clearance (85 years after Station shutdown).
Definition of total alpha and total beta/gamma:	Total beta/gamma is defined as the sum of the listed activities of all nuclides other than alpha emitters. Activity for alpha emitting nuclides are insignificant.
Measurement of radioactivities:	The specific activities have been estimated from the weighted mean of all the ILW and LLW streams.
Other information:	The activities quoted are those at the time of Final Dismantling & Site Clearance.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3			2.59E-06	C C 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			2.99E-05	C C 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			7.85E-08	C C 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41			1.28E-07	C C 2	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55				8	Pb 210				8
Co 60			1.48E-08	C C 2	Bi 208				8
Ni 59			9.72E-07	C C 2	Bi 210m				8
Ni 63			6.61E-05	C C 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				8	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			4.94E-09	C C 2	Th 234				8
Mo 93			7.95E-09	C C 2	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			1.73E-09	C C 2	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			4.27E-09	C C 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m			4.74E-08	C C 2	Pu 238				6
Sn 123				8	Pu 239				6
Sn 126				8	Pu 240				6
Sb 125				8	Pu 241				8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241				6
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137				8	Cm 244				8
Ba 133				8	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			1.37E-08	C C 2	Other a				
Eu 152			1.04E-07	C C 2	Other b/g				
Eu 154				8	**Total a**	**0**		**0**	
Eu 155				8	**Total b/g**	**0**		**1.00E-04**	**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