

WASTE STREAM	9C318	Miscellaneous Metals and Materials (Reactor and Non-Reactor) LLW
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SITE Dungeness A
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2092 - 31.3.2095.....	762.0 m ³
Total future arisings:		762.0 m ³
Total waste volume:		762.0 m ³

Comment on volumes: For inventory purposes the arisings are assumed to arise at a uniform rate over three years. Final Dismantling & Site Clearance is assumed to commence in 2088 with reactor dismantling commencing in 2092 and lasting for 3 years. The volumes and radioactivity have been calculated for 85 years after reactor shutdown, i.e. 2091.

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

WASTE SOURCE A variety of materials from plant dismantling.

PHYSICAL CHARACTERISTICS

General description: A variety of materials including metals and insulation materials. Waste can be packaged in standard LLW packages.

Physical components (%vol): A variety of constituents including metallic items (~1%), insulating materials (~79%), temporary active drains (~12%) and vacuum clean and washdown items (~8%).

Sealed sources: -

Bulk density (t/m³): ~1

Comment on density: The density is of the waste as prepared for packaging.

CHEMICAL COMPOSITION

General description and components (%wt): A variety of materials including metals and insulation materials.

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 but may be graphite.
 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 content is insignificant.
 Th: The thorium content is insignificant.
 U: The uranium content is insignificant.
 Np: The neptunium content is insignificant.
 Pu: The plutonium content is insignificant.

Metals and alloys (%wt): Items will have been cut for packaging but an assessment of item dimensions has not been made.

Stainless steel.....	0	
Other ferrous metals.....	~1.0	Mild steel and a little aluminium will be included.
Iron.....		
Aluminium.....	NE	
Beryllium.....	0	
Cobalt.....		
Copper.....	0	
Lead.....	0	

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	Magnox/Magnesium.....	0	
	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....	0	
	Zircaloy/Zirconium.....	0	
	Other metals.....	0	
Organics (%wt):	Plastics may be expected. Halogenated rubbers are not expected. Halogenated plastics have not been estimated.		
	Total cellulosics.....	~0	
	Paper, cotton.....	0	
	Wood.....	0	
	Halogenated plastics	NE	
	Total non-halogenated plastics.....	NE	
	Condensation polymers.....	NE	
	Others.....	NE	
	Organic ion exchange materials....	0	
	Total rubber.....	0	
	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.....	0	
Other materials (%wt):	There might be traces of graphite.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	8.0	vacuum clean and washdown items
	Soil.....	0	
	Brick/Stone/Rubble.....	0	
	Cementitious material.....	12.0	temporary active drains
	Sand.....		
	Glass/Ceramics.....	79.0	MMM (Man Made Mineral Fibre) insulation material
	Graphite.....	0	
	Desiccants/Catalysts.....		
	Asbestos.....		
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		

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	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	-	
	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:

The presence or absence of asbestos has yet to be confirmed.

	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:

	-	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	
	Other organophosphates.....	

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- 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		
Recycling / reuse		
Other / various		
None		100.0

Comment on planned treatments:

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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 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: Data have been presented as though the waste will be in dedicated containers. However it is likely that this waste will be placed in containers with other waste.

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

Container voidage: In-accessible voidage is not expected.

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: The timing of consignment of the waste for disposal cannot be determined at present.

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: -

WASTE STREAM**9C318****Miscellaneous Metals and Materials (Reactor and Non-Reactor) LLW****RADIOACTIVITY**

Source:	Activation of the materials and impurities. There may be some contamination.
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.
Definition of total alpha and total beta/gamma:	All alpha emitter activities are insignificant.
Measurement of radioactivities:	The specific activities were estimated from neutron activation calculations of the reactor material and its impurities, but this only accounted for ~1% of the total volume. The specific activities of the reactor material were assumed to be the same as Trawsfynydd (about 79% of the volume). There are no data for the remaining Non-Reactor materials.
Other information:	The activities quoted are those at 85 years after reactor shutdown, i.e. in 2091. There may be some contamination by Cs137.

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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			3.5E-05	CC 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			6.75E-05	CC 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26			1E-06	CC 2	Tm 171				8
Cl 36			1.11E-06	CC 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41			1.41E-05	CC 2	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55				8	Pb 210				8
Co 60			2.67E-08	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			2.58E-05	CC 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				6	Th 232				8
Nb 94			1.45E-09	CC 2	Th 234				8
Mo 93			1.16E-08	CC 2	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				6	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m				6	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				6	Pu 238				8
Sn 123				8	Pu 239				8
Sn 126				8	Pu 240				8
Sb 125				8	Pu 241				8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241				8
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				6	Cm 244				8
Ba 133			2.54E-08	CC 2	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			1.78E-06	CC 2	Other a				
Eu 152			7.13E-06	CC 2	Other b/g				CC 2
Eu 154			1.13E-07	CC 2	Total a	0		0	
Eu 155				8	Total b/g	0		1.54E-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