WASTE STREAM 9C911 Reactor and Boiler Systems LLW

SITE Dungeness A

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	146.0 m³
Future arisings -	1.4.2019 - 31.3.2025.....	124.0 m³
Total future arisings:		124.0 m³
Total waste volume:		270.0 m³

Comment on volumes: Waste volumes take no account of volume reduction by supercompaction.

Uncertainty factors on volumes:

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

WASTE SOURCE Care and Maintenance preparations and procedures in the areas covered by the waste stream.

PHYSICAL CHARACTERISTICS

General description: Mild steel and mixed trash. Any large items will be cut to fit standard packages.

Physical components (%wt): Steel components, scrapped plant items, protective sheeting, decontamination materials, filters and drums containing the waste.

Sealed sources: -

Bulk density (t/m³): 1

Comment on density: data taken from WCH mass divided by volume

CHEMICAL COMPOSITION

General description and components (%wt): The waste consists of metal , plastic, rubble, wood and glass all in the form of scrapped plant, protective sheeting, decontamination materials and filters. The filters may contain aluminium. The breakdown is metal (including the steel drum) ~50%wt, concrete ~9%wt, soil ~9%, plastic ~4%, rubber ~11%, wood 4%, other ~12%.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Tritium is present as surface contamination of waste by tritiated liquor.
C-14: The chemical form of Carbon 14 has not been determined but may be graphite.
Cl-36: Chlorine 36 may be present as a contaminant of graphite dust.
U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.
Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Metal thickness may vary from ~1mm to ~30mm.

Stainless steel.....	P	Percentage not assessed, will include trace amounts of chromium and approximately 0.1% nickel
Other ferrous metals.....	48.9	
Iron.....		
Aluminium.....	0.50	Sheet/Scaffold Tubes
Beryllium.....		
Cobalt.....		
Copper.....		
Lead.....	0.10	Lead shot
Magnox/Magnesium.....	<<0.10	
Nickel.....	0	

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	Titanium.....		
	Uranium.....		
	Zinc.....	<<0.10	
	Zircaloy/Zirconium.....		
	Other metals.....		
Organics (%wt):	The waste may contain halogenated rubber as neoprene, and contain halogenated plastics as PVC.		
	Total cellulosics.....	4.0	
	Paper, cotton.....		
	Wood.....	4.0	
	Halogenated plastics	4.3	Plastic bags and other items
	Total non-halogenated plastics.....	0	
	Condensation polymers.....		
	Others.....		
	Organic ion exchange materials....		
	Total rubber.....	11.0	
	Halogenated rubber	6.0	
	Non-halogenated rubber.....	5.0	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar).....		
	Bitumen.....		
	Others.....		
	Other organics.....		
Other materials (%wt):	-		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....	~9.0	
	Brick/Stone/Rubble.....	~9.0	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....	11.0	Man Made Mineral Fibre lagging
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....	<1.0	
	Non/low friable.....	<1.0	Galbestos sheeting
	Moderately friable.....	0	
	Highly friable.....	0	
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		
	Powder/Ash.....		

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Inorganic anions (%wt): Not expected, but possibly present in trace quantities.

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: Asbestos may be present.

- Combustible metals
- Low flash point liquids
- Explosive materials
- Phosphorus
- Hydrides
- Biological etc. materials
- Biodegradable materials
  - Putrescible wastes
  - Non-putrescible wastes
- Corrosive materials
- Pyrophoric materials
- Generating toxic gases
- Reacting with water
- Active particles
- Soluble solids as bulk chemical compounds

Hazardous substances / non hazardous pollutants: Asbestos

- 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..... NE

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	0.30
Supercompaction (HFC)	Off-site	0.30
Incineration	Off-site	3.7
Solidification		
Decontamination		
Metal treatment	Off-site	0.10
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		95.9

Comment on planned treatments: It is expected that 95% of this waste stream will be sent to Landfill as VLLW.

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Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	1.2
Expected to be consigned to a Landfill Facility	95.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	3.7
Expected to be consigned to a Metal Treatment Facility	0.10
Expected to be consigned as Out of Scope	
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:

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	0.30	43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	0.90	10	< 1
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: 43.2m3 loading volume is calculated based on the fact that you can low force compact two times the normal volume of waste into a 200 litre/0.2m3 drum (400 litres/0.4m3), you can then fit 36 drums (14.4m3) into a ½ height ISO, each drum can be super-compacted to a 1/3 of its original volume so therefore we can get 3 x the amount of un-compacted drums into the final disposal container (43.2m3).

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 has a current WCH.

Waste consigned for disposal to LLWR in year of generation: No. 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: -

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Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source:	Activation and contamination of materials.
Uncertainty:	Activity values are current best estimates. Specific activity is a function of operating history. The values are indicative of the activities that would be expected.
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:	Data taken from WCH - 1MXN-3DUA-0-WCH-0-3390 decayed by three years
Other information:	-

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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	8.26E-06	C C 1	8.26E-06	C C 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	3.51E-06	C C 1	3.51E-06	C C 1	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	1.21E-05	C C 1	1.21E-05	C C 1	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55	1.53E-05	C C 1	1.53E-05	C C 1	Pb 210		8		8
Co 60	6.48E-06	C C 1	6.48E-06	C C 1	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	7.27E-06	C C 1	7.27E-06	C C 1	Po 210		8		8
Zn 65		8		8	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226		8		8
Kr 85		8		8	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	9.49E-08	C C 1	9.49E-08	C C 1	Th 227		8		8
Zr 93		8		8	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94	1.37E-07	C C 1	1.37E-07	C C 1	Th 234		8		8
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99		8		8	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m	1.76E-07	C C 1	1.76E-07	C C 1	U 235		8		8
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238		8		8
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	9.6E-09	C C 1	9.6E-09	C C 1
Sn 123		8		8	Pu 239	7.18E-09	C C 1	7.18E-09	C C 1
Sn 126		8		8	Pu 240	9.39E-09	C C 1	9.39E-09	C C 1
Sb 125	1.54E-08	C C 1	1.54E-08	C C 1	Pu 241	7.42E-07	C C 1	7.42E-07	C C 1
Sb 126		8		8	Pu 242		8		8
Te 125m	3.87E-09	8	3.87E-09	8	Am 241	3.35E-08	C C 1	3.35E-08	C C 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	3.49E-09	C C 1	3.49E-09	C C 1	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	5E-07	C C 1	5.00E-07	C C 1	Cm 244	1.95E-09	C C 1	1.95E-09	C C 1
Ba 133	4.76E-08	C C 1	4.76E-08	C C 1	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	4.62E-09	C C 1	4.62E-09	C C 1	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	1.04E-08	C C 1	1.04E-08	C C 1	Other a				
Eu 152	2.26E-07	C C 1	2.26E-07	C C 1	Other b/g				
Eu 154	1.39E-07	C C 1	1.39E-07	C C 1	**Total a**	**6.16E-08**	**C C 1**	**6.16E-08**	**C C 1**
Eu 155	7.29E-08	C C 1	7.29E-08	C C 1	**Total b/g**	**5.51E-05**	**C C 1**	**5.51E-05**	**C C 1**

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