

WASTE STREAM**9E914****Ponds and Other Wet Fuel Routes LLW**

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

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	7.2 m ³
Future arisings -	1.4.2019 - 31.3.2020.....	64.7 m ³
	1.4.2020 - 31.3.2021.....	14.3 m ³
	1.4.2021 - 31.3.2022.....	7.2 m ³
	1.4.2022 - 31.3.2027.....	28.6 m ³
Total future arisings:		114.8 m ³
Total waste volume:		122.0 m ³

Comment on volumes: waste in this stream is assumed to arise after defueling.

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 preparation procedures in the ponds and other wet fuel routes.

PHYSICAL CHARACTERISTICS

General description: Mixed trash and demolition wastes. Any large items will be cut to fit standard packages.
 Physical components (%wt): Metal (~33% wt), rubble (~9%wt), soil (~1%), biodegradables (~9%), plasterboard (~1%), plastics (~37%), rubber (~1%), wood (~3%wt), other organic (~1%), Others including asbestos and MMMF (Man Made Mineral Fibre) (~5wt).
 Sealed sources: -
 Bulk density (t/m³): ~0.8
 Comment on density: The density is of the waste as cut for packaging. data taken from WCH mass divided by volume

CHEMICAL COMPOSITION

General description and components (%wt): The waste comprises various general wastes, rubble and metals, including steel, stainless steel, iron ductwork and MMMF. Metal (~33% wt), rubble (~9%wt), soil (~1%), biodegradables (~9%), plasterboard (~1%), plastics (~37%), rubber (~1%), wood (~3%wt), other organic (~1%), Others including asbestos and MMMF (Man Made Mineral Fibre) (~5wt).

Chemical state: Alkali

Chemical form of radionuclides: H-3: The chemical form of tritium has not been determined but may be tritiated water.
 C-14: Carbon 14 may be present as traces of graphite.
 Cl-36: The chemical form of chlorine 36 has not been determined.
 Se-79: The selenium content is insignificant.
 Tc-99: The technetium content is insignificant.
 Ra: Radium isotope content is expected to be insignificant.
 Th: The thorium content is insignificant.
 U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
 Np: The neptunium content is insignificant.
 Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Thickness of metal items varies from 1 mm to 30 mm.

Stainless steel.....	~5.0	pipework, pumps, motors, hand tools lifting equipment, tables, frames - the amount of stainless steel may increase due to the increased use of stainless steel in pond components.
Other ferrous metals.....	~27.9	Mild steel - pipework, pumps, motors, hand tools lifting

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equipmet, tables, frames

Iron.....
 Aluminium..... ~0.08
 Beryllium..... NE
 Cobalt.....
 Copper..... ~0.02
 Lead..... 0.08
 Magnox/Magnesium..... TR

 Nickel.....
 Titanium.....
 Uranium..... NE
 Zinc..... 0.02
 Zircaloy/Zirconium..... TR
 Other metals..... 0

sheet, pipe block and shot

Magnox may be present in trace quantities, but will not constitute a hazard

Trace (in galvanised steel)

"Other" metals have not been identified.

Organics (%wt):

Wood is expected.
 Total cellulosics..... ~3.0
 Paper, cotton..... 0
 Wood..... ~3.0
 Halogenated plastics ~17.0
 Total non-halogenated plastics..... 20.0
 Condensation polymers..... 10.0
 Others..... 10.0
 Organic ion exchange materials.... 0
 Total rubber..... ~1.0
 Halogenated rubber ~0.50
 Non-halogenated rubber..... ~0.50
 Hydrocarbons.....
 Oil or grease
 Fuel.....
 Asphalt/Tarmac (cont.coal tar)...
 Asphalt/Tarmac (no coal tar)....
 Bitumen.....
 Others.....
 Other organics..... ~1.0

PVC,PPE

pipes,poly, ppe, perspex, containers, sheet and hoses

pipes,poly, ppe, perspex, containers, sheet and hoses

neoprene

Other materials (%wt):

-
 Inorganic ion exchange materials. 0
 Inorganic sludges and flocs..... 0
 Soil..... 1.0
 Brick/Stone/Rubble..... 9.0
 Cementitious material.....

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	Sand.....		
	Glass/Ceramics.....	5.0	including 0.01% MMMF lagging
	Graphite.....	0	
	Desiccants/Catalysts.....		
	Asbestos.....	~0.01	
	Non/low friable.....	0	
	Moderately friable.....	0	
	Highly friable.....	~0.01	Lagging / gaskets - mixture
	Free aqueous liquids.....	0	
	Free non-aqueous liquids.....	0	
	Powder/Ash.....	0	
Inorganic anions (%wt):	Carbonates and sulphates present in trace quantities.		
	Fluoride.....	0	
	Chloride.....	0	
	Iodide.....	0	
	Cyanide.....	0	
	Carbonate.....	TR	
	Nitrate.....	0	
	Nitrite.....	0	
	Phosphate.....	0	
	Sulphate.....	TR	
	Sulphide.....	0	
Materials of interest for waste acceptance criteria:	Magnox may be present in trace quantities but will not constitute a hazard. Some MMMF is expected to be present.		
	Combustible metals.....	TR	
	Low flash point liquids.....	0	
	Explosive materials.....	0	
	Phosphorus.....	0	
	Hydrides.....	0	
	Biological etc. materials.....	0	
	Biodegradable materials.....	9.0	
	Putrescible wastes.....	1.0	
	Non-putrescible wastes.....	8.0	
	Corrosive materials.....	0	
	Pyrophoric materials.....	0	
	Generating toxic gases.....	0	
	Reacting with water.....	TR	
	Active particles.....		
	Soluble solids as bulk chemical compounds.....		

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non hazardous pollutants:

-

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..... P

10 off Electronic panels and test
equipment

EEE Type 2..... P

50 off Electronic motors and
pumps

EEE Type 3..... P

120 off Electrical power tools

EEE Type 4..... P

100 off Fluorescent tubes / lamps

EEE Type 5..... P

10 off Rechargeable batteries,
Nickel-Cadmium/Lithium-ion

Complexing agents (%wt):

No

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids.....

Other organic complexants.....

Total complexing agents..... 0

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	15.0
Supercompaction (HFC)	Off-site	15.0
Incineration	Off-site	65.0
Solidification		
Decontamination		
Metal treatment	Off-site	5.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		15.0

Comment on planned treatments:

5% of this waste stream is expected to be sent for Metal Recycle.

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	30.0
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	65.0
Expected to be consigned to a Metal Treatment Facility	5.0
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 m ³	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO	15.0	43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	15.0	~10	2
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information:

It is likely that this waste will be placed in a container with other LLW. 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 1/2 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

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(43.2m3).

Waste Planned for Disposal at the LLW Repository:

Container voidage:	No significant inaccessible voidage is expected.
Waste Characterisation Form (WCH):	The waste meets the LLWR's Waste Acceptance Criteria (WAC). The waste has a current WCH. Inventory information is consistent with the WSCD.
Waste consigned for disposal to LLWR in year of generation:	Yes.
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:	Activation and contamination of materials.
Uncertainty:	Activity values are current best estimates. Specific activity is a function of Station operating history. The values quoted are indicative of the activities that would be expected, although demolition wastes are predicted to be lower in activity than the routine operational wastes and so the values quoted for this stream are expected to be an over estimate.
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-3OLD-0-WCH-0-3928 V5 and decayed by 2 years for RWI 2019
Other information:	-

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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	7.28E-05	CC 1	7.28E-05	CC 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	4.96E-04	CC 1	4.96E-04	CC 1	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36	4.65E-07	CC 1	4.65E-07	CC 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	2.1E-09	CC 2	2.1E-09	CC 2	Pb 205		8		8
Fe 55	2.2E-05	CC 1	2.2E-05	CC 1	Pb 210		8		8
Co 60	2.32E-05	CC 2	2.32E-05	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	6.15E-06	CC 1	6.15E-06	CC 1	Po 210		8		8
Zn 65	1.03E-09	CC 2	1.03E-09	CC 2	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	5.59E-05	CC 1	5.59E-05	CC 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	2.76E-07	CC 2	2.76E-07	CC 2	Th 234	9.73E-08	CC 2	9.73E-08	CC 2
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	9.76E-08	CC 2	9.76E-08	CC 2	U 233		8		8
Pd 107		8		8	U 234	7.97E-08	CC 1	7.97E-08	CC 1
Ag 108m	5.58E-07	CC 2	5.58E-07	CC 2	U 235	4E-09	CC 1	4E-09	CC 1
Ag 110m	4.31E-09	CC 2	4.31E-09	CC 2	U 236	2.01E-08	CC 1	2.01E-08	CC 1
Cd 109		8		8	U 238	9.73E-08	CC 1	9.73E-08	CC 1
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	1.1E-06	CC 1	1.1E-06	CC 1
Sn 123		8		8	Pu 239	1.13E-06	CC 1	1.13E-06	CC 1
Sn 126		8		8	Pu 240	1.48E-06	CC 1	1.48E-06	CC 1
Sb 125	4.56E-07	CC 2	4.56E-07	CC 2	Pu 241	4.73E-05	CC 1	4.73E-05	CC 1
Sb 126		8		8	Pu 242		8		8
Te 125m	1.14E-07	CC 2	1.14E-07	CC 2	Am 241	4.58E-06	CC 1	4.58E-06	CC 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	1.48E-06	CC 2	1.48E-06	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243	4.08E-09	CC 1	4.08E-09	CC 1
Cs 137	1.93E-04	CC 2	1.93E-04	CC 2	Cm 244	9.82E-08	CC 1	9.82E-08	CC 1
Ba 133	5.67E-07	CC 2	5.67E-07	CC 2	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144	1.35E-08	CC 2	1.35E-08	CC 2	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	1.83E-06	CC 1	1.83E-06	CC 1	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152	1.18E-06	CC 2	1.18E-06	CC 2	Other b/g				
Eu 154	1.44E-06	CC 2	1.44E-06	CC 2	Total a	8.59E-06	CC 2	8.59E-06	CC 2
Eu 155	5.81E-07	CC 2	5.81E-07	CC 2	Total b/g	9.25E-04	CC 2	9.25E-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