WASTE STREAM 9E913 Care & Maintenance Preparation : AETP LLW

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

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	3.0 m³
Future arisings -	1.4.2019 - 31.3.2020.....	10.5 m³
	1.4.2020 - 31.3.2021.....	139.0 m³
	1.4.2021 - 31.3.2022.....	69.5 m³
	1.4.2022 - 31.3.2027.....	278.0 m³
Total future arisings:		496.9 m³
Total waste volume:		499.9 m³

Comment on volumes:	Waste in this stream is assumed to arise from after defueling			
Uncertainty factors on volumes:	Stock (upper):	x 1.1	Arisings (upper)	x 1.2
	Stock (lower):	x 0.9	Arisings (lower)	x 0.8

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

PHYSICAL CHARACTERISTICS

General description:	The waste consists mostly of mixed trash, any large items will be cut to fit standard packages.
Physical components (%wt):	Metal (~47%wt), rubble including concrete and brick/blockwork (~8%wt), soil (~1%), biodegradables (~2%), plasterboard (1%), PVC/plastic pipework (~23%wt), rubber (~1%), wood (~7%wt), other organic (~1%) and others including asbestos (~9%).
Sealed sources:	-
Bulk density (t/m³):	~0.27
Comment on density:	data taken from WCH mass divided by volume

CHEMICAL COMPOSITION

General description and components (%wt):	The waste comprises metal (including iron ductwork, motors, general scrap, steel and stainless steel), various plastics, wood and concrete/rubble. Metal (~47%wt), rubble including concrete and brick/blockwork (~8%wt), soil (~1%), biodegradables (~2%), plasterboard (1%), PVC/plastic pipework (~23%wt), rubber (~1%), wood (~7%wt), other organic (~1%) and others including asbestos (~9%).
Chemical state:	Alkali
Chemical form of radionuclides:	H-3: The tritium may be present as tritiated water. C-14: The chemical form of carbon 14 has not been determined. 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):	The thickness of the metal varies from 1 mm to 30 mm.

WASTE STREAM	9E913	Care & Maintenance Preparation : AETP LLW	
	Stainless steel	~3.7	pipe work,pumps, motors, tanks - the percentage of stainless steel may incease due to its increased use in Active Effluent Treatment Plant components.
	Other ferrous metals	~40.4	mild steel - pipe work,pumps, motors, tanks
	Iron		
	Aluminium	~0.40	
	Beryllium	0	
	Cobalt		
	Copper	~0.02	
	Lead	2.3	Sheet, pipe, block & shot
	Magnox/Magnesium	TR	Magnox may be present in trace quantities, but will not consitute a hazard
	Nickel		
	Titanium		
	Uranium	NE	
	Zinc	0.08	Trace (in galvanised steel)
	Zircaloy/Zirconium	TR	
	Other metals	0	"Other" metals have not been identified. Mass estimates in the table above for mild steel and stainless steel include the constituent alloying elements such as Cr, Fe, Ni, & Co. Therefore, these constituent alloying elements are not recorded seperately to avoid double accounting.
Organics (%wt):	Trace quantities of oil may be present.		
	Total cellulosics	~7.0	
	Paper, cotton	0	
	Wood	~7.0	
	Halogenated plastics	~10.0	PVC, PPE
	Total non-halogenated plastics	13.0	
	Condensation polymers	6.5	Pipes,poly, PPE, perspex,containers, sheet and hoses
	Others	6.5	Pipes,poly, PPE, perspex,containers, sheet and hoses
	Organic ion exchange materials	0	
	Total rubber	~1.0	
	Halogenated rubber	~0.50	Neoprene
	Non-halogenated rubber	~0.50	
	Hydrocarbons		
	Oil or grease		
	Fuel		
	Asphalt/Tarmac (cont.coal tar)		

WASTE STREAM	9E913	Care & Maintenance Preparation : AETP LLW	
	Asphalt/Tarmac (no coal tar).....		
	Bitumen.....		
	Others.....		
	Other organics.....	~1.0	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	~1.0	
	Brick/Stone/Rubble.....	~8.0	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....	3.0	0.04% MMMF Lagging, remainder glass
	Graphite.....	0	
	Desiccants/Catalysts.....		
	Asbestos.....	0.04	
	Non/low friable.....	0	
	Moderately friable.....	0	
	Highly friable.....	0.04	Lagging / gaskets chrysotile (white)
	Free aqueous liquids.....	0	
	Free non-aqueous liquids.....	0	
	Powder/Ash.....	TR	
Inorganic anions (%wt):	Carbonates and sulphates expected to be 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:	There may be traces of powder as residues. Magnox may be present in trace quantities, but will not constitute a hazard.		
	Combustible metals.....	TR	
	Low flash point liquids.....	0	
	Explosive materials.....	0	
	Phosphorus.....	0	
	Hydrides.....	0	
	Biological etc. materials.....	0	
	Biodegradable materials.....	2.0	
	Putrescible wastes.....	1.0	

WASTE STREAM **9E913** **Care & Maintenance Preparation : AETP LLW**

Non-putrescible wastes.....	1.0
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	TR
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.....

Vinyl chloride.....

Arsenic.....

Barium.....

Boron.....

Cadmium.....

Caesium.....

Selenium.....

Chromium.....

Molybdenum.....

Thallium.....

Tin.....

Vanadium.....

Mercury compounds.....

Others.....

Electronic Electrical Equipment (EEE)

EEE Type 1.....	P	5 off Electronic panels and test equipment
EEE Type 2.....	P	30 off Electronic motors and pumps
EEE Type 3.....	P	50 off Electrical power tools
EEE Type 4.....	P	25 off Fluorescent tubes / lamps
EEE Type 5.....	P	5 off Rechargeable batteries which are nickel-Cadmium and Lithium-ion.

WASTE STREAM 9E913 Care & Maintenance Preparation : AETP LLW

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	27.0
Supercompaction (HFC)	Off-site	27.0
Incineration	Off-site	40.0
Solidification		
Decontamination		
Metal treatment	Off-site	5.0
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		28.0

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	55.0
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	40.0
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:

WASTE STREAM 9E913 Care & Maintenance Preparation : AETP LLW

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	27.0	43.2	4
1/2 Height IP-2 Disposal/Re-usable ISO	28.0	10	14
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 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: 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.

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-0-3927 and decayed by 2 years for RWI 2019

Other information: -

WASTE STREAM 9E913 Care & Maintenance Preparation : AETP LLW

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	2.06E-05	C C 1	2.06E-05	C C 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	1.08E-05	C C 1	1.08E-05	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	3.27E-08	C C 1	3.27E-08	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	2.04E-09	C C 2	2.04E-09	C C 2	Pb 205		8		8
Fe 55	9.76E-07	C C 1	9.76E-07	C C 1	Pb 210		8		8
Co 60	9.99E-07	C C 2	9.99E-07	C C 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	5.02E-06	C C 1	5.02E-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	1.11E-04	C C 1	1.11E-04	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	4.67E-07	C C 2	4.67E-07	C C 2	Th 234	1.77E-07	C C 2	1.77E-07	C C 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	8.62E-08	C C 2	8.62E-08	C C 2	U 233		8		8
Pd 107		8		8	U 234	1.59E-07	C C 1	1.59E-07	C C 1
Ag 108m	1.14E-06	C C 2	1.14E-06	C C 2	U 235	2.11E-09	C C 1	2.11E-09	C C 1
Ag 110m	2.19E-09	C C 2	2.19E-09	C C 2	U 236	1.04E-08	C C 1	1.04E-08	C C 1
Cd 109		8		8	U 238	1.77E-07	C C 1	1.77E-07	C C 1
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	2.63E-07	C C 1	2.63E-07	C C 1
Sn 123		8		8	Pu 239	1.56E-07	C C 1	1.56E-07	C C 1
Sn 126		8		8	Pu 240	2.04E-07	C C 1	2.04E-07	C C 1
Sb 125	1.11E-06	C C 2	1.11E-06	C C 2	Pu 241	8.08E-06	C C 1	8.08E-06	C C 1
Sb 126		8		8	Pu 242		8		8
Te 125m	2.77E-07	C C 2	2.77E-07	C C 2	Am 241	6.17E-07	C C 1	6.17E-07	C C 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	9.05E-06	C C 2	9.05E-06	C C 2	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	1.03E-03	C C 2	1.03E-03	C C 2	Cm 244	2.28E-08	C C 1	2.28E-08	C C 1
Ba 133	1.13E-06	C C 2	1.13E-06	C C 2	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144	1.37E-08	C C 2	1.37E-08	C C 2	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	3.97E-07	C C 1	3.97E-07	C C 1	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152	3.68E-06	C C 2	3.68E-06	C C 2	Other b/g				
Eu 154	4.53E-07	C C 2	4.53E-07	C C 2	**Total a**	**1.61E-06**	**C C 2**	**1.61E-06**	**C C 2**
Eu 155	1.24E-06	C C 2	1.24E-06	C C 2	**Total b/g**	**1.21E-03**	**C C 2**	**1.21E-03**	**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