WASTE STREAM 9E959 BCD LLW

SITE	Oldbury
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	LLW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0.3 m^3
Future arisings -	1.4.2023 - 31.3.2024.....	0.3 m^3
	1.4.2024 - 31.3.2025.....	1.0 m^3
	1.4.2025 - 31.3.2026.....	2.0 m^3
	1.4.2026 - 31.3.2031.....	10.6 m^3
Total future arisings:		13.9 m^3
Total waste volume:		14.1 m^3

Comment on volumes: Waste in this stream is assumed to arise 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 Waste arising from areas associated with BCDs.

PHYSICAL CHARACTERISTICS

General description:	The waste consigned under waste stream 9E959 mainly comprises metal, concrete and rubble, soil, biodegradeable materials, plasterboard, plastics, rubber, wood and other materials. The waste is expected to be in the form of mixed trash, with occasional large items such as pipework, motors and pumps. The material of the waste includes aluminium, copper, iron, magnesium, mild steel, plastics, stainless steel, zinc, EEE materials, MMMF and asbestos.
Physical components (%wt):	Metal (54% wt), concrete/rubble (1%), soil (1%), biodegradables (21%), plasterboard (1%), plastics (6%), rubber (2%), wood (3%), other organic (1%), others including asbestos (10%).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m^3):	0.42
Comment on density:	WCH mass divided by volume

CHEMICAL COMPOSITION

General description and components (%wt):	Metal (54% wt), concrete/rubble (1%), soil (1%), biodegradables (21%), plasterboard (1%), plastics (6%), rubber (2%), wood (3%), other organic (1%), others including asbestos (10%).
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: Tritium is present as surface contamination of waste by tritiated liquor. C-14: Carbon 14 may be contamination in the form of graphite dust. Cl-36: Chlorine 36 may be present as a contaminant of graphite dust. Se-79: The selenium 79 content is insignificant. Tc-99: The technetium 99 content is insignificant. Ra: The radium isotope content is 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 isotope content is insignificant. Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.
Metals and alloys (%wt):	Thicknesses of metal may vary from 1 mm to 30 mm.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	~8.3	Items such as pipework, flooring plates, brackets, frames.	
Other ferrous metals	~41.0	Mild steel - Items such as pipework, flooring plates, brackets, frames.	
Iron	~3.3	Iron in waste items such as cast iron pipework.	
Aluminium	0.03	Aluminium in waste items such as small bore pipework.	
Beryllium			
Cobalt			
Copper	~0.42	Trace in waste items such as pipework.	
Lead	0		
Magnox/Magnesium	0.01	Trace in waste items.	
Nickel			
Titanium			
Uranium			
Zinc	0.83	Galvanised steel such as gratings and buckets.	
Zircaloy/Zirconium	0		
Other metals	0	Mass estimates in the table above for mild steel and stainless steel include the constituent alloying elements such as Cr, Fe, Ni and Co. Therefore, these constituent alloying elements are not recorded seperately to avoid double accounting.	

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	3.0		
Paper, cotton	0		
Wood	3.0		
Halogenated plastics	~1.0	PVC, PPE.	
Total non-halogenated plastics	~5.0		
Condensation polymers			
Others	~5.0	Pipes, poly, PPE, perspex, containers, sheet and hoses.	
Organic ion exchange materials	0		
Total rubber	~2.0		
Halogenated rubber	~2.0	Neoprene.	
Non-halogenated rubber			
Hydrocarbons			
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			

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Bitumen.....		
Others.....		
Other organics.....	~1.0	Other organic includes miscellaneous items not covered in any other category e.g. wipes, absorbent material.

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	~1.0		
Brick/Stone/Rubble.....	~1.0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	0.80	Includes 0.4% MMMF Laggging (associated with general plant items).	
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	~0.40		
Non/low friable.....	0		
Moderately friable.....	0		
Highly friable.....	~0.40	Lagging / gaskets - chrysotile (white).	
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): None present.

	(%wt)	Type(s) and comment
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: Trace of Magnox may be present but will not constitute a hazard.

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	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	21.0	
Putrescible wastes.....	~1.0	
Non-putrescible wastes.....	~20.0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	P	3.4m2
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		

Mercury compounds.....		
Others.....	6.0	Others include EEE materials. EEE weight is approx. 150kg (6%).
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	P	10 off Items with circuit boards.
EEE Type 2.....	P	15 off Plant items containing electrical components such as pumps and motors, transformers and capacitors.
EEE Type 3.....	P	20 off Electrical tools such as saws and drills.
EEE Type 4.....	P	5 off Fluorescent tubes / lamps.
EEE Type 5.....	P	1 off Rechargeable batteries, Nickel-Cadmium/Lithium-Ion.

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		
Total complexing agents.....	0	

Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	73.8
Supercompaction (HFC)	Off-site	73.8
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		26.2

Comment on planned treatments: -

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	100.0	0.42
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		

Classification codes for waste expected to be consigned to a landfill facility: -

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Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
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			

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

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	73.8	~43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	26.2	~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.
Inventory information is consistent with the current WCH.

Waste consigned for disposal to LLWR in year of generation: Yes.

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:	Principal constituents are activation products arising from dry fuel routes. Waste also contains fission products and actinides.
Uncertainty:	Specific activity is a function of Station operating history. The values quoted 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-3OLD-0-WCH-0-4747 V4 decayed by one year for RWI 2022
Other information:	-

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	2.72E-03	C C 1	2.72E-03	C C 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	1.63E-04	C C 1	1.63E-04	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	3.35E-05	C C 2	3.35E-05	C C 2	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	9.09E-07	C C 1	9.09E-07	C C 1	Pb 210		8		8
Co 60	2.12E-06	C C 2	2.12E-06	C C 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	5.34E-06	C C 2	5.34E-06	C C 2	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	4.66E-06	C C 2	4.66E-06	C C 2	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	1.2E-06	C C 2	1.2E-06	C C 2	Th 234	2.67E-08	C C 8	2.67E-08	C C 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	1.01E-08	C C 2	1.01E-08	C C 2	U 233		8		8
Pd 107		8		8	U 234	2.33E-08	C C 2	2.33E-08	C C 2
Ag 108m	1.18E-06	C C 2	1.18E-06	C C 2	U 235		8		8
Ag 110m		8		8	U 236	3.33E-09	C C 2	3.33E-09	C C 2
Cd 109		8		8	U 238	2.67E-08	C C 2	2.67E-08	C C 2
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	4.96E-08	C C 1	4.96E-08	C C 1
Sn 123		8		8	Pu 239	1.5E-08	C C 1	1.5E-08	C C 1
Sn 126		8		8	Pu 240	2.18E-08	C C 1	2.18E-08	C C 1
Sb 125	3.03E-07	C C 2	3.03E-07	C C 2	Pu 241	4.55E-06	C C 1	4.55E-06	C C 1
Sb 126		8		8	Pu 242		8		8
Te 125m	7.47E-08	C C 8	7.47E-08	C C 8	Am 241	2.59E-06	C C 1	2.59E-06	C C 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	3.57E-08	C C 2	3.57E-08	C C 2	Cm 242		8		8
Cs 135		8		8	Cm 243	6.19E-08	C C 1	6.19E-08	C C 1
Cs 137	4.9E-06	C C 2	4.9E-06	C C 2	Cm 244	1.42E-06	C C 1	1.42E-06	C C 1
Ba 133	6.98E-07	C C 2	6.98E-07	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		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	1.01E-06	C C 2	1.01E-06	C C 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152	1.9E-06	C C 2	1.9E-06	C C 2	Other b/g				
Eu 154	1.84E-06	C C 2	1.84E-06	C C 2	**Total a**	**4.21E-06**	**C C 2**	**4.21E-06**	**C C 2**
Eu 155	9.36E-07	C C 2	9.36E-07	C C 2	**Total b/g**	**2.94E-03**	**C C 2**	**2.94E-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