WASTE STREAM 9F910 Reactor Area LLW

SITE	Sizewell A
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 m^3
Future arisings -	1.4.2022 - 31.3.2031.....	256.7 m^3
Total future arisings:		256.7 m^3
Total waste volume:		256.7 m^3

Comment on volumes: Waste in this stream is assumed to arise following Defuelling. Volumes stated assume waste has been removed from the system and size corrected awaiting further treatment and disposal. This work will occur during Care and Maintenance Preparations.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.1
Stock (lower):	x	Arisings (lower)	x 0.9

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

PHYSICAL CHARACTERISTICS

General description:	Hard and soft trash. The waste includes HEPA filters. All large items which cannot be cut to fit standard packages are disposed of in half height ISO containers.
Physical components (%wt):	Metal (~40%), plastic (30%), rubber/paper/wood (11%), concrete/rubble (7%), Soil (1%), organics (10%), and other materials (1%).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m^3):	~0.8
Comment on density:	Bulk density has been based on the assumed density of concrete 2.4 t/m3, lead 11 t/m3, metal 7.9 t/m3, plastic 1.3 t/m3, and wood 0.5 t/m3

CHEMICAL COMPOSITION

General description and components (%wt):	The waste comprises metals, mainly steel, various plastics including polythene, rubber, paper and components. The waste also contains HEPA filters. Metal (~40%), plastic (30%), rubber/paper/wood (11%), concrete/rubble (7%), Soil (1%), organics (10%), and other materials (1%).
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: Tritium may be present as surface contamination of waste by tritiated liquor. C-14: Chemical from of of 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: The chemical form of uranium isotopes has not been determined but may be uranium oxides. Np: The neptunium isotope content is insignificant. Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.
Metals and alloys (%wt):	200 litre steel drums have a wall thickness of about 1mm.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	18.6		
Other ferrous metals	21.0	Made up of 18.6% iron, 1.2% chromium, 0.2% copper and 1% nickel	
Iron			
Aluminium	0.20	Scaffolding	
Beryllium			
Cobalt			
Copper			
Lead	0.10	Shielding	
Magnox/Magnesium			
Nickel			
Titanium			
Uranium			
Zinc	0.20	Cladding, buckets, scaffolding	
Zircaloy/Zirconium			
Other metals	0	"Other" metals have not been identified.	

Organics (%wt): The waste contains cellulose in the form of wood (~0.01%vol).

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	1.0		
Paper, cotton			
Wood	1.0		
Halogenated plastics	10.0	Poly wrap, packaging, general miscellaneous waste	
Total non-halogenated plastics	20.0		
Condensation polymers			
Others	20.0	Poly wrap, packaging, general miscellaneous waste	
Organic ion exchange materials			
Total rubber	10.0		
Halogenated rubber			
Non-halogenated rubber	10.0		
Hydrocarbons	0.30		
Oil or grease	0.20		
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen	0.10	Sizalcraft, bitumen backing	
Others			
Other organics	10.0		

Other materials (%wt): -

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..			
Inorganic sludges and flocs.....			
Soil.....	1.0		
Brick/Stone/Rubble.....	3.5		
Cementitious material.....	3.5		
Sand.....			
Glass/Ceramics.....			
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....			
Free non-aqueous liquids.....			
Powder/Ash.....			

Inorganic anions (%wt): None expected, but possibly present in trace quantities.

	(%wt)	Type(s) and comment
Fluoride.....		
Chloride.....		
Iodide.....		
Cyanide.....		
Carbonate.....		
Nitrate.....		
Nitrite.....		
Phosphate.....		
Sulphate.....		
Sulphide.....		

Materials of interest for waste acceptance criteria: -

	(%wt)	Type(s) and comment
Combustible metals.....		
Low flash point liquids.....		
Explosive materials.....		
Phosphorus.....		
Hydrides.....		
Biological etc. materials.....		
Biodegradable materials.....	0.20	
Putrescible wastes.....	0.20	Pigeon waste
Non-putrescible wastes.....		

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Corrosive materials.....

Pyrophoric materials.....

Generating toxic gases.....

Reacting with water.....

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.....	0	includes vacuum cleaner (nilfisk) bags, respirators and HEPA filters.

Electronic Electrical Equipment (EEE)

EEE Type 1.....

EEE Type 2.....

EEE Type 3.....

EEE Type 4.....

EEE Type 5.....

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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	3.0
Supercompaction (HFC)	Off-site	3.0
Incineration	Off-site	81.0
Solidification		
Decontamination		
Metal treatment	Off-site	8.0
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		8.0

Comment on planned treatments: -

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	11.0	0.80
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	81.0	0.40
Expected to be consigned to a Metal Treatment Facility	8.0	1.4
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: -

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			

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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 m^3	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO	3.0	43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	8.0	10	3
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: Data have been presented as though the waste will be segregated and packaged in dedicated containers. It is likely that the waste will be packaged in containers with other LLW. 43.2m3 loading volume (for the WAMAC container) 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: Significant inaccessible voidage is not 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 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

Source: Activation and contamination of materials.

Uncertainty: All of the waste will fall into the LLW category. The activity values quoted are the current best estimates.

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 LLWR WCH 1MXN-3SIA-0-WCH-0-4555 v6 (correct for 01/04/2022)

Other information: -

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			1.95E-04	C C 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.84E-05	C C 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			1.48E-05	C C 1	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41				8	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55			2.62E-06	C C 1	Pb 210				8
Co 60			2.48E-06	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			6.85E-06	C C 1	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			1.18E-05	C C 1	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232				8
Nb 94			3.11E-07	C C 2	Th 234			4E-07	C C 2
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234			3.68E-07	C C 1
Ag 108m				8	U 235			2.8E-08	C C 1
Ag 110m				8	U 236			1.39E-07	C C 1
Cd 109				8	U 238			4E-07	C C 1
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			5.47E-08	C C 1
Sn 123				8	Pu 239			6.27E-08	C C 1
Sn 126				8	Pu 240			8.3E-08	C C 1
Sb 125			3.86E-08	C C 2	Pu 241			4.37E-06	C C 1
Sb 126				8	Pu 242				8
Te 125m			9.67E-09	C C 2	Am 241			2.48E-07	C C 1
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			1.39E-08	C C 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			1.68E-06	C C 2	Cm 244			9.99E-07	C C 1
Ba 133			1.73E-07	C C 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			2.35E-07	C C 1	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152			4.66E-07	C C 2	Other b/g				
Eu 154			3.88E-07	C C 2	**Total a**	**0**		**2.38E-06**	**C C 2**
Eu 155			1.81E-07	C C 2	**Total b/g**	**0**		**2.60E-04**	**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